ERASMUS MUNDUS JOINT DOCTORATE PROGRAMME
APPLICATION FORM
INTERNATIONAL RELATIVISTIC ASTROPHYSICS DOCTORATE PROGRAM
IRAP PHD

EUROPE EDUCATION FORMATION France

DG Éducation et culture

ERASMUS MUNDUS

Je, soussigné(e) Albert MAROUANI, Président de l'Université de Nice Sophia-Antipolis certifie que le diplôme de doctorat délivré par mon établissement à tous les étudiants Erasmus Mundus (européens et pays tiers) à l'issue du cursus conjoint Erasmus Mundus dont le titre suit :

International Relativistic Astrophysics Doctorate Program

Sera :

- **un diplôme conjoint** (un seul document/diplôme avec logos et emblèmes de tous les partenaires, signé par les présidents de tous les établissements impliqués dans le consortium) dont le titre suit:

Doctorat en Astrophysique Relativiste

Ce diplôme conjoint s'adosse à notre diplôme national de doctorat indiqué ci-dessous:

***Diplôme National de Doctorat en* Astrophysique Relativiste**
Adopté par le Conseil Scientifique de l'Université du 26 avril 2002

Fait à Nice..... le 2 juillet 2009.....

UNIVERSITÉ DE NICE-SOPHIA ANTIPOLIS

AGENCE EUROPE-EDUCATION-FORMATION-FRANCE
25, quai des Chartrons – 33080 Bordeaux Cedex
Tél : 05 56 00 94 64 – Fax : 05 56 00 94 80
contact@2e2f.fr / www.2e2f.fr/erasmus-mundus.php

Éducation et culture

Agence EUROPE EDUCATION FORMATION France

DG Éducation et culture

ERASMUS MUNDUS

Modèle-type - Effacer ou Ajouter toute mention nécessaire

Je, soussigné Gilbert Angénieux , Président de l' Université de Savoie

Certifie que le diplôme de doctorat délivré par mon établissement à tous les étudiants Erasmus Mundus (européens et pays tiers) à l'issue du cursus conjoint Erasmus Mundus dont le titre suit :

International Relativistic Astrophysics Doctorate Program

Sera :

- **un diplôme conjoint** (un seul document/diplôme avec logos et emblèmes de tous les partenaires, signé par les présidents de tous les établissements impliqués dans le consortium) dont le titre suit:

  Doctorat en Astrophysique Relativiste

  Ce diplôme conjoint s'adosse à notre diplôme national habilité comme doctorat (ou diplôme donnant grade de doctorat) indiqué ci-dessous:

  *le **Diplôme National de Doctorat : Physique Théorique.***

Fait à Chambéry, le 02 Juillet 2009

Signature du Président de l' Université de Savoie
Et cachet de l'établissement

Pour le Président et par délégation,
le Vice-Président du Conseil Scientifique

Luc FRAPPAT

SIGILLUM UNIVERSITATIS SABAUDIENSIS

Reference Number *To be filled in by the Agency*	

APPLICATION FORM

PROGRAMME	**ERASMUS MUNDUS 2009-2013**
Call for Proposals *Detailed information on the application procedure and the implementing rules of the Action is available in the Erasmus Mundus 2009-2013 Programme Guide*	**EAC / 04 / 2009**
Action	**Action 1 – Joint Programmes**
Sub-Action *Applicants wishing to apply to both sub-actions, must submit two separate applications*	**EMJD - Joint Doctorate Programme**
Application Deadline	**30 April 2009** *(as per postmark)* *For **EMJDs**, the electronic version of the summary sheet (annex 3) should be sent by email to the address below by **31 March 2009***
Project Title	**International Relativistic Astrophysics Doctorate Program**
Project Acronym	**IRAP PhD**
Application Language	**English**

By the deadline of 30 April 2009:

The signed original of the application (together with the relevant annexes) and 2 copies thereof must be sent in the same envelope to:

Education, Audiovisual and Culture Executive Agency
Unit P4 (BOUR 00/38)
Avenue de Bourget, 1
B-1140 Evere (Brussels)

An electronic version of the application must be sent to the following email address:

EACEA-EM2-A1@ec.europa.eu

Paper and electronic copies of the application must be sent to the National Structures in the countries of each of the European participating institutions (not applicable to associated members and third country institutions)

Présidence et
Services Centraux

Université
Nice SOPHIA ANTIPOLIS

Le Président

Affaire suivie par :

Caty CONRAUX
Chef de Cabinet

Tél. : 04 92 07 66 06
Fax : 04 92 07 66 00
cabinet@unice.fr

N/REF
AM/CC N° 2009-223

April 30,2009

To whom it may concern,

The University of Nice-Sophia Antipolis (UNS) will actively participate in the joint programme "Erasmus Mundus Joint Doctorate (EMJD) in Relativistic Astrophysics" as the Coordinating Organisation. Thanks to many Ph.D., I am aware that UNS is involved in its application.

The Doctoral School "Sciences Fondamentales et Appliquées" (ED.SFA: Fundamental and Applied Sciences), ED364, has had a wide experience in cosupervision of Ph.D. thesis since its beginning in 2000. Since then, a total of 38 Ph.D. thesis under co-direction, based either in the Partner Institution or directly in-house, have been engaged. Of these, 21 are active, meaning that the international engagement is alive and growing steadily. Because of the ED.SFA's geographical location, Italy has always been a strong partner with 11 Ph.D. thesis already defended and 9 underway. As part of the French requirements for a Ph.D., a variety of courses are offered divided in 3 different groups: general background, specialty courses and professional courses. The former aim at broadening the knowledge of our students and are directly organized by the ED.SFA, whereas for specialty courses, UNS supports Summer Schools and similar initiatives. For professional courses, the "College des Etudes Doctorales" (Federation of the Doctoral Schools of the UNS) has developed a very strong offer with the help of professionals who typically intervene in the private sector with a similar offer.

The University of Nice-Sophia Antipolis will be engaged in providing all necessary support for this joint programme.

Sincerely yours,

UNIVERSITE DE NICE - SOPHIA ANTIPOLIS 1.1.1996

Pr Albert MAROUANI
President of UNS University

GRAND CHÂTEAU
28 AV VALROSE • BP 2135
06103 NICE CEDEX 2

PART A: Identification of the applicant and other participating organisations

Parts A and B must be filled in separately for each organisation involved in the project (including associated members). **The application must be accompanied by copies of letters from the legal authority of each participating organisation** confirming their support to the joint programme and their agreement with the submitted application (*not necessary for associated members*)

A. 1 ORGANISATION

Role in the consortium *(leave the relevant role only)*	☛ Applicant / Coordinating Organisation ☛ ~~Partner Organisation~~ ☛ ~~Associated member~~			
Official name of the organisation: If applicable, organisation's name in latin characters	**UNIVERSITE DE NICE SOPHIA ANTIPOLIS**			
Acronym:	UNS			
N° of the Erasmus University Charter (if applicable), for European Higher Education Institutions only	28502			
Department, if applicable:	Présidence			
Official Address	Grand Château 28 avenue Valrose, BP 2135			
Postal Code:	06103	Town:	NICE	
Region:		Country:	FRANCE	
Internet address:	http:// portail.unice.fr			
Telephone 1: +33492076460		Telephone 2:		Fax: +33492076510

A.2. LEGAL REPRESENTATIVE

Name of the person entitled to legally commit the organisation (for the coordinating organisation only)

Last Name:	*Mr*	MAROUANI	First Name:	ALBERT
Function:	PRESIDENT			
Address (*Only if different from official address above)*:				

A.3. CONTACT PERSON / COORDINATOR

(responsable for the management of the project in the organisation)

Last Name:	*Mr*	COULLET	First Name:	PIERRE
Function:	Professor of Physics			
@ : Pierre.COULLET@unice.fr	Telephone: +33492076460		Fax number	+33492076510
Address (*Only if different from official address above)*:	Présidence, Grand Château 28 avenue Valrose BP 2135 F-06103 Nice Cedex 2			

PART B: Description of the Organisation

B.1. NATURE OF THE ORGANISATION

Status: *(leave only the relevant status)*	☙ Public ☙ ~~Private~~ *(an organisation which has received over 50 % of its annual revenues from public sources over the preceding two years, or which is controlled by public bodies or their representatives can be declared as "public")*	
Type of organisation: *(leave only the relevant type(s))*	X Higher Education Institution ❑ HE research centre/organisation ❑ Private research centre/organisation ❑ Public research centre/organisation (not HE) Graduate/Doctoral School ❑ Public authority (local) ❑ Public authority (national) ❑ Public authority (regional) ❑ Chamber of commerce / crafts	❑ Chamber of industry ❑ Enterprise large (> 500 employees) ❑ SME ❑ Professional associations ❑ Social partners (trade unions, etc) ❑ Assoc. of professors and researchers ❑ Assoc. of Universities / Research centres ❑ Other (please specify under B.2)

B.2.PURPOSE AND ACTIVITY OF THE ORGANISATION

Please provide a short presentation of your organisation in relation with the activities covered by the project and more particularly concerning its postgraduate (masters/doctorate level) and international cooperation activities *(max. 20 lines).*

-The University of Nice Sophia Antipolis is a young and dynamic French University with a complete cursus of possibilies:medicine, science, law, art and litterature. Nice is equiped with the second international french airport after Paris and the city is situated on on the head of mediteranean sea. This will facilitated the connection with other Institutions. The University is part of the recent french governement PRES (Pole de Recherche et d'Enseignement Superieur), called euro-mediteranean PRES for the specific relations with Italy and the countries in the border of the mediteranean sea. The University will benefit of the dynamism of the local region PACA which has invest a lot in new technology and space science. The technopol of Sophia Antipolis and Thales Alenia are examples. The university hosts the academic base of the present doctorate. It benefits from the presence of the astrophysics reserach institute of Observatoire de la Côte d'Azur involved in relativistic and non-photonic astrophysics: gravitational waves experiement, spatial mission like GAIA, best measurement of the earth-moon distance at Calern site, experiements in Antartic and for the european Very Large Telescope in Chile. With Nice University, the first european doctorate in Relativistic Astrophysics was born in 2002: the IRAP PhD program. Since 2002, 18 doctorates were form inside the international collaboration with Roma, Ferrara, Zurich, Berlin and Chambery.

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Provide a short description of the organisation's specific role in the project *(max. 10 lines)*

The Doctoral School "Sciences Fondamentales et Appliquees" (ED.SFA: Fundamental and Applied Sciences), ED364, has had a wide experience in cosupervision of Ph.D. thesis since its beginning in 2000. Since then, a total of 38 Ph.D. thesis under co-direction, based either in the Partner Institution or directly in-house, have been started. Of these, 21 are active, sign that the international engagement in alive and growing steadily. Because of the ED.SFA's geographical location, Italy has always

been a strong partner with 11 Ph.D. theses already defended and 9 underway.

As part of the French requirements for a Ph.D., a variety of courses are offered divided in three different groups: general background, specialty courses and professional courses. The former are aimed at broadening the knowledge of our students and are directly organized by the ED.SFA, while for the specialty courses we participate in supporting Summer Schools and similar initiatives. For the professional courses, the "College des Etudes Doctorales" (Federation of the Doctoral Schools of the Universite de Nice-Sophia Antipolis) has developed a very strong offer with the helpof professionals who typically intervene in the private sector with a similar offer.

B.3 OTHER COMMUNITY GRANTS ***(for the applicant organisation only)***		
Projects related to the application (i.e. development/implementation of joint study programmes and/or management of scholarship schemes) and for which the applicant organisation has received financial support from the European Community during the last financial year.		
Programme or funding scheme	*ID / Contract number*	*Project Title*
See Annexe 1		

PART C: Description of the Joint Programme

C.1.a For EMMCs ONLY

The full programme covers study months (excluding any academic break of one month or more) and corresponds to a total of ECTS credits (or equivalent; if another system is used, please specify under the relevant award criteria**)**

The joint programme will start in (month) of year "n" and will end in (month) of year "n + "; *the end of the programme includes the graduation ceremony and communication of final results to the students; the end date cannot be later than October of "year n+1" – for one year EMMCs - or "year n+2" – for 2 years EMMCs - following the beginning of the programme.*

Is the proposal a continuation of an existing EMMC:

- An EMMC? ; if yes, please specify hereafter the EMMC original title and acronym:

During their EMMC period, the students will study in <u>at least</u> different partner organisations.

Not counting the first "home university", the minimal mobility for each student will be months (corresponding to ECTS credits or equivalent)

C.1.b For EMJDs ONLY

The joint programme will be mainly laboratory based
(If the proposal is selected, the confirmation of laboratory or non laboratory based research will be applied individually to each fellowship candidate proposed by the consortium)

If applicable, the joint programme training / teaching period will last 36
(*specify months, days, hours and/or ECTS credits*).

Is the EMJD directly linked to:

- an EMMC? No; if yes, please specify hereafter the EMMC title and acronym:
- a Marie Curie Initial Training Network (ITN)?No; if yes, please specify hereafter the ITN title, name of the contracting organisation and agreement number

During their EMJD period, the candidates will visit <u>at least</u> 05 different partner organisations.

Not counting the first "home university", the minimal mobility for each doctoral candidate will be 07 months.

C.2. NUMBER OF STUDENTS / DOCTORAL CANDIDATES PLANNED TO BE <u>ENROLLED</u> IN THE FIRST EDITION OF THE JOINT PROGRAMME

(applies to all students/doctoral candidate, with or without EM scholarship/fellowship)

Third Country Students / doctoral candidates: 9	EU Students / doctoral candidates: 3

C.3 STUDY AREA / DOCTORAL RESEARCH DISCIPLINE

Main Area *(see annex 2 for List of thematic study fields):* **13 . 07**

(if not listed please specify hereafter)

Second Area *(see annex 2 for List of thematic study fields):* **13 . 02**

(if not listed please specify hereafter)

Third Area *(see annex 2 for List of thematic study fields):* **13 . 05**

(if not listed please specify hereafter)

C.4 STUDENT / DOCTORATE CANDIDATE PARTICIPATION COSTS IN THE JOINT PROGRAMME

Please indicate the estimated student/doctorate candidate participation costs in the joint programme during the first edition of the programme (these will be the costs advertised on the joint programme website in case of approval). Please refer to sections 4.4 (for EMMCs) or 5.5 (for EMJD) of the Programme Guide for the programme's maximum contribution to these costs

Participation costs for a Third-Country student/doctorate candidate *(in euros)*	21600 /3 years
Participation costs for a European student/doctorate candidate *(in euros)*	21600 /3 years

C.5 SUMMARY DESCRIPTION OF THE JOINT PROGRAMME

(max. 400 words)

Please provide a summary description of your joint programme covering aspects such as its objectives and main characteristics (content/research area, type of organisations and countries involved, duration, mobility options available for students/doctoral candidates, language(s), type of degrees awarded and any other information considered relevant for the description of the course/programme)

If your application is successful, this summary will be used as the official description of the Masters course/doctorate programme. It will be part of your grant agreement and published on the internet. You are therefore kindly requested to formulate it clearly and carefully and to provide this summary in English, French or German.

Following the successful scientific space missions by the European Space Agency (ESA) and the European Southern Observatory (ESO) in Chile, as well as the high-energy particle activities at CERN in Genève, we have created a Ph.D. program dedicated to the formation of scientists in the field of relativistic astrophysics. The students of such a program will lead the theoretical developments of one of the most active fields of research, based on the above observational and experimental facilities. This program needs expertise in the most advanced topics of mathematical and theoretical physics, and in relativistic field theories. It requires the ability to model the observational data received from the above facilities, as well as all the basic knowledge in astronomy, astrophysics and cosmology. This activity is necessarily international, no single university can cover the broad expertises. From this, the proposed program of the IRAP Ph.D., in one of the youngest and most dynamical French universities, pole of research and teaching in the Euro-Mediterranean region (PRES): the University of Nice. It benefits from the presence of the astrophysics research institute of Observatoire de la Côte d'Azur involved in relativistic and non-photonic astrophysics. The participation of the Freie Universitaet Berlin and of the Einstein Institute in Potsdam offers the possibility of teaching in relativistic field theories at the highest level. The University of Savoy offers the link to the particle physics at CERN. The activities at the University of Rome, at Stockholm University and at ICRANet offer teaching programs in all the fields of relativistic astrophysics, including cosmology, the physics of gravitational collapse, gamma-ray bursts, and black hole physics. Finally, the University of Ferrara will be present with lectures and researches in the topics they have pioneered such as x-ray astrophysics and observational cosmology. Through ICRANet the extra-European connections with Brazil, China and India will be guaranteed: in China, with the Shanghai Observatory of the Chinese Academy of Science, studying the formation and evolution of large-scale structure and galaxies; in India, with the Indian Centre for Space Physics (ICSP), renowned for its research on compact objects as well as on solar physics and astrochemistry; in Brazil, with ICRA-BR at CBPF, where a successful program of research and teaching in relativistic astrophysics has been established in recent years.

PART D: Technical Capacity

Consortium experience in the area of joint programmes and the specific study/research field of the project

- *Provide a list of projects/activities implemented by the consortium organisations in relation with the proposal (title, duration, funding programme, partners involved, etc.)*
- *Provide (in annex to the application) the CVs of the main actors (/team leaders) in the comsortium participating organisations*

Every institution participating the consortium is recognised as having given contributions in research as well as in teaching PhD programs. Particularly relevant has been the creation since 2002 of the IRAP PhD program which has been the first PhD jointly recognized by the presidents and by the rectors of the following six universities: ETH Zurich, Freie Universität Berlin, Università di Ferrara, Università di Roma "La Sapienza", Université de Nice Sophia Antipolis, Université de Savoie. 34 students coming from all over the world have already been enrolled, 29 with fellowship given by the participating universities. Since 2005 the creation of ICRANet, the first

international organization dedicated to the study of relativistic astrophysics, has fostered these activities. All the above organizations, with the only exception of ETH Zurich, are participating to the present proposal.

PART E: Implementation of the Joint Programme

Provide a detailed answer to each of the specific questions listed under annex 1 and corresponding to the following award criteria:

EMMC		**EMJD**	
A.1) Course content	*(25%)*	***B.1) Academic and research quality***	*(20%)*
A.2) Course integration	*(25%)*	***B.2) Partnership experience and composition***	*(20%)*
A.3) Course Management, visibility and sustainability measure	*(20%)*	***B.3) European integration and functioning of the programme***	*(20%)*
A.4) Students' services and Facilities	*(15%)*	***B.4) Provisions for EMJD candidates and fellowship holders***	*(20%)*
A.5) Quality Assurance and evaluation	*(15%)*	***B.5) Programme Management and Quality Assurance***	*(20%)*

Answers must be provided in a separated document, respecting the numbering of the questions and in 15 to 20 pages maximum (annexes not included)

Erasmus Mundus Joint Doctorate
PART E
Implementation of the Joint Programme EMJD

INTERNATIONAL RELATIVISTIC ASTROPHYSICS PHD

B.1 Academic and research quality (20% of the max. score) Under this criterion applicants should specify/describe/justify,

B.1.1 the needs analysis (including in socio-economic terms) of the joint programme taking into account the current state of the art in science and technology terms;

Why a Ph.D. program in relativistic astrophysics? The enormous conceptual revolution introduced by Albert Einstein with general relativity in 1916 was followed by meagre experimental verification and observational evidences extremely hard to be objectively assessed. In 1939 two extremely important contributions were made by Robert Oppenheimer and his students: the concept of massive neutron cores and the concept of continuous gravitational contraction following the process of gravitational collapse.
General relativity was also plagued by the enormous mathematical difficulty in solving the fundamental field equations. By 1955, the year of the death of Albert Einstein, only very few mathematicians were interested in general relativity and the physics community regarded with disdain all the attempts by Albert Einstein to unify the basic interactions.
Epochal changes start to occur with the discovery of quasars and especially by the discovery of an exact solution of the Einstein equations for a rotating object by Roy Kerr [Physical Review Letters, 11 (1963) 237]. Enormous momentum was gained by the discovery of the pulsar NP0532 in the Crab nebula, clearly pointing to the existence of the neutron stars postulated by Robert Oppenheimer and to the confirmation of the proposal by Baade and Zwicky [Physical Review, 46 (1934) 76] that both supernovae and cosmic rays originate from the process of collapse leading to the formation of a neutron star. Further momentum was gained by the work "Introducing the Black Hole" [Ruffini and Wheeler, Physics Today, January 1971, just reprinted in the April 2009 issue of Physics Today]. The introduction by Riccardo Giacconi of x-ray astronomy led to the discovery of a black hole in our galaxy [Riccardo Giacconi, Nobel lecture, 2002]. These events, and the discovery of gravitational waves by Joe Taylor in a binary pulsar, signed the clear becoming of maturity of the field of relativistic astrophysics: Einstein's theory, far from being a field of interest for a small number of mathematicians, had become the central theoretical framework for new chapters of astrophysics.
All these discoveries, with the sole exception of the introduction of Einstein's Theory in Germany, were actually achieved in the United States of America. Three of the participants to these discoveries are among the proponents of the present Ph.D. proposal: Riccardo Giacconi, Roy Kerr and Remo Ruffini. In the last 30 years, Europe has made enormous technological and instrumental progress with a very successful pan-European collaboration. The European Space Agency (ESA) has launched a total of 17 scientific satellites. This opens a new era for a continued story of Europe in space. The European Center for Nuclear Research (CERN) in Genève is leading the international scene of particle physics. The European Southern Observatory (ESO) has built the largest optical telescope in the world in Chile. These tremendous experimental and observational facilities give a new opportunity to approach some of the most profound issues in relativistic astrophysics. Such topics as the origin of the universe, the end of the life of the stars, a new understanding of the fundamental physical laws of the universe can now be addressed, but a new theoretical culture is needed. The new graduate students should master the mathematical aspects of the field theories. They should be at ease with the basic

understanding of the ultrarelativistic quantum phenomena. They should as well know the basic concepts of classical astronomy and astrophysics. In 2005 a new international organization dedicated to the theoretical aspects of relativistic astrophysics has been founded. Together with the University of Arizona, the University of Stanford and the International Centre for Relativistic Astrophysics (ICRA), the States of the Republic of Armenia, the Federal Republic of Brazil, the Republic of Italy and the Vatican are the founding members of ICRANet. As a first step of such an organization, the International Relativistic Astrophysics Ph.D. program has been established, founded by ETH Zurich, Freie Universität Berlin, Institut des Hautes Etudes Scientifiques, Observatoire de la Côte d'Azur, Università di Ferrara, Università di Roma "La Sapienza", Université de Nice Sophia Antipolis, Université de Savoie.
The present proposal is aimed at fostering this activity and extending this European collaboration to new European institutions such as the Albert Einstein Institute in Potsdam and Stockholm University and Tartu Observatory. In addition, it is planning to fortify the connections to three leading institutions in Brazil, China and India, who are collaborating successfully with ICRANet.

B.1.2 the objectives of the EMJD (including in terms of inter/multi-disciplinary, intersectorial and/or newly emerging fields);

The EMJD intend to create the condition of high level education in Astrophysics in Europe to create a new generation of leading scientists in Europe. No single university in Europe today has the expertise required by the formation of such a new generation of scientists by itself. For this reason we have identified universities which offers a very great complementarity and selected as coordinator one of the youngest and most dynamical French universities: the University of Nice Sophia Antipolis. The University of Rome participates as well, with its large faculty, operating in many of these fields of research with its great tradition since the days of Tullio Levi Civita in the Mathematics department and Enrico Fermi in the Physics Department. The University of Ferrara, one of the oldest universities in Italy, where Nicolaus Copernicus was a student, and also one of the most dynamical ones in recent achievements in x-ray astronomy, is also participating to this project. The University of Savoie, one of the newest universities created to keep contacts with the particle physics activities developed at CERN, also participates. The Freie Universitaet Berlin also participates, where new theoretical approaches have been applied, ranging from the study of particle physics to solid state physics to economics. Also participating is Stockholm University, where novel interests in general relativity and in relativistic phenomena of gamma-ray bursts are reaching new important results. To these academic institutions, three research institutions are added: the Albert Einstein Institute in Potsdam, where some of the most profound implications of symmetries of the Einstein field equations are explored, with the goal of reaching a new unification of physical interactions; the Observatorie de la Cote d'Azur, where many topics of classical astronomy as well as new astrophysical space missions and non-photonic astronomy are being developed; Tartu Observatory where Prof. Einasto and his group have lead the study of the large scale structures of the Universe and finally ICRANet in Pescara, where some of the new theoretical approach on quantum field theory and general relativity are being developed and confronted with experts worldwide in an intense series of meetings and scientific encounters. The Faculty, made by Professors of these institutions, is in charge to follow the students in their three year cycle doctorate.

Particularly important are the researches in our partner centers in Brazil, China and India, where emerging new field of researches are occurring and a great opportunity of exchange between local and European scientists is going to be created both in teaching and in research.
Each student admitted to the Ph.D. will be part of a team inside a laboratory of our organization. Each

year they will have the opportunity to visit the other laboratories of the consortium and to learn new languages.

B.1.3 the joint programme's contribution to European education, research, excellence and competitiveness and its added value compared with existing programmes at national and international level

The aim of our Ph.D. program is to bring in direct contact some of the leading scientists in the world working in general relativity and in quantum field theory with the students. In addition to the theoretical centers, we associate experimental and observational centers. This will give to the Ph.D. students a complete education in theoretical relativistic astrophysics and also an experience on how to manage a specific astrophysical mission. In this sense, just to mention a few:
Felix Aharonian, from the Max Planck Institute and ICRANet, will deliver lectures on high energy gamma-ray sources from the HESS telescope;
Vladimir Belinski will deliver lectures on the classical BKL approach to the cosmological singularity;
Sandip Chakrabarti from the Indian Center of Space Physics will report on his classical work on accretion on black holes and neutron stars, as well as on a totally new field of exobiology;
Pascal Chardonnet will give lectures on particle physics applied to astrophysics;
Thibault Damour, member of Academie des Sciences and permanent professor at Institut des Hautes Etudes Scientifiques at Bures sur Yvette, will give a series of lectures on general relativity and gravitational waves emission process;
Jaan Einasto, one of the founders of the study of the large scale structure of the universe, will introduce his recent understanding of the cellular structure of the universe;
Filippo Frontera, the principal investigator of the BeppoSAX satellite, the satellite who revolutionized the gamma ray bursts physics, will share his unique experience to our PhD students;
Riccardo Giacconi, Nobel laureate 2002, will deliver lectures on the future missions to study x-ray clusters;
Roy Kerr will deliver lectures on the mathematical structure which have led to the discovery of the Kerr solution; it is appropriate here to remember that, with more than 2 millions of citations in the citation index, Roy Kerr is one of the most quoted scientists in the world;
Hagen Kleinert will present his unified approach to relativistic field theory, spanning from astrophysics to solid state physics, particle physics and financial markets;
Hermann Nicolai will present some developments on the classical BKL model, and its generalization toward process of unification in physical theories;
Mario Novello will bring his experience in teaching cosmology;
José Pacheco will give lectures on extragalactic astrophysics;
Remo Ruffini will give lectures on black holes and fundamental physics.

In addition to that, the Observatorie de la Cote d'Azur, with two permanent scientists and more than one hundred engineers and technicians involved in astronomy, astrophysics and geophysics, will give to the students a great opportunity to be in touch with the very important missions of ESO such as VLT and VLTI, the geodesical laser ranging activity to the moon and satellites, the present and future ESA missions like CoRoT and GAIA. These projects cross-benefit from other research areas like plasma physics (MHD), leading edge R&D for top-level instrumentation (interferometry, space-time metrology, optics and laser technology among others) and basic research in applied mathematics, physics and signal processing. The Observatory is already collaborating with major European and other non-European organizations as, for instance ESA, ESO, NASA, Polar Institutes, EGU and has developed a long tradition of forming graduate young students from all continents.

Each annual batch of students are part of an academic year of our Ph.D. each cycle during 3 years. Every year, all the students of a batch will be grouped in some of the organization partners to follow the lectures mentioned above in period of one month each. These sessions are a unique occasion to create a spirit of school inside our Ph.D. even if our students will be all over the institutions for their respective research. In this way they are part of a group and the Organization coordinator is in charge of supervising all the mobility of professors and students. During these month sessions, each student will present his personal research to the faculty and to the other students of the group. This is also the occasion to discuss together to our organization and have the feedback of our students.

All these opportunities are clearly added values compared with existing programs at national and international levels.

B.1.4 the scientific quality of the education, training and research programme, including its originality and innovative aspects notably as regards research methodologies and approaches (incl. training activities in core and transferable skills, articulation between education / training activities and the research part, participation of industry/public sector, etc.);

To educate students in the techniques of research we do systematically train students in the nature and organization of scientific projects. The future scientists have to assume leadership role in new investigations in astronomy and astrophysics.
New ideas are the key to moving science forward. Productive astronomers have the ability to envision and recognize the best ideas and they effectively implement research strategies to tackle them. However, designing, managing, and bringing a scientific project to completion requires more than original scientific thinking. It also requires project management skills which are well understood but are not currently taught in PhD programs.
Some of our graduate students will become scientists working for businesses, government agencies. In all the real world setting, the project management and leadership stills are paramount. We intend also adopt a pragmatic approach on education and train astronomers and astrophysicists for a wide range of career paths.
We have the chance in our organization to have a leading observatory in Europe: Observatoire de la Cote d'Azur. This institution is in contact also with the European Southern Observatory where the biggest telescope (VLT) and projects in astronomy (ALMA) are built. They have a great experience in managing projects. We want to develop competence in leadership and project management through one month stage of our PhD student in Observatoire de la Cote d'Azur (see annexe 4).
The Observatory will actively contribute to different areas of the EMJD training courses in the following areas: planetary science, including extra-solar planets, extragalactic astronomy and data analysis related to observational astrophysics. In addition an important number of senior scientists are willing to supervise or co-supervise Ph.D. level young scientists with the perspective to develop new international collaborative projects both in observational and theoretical fields. Indeed the institute will offer its major facilities (instruments, computing clusters, etc..) to support such educational and research programs. The Observatory has also a regional well established tradition of collaboration with local industries Thalès Alenia Space Cannes, SESO among others.
Every scientist who has undertaken a sponsored research project has experienced administrative and leadership tasks, such as planning budgeting, fundraising, distributing tasks, motivating and coordinating staff, and writing reports. This session at the Observatory could be the occasion for the student to approach: project management (experimental and theoretical), proposal writing as an example of project and presentation skills as an example of winning support for an idea.

See Annexe 3 and 4

B.1.5 the extent to which the programme includes inter-sector and inter-organisation collaboration and mobility (such as placements) to better address societal and economical needs and the graduates' employability issue;

In add to the theoretical formation, we need to take account in our PhD formation that the careers of scientists have changed. There is not only academia. Many of the future European space program will be collaboration with different partners and the size will be ever more demanding. We will prepare the future scientists in Europe to this reality.

B.1.6 the nature and quality of the expected innovative educational, scientific and technological outcomes, including in terms of skills and competences acquired;
included in our organization institutions partners of these emergent countries.

By this innovative education proposal of the EMJD we expect the students to reach an unprecedented maturity: they will be exposed to some of the most outstanding teachers at international level; they will reach scientific competence in a variety of fields, all necessary in order to become autonomous in their scientific judgment; they will be acquainted with the most advanced technological developments; at the same time they will have a vast knowledge through their mobility program within other European institutions; finally they will be introduced to three of the most prestigious and advanced centers of researches in the fast moving developing world in Brazil, China and India.

B.2 Partnership experience and composition (20% of the max. score) Under this criterion applicants should specify/describe/justify,

B.2.1 the partners' (understood as both the institutions and the key academic, research and administrative staff) recognised capacity, expertise and experience to achieve the EMJD objectives;

All the institutions in the proposed EMJD have a great experience in international collaboration both with visiting professors, post-doctoral researchers and training Ph.D. students. All of our Partners have enrolled Ph.D. students inside their laboratories in various aspects of astrophysics. In addition, all the previous members of the IRAP-PhD program have successfully enrolled 34 graduate students over a period of 7 years, and they have delivered to them a common Ph.D. degree recognized by all the rectors or presidents of the participating universities.
The European universities of Berlin, Ferrara, Roma, Nice, Savoie and Stockholm have also the needed structures to organize courses at Ph.D. level through numerous qualified professors. In addition the non European partners will give expertises in their topics and could host Ph.D. students through mobility.
The High Energy Astrophysical Group of Ferrara University, developing Beppo-SAX satellite, have obtained the Bruno Rossi Prize in 1998 of the American Astronomical Society and the Descartes Prize of European Committee in 2002 for their contribution in solving a mystery of gamma ray bursts.
Nice is the coordinating organization and we will use the "savoir faire" of the "Ecole Doctorale" in term of logistic and administrative experience on the management of Ph.D. students. We will enroll a secretary in charge of following all the activity of the Eramus Mundus in Relativistic Astrophysics. She/He will be based in an office of Ecole Doctorale of Nice University. On this way, the secretary could benefit of the experience of all the others collaborators of this School to administer our Ph.D. students. She/He will in charge of following the administrative activities of our Erasmus Mundus in collaboration with all the services of Nice University. It is appropriate to mention that the Municipality of Nice has recently granted to ICRANet for 30 years the use of the prestigious Villa Ratti as a seat for its activities in Nice, a few hundred meters away from the University. Villa Ratti, as soon as it will be restored, will be the main location of coordination for the entire EMJD program (see annexe 8).

B.2.2 the diversity (in terms of countries / regions, types of organisation, etc.) and complementarity (in terms of education, training, research or dissemination/valorisation activities) of the consortium
members;

The Ph.D. students will have the great opportunity to use the different geographical locations of the participating institutions, ranging from the Southern Europe (Italy) all the way to the Northern countries (Sweden, Estonia), with the participation of leading institutions in France and Germany. They will have also the possibility to interface in these Countries with academic institutions such as the universities of Berlin, Ferrara, Nice, Rome, Savoie and Stockholm, and with research institutions such as the Albert Einstein Institute in Potsdam, the Nice Observatory, the Tartu Observatory, and ICRANet. The complementarity of these two participating groups is also represented by the "bridges" created by the cooperation agreements already signed between the parts. As an example, we enclose the agreement signed between ICRANet and the Physics Department of the University of Rome and the one signed between ICRANet and the University of Nice (see annexe 9). These agreements, already implemented, are essential in creating opportunities for scientists of the research institutes to give

lectures in the universities within the Ph.D. program, and vice versa for the faculty of the universities to have a sabbatical leave for research in the research institutions.
The partner "Observatoire de la Cote d'Azur" has indeed such an agreement with the University of Nice, and it will provide lectures on Planetology, Extragalactic Astronomy and Data Analysis during the first year of our Ph.D. program. These courses will be organized one month in Nice Observatory. Analogous programs of one month length will be organized for the first year students at the University of Rome, with lectures on relativistic astrophysics, and for an additional month at the University of Berlin on quantum field theory and cosmology. In addition, weekly training in local language will be done in each institutions.
The second year students will receive training on project management and courses both at the Nice Observatory and at the University of Ferrara on Planetology. The Physics Department of Ferrara University has a long experience in X and gamma ray observations. Prof. Filippo Frontera who was the PI of BeppoSAX will propose theoretical studies of compact sources and GRBs, as well as a direct contact with experimental research activities in space missions.
Students will have also the opportunity, in the second year, to spend one month in Stockholm University for lectures on general relativity and gravitational collapse. Particularly important are going to be the lectures in local languages and the weekly courses during all the three years. The official language of the present EMJD program is English, but the acquisition of at least one additional European language (French, Germany, Italian, or Swedish) is highly recommended.
Particularly noteworthy are the dissemination/valorization activities of the consortium, especially in Brazil, China and India. Particularly important are, in this respect, the encouraged publications on international refereed journals of research papers by the students and the active participation and presentation of work in all the major international meetings in Europe, Americas, and Asia.

B.2.3 the partnership track records in terms of networking and cooperation activities (through their joint involvement in EU/International research and/or education projects); if relevant, the added value of third-country organisations to the EMJD objectives and content;

There is a long tradition in astronomy of International collaboration all around the world. Our Ph.D. student will strongly participate of this reality. We have chosen three third-countries in our program. They represent the emergent countries with a great potential of development in science. Our attention toward these activities is well represented by the activities organized by ICRANet with the participation of students and faculty of the IRAP-PhD in 2009. Such activities will be fostered within the EMJD program in the future. We just mention the Second Kolkata conference on observational evidence for black holes in the universe (10-15 February 2008) and the Satellite meeting on black holes, neutron stars and gamma-ray bursts (16-17 February 2008) organized by our Indian partner in the present EMJD program ICSP (see annexe 10). The proceedings have just been published by the American Institute of Physics in the volume 1053 of the AIP Conference Proceedings Series. With Brazil, we recall the very successful activities organizing every two years the Brazilian School on Cosmology and Gravitation together with our Brazilian partner in the present EMJD program ICRA-BR, whose proceedings have been published by the American Institute of Physics in volumes 910 and 782 of the AIP Conference Proceedings Series (see annexe 11). Particularly relevant in this year of astronomy 2009, the celebration organized by ICRANet, an official institutional member of the celebration organized by Unesco and United Nation, of the 90th anniversary of the light deflection by the gravitational field of the Sun made in Sobral. This international conference will take place from the 26rd to the 29th of May (see annexe 12). We mention again for the year of astronomy 2009 the first international Xu Guangqi – Galileo meeting in Shanghai from 26th to 30th October 2009, co-organized by ICRANet and our Chinese partner in present EMJD program (see annexe 13). We finally mention also the first opening to the Austral-Asia scientific community with the meeting organized in Christchurch, New Zealand, from 16th to 18th December 2009.

B.2.4 the extent to which the partner teams demonstrate a high level of internationalisation (international staff, international activities, etc.);

A great attention to international collaboration is well rooted in our program. We promote sabbatical leaves of scientists from the Americas and Asian countries at ICRANet. Currently, graduate students from Belarus, Brazil, China are participating to our IRAP-PhD program. Among the many organized international meetings, there are the Italo-Korean meetings, organized every two years alternatively in Italy and in Korea, the Italo-Chinese meetings, held yearly at ICRANet, and the Stueckelberg meetings on the fundamental aspects of field theory, also held yearly at ICRANet. Particularly, we recall the major event which has been started 30 years ago by Abdus Salam and Remo Ruffini, the Marcel Grossman meetings on relativistic astrophysics, which have characterized the birth and followed the developments of relativistic astrophysics. These meetings occurs every three years and they have been held in Australia, Brazil, China, Israel, Italy, Japan, United States, and in this year 2009, in celebration of the International year of astronomy, in Paris in June (see annexe 14).

B.2.5 the role and appropriateness of the professional (/economic/scientific/cultural) sector participation in terms of activities and responsibilities, and the way this participation is formalised in specific arrangements and agreements covering issues such as co-funding, co-supervision, intellectual property rights, publishing possibilities, quality assurance, etc.

In astrophysical research there is a natural link between industry and research. The University of Ferrara has been a strong partner with industries in the aerospace sector, and so has been the Observatoire de la Cote d'Azur with a long tradition of collaboration with industries such as Aerospatiale and Thales. Similar activities have been promoted by the Tartu Observatory. All these experiences will be transmitted to our students.
In addition, we recall the agreements between CNRS and industrial partner to finance grant for Ph.D. student on specific research in developing prototype. We will also encourage some Ph.D. students to obtain a job in industry, related to the development done during their Ph.D. theses. This will be a powerful instrument, not only to have optimal economical reward but also to reinforce a virtuous contact between the world of research and the industrial reality. We would like also to mention a different aspect which is crucial. At ICRANet, electronic editing coupled with some of the leading publishing companies has been established. The students will participate to this activity and, again, be encouraged to have position in this very crucial field of "virtuous" collaboration with the industrial world in the publishing arena. All this is of course crucial not only for the scientific and economic aspects, but also for the broader cultural activities. It is important to stress, especially, in this respect the Marcel Grossman meeting in Paris, which will be held under the official heading of Unesco. Major publishing company have asked to be present and to put their stands at this event, which will become an emblem as well for our present EMJD program.
We will propose to have three members of our Quality Board designated by CERN, ESA and ESO.

B.3 European integration and functioning of the programme (20% of the max. score) Under this criterion applicants should specify/describe/justify,

B.3.1 the extent to which the EMJD programme is organised in a structured and integrated way ; exploiting current good-practices in terms of doctoral/ graduate/research schools or co-tutelle arrangements; providing a strong research environment capable to enhance excellence and international collaboration; ensuring full recognition - through ECTS or other built-in mechanisms - for all the training and research activities performed by the candidates;

Our proposition of EMJD programme is based on the 7 years experience of working together on a PhD programme in Relativistic Astrophysics. Our experience started with a common international agreement (see annexe 7) between Institutions. This agreement establish the role of the Faculty, a group of professor and senior researcher of all the Institution. This Faculty is the analogous of the French term "Ecole Doctorale". In the present application we propose to generalize this Faculty to all the partners of our Organization. This structure in term of Faculty is adapted to the diversity in terms of regions and institution types (both universities and research centers).
The Faculty is in charged of recruitment, selection criteria and supervision of all the Ph.D. students. Each student has, in addition of her/his Ph.D. director, a member of the Faculty which correspond to her/his tutor. The Faculty defines the courses of each year to be followed by the students. We have established a code for the Ph.D. student, which generalized the French "Chartre des theses" including all the duty and the law of the student. The Faculty organized meeting twice a year in the Coordinating Organization, first in order to select the Ph.D. student and second to follow the development of research of each student (see the rules of the IRAP PhD in the annexe 3).

Each year the students must follow training and learning activities for three months. These activities are developed in the annexe 4. In addition, in each place where the students are they follow local language lessons. We thought that for their future career it is important to give a solid background to our Ph.D. students in addition to their Ph.D. diploma. This is the reason why the third year is totally dedicated to the preparation of the thesis in the laboratories and in the universities in contact with major technological, scientific, editorial, processes. Only when all these procedures will be accomplished, the students will be able to submit the final discussion of the thesis.

B.3.2 the relevance and appropriate organisation of the mandatory mobility periods of the candidates in the participating institutions;

Clearly the mobility periods are of crucial relevance in our program: three months in the first year and three months in the second year. Equally important are the efforts to make all Ph.D. students fluent in English (mandatory) and in one additional European language. Each Ph.D: student will follow language courses every week. There is a well established procedure for this in all the participating institutions. For Italian at the universities of Ferrara and Rome, for French at the universities of Nice and Savoie, for Germany at the university of Berlin and we understand the same program is being started for us for Swedish a Stockholm university. Of course, this will be in parallel to the scientific activities which have been highlighted in the lectures proposed.

The last Ph.D. year will be also the occasion to chose a lab inside our network to spend one month without the supervisor. This will give to the student the occasion to present her/his results to other people and to finish the writing of her/his Ph.D. thesis in a different environment.
In addition to all this, every year the Faculty will have the opportunity to participate to the yearly meeting of the ICRANet scientific committee, actually chaired by Riccardo Giacconi (Nobel laureate 2002). This will give the opportunity to each student to outline her/his research activities and the progresses toward obtaining the final Ph.D. degree.

B.3.3 the common standards and mechanisms developed by the consortium for the application, selection, admission and examination of doctoral candidates (European and Third-Country), in order to ensure recruiting the best candidates; the extent to which these mechanisms are transparent, fair and objective; the provisions to take into account the equity issues, exploring alternative ways of recruitment and considering the LLL requirements;

Our experience of IRAP-PhD program tells us that we must rely on external advise and on reference letters by distinguished scientists who have been in contact with the candidate. In the case of IRAP-PhD program we have organized the selection as follow. Each year we have prepare a poster distributed in 2500 copies all over the world through universities and research centers. Associated with this call, we prepare an internet site: http://www.icra.it/IRAPPhD/2008/Welcome.htm. All information about our doctorate is presented including application and fellowship. The candidate fill in an application form online and requests the recommendation letters of at least two eminent scientists acquainted with her/his work.
At the end of the call, we send all the application form to the faculty members and then we start the selection by discussion via email. After a first selection made on basic criteria related to the relevance of the curriculum, we fix a date for a meeting of the faculty, where all the candidatures will be discussed. In addition to the examination of the reference letters, we proceed to have additional opinions by e-mails and by phone from eminent scientists. In necessary, in some cases we invite the candidate to give a seminar in one of the participating institutions or, alternatively, to participate to one of the international meetings we organize, for a direct interview. The final decision is taken by the Faculty. There is also the possibility to admit some students without fellowship, if the presence of satisfactory external financial resources is verified.
In this spirit, we will use our past experience. In add of this method, we have prepare a document in order to select candidates. This document is in annexe 1. This application form will be available for download on the internet site we will prepare. Among the requirements, there is a good level in English. These criteria are written in our application form.

B.3.4 the quality of the joint mechanisms envisaged to ensure a high quality supervision and monitoring of the candidate activities;

In supplement of the application form for the PhD, we have prepare a "Charter of Thesis" which is kind of student code of duties and rights. This document, once the student will be enrolled, must be signed by himself and his supervisor. In add of his supervisor, each student has a tutor inside the Faculty. In this sense, if the student have some difficulty with his supervisor, he could discuss them with the tutor.
Each year, all the students will present their research to the faculty, which will verify as well the satisfactory accomplishment of following the mandatory courses. The Faculty will recommend the continuation of the Ph.D. activities or, if necessary, the deepening of special scientific topics of learning.

B.3.5 the appropriateness of the joint assessment procedures (including the exams for the taught part and the assessment and defence of the thesis) to ensure the highest quality of the outcomes; if relevant, the extent to which assessment committees include external representation chosen at international level and/or non academic experts; the extent to which assessment criteria include compulsory publication requirements and/or an evaluation of the potential contribution of the candidate's work to innovation.

Our aim is to contribute to the excellence in Europe in Astrophysical Research and Education. Each of our students should be familiar with the fundamentals of mathematical physics, theoretical physics, as well as astrophysics. This is why we have prepared this seminar week to be sure that every Ph.D. cycle will be able to deal with all aspects of theoretical astrophysics without hesitation. In addition to the teaching and learning procedures, it will be held a weekly seminar, electronically broadcasted among the participating institutions of the EMJD program. Such seminars can be delivered by students, to verify their ability to approach a wide class of astrophysical problems without hesitations. This correspond to an ongoing procedure to verify the thought part of the learning procedure.
For the final exam, the Ph.D. thesis defense is held in the host institution. The examination committee for each student is formed by the tutor, four professors of the Member institutions and an expert from a university or research center from a country different from the one of the host institution. The examination committee is appointed by the Faculty. The judgment of the examination committee is transmitted to the rector, the president or the director of the host institution. In case of positive judgment, the candidate receives the Ph.D. degree from all the Member institutions.

B.3.6 the kind and nature of the degree(s) awarded and and, if applicable, the measure taken or envisaged by the consortium to deliver a fully accredited and recognised joint degree;

Our IRAP-PhD program has a joint Ph.D. diploma. We expect also in the present EMJD the Stockholm University to join and sign such an agreement. Therefore we are planning for a joint Ph.D. diploma

B.4 Provisions for EMJD candidates and fellowship holders (20% of the max. score) Under this criterion applicants should specify/describe/justify,

B.4.1 the information and promotion strategy envisaged by the consortium to reach out potentially interested candidates and more particularly from third-countries;

We shall follow for information and promotion strategy the well verified and successful procedure adopted for the IRAP-PhD already mentioned above. This will include electronic mailing announcements to organizations usually addressing this problem in relativity, in the astroparticle physics and in the astrophysics community. In addition, we will send worldwide 2500 copies of our posters. This will include, in addition to the scientific and university communities, also the Consulates of the European countries all over the world. Of course, one of the major and most successful approach to contact young candidates, is to invite their participation to scientific events organized by all the Member institutions. We will make sure that, in each one these event, the EMJD program will be well advertised and present

B.4.2 the quality and nature of the services provided by the consortium to host doctoral candidates (housing facilities, coaching, language courses, activities aiming at social integration, assistance with visas and social insurance); the extent to which specific services are available for grantees with a family or with special needs

We have analyzed in which why the social insurance could be better for the all the student of our Ph.D.. The best way is to make an administrative registration of all of them in Nice University coordinator partner. In such a way, the student of our program of any nationality could be part of French "securite sociale" for 205 euro per year. With this he will acquire a European social security card. We have study in detail the way to have a better insurance. It exists two pack for students under 28. The European pack with a prize of 207 euros per year covers them all over in Europe. The world pack is the complementary for the rest of the world and it cost 400 euros.
The Universities of our network will provide house facilities for their Erasmus Mundus Ph.D. students. During mobility of the Ph.D. students, the lodging will be provide by the institutions in charge of the courses. The travel expenses of the mobility period is also take account as presented in the annexe 6. This is part of our expenses for the program.
The language courses are also paid, where needed, by the network for each students as well as specialty and professional courses.
Since the Ph.D. student will be enrolled under 3 years contracts, we will need scientific visa. The secretary in Nice in charge of our program will provide the help in following the administrative procedure with the candidates and with the French Consulates in the world. She could also use the experience on this point from the Ecole Doctorale and Service des Relations Internationales..

B.4.3 the way the linguistic aspects of candidates' mobility have been addressed (e.g. training facilities, mentorship, local language learning, etc.) and the specific language policy in place in the joint programme (e.g. integration, availability, costs coverage, recognition of the language courses in the joint programme); the way the consortium intends to meet the objective to offer candidates the possibility to use at least two different European language

Each student will be required to be fluent in English, since this is the official language of our doctorate. Where necessary, specific courses will be organized with high priority. In addition, in each institution where the Ph.D. thesis is prepared, the students will follow local language lessons. At the completion of her/his Ph.D. program, each student must be fluent in an European language in addition to English.

B.4.4 the extent to which administrative arrangements are foreseen to address the candidates' rights (including health care, social security and pension rights) and the extent to which employment contracts are used to appoint the candidates;

The student will benefit of a contract with the university of Nice for a period of 3 years. This contract will detail the social security and pension rights.

B.4.5 the relevance of the measures taken to deliver the fellowship scheme, and in particular for the distribution of grantees between institutions and the financial management of fellowships;

For the financial balance, we have prepare a table in order to precise the charge related to the mobility, the courses and the local expense of the institutions.

B.4.6 the measures taken by the consortium to ensure the candidate's career prospects and to monitor his/her career development once graduated;

The future career of the Ph.D. students is part of our engagement. In fact in the Charter of Thesis we have a part related to the post-thesis period where we will follow his activities and help him through associations like Bernard Gregory.
In addition the University organizes every year a special week in order to discover the industry. We will associate our PhD students to these activities.
The continuous contacts between our former IRAP-PhD and the graduate school has been well established and successful. Former students are invited to give lectures during the following years of their graduation in our weekly seminars, in order to make the students and the Faculty acquainted with their successful path in science, or in the industrial world, or in the publishing activities. These experiences have been extremely important for the morale of the students and for the Faculty. We plan to continue them in the EMJD program.

B.4.7 the nature and comprehensiveness of the Doctoral Candidate Agreement defining the joint course implementation rules and mechanisms as well as the mutual rights, obligations and responsibilities of the two parties for what concerns the academic, research, administrative and financial aspects of the candidate's participation in the joint programme; the extent to which the consortium adheres to and implements the European Charter for Researchers and the Code of Good Conduct for the Recruitment of Researchers;

For this part we have the Charter of Thesis which precise the mutual rights and obligations. It is in annexe 3. It is a document signed by the student and by his supervisor.

B.5 Programme Management and Quality Assurance (20% of the max. score)
Under this criterion applicants should specify/describe/justify,

B.5.1 the quality of the organisational arrangements and cooperation mechanisms within the consortium (degree of institutionalisation, financial and human resources allocated to the programme, existence of management and supervision board, clearly defined and active role of all partners, established feed-back system, existence of detailed partnership agreements covering the academic, scientific and administrative aspects of the Programme, etc.) and the specific role played by each of its members.

For the reasons already mentioned, we have centered our Ph.D. program at the University of Nice. The central location, the excellent transportation facilities, including an international airport, the electronic communication backbones, the attention of the Municipality and all local Institutions to these activities are reasons to be confident in a successful outcome. The main supporting structure for the previous Ph.D. program, the IRAP-PhD, has been ICRANet, which is linked to the University of Nice by an already mentioned cooperation agreement. ICRANet, as well as all the previous IRAP-PhD partners are all participating in the EMJD program. These institutions will participate actively with financial and human resources also by providing a full time secretary detached in Nice for this EMJD. She/He will be in contact with the staff of the other organizations and her/his role will be to synchronize the cooperation around our EMJD within the framework of each administrative constrains of the partner organizations. She/He will be using all the experience of the services of Nice University such as Relations Internationales, Agent Comptable, Ecole Doctorale acting for the benefit of the EMJD program. The other partner institutions will naturally collaborate with the secretary. One of the first missions of the Faculty, before the selection of the candidates, will be to organize such a local cooperation with the EMJD, in order to have a harmoniously collaboration between countries of different administrative rules and the local structure at the University of Nice. This process is essential in order to work with efficiency and maximizing positively all the national and international connections.
In summary, our administrative structure is centered around an administrative manager in Nice which is in direct collaboration with other secretarial and administrative branches in Nice as well as in each participating institution. The Faculty, which has already a long experience of positive collaboration together within the IRAP-PhD, will be certainly able to fulfill this task.

B.5.2 The way participations costs in the joint programme have been calculated; if differences exist between Third-Country and European candidates, the reasons for such differences; in which way will these costs will be distributed among the participating institutions;

Astrophysics is an observational science and so we have naturally a laboratory based EMJD. We don't want to have segregation between students and so will propose a unique participation coast of 600 euro per month. This money will the consortium to prepare the mobility periods and the high level formation as explained in annexes 4,5 and 6.

B.5.3 the consortium development and sustainability plan designed to ensure the proper implementation and continuity of the joint programme beyond Community funding (including implementation timeline, enrolment projections, mid and long term potential benefits for the institutions involved, etc.); the way this plan involves not only the consortium members but also other public and/or private organisations in the countries concerned (and in particular associated members);

As already mentioned, our IRAP-PhD program has been operative since 2002, and it has seen the participation of 8 new graduate students registering every year and reaching a joint degree. The aim now is threefold:
1) to keep this program going, enlarging its participation to the new entrance of the Albert Einstein Institute in Postdam and of the Stockholm University;
2) to double in three years the number of students, thanks to the EMJD program;
3) the expand our activities both toward other European countries and toward our partners in Brazil, China, India.
If this program will be successful, we are confident that a new standard of young scientists will be created and will be strongly requested for future works in European institutions as well as in the partner institutions abroad. We are thinking to create a precious "scientific reservoir" of high level young scientists which will have a tremendous impact in the further developments of scientific and industrial activities in Europe but will be especially meaningful also in the three extra European countries participating with us. Prof. Chakrabarti in his form, stresses the crucial role his Center may play in the scientific development in South-East Asia countries. Prof. Jing Yipeng well represent a successful story of our many activities in China. With a scientific base developed in Italy, he has created the most successful activity on relativistic astrophysics in China. Finally, the recent entrance of Brazil into ICRANet gives the great opportunity to new agreements of ICRANet with local Governments and scientific institutions in Brazil to open three additional Centers devote to relativistic astrophysics in addition to the one in Rio.
For all this, the role of EMJD at this moment is crucial and essential. If this possibility will be granted, scientific activities with a new imprint of European activities will be known internationally, fostering very successful and similar positive examples in the past history of science.

B.5.4 the nature of the internal evaluation (by the institutions themselves, through candidates/ scholars feed-back systems, etc.) and external quality assessment (by e.g. national, international or professional bodies) envisaged;

We think to implement the internal evaluation and external quality assessment by co-opting three experts from Europe, one from ESA, one from ESO and one from CERN. Three additional experts will be co-opted from the third countries partner in our EMJD program. We also plan to have consistent and monitoring support from the scientific and visitor committees of the four research institutions which are partner in the present proposal: the Albert Einstein Institute in Potsdam, ICRANet, the Observatoire de la Cote d'Azur and the Tartu Observatory.

B.5.5 the extent to which complementary funding possibilities have been explored and secured, in particular to provide additional (full or partial) fellowships to doctoral additional candidates and, if applicable, to top up the difference between the fixed programme contribution to the candidates participation costs and the actual cost for the consortium

All the institutions already participating in the IRAP-PhD will secure the funding of the fellowships of their program joining the ones guaranteed by the possible funding of the EMJD program. In such a merging, we are sure to reach the goal we have established in the previous point and so reaching the long term potential benefit for all the involved institutions.

B.5.6 the way the consortium intends to address issues such as gender balance and the access to the programme by candidates with special needs.

We have long experience in this respect. The IRAP-PhD has seen the participation of an equal number of male and female students, with two of the women coming from Lebanon and Pakistan. In addition, one of the success story of the ICRANet activities in Rome has been the one to guarantee the teaching and research activities of a visually impaired theoretical physicists who has been successful in advising a large number of students in the IRAP-PhD program.

PART F: Degree(s) awarded

The joint programme will result in the award of **a joint degree**

To be filled in for each degree awarding organisation

Name of the degree awarding organisation	Official name of the degree in national language (and in English)	Type	Recognition status[1]	
		❒ Part of double degrees ❒ Part of multiple degrees ❒ Joint degree	Already recognised?	Expected recognition date **OR** validity end date (/ next review date)
University of Nice Sophia Antipolis	Docteur de Recherche en Astrophysique Relativiste (PhD in Relativistic Astrophysical)	a joint degree	**No**	2010
University of Savoie	Docteur de Recherche en Physique Theorique (PhD in Theoretical Physics)	a joint degree	**No**	2010
University of Roma La Sapienza	Dottore di Ricerca in Astrofisica Relativistica (PhD in Relativistic Astrophysics)	a joint degree	**No**	2010
University of Ferrara	Dottore di Ricerca in Fisica (PhD in Physics)	a joint degree	**No**	2010
University of Stockholm	Filosofie doktorsexamen (Doctor of Philosophy Degree)	a joint degree	**No**	2010
Freie University of Berlin	Doktor rer.nat. (PhD in Natural Things)	a joint degree	**No**	2010

[1] In cases of doubt, the diploma status will have to be confirmed by the Erasmus Mundus National Structure or by the competent authorities of the country concerned

Check list and Declaration of Honour by legal representative of applicant organisation

To be completed by the person legally authorised to sign on behalf of the applicant organisation, as defined in Part A.2 of the application form.

he application is completed in full. All questions have been answered.	☐
ach page has been numbered.	☐
he application has been typewritten or word–processed.	☐
opies of letters from the appropriate authorities of each institution participating in the Masters Course and Joint rogramme, confirming their agreement with the application as submitted are attached.	☐
he original application has been signed by the legal representative of the co-ordinating institution and stamped. (Please ote that scanned coloured copy of the signed application is not accepted as original)	☐
he original application and 2 copies thereof are being sent to the address indicated on page 1 of the application form y express mail, in the same envelope and before the closing date.	☐
he original application is being sent to the e-mail address indicated on page 1 of the application form by e-mail.	☐
aper and electronic copies of this application are being sent to the National Structures in the countries of each of the uropean participating institutions before the closing date.	☐

I the undersigned, certify that all information contained in the Erasmus Mundus 2009-2013 Action - Joint programme application named roject title" International Relativistic Astrophysics Doctorate Program , including the description of the project, is correct to the best of y knowledge and that I am aware of the content of the annexes to the application form.

confirm that my institution/organisation has the financial and operational capacity to carry out the proposed project.

ake note that under the provisions of the Financial Regulation applicable to the general budget of the European Communities, grants([2]) ay not be awarded to applicants who are in any of the following situations:

are bankrupt or being wound up, are having their affairs administered by the courts, have entered into an arrangement with creditors, ave suspended business activities, are the subject of proceedings concerning those matters, or are in any analogous situation arising om a similar procedure provided for in national legislation or regulations;

have been convicted of an offence concerning their professional conduct by a judgment which has the force of *res judicata*;

have been guilty of grave professional misconduct proven by any means which the contracting authority can justify;

have not fulfilled obligations relating to the payment of social security contributions or the payment of taxes in accordance with the gal provisions of the country in which they are established or with those of the country of the contracting authority or those of the ountry where the contract is to be performed;

have been the subject of a judgment which has the force of *res judicata* for fraud, corruption, involvement in a criminal organisation any other illegal activity detrimental to the Communities' financial interests;

following another procurement procedure or grant award procedure financed by the Community budget, have been declared to be in erious breach of contract for failure to comply with their contractual obligations;

in their grant application, are subject to a conflict of interest;

in their grant application, are guilty of misrepresentation in supplying the information required by the contracting authority as a ndition of participation in the grant award procedure, or fail to supply this information.

confirm that neither I nor the institution for which I am acting as legal representative are in any of the situations described above, and at I am aware that the penalties set out in the Financial Regulation may be applied in the case of a false declaration.

the event that my application is successful, I am aware that the Education, Audiovisual and Culture Executive Agency / European ommission will publish on its website or in any other appropriate medium the name and address of the beneficiary of the grant, the bject of the project, the future grant awards;

leclare that the organisation I represent is (please tick as appropriate):

☐ a public body ([3])

☐ a private body which has financial and operational capacity to carry out the proposed action or work programme and is able to *provide a Bank Guarantee for the amount of the 1st (and 2nd, if applicable) pre-financing payment(s), should the Education,* Audiovisual and Culture Executive Agency request so.

signing this application form, I accept all the conditions set out in the Erasmus Mundus 2009-2013 Programme Guide and the Call for oposals EAC/04/2009, including the general conditions published on the Education, Audiovisual and Culture Executive Agency's bsite. I also declare that all the partners participating in this project have agreed with the content of the application and have confirmed eir intention to carry out the tasks described accordingly.

one at: Président de l'Université

ignature: Nice-Sophia Antipolis

Date 29 / 04 / 2009 (day/month/year)

Stamp of the applicant organisation

ame and position in capitals:

Albert MAROUANI

UNIVERSITE DE NICE - SOPHIA ANTIPOLIS

1.1.1936

Council Regulation (EC, Euratom) No 1605/2002 (OJ L 248 of 16.09.2002), amended by Regulations (EC, Euratom) No 1995/2006 (OJ L 390 of 30.12.2006) and (EC) No 1525/2007 (OJ L 343 of 27.12.2007). These can be consulted in the Official Journal online at: http://europa.eu.int/eur-lex/lex/en/index.htm.

For the Erasmus Mundus Programme, considered to be public bodies are all higher education institutions specified by Member States (participating countries), and all institutions or organisations which have received over 50 % of their annual revenues from public sources over the last two years, or which are controlled by public bodies or their representatives.

Freie Universität Berlin

Der Kanzler

Freie Universität Berlin, - Der Kanzler -
Kaiserswerther Str. 16-18, 14195 Berlin

Kaiserswerther Str. 16-18
14195 Berlin
Germany

Telefon: +49 30 838-53443
Fax: +49 30 838-53448
E-Mail: Claudia.Christmann@fu-berlin.de
Internet: www.fu-berlin.de

Bearb.-Zeichen: VI C DMV 7
Bearbeiter: Ms. Christmann

27. April 2009

To whom it may concern,

The Physics Department of the Freie Universitaet Berlin will actively participate in the European Programme Erasmus Mundus Joint Doctorate (EMJD) in Relativistic Astrophysics as a European Institution Partner.

The research and education required by the joint programme will be carried out within the Doctorate Program in Physics led by Prof. Dr. Dr. h.c. mult. Hagen Kleinert. The research activity of the Doctorate students of this program will be carried out in the Physics Department. The Freie Universitaet Berlin welcomes this initiative which will link its Physics Department to a large number of prestigous international research centers.

For the institution (applicant legal entity)

FREIE UNIVERSITÄT BERLIN
DAS PRÄSIDIUM
Abt.: VI – Drittmittelverwaltung DMV
Kaiserswerther Str. 16-18, 14195 Berlin
Dienstgebäude: Rudeloffweg 25-27

Peter Lange
Director of Administration and Finance
Email: Claudia.christmann@fu-berlin.de

PART A: Identification of the applicant and other participating organisations

Parts A and B must be filled in separately for each organisation involved in the project (including associated members). **The application must be accompanied by copies of letters from the legal authority of each participating organisation** confirming their support to the joint programme and their agreement with the submitted application (*not necessary for associated members*)

A. 1 ORGANISATION

Role in the consortium *(leave the relevant role only)*	~~Applicant / Coordinating Organisation~~ Partner Organisation ~~Associated member~~			
Official name of the organisation:	**Freie Universität Berlin**			
Acronym:	FUB			
N° of the Erasmus University Charter (if applicable), for European Higher Education Institutions only	28233-IC-1-2002-1-FR Erasmus-EUC-1			
Department, if applicable:	Institut für Theoretische Physik			
Official Address	Arnimallee 14			
Postal Code:	14195	Town:	Berlin	
Region:		Country:	Germany	
Internet address:	http://www.physik.fu-berlin.de			
Telephone 1:		Telephone 2:		Fax

A.2. LEGAL REPRESENTATIVE

Name of the person entitled to legally commit the organisation (for the coordinating organisation only)

Last Name:	*Mr, Ms*	Lenzen	First Name:	Dieter
Function:	PRESIDENT			
Address (*Only if different from official address above)*:				

A.3. CONTACT PERSON / COORDINATOR

(responsable for the management of the project in the organisation)

Last Name:	*Mr, Ms*	Kleinert	Hagen First Name:	
Function:	Professor of Theoretical Physics			
@ : kleinert@physik.fu-berlin.de		Telephone: +493083853034	Fax number:+493 083856510	

PART B: Description of the Organisation

B.1. NATURE OF THE ORGANISATION

Status: *(leave only the relevant status)*	✒ Public ✒ ~~Private~~ *(an organisation which has received over 50 % of its annual revenues from public sources over the preceding two years, or which is controlled by public bodies or their representatives can be declared as "public")*	
Type of organisation: *(leave only the relevant type(s))*	X Higher Education Institution ❑ HE research centre/organisation ❑ Private research centre/organisation ❑ Public research centre/organisation (not HE) Graduate/Doctoral School ❑ Public authority (local) ❑ Public authority (national) ❑ Public authority (regional) ❑ Chamber of commerce / crafts	❑ Chamber of industry ❑ Enterprise large (> 500 employees) ❑ SME ❑ Professional associations ❑ Social partners (trade unions, etc) ❑ Assoc. of professors and researchers ❑ Assoc. of Universities / Research centres ❑ Other (please specify under B.2)

B.2.PURPOSE AND ACTIVITY OF THE ORGANISATION

Please provide a short presentation of your organisation in relation with the activities covered by the project and more particularly concerning its postgraduate (masters/doctorate level) and international cooperation activities *(max. 20 lines)*

The research group at the Freie Universität Berlin is internationally known for its research and teaching in quantum field theory with applications to a wide range of physical phenomena. The group uses the modern techniques of functional integration and develops analytic as well as numeric approximation procedures, extending and improving greatly seminal work which the contact person did in collaboration with the late American physicist and Nobel Laureate Richard Feynman. The range of applications includes nuclear physics, quark physics, solid state physics, liquid crystal physics, string theory, and financial markets.

Within the project which may run under the title « From the Nuclei to the Stars », the process of pair creation in strong electric and gravitational fields plays an essential role. The star formation will modelled by an extension of the Oppenheimer-Volkoff model of gas stars by including nuclear forces so that the star appears as a natural continuation of nuclei beyond the instability region of superheavy nuclei. In a first stage, the theory will have the following key ingredients: 1.) Fermi seas of neutrons, protons, and electrons whose Fermi levels account for the weak transitions between these particles. 2.) The electric field to account for the Coulomb energy. 3.) A scalar field, an omega field, and a rho field to account for the strong nuclear forces so that small lumps of nucleons form proper nuclei whose masses satisfy the Bethe-Weizsäcker mass formula. 4.) The metric of general relativity and an Einstein-Hilbert action to take care of the proper gravitational forces. Therein, the theory of spontaneous symmetry-breaking transitions is important since the nucleon mass will be different inside and outside the nuclear matter. At higher pressures, the nuclear matter will become quark matter and will therefore be described by a chirally-symmetric effective Lagrangian of the type that the contact person derived from quark theories by Hadronization in the seventies.

Provide a short description of the organisation's specific role in the project *(max. 10 lines)*

The Berlin group will contribute to the project courses in quantum field theory taylored to the application in astrophysics. In particular, the field-theoretic formulation of the extension of nuclear physics to stellar physics will be formulated in a consistent field-theoretic way with a special emphasis on the theory of critical phenomena. To this end the theory of phase transitions in condensed matter physics will be taught in such a way that the students can apply it to nuclear matter physics. In order to exercise the students in phase transitions that can be compared with experimental results at all stages, they will be taught the instructive example of the theory and experiments of Bose-Einstein condensation in both magnetic traps and optical lattices. Particular attention will be paid to train the students in delivering well-understandable presentations of their results.

MAX-PLANCK-INSTITUT FÜR GRAVITATIONSPHYSIK
(ALBERT-EINSTEIN-INSTITUT)

MPI für Gravitationsphysik, 14424 Potsdam, Germany

Prof. Pierre Coullet
Université de Nice Sophia Antipolis
Présidence (Dossier Erasmus Mundus)
Grand Château
28 avenue Valrose
BP 2135
F-06103 Nice Cedex 2
FRANCE

Prof. Dr. Hermann Nicolai
Tel.: +49 (331) 567-7216
Fax: +49 (331) 567-7297
E-Mail: hermann.nicolai@aei.mpg.de
http://www.aei.mpg.de

April 29, 2009

Letter of intent

The Albert Einstein Institute will actively participate in the joint programme « Erasmus Mundus Joint Doctorate (EMJD) in Relativistic Astrophysics » as an European Institution Partner.

The research and education required will be carried out by the Department of Quantum Gravity and Unified Theories led by myself. The Albert Einstein Institute will provide all necessary support for this joint programme.

Sincerely yours,

H. Nicolai

Prof. Hermann Nicolai
Director

PART A: Identification of the applicant and other participating organisations

Parts A and B must be filled in separately for each organisation involved in the project (including associated members). **The application must be accompanied by copies of letters from the legal authority of each participating organisation** confirming their support to the joint programme and their agreement with the submitted application (*not necessary for associated members*)

A. 1 ORGANISATION

Role in the consortium *(leave the relevant role only)*	~~Applicant / Coordinating Organisation~~ Partner Organisation ~~Associated member~~			
Official name of the organisation:	Max Planck Institute for Gravitational Physics (Albert Einstein Institute) – Potsdam			
If applicable, organisation's name in latin characters				
Acronym:	AEI – Potsdam			
N° of the Erasmus University Charter (if applicable), for European Higher Education Institutions only				
Department, if applicable:				
Official Address	Am Mühlenberg 1			
Postal Code:	14476	Town:	GOLM	
Region:		Country:	GERMANY	
Internet address:	http://www.aei.mpg.de			
Telephone 1:+49-331-567-0-		Telephone 2:		Fax number: +49-331-567 - 7297 / 7298 / 7699

A.2. LEGAL REPRESENTATIVE

Name of the person entitled to legally commit the organisation (for the coordinating organisation only)

Last Name:	*Mr*	NICOLAI	First Name:	HERMANN
Function:	Director of Quantum Gravity Division			
Address (*Only if different from official address above)*:				

A.3. CONTACT PERSON / COORDINATOR

(responsable for the management of the project in the organisation)

Last Name:	*Mr*	NICOLAI	First Name:	HERMANN
Function:	Director of Quantum Gravity Division			
@ : hermann.nicolai@aei.mpg.de	Telephone: +49 (331) 5677216		Fax number	+49 (331) 567-7297
Address (*Only if different from official address above)*:				

PART B: Description of the Organisation

B.1. NATURE OF THE ORGANISATION

Status: *(leave only the relevant status)*	Public Private *(an organisation which has received over 50 % of its annual revenues from public sources over the preceding two years, or which is controlled by public bodies or their representatives can be declared as "public")*	
Type of organisation: *(leave only the relevant type(s))*	X Higher Education Institution X HE research centre/organisation ❑ Private research centre/organisation ❑ Public research centre/organisation (not HE) Graduate/Doctoral School ❑ Public authority (local) ❑ Public authority (national) ❑ Public authority (regional) ❑ Chamber of commerce / crafts	❑ Chamber of industry ❑ Enterprise large (> 500 employees) ❑ SME ❑ Professional associations ❑ Social partners (trade unions, etc) ❑ Assoc. of professors and researchers ❑ Assoc. of Universities / Research centres ❑ Other (please specify under B.2)

B.2.PURPOSE AND ACTIVITY OF THE ORGANISATION

Please provide a short presentation of your organisation in relation with the activities covered by the project and more particularly concerning its postgraduate (masters/doctorate level) and international cooperation activities *(max. 20 lines).*

During the last years, significant progress has been achieved in the development and generalization of the BKL (Belinski, Khalatnikov, Lifshitz) Theory of cosmological singularity. Since the behaviour of the universe at the initial stage of its evolution determines essentially also the late aspects of cosmology, such a topic is a must for a complete scientific program of research and teaching in Relativistic Astrophysics. Since the year 2000, a series of works have developed a new effective description of the BKL theory using the notion of the so-called "Cosmological Billiard". This research began in France at the Institut Hautes Etudes Scientifiques (IHES) lead by Thibault Damour, at the University of Bruxelles lead by Marc Henneaux, and in Germany here at the Albert Einstein Institute Potsdam under Hermann Nicolai. This work has lead to the discovery of very interesting hidden symmetries describable by an infinite-dimensional hyperbolic Lie Algebras of the type discovered forty years ago by V. Kac and Moody. The results can lead to modifications in the standard Big Bang Theory as well as to new approach of unification of fundamental interactions. Aspects connected to Quantum Field theory will be developed in contact with the Freie Universitaet of Berlin. The astrophysical aspects will be discussed with all the partners of the IRAP PhD program. The graduate students will be able to follow courses delivered by the Faculty of the Einstein Institute in the IRAPPhD and do their research works in any of the participating institutions including the Einstein Institute in Potsdam.

Provide a short description of the organisation's specific role in the project *(max. 10 lines)*

Do research on Cosmology close to the initial singularity including: 1) rigorous mathematical analysis of the appearance of the asymptotic billiard structure, 2) construction of the integrable supersymmetric models in the vicinity of the singularity, 3) clarification of the integrability of the equation of motion of the theory with clarification of the role of the Kac Moody symmetry

Università degli Studi di Ferrara

RIPARTIZIONE DIDATTICA E SERVIZI AGLI STUDENTI

Ufficio Mobilità Internazionale e Studenti Stranieri

SINCERT

Ferrara April 15th, 2009

To whom it may concern,

The Physics Department of the University of Ferrara will actively participate in the joint programme "Erasmus Mundus Joint Doctorate (EMJD) in Relativistic Astrophysics" as a European Institution Partner.

I am aware of its application.

The research and education required by the joint programme will be carried out within the Doctorate Program in Physics, curriculum of Astrophysics, led by Prof. Filippo Frontera. The research activity of the Doctorate students of this program will be carried out in Physics Department. The University of Ferrara will provide all the necessary support for this joint programme.

Sincerely yours,

Prof. Patrizio Bianchi
RECTOR

UNIVERSITÀ DEGLI STUDI DI FERRARA

PP/ga

Via Savonarola, 9
44100 Ferrara

Partita Iva 00434690384
Cod. Fiscale 80007370382

Fax: (0039) 0532 293368
Telefono: (+39) 0532 293267

PART A: Identification of the applicant and other participating organisations

Parts A and B must be filled in separately for each organisation involved in the project (including associated members). **The application must be accompanied by copies of letters from the legal authority of each participating organisation** confirming their support to the joint programme and their agreement with the submitted application (*not necessary for associated members*)

A. 1 ORGANISATION

Role in the consortium *(leave the relevant role only)*	~~Applicant / Coordinating Organisation~~ Partner Organisation ~~Associated member~~				
Official name of the organisation: If applicable, organisation's name in latin characters	**Università di Ferrara**				
Acronym:	UNIFE				
N° of the Erasmus University Charter (if applicable), for European Higher Education Institutions only	UNIFE IT 29176-IC-1-2007-1-IT Erasmus- EUC-1				
Department, if applicable:	Physics Department				
Official Address	Via Saragat, 1				
Postal Code:	44100	Town:	FERRARA		
Region:	IT4	Country:	ITALIA		
Internet address:	http:// www.unife.it/				
Telephone 1: +39-0532-974211		Telephone 2:		Fax	+39-0532-974210

A.2. LEGAL REPRESENTATIVE

Name of the person entitled to legally commit the organisation (for the coordinating organisation only)

Last Name:	*Mr, Ms*	BIANCHI	First Name:	PATRIZIO
Function:		RECTOR		
Address (*Only if different from official address above)*:		Via Savonarola 9, 44100 FERRARA		

A.3. CONTACT PERSON / COORDINATOR

(responsable for the management of the project in the organisation)

Last Name:	*Mr, Ms*	FRONTERA	First Name:	FILIPPO
Function:		Full Professor of General Physics		
@ : frontera@fe.infn.it		Telephone: +390532-974254	Fax number	+39-0532-974210
Address (*Only if different from official address above)*:				

PART B: Description of the Organisation

B.1. NATURE OF THE ORGANISATION

Status: *(leave only the relevant status)*	☛ Public ☛ ~~Private~~ *(an organisation which has received over 50 % of its annual revenues from public sources over the preceding two years, or which is controlled by public bodies or their representatives can be declared as "public")*	
Type of organisation: *(leave only the relevant type(s))*	X Higher Education Institution ❑ HE research centre/organisation ❑ Private research centre/organisation ❑ Public research centre/organisation (not HE) Graduate/Doctoral School ❑ Public authority (local) ❑ Public authority (national) ❑ Public authority (regional) ❑ Chamber of commerce / crafts	❑ Chamber of industry ❑ Enterprise large (> 500 employees) ❑ SME ❑ Professional associations ❑ Social partners (trade unions, etc) ❑ Assoc. of professors and researchers ❑ Assoc. of Universities / Research centres ❑ Other (please specify under B.2)

B.2.PURPOSE AND ACTIVITY OF THE ORGANISATION

Please provide a short presentation of your organisation in relation with the activities covered by the project and more particularly concerning its postgraduate (masters/doctorate level) and international cooperation activities *(max. 20 lines).*

The University of Ferrara is one of the oldest in Italy. It was founded in 1391. It includes many faculties: Law, Humanities, Economics, Medicine and Surgery, Pharmacy, Architecture, Engineering, Mathematical, Physical and Natural Sciences. Many courses are offered by the last Faculty, among which those for a first level graduation in Physics and Astrophysics and a higher level graduation in Physics, with several curricula, inclusive of Astrophysics. At the highest level, the University of Ferrara has set up the Institute for Higher Studies, IUSS - Ferrara 1391, that offers Doctorate courses to Italian and international students through a proper selection. One of them is the Doctoral Program in Physics, with several curricula, among which Astrophysics. Enrolled students of this Curriculum can also be admitted to the International Relativistic Astrophysics PhD (IRAPP) program. The main reference structure for PhD students in Physics is the Physics Department, that performs research activity in different fields, from nuclear and subnuclear physics to solid state physics, physics of atmosphere, astroparticles and high energy astrophysics. PhD students of the astrophysics curriculum mainly join the High Energy Astrophysics Group, that since many years is involved, through national and international collaborations, in experimental and observational X-/gamma-ray astronomy programmes. Among these, it merits to mention the PI-ship of the high energy instrument PDS and the Gamma Ray Burst Monitor (GRBM) aboard the BeppoSAX satellite, through which we have solved a thirty year mystery, that of the Gamma Ray Burst (GRB) sites, though the discovery of their afterglow. For this discovery we have obtained the Bruno Rossi Prize 1998 of the American Astronomical Society and the Descartes Prize 2002 of the European Committee. The current research activity, with national and international collaborations, mainly concerns studies of GRBs and compact objects in binary systems, and the development of Laue lens telescopes for soft gamma-ray astronomy.

Provide a short description of the organisation's specific role in the project *(max. 10 lines)*

The University of Ferrara will contribute to the International Relativistic Astrophysics Doctorate Program through formation of the enrolled Doctorate students of the proposing institutions in the following fields:

a) observational studies of compact sources (mainly neutron stars and black holes) in binary systems, through data analysis of X-/gamma-ray observations obtained with currently operative missions or past missions (e.g., BeppoSAX); b) Observational studies of Gamma Ray Bursts thorough systematic analysis of GRBs data archive and/or new GRB detections. c) Theoretical studies of compact sources and GRBs, through development of analytical or Monte Carlo models. d) Experimental research activity. This include participation to feasibility studies of new mission, development of Laue lens telescopes for gamma-astronomy.

Indian Centre for Space Physics

43 Garia Station Road, Kolkata - 700 084
PHONE: +91-(0) 33-2436 6003, 2462-2153
FAX: +91-(0) 33- 2436 6003, 2462-2153; EMAIL:root@csp.res.in

TO WHOMSOEVER IT MAY CONCERN

Date: April 23rd, 2009

Sub: Pledging our support to the joint programme

This is to confirm that Indian Centre for Space Physics wishes to join in the team of ERASMUS MUNDUS and is submitting the application to this effect. We are fully committed to support such a programme and carry out our obligations to the best of our abilities.

Prof. B.B. Bhattacharyya,
President, Governing Body of ICSP

President
Indian Centre for Space Physics

PART A: Identification of the applicant and other participating organisations

Parts A and B must be filled in separately for each organisation involved in the project (including associated members). **The application must be accompanied by copies of letters from the legal authority of each participating organisation** confirming their support to the joint programme and their agreement with the submitted application (*not necessary for associated members*)

A. 1 ORGANISATION

Role in the consortium *(leave the relevant role only)*	~~Applicant / Coordinating Organisation~~ Partner Organisation ~~Associated member~~				
Official name of the organisation:	**Indian Centre for Space Physics**				
If applicable, organisation's name in latin characters					
Acronym:	ICSP				
N° of the Erasmus University Charter (if applicable), for European Higher Education Institutions only					
Department, if applicable:					
Official Address	43 Chalantika, Garia Station Road,				
Postal Code:	700084	Town:	Kolkata		
Region:		Country:	India		
Internet address:	http://csp.res.in				
Telephone 1: +913324366003		Telephone 2:		Fax	+913324622153 ext.28

A.2. LEGAL REPRESENTATIVE

Name of the person entitled to legally commit the organisation (for the coordinating organisation only)

Last Name:	*Mr.*	Bhattacharyya	First Name:	Bimalendu
Function:	PRESIDENT, Governing Body			
Address (*Only if different from official address above)*:				

A.3. CONTACT PERSON / COORDINATOR

(responsable for the management of the project in the organisation)

Last Name:	*Mr*	Chakrabarti	First Name:	Sandip
Function:	Senior Professor and In Charge, Academic Affairs			
@ : sandip@csp.res.in		Telephone: +919903120700	Fax number	+913324622153 ext.28
Address (*Only if different from official address above)*:				

PART B: Description of the Organisation

B.1. NATURE OF THE ORGANISATION

Status: *(leave only the relevant status)*	☙ Public ☙ ~~Private~~ *(an organisation which has received over 50 % of its annual revenues from public sources over the preceding two years, or which is controlled by public bodies or their representatives can be declared as "public")*	
Type of organisation: *(leave only the relevant type(s))*	X Higher Education Institution ❑ HE research centre/organisation	

B.2.PURPOSE AND ACTIVITY OF THE ORGANISATION

Please provide a short presentation of your organisation in relation with the activities covered by the project and more particularly concerning its postgraduate (masters/doctorate level) and international cooperation activities *(max. 20 lines).*

Indian Centre for Space Physics (ICSP) is mainly engaged in research activities is various branches of astrophysics, astronomy and space science. The research topics range from relativistic astrophysics around compact objects, theoretical and observational studies (through satellite data analysis) of activities around compact objects, solar science through satellite observations, payload developments for satellites, developments of detectors for space applications, astro-chemistry, very low frequency (VLF) studies of ionospheres for possible correlations with seismic activities etc. ICSP recently participated in three payload developments for Indo-Russian satellite CORONAS-PHOTON. It is collaborating with Stanford University in VLF projects. International Centre for Theoretical Physics (ICTP) supports ICSP through ICTP fellowships to train Ph.D. students from developing worlds. It is recognized by Calcutta University. ICSP students receive Ph.D. degree from Calcutta or Jadavpur Universities.

Provide a short description of the organisation's specific role in the project *(max. 10 lines)*

ICSP is strategically located in a position surrounded by a large number of developing nations such as Nepal, China, Bhutan Srilanka, Thiland, Bangladesh, Indonesia and other southeast asian countries. It is therefore of great advantage to have a centre here so that young students from these developing nations may be trained in modern aspects of relativistic astrophysics, data analysis of various satellites, instrumentations etc. The institute is strong in theoretical aspects and students of varied interests may be catered. It can identify bright students from south and southeast asia and can recommend them to European counterparts for further higher studies if needed. Being itself in a developing nation, the cost of training would be lesser compared to European nations. Thus ICSP can contribute in a major way to have a healthy community of research workers in the relevant fields at a lesser cost.

ICRANet

International Center for Relativistic Astrophysics Network

Pescara, 29/04/2009

Prot. n. 592

Subject: Letter of Endorsement - ERASMUS MUNDUS ACTION 1 B APPLICATION

I undersigned Remo Ruffini, confirm that ICRANet fully undertakes to coordinate the Erasmus Mundus Action 1 B Doctoral Program: IRAP Ph.D. International Relativistic Astrophysics Ph. D. Program.

ICRANet will undertake to contribute to the joint-Ph.D. program curriculum design, teaching and research. Moreover ICRANet will facilitate the practical placement of staff and students in its facilities.

I have read and approved the content of the proposal submitted to the Agency. I undertake to comply with the principles of good partnership practice

Prof. Remo Ruffini
Director of ICRANet

P.le della Repubblica, 10 - 65100 Pescara - Italy - CF: 91080720682
Phone: +39.085.23054200 Fax: +39.085.4219252
Email: Director@icranet.org - Secretariat@icranet.org Http://www.icranet.org

PART A: Identification of the applicant and other participating organisations

Parts A and B must be filled in separately for each organisation involved in the project (including associated members). **The application must be accompanied by copies of letters from the legal authority of each participating organisation** confirming their support to the joint programme and their agreement with the submitted application (*not necessary for associated members*)

A. 1 ORGANISATION

Role in the consortium *(leave the relevant role only)*	Partner Organisation				
Official name of the organisation:	**International Center for Relativistic Astrophysics Network**				
If applicable, organisation's name in latin characters					
Acronym:	ICRANet				
N° of the Erasmus University Charter (if applicable), for European Higher Education Institutions only					
Department, if applicable:					
Official Address	at ICRANet, Piazza della Repubblica, 10				
Postal Code:	65122	Town:	PESCARA		
Region:	ABRUZZO	Country:	ITALIA		
Internet address:	http:// www.icranet.org/				
Telephone 1: +39-085-23054		Telephone 2:		Fax	+39-085-4219252

A.2. LEGAL REPRESENTATIVE

Name of the person entitled to legally commit the organisation (for the coordinating organisation only)

Last Name:	*Prof.*	RUFFINI	First Name:	REMO
Function:	DIRECTOR			
Address (*Only if different from official address above)*:				

A.3. CONTACT PERSON / COORDINATOR

(responsable for the management of the project in the organisation)

Last Name:	*Prof.*	RUFFINI	First Name:	REMO
Function:	Director of ICRANet and Chair of Theorethical Physics at University “Sapienza” – Rome			
@ : frontera@fe.infn.it	Telephone: +39-085-23054		Fax number	+39-085-4219252
Address (*Only if different from official address above)*:				

PART B: Description of the Organisation

B.1. NATURE OF THE ORGANISATION

Status: *(leave only the relevant status)*	X Public *(an organisation which has received over 50 % of its annual revenues from public sources over the preceding two years, or which is controlled by public bodies or their representatives can be declared as "public")*	
Type of organisation: *(leave only the relevant type(s))*	X Higher Education Institution X No-profit International research centre/organisation X Assoc. of Universities / Research centres	

B.2.PURPOSE AND ACTIVITY OF THE ORGANISATION

Please provide a short presentation of your organisation in relation with the activities covered by the project and more particularly concerning its postgraduate (masters/doctorate level) and international cooperation activities *(max. 20 lines).*

ICRANet, the International Centers for Relativistic Astrophysics Network, is an International Organization doing theoretical Research on Relativistic Astrophysics, whose Members States are Armenia, Brazil, Italy, The Vatican as well as the University of Stanford, the University of Arizona, and ICRA. The seat is located in Pescara (Italy). In addition to the Board chaired by the Chinese astrophysicist Fang Li-Zhi and the Director Remo Ruffini, there is a Scientific Committee chaired by the Nobel Laureate Riccardo Giacconi, with Members including distinguished Astronomers and Space Scientists such as Felix Aharonian, David Arnett, João Braga and Bill Stoeger. Faculty Members include Vladimir Belinski, the co-author of the famous BKL theory of the primordial Universe, and Roy Kerr, author of the famous Black Hole Kerr solution, and in part time Thibault Damour from the IHES in Paris. The ICRANet is co-sponsoring the IRAP Ph.D. program, as well as an intense series of meetings including the Italian-Korean meeting on Relativistic Astrophysics which is held every two years alternatively in Italy and Korea, the Italian-Chinese meeting held every year in Italy, the newly created Xu Guangqi meeting, the Brazilian School on Cosmology. A major activity of ICRANet is the organization of the Marcel Grossmann Meetings, held every three years in selected Countries all over the world with publication of 3 volumes of proceedings and assembling up to 1000 scientists.

Provide a short description of the organisation's specific role in the project *(max. 10 lines)*

Particularly relevant is the commitment of ICRANet to the graduate students, postdoc programs, visiting scientists and scientific meetings. It is important to mention a vigorous program of scientific exchange, as well as a vast series of publications in scientific journals and of textbooks in English, Italian, Chinese, Korean etc…Topics of Research include Early Cosmology, the Physics and Astrophysics of Neutron Stars and Black Holes, structure formation in Cosmology, exact solutions of the Einstein-Maxwell equations, Gamma Ray Bursts, Binary X Ray sources, Pulsars and Galactic Halos.

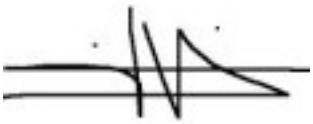
Bd de l'Observatoire
BP 4229
06 304 Nice cedex 4
France

To Whom it May Concern

Our institute, Observatoire de la Côte d'Azur (OCA) agrees to participate as a partner in the project Erasmus Mundus, aiming to support the academic activities of the International Relativistic Astrophysics school, particularly in the fields of Planetary Science, including extra-solar planets, Extragalactic Astrophysics and Data Analysis.

OCA will also offer to students of this school the access to its facilities as laboratories, computating services and Library.

Farrokh VAKILI
Director OCA
Nice April 28th 2009



IRAP 28/4/2009

PART A: Identification of the applicant and other participating organisations

Parts A and B must be filled in separately for each organisation involved in the project (including associated members). **The application must be accompanied by copies of letters from the legal authority of each participating organisation** confirming their support to the joint programme and their agreement with the submitted application (*not necessary for associated members*)

A. 1 ORGANISATION

Role in the consortium *(leave the relevant role only)*	☛ ~~Applicant / Coordinating Organisation~~ ☛ Partner Organisation ☛ ~~Associated member~~				
Official name of the organisation: If applicable, organisation's name in latin characters	**Observatoire de la Côte d'Azur**				
Acronym:	OCA				
N° of the Erasmus University Charter (if applicable), for European Higher Education Institutions only					
Department, if applicable:					
Official Address	Boulevard de l'0bservatoire				
Postal Code:	06304	Town:	Nice		
Region:	Alpes Maritimes	Country:	France		
Internet address:	http:// www.oca.eu				
Telephone 1: +33492003001		Telephone 2:		Fax	

A.2. LEGAL REPRESENTATIVE

Name of the person entitled to legally commit the organisation (for the coordinating organisation only)

Last Name:	Vakili	First Name:	Farrokh	
Function:	Director			
Address (*Only if different from official address above)*:				

A.3. CONTACT PERSON / COORDINATOR

(responsable for the management of the project in the organisation)

Last Name:	de Freitas Pacheco	First Name:	José
Function:	Astronomer		
@ : pacheco@oca.eu	Telephone: +33492003182	Fax number	
Address (*Only if different from official address above)*:			

PART B: Description of the Organisation

B.1. NATURE OF THE ORGANISATION

Status: *(leave only the relevant status)*	✒ Public ✒ ~~Private~~ *(an organisation which has received over 50 % of its annual revenues from public sources over the preceding two years, or which is controlled by public bodies or their representatives can be declared as "public")*	
Type of organisation: *(leave only the relevant type(s))*	X Higher Education Institution ❑ Public research centre/organisation (not HE) Graduate/Doctoral School	

B.2.PURPOSE AND ACTIVITY OF THE ORGANISATION

Please provide a short presentation of your organisation in relation with the activities covered by the project and more particularly concerning its postgraduate (masters/doctorate level) and international cooperation activities (max. 20 lines).

Observatoire de la Côte d'Azur (OCA) is a multi-disciplinary research institute with 200 permanent scientists and more than 100 engineers and technicians involved in Astronomy, Astrophysics and Geophysics academic research based on major ground-based instruments: e.g. VLT and VLTI at ESO, the VIRGO gravitational antenna in Italy, Geodesical Laser Ranging (Moon and satellites) and more generally in ESA present and future space missions like CoRoT and GAIA. These projects cross-benefit from other research areas like plasma physics (MHD), leading edge R&D for top-level instrumentation (interferometry, space-time metrology, optics and laser technology among others) and basic research in applied mathematics, physics and signal processing.

OCA is already collaborating with major european and other non-european organisations as, for instance ESA, ESO, NASA, Polar Institutes, EGU and has developped a long tradition of forming graduate young students from all continents. It is worth to remind that OCA has been a founder member of IRAP so that our institute will naturally contribute to the present Erasmus Mundus extension.

Provide a short description of the organisation's specific role in the project (max. 10 lines)

OCA intends to actively contribute to different areas of IRAP training courses in relation OCA expertise in the followings in particular: planetary science, including extra-solar planets, extragalactic astronomy and data analysis related to observational astrophysics. In addition an important number of OCA senior scientists are willing to supervise or co-supervise PhD level young scientists with the perspective to develop new international collaborative projects both in observational and theoretical fields. Indeed the institute will offer its major facilities (instruments, computing clusters, etc..) to support such educational and research programs. OCA has also a regional well established tradition of collaboration with local industries Thalès Alenia Space Cannes, SESO among others.

CBPF
Centro Brasileiro de Pesquisas Físicas

Ministério da Ciência e Tecnologia
BRASIL UM PAÍS DE TODOS GOVERNO FEDERAL

April 23, 2009

To whom which may concern

The Brazilian Center of Physics Research (CBPF), will actively participate in the joint programme "Erasmus Mundus Joint Doctorate (EMJD) in Relativistic Astrophysics" as a non-European Institution Partner. The research and education required by the joint program will be carried out by Insituto de Cosmologia, Relatividade e Astrofisica (ICRA-Br) led by Prof. Mario Novello. CBPF will provide all necessary support for this joint programme.

RICARDO M. O. GALVÃO
Diretor do CBPF
~~PO 829~~/08 PO 407/06

Ricardo Galvão
Diretor
Centro Brasileiro de Pesquisas Fisicas

Rua Dr. Xavier Sigaud, 150 - Rio de Janeiro, RJ CEP: 22290-180 - Brasil
Tel. (55 21) 2141-7100 - Fax: (55 21) 2141-7400 - http://www.cbpf.br

PART A: Identification of the applicant and other participating organisations

Parts A and B must be filled in separately for each organisation involved in the project (including associated members). **The application must be accompanied by copies of letters from the legal authority of each participating organisation** confirming their support to the joint programme and their agreement with the submitted application (*not necessary for associated members*)

A. 1 ORGANISATION

Role in the consortium *(leave the relevant role only)*	~~Applicant / Coordinating Organisation~~ Partner Organisation ~~Associated member~~				
Official name of the organisation:	**Centro Brasileiro de Pesquisas Fisicas**				
If applicable, organisation's name in latin characters					
Acronym:	CBPF				
N° of the Erasmus University Charter (if applicable), for European Higher Education Institutions only	28233-IC-1-2002-1-FR Erasmus-EUC-1				
Department, if applicable:	Instituto de Cosmologia Relatividade Astrofisica (ICRA-Br)				
Official Address	150, Rua Dr. Xavier Sigaud				
Postal Code:	22290-180	Town:	Rio de Janeiro		
Region:		Country:	Brasil		
Internet address:	http:// www.cbpf.br				
Telephone 1: 5521214171 99		Telephone 2:		Fax	552121417266

A.2. LEGAL REPRESENTATIVE

Name of the person entitled to legally commit the organisation (for the coordinating organisation only)

Last Name:	*Mr, Ms*	GALVÃO	First Name:	RICARDO
Function:		Director		
Address (*Only if different from official address above)*:				

A.3. CONTACT PERSON / COORDINATOR

(responsable for the management of the project in the organisation)

Last Name:	*Mr, Ms*	NOVELLO	First Name:	MARIO
Function:		Professor of Physics		
@ : novello@lcbpf.br		Telephone: 5521214171 99	Fax number	552121417266
Address (*Only if different from official address above)*:				

PART B: Description of the Organisation

B.1. NATURE OF THE ORGANISATION

Status: *(leave only the relevant status)*	☛ Public ☛ ~~Private~~ *(an organisation which has received over 50 % of its annual revenues from public sources over the preceding two years, or which is controlled by public bodies or their representatives can be declared as "public")*	
Type of organisation: *(leave only the relevant type(s))*	X Higher Education Institution ❑ HE research centre/organisation ❑ Private research centre/organisation ❑ Public research centre/organisation (not HE) Graduate/Doctoral School ❑ Public authority (local) ❑ Public authority (national) ❑ Public authority (regional) ❑ Chamber of commerce / crafts	❑ Chamber of industry ❑ Enterprise large (> 500 employees) ❑ SME ❑ Professional associations ❑ Social partners (trade unions, etc) ❑ Assoc. of professors and researchers ❑ Assoc. of Universities / Research centres ❑ Other (please specify under B.2)

B.2.PURPOSE AND ACTIVITY OF THE ORGANISATION

The Institute of Cosmology, Relativity and Astrophysics (ICRA-Br) is an organization linked to the Brazilian Center for Physics Research of Brazilian Ministry of Science and Technology. It consists of 10 permanent positions for scientists, 3 Administration Staff, 6 position for Visiting Professors, 14 PhD Students and 2 Pos-Doctoral associates. The main lines of research includes: Cosmological effects of non-linear electrodynamics; Analog Models; Structure Formation in Singular and Bouncing Universe; Field theory in Curved Space-Times.

The Institute of Cosmology, Relativity and Astrophysics is responsible for representing CBPF in the coordination promoted by the Institute, as well as in other institutions working in relativistic cosmology and astrophysics fields; coordinating, developing and supporting experimental and observational researches in the field of relativistic astrophysics, theoretical and observational cosmology, particularly the groups associated to the Relativistic Astrophysics International Center – ICRA, and other institutions having agreements with CBPF; supporting existing research areas and stimulating new innovative proposals in the field of cosmology, relativity and astrophysics; supporting scientific information exchange between members of ICRA in order to develop international programs; developing an electronic network to exchange information between laboratories and departments working with relativistic astrophysics and theoretical and observational cosmology; promoting and organizing seminars, workshops, courses and other meetings related to its activities.

The Institute of Cosmology, Relativity and Astrophysics is also responsible for coordinating ICRANet activities in Brazil, based on the Brazil-Italy agreement signed on September 21st 2005 by the Brazilian Government.

Due to the experience in teaching at Master and Doctorate level, inside ICRA-Br / CBPF, we could propose a large variety of courses in Classical and Quantum Field Theory in Curved Space-Time, Astro-particle, Astrophysical Aspects of Non-Linear Eletrodynamics,General Relativity and Gravitation. In add, some invited professors in ICRA-BR / CBPF can give advanced lectures for the benefit of the students in the Erasmus Mundus program.

RIPARTIZIONE IX
RELAZIONI INTERNAZIONALI

SAPIENZA
UNIVERSITÀ DI ROMA

LETTER OF ENDORSEMENT

ERASMUS MUNDUS ACTION 1 B APPLICATION

I undersigned, Luigi Frati, confirm that the Università degli Studi di Roma "La Sapienza" fully undertakes to coordinate the Erasmus Mundus- Action 1 B- Doctoral Programs:

IRAP
International Relativistic Astrophysics

Submitted by:

- Université de of Nice Sophia Antipolis
- Università di Roma La Sapienza
- Freie Universitaet Berlin
- Université de Savoie
- Università degli studi di Ferrara
- ETH Zurich
- Stockholm Universitet

The Università degli Studi di Roma "La Sapienza" will award the degree in *"Dottorato di Ricerca in Astrofisica relativistica "* and undertakes to contribute to the joint-Phd program curriculum design, teaching and research. Moreover, the Università degli Studi di Roma "La Sapienza" will facilitate the practical placement of staff and students in its facilities.

I have read and approved the contents of the proposal submitted to the Agency. I undertake to comply with the principles of good partnership practice.

Signature

UNIVERSITÀ DEGLI STUDI "LA SAPIENZA" * ROMA *

Rector

Roma 28/04/2009

Ripartizione IX Relazioni internazionali
Indirizzo per corrispondenza: Piazzale Aldo Moro 5 00185 ROMA
Sede: Palazzo Botconi, Corso Vittorio Emanuele II, 244 ROMA
T (+39) 06 49910435 (+39) 06 49910089
Mail
www.uniroma1.it

PART A: Identification of the applicant and other participating organisations

Parts A and B must be filled in separately for each organisation involved in the project (including associated members). **The application must be accompanied by copies of letters from the legal authority of each participating organisation** confirming their support to the joint programme and their agreement with the submitted application (*not necessary for associated members*)

A. 1 ORGANISATION

Role in the consortium *(leave the relevant role only)*	~~Applicant / Coordinating Organisation~~ Partner Organisation ~~Associated member~~			
Official name of the organisation: If applicable, organisation's name in latin characters	**SAPIENZA – Università di Roma**			
Acronym:				
N° of the Erasmus University Charter (if applicable), for European Higher Education Institutions only	29415-IC-1-2007-1-IT-ERASMUS-EUC-1			
Department, if applicable:	Dipartimento di Fisica (Physics Department)			
Official Address	Piazzale Aldo Moro 5			
Postal Code:	00185	Town:	Roma	
Region:		Country:	ITALY	
Internet address:	http://www.uniroma1.it – http://www.phys.uniroma1.it			
Telephone 1:	+39 0649911	Telephone		Fax

A.2. LEGAL REPRESENTATIVE

Name of the person entitled to legally commit the organisation (for the coordinating organisation only)

Last Name:	*Mr*	Frati	First Name:	Luigi
Function:	Rector			
Address (*Only if different from official address above)*:	SAPIENZA – Università di Roma Piazzale Aldo Moro, 5 00185 Roma (ITALY)			

A.3. CONTACT PERSON / COORDINATOR

(responsable for the management of the project in the organisation)

Last Name:	*Mr*	RUFFINI	First Name:	REMO
Function:	Professor of Physics			
@ : ruffini@icra.it	Telephone: +390649914304		Fax number	+39064454992
Address (*Only if different from official address above)*:				

PART B: Description of the Organisation

B.1. NATURE OF THE ORGANISATION

Status: *(leave only the relevant status)*	✓ Public ✓ ~~Private~~ *(an organisation which has received over 50 % of its annual revenues from public sources over the preceding two years, or which is controlled by public bodies or their representatives can be declared as "public")*	
Type of organisation: *(leave only the relevant type(s))*	X Higher Education Institution ❑ HE research centre/organisation ❑ Private research centre/organisation ❑ Public research centre/organisation (not HE) Graduate/Doctoral School ❑ Public authority (local) ❑ Public authority (national) ❑ Public authority (regional) ❑ Chamber of commerce / crafts	❑ Chamber of industry ❑ Enterprise large (> 500 employees) ❑ SME ❑ Professional associations ❑ Social partners (trade unions, etc) ❑ Assoc. of professors and researchers ❑ Assoc. of Universities / Research centres ❑ Other (please specify under B.2)

B.2.PURPOSE AND ACTIVITY OF THE ORGANISATION

Please provide a short presentation of your organisation in relation with the activities covered by the project and more particularly concerning its postgraduate (masters/doctorate level) and international cooperation activities *(max. 20 lines).*

The Physics Department of the University of Rome “Sapienza” consists of 50 Full Professors, 47 Associate Professors and 40 Researchers. The activities cover almost all fields of physics, from Astrophysics and Cosmology, from both theoretical and observational points of view, to nuclear, subnuclear and elementary particle physics, to condensed matter physics, to theoretical and mathematical physics. Many collaboration exists on such topics also with other Research Centers such as Astronomical Observatory of Rome, CNR (National Research Council), ENEA (National Institute for Energy and Environment), ICRA (International Center for Relativistic Astrophysics), ICRANet (the only international organization working in the field of relativistic astrophysics – its seat is in Pescara, Italy), INAF (National Institute for Astrophysics), INFN (National Institute for Nuclear Physics). The concentration in the Department of so many different topics of research and the collaboration with so many different groups and institutions allows a very strong interaction between them. This promotes a truly interdisciplinary approach to the research on topics which are traditionally crossing different fields, such as Astroparticle physics or the physics of collapsed objects. This interdisciplinary approach is a key point in the training of the next generation of researchers. In addition to the Ph.D. program in physics, which consists of many different curricula, including also Astrophysics, the University of Rome “Sapienza” participate to the International Ph.D. Program on Relativistic Astrophysics (IRAP-PhD), together with ETH Zurich, Freie Universität Berlin, ICRA, Institut des Hautes Etudes Scientifiques, Observatoire de la Côte d’Azur, Università di Ferrara, Université de Nice Sophia Antipolis and Université de Savoie. The six participating Universities jointly deliver the Ph.D. degree.

Provide a short description of the organisation's specific role in the project *(max. 10 lines)*

University of Rome “Sapienza” can provide a large variety of courses in all the above mentioned fields of physics, from both a theoretical and experimental approach. Professors of the University will give invited advanced lectures and serve as Thesis Advisor for the students of the Erasmus Mundus program, which will benefit also of the multidisciplinary approach described above.

UNIVERSITE CHAMBERY ANNECY DE SAVOIE

Chambéry, le 14 avril 2009

Présidence

Affaire suivie par :
Eric BRUNAT
Vice-Président en charge des Relations Européennes et Internationales
Tél. : 04 79 75 91 15
Fax : 04 79 75 83 65
vpri@univ-savoie.fr

N/Réf. : PRE/GA/sch/2008-09/148

Objet : Erasmus Mundus International Relativistic Astrophysics Doctorate IRAP PhD

If we look to the priority of research in Europe through the next decades, Space Science sounds to be essential. The European Space Agency (ESA) is involved in not less than 17 space missions. For exemple, to conceive and execute the Huygens mission on Titan it took more than 20 years. Europe is also present through ESA on the main research with ground based telescope in Chile.

Clearly, the complete achievement of Europe Space Science will need outstanding human capacities. In that respect, this **Erasmus Mundus International Relativistic Astrophysics Doctorate program** will actively contribute to educate the future generation of scientists in this field. Inside the network is mobilised the previous successful collaboration between University of Savoie, University of Nice Sophia Antipolis, Observatoire de la Côte d'Azur, Freie University of Berlin, University of Roma La Sapienza and Institut des Hautes Etudes Scientifiques. Stockholm University will join the network as well as Ferrara University and the Institut des Hautes Etudes Scientifiques. Thanks to the collaboration with Shangai Observatory, Rio CBPF and Bose National Centre for Basic Sciences, partners from China, Brazil and India will be added. The past collaboration between the partners mentionned above will assure a perfect coordination of this new activity.

In that respect, with this commitment letter I do confirm that the University of Savoie will actively participate to the consortium. In my capacity of President of the University of Savoie, I am aware that the University of Savoie is involved in this application. The research and education required by the joint program will be carried out by Professor Pascal Chardonnet from the Laboratoire d'Annecy-le-Vieux de Physique des Particules - LAPP. The University of Savoie will support this joint program.

Sincerely yours,

Gilbert ANGENIEUX
President of the University of Savoie

Copies :
Eric BRUNAT, Vice-Président en charge des Relations Européennes et Internationales
Pascal CHARDONNET, LAPP
Direction de Relations Internationales

1979
2009
L'Université de Savoie a 30 ans

Présidence
27 rue Marcoz - BP 1104
73011 CHAMBERY CEDEX
Tél. : 33 (0)4 79 75 84 22
Fax : 33 (0)4 79 75 83 51
Mél : presidence@univ-savoie.fr

Siège social
Université de Savoie
B.P. 1104
73011 Chambéry cedex
France

PART A: Identification of the applicant and other participating organisations

Parts A and B must be filled in separately for each organisation involved in the project (including associated members). **The application must be accompanied by copies of letters from the legal authority of each participating organisation** confirming their support to the joint programme and their agreement with the submitted application (*not necessary for associated members*)

A. 1 ORGANISATION

Role in the consortium *(leave the relevant role only)*	~~Applicant / Coordinating Organisation~~ Partner Organisation ~~Associated member~~				
Official name of the organisation: If applicable, organisation's name in latin characters	**Université de Savoie**				
Acronym:	UDS				
N° of the Erasmus University Charter (if applicable), for European Higher Education Institutions only	28233-IC-1-2002-1-FR Erasmus-EUC-1				
Department, if applicable:	UFR Sciences Fondamentales et Appliquées / LAPTH				
Official Address	27, Rue Marcoz B.P. 1104				
Postal Code:	73011	Town:	CHAMBERY		
Region:		Country:	FRANCE		
Internet address:	http:// www.univ-savoie.fr				
Telephone 1: +33479758585		Telephone 2:		Fax	+33479759105

A.2. LEGAL REPRESENTATIVE

Name of the person entitled to legally commit the organisation (for the coordinating organisation only)

Last Name:	*Mr, Ms*	ANGENIEUX	First Name:	GILBERT
Function:	PRESIDENT			
Address (*Only if different from official address above)*:				

A.3. CONTACT PERSON / COORDINATOR

(responsable for the management of the project in the organisation)

Last Name:	*Mr, Ms*	CHARDONNET	First Name:	PASCAL
Function:	Professor of Physics			
@ : chardonnet@lapp.in2p3.fr	Telephone: +33625622554		Fax number	+33450279495
Address (*Only if different from official address above)*:	LAPTH, 9 CHEMIN DE BELLEVUE BP 110 74940 ANNECY-LE-VIEUX CEDEX FRANCE			

PART B: Description of the Organisation

B.1. NATURE OF THE ORGANISATION

Status: *(leave only the relevant status)*	✒ Public ✒ ~~Private~~ *(an organisation which has received over 50 % of its annual revenues from public sources over the preceding two years, or which is controlled by public bodies or their representatives can be declared as "public")*	
Type of organisation: *(leave only the relevant type(s))*	X Higher Education Institution ❑ HE research centre/organisation ❑ Private research centre/organisation ❑ Public research centre/organisation (not HE) Graduate/Doctoral School ❑ Public authority (local) ❑ Public authority (national) ❑ Public authority (regional) ❑ Chamber of commerce / crafts	❑ Chamber of industry ❑ Enterprise large (> 500 employees) ❑ SME ❑ Professional associations ❑ Social partners (trade unions, etc) ❑ Assoc. of professors and researchers ❑ Assoc. of Universities / Research centres ❑ Other (please specify under B.2)

B.2.PURPOSE AND ACTIVITY OF THE ORGANISATION

Please provide a short presentation of your organisation in relation with the activities covered by the project and more particularly concerning its postgraduate (masters/doctorate level) and international cooperation activities *(max. 20 lines).*

LAPTH (Laboratoire d'Annecy-le-Vieux de Physique Théorique) is a mix research unit co-directed by the CNRS and the University of Savoie. The laboratory depends on the Physics and Mathematics Department of CNRS. It consists of 25 permanent members (15 CNRS staff, 6 professors and 4 Administration staff), 4 PhD students and 2 post-doctoral associates. The laboratory hosts many French and foreign visitors throughout the year and their stay at the LAPTH varies from a day to several months. LAPTH also takes great advantage of sharing its building with experimental colleagues in LAPP who participate in large and important experiments to understand the nature of elementary particles and of the cosmos. Three main fields are studied by the LAPTH theorists: Elementary Particle Physics, Cosmology/astrophysics and Mathematical Physics. LAPTH is part of Université de Savoie which has a master in theoretical Physics with Ecole Normale Supérieure of Lyon. The graduate courses include a solid background in particle physics, statistical physics and astroparticle. Raymond Stora is Emeritus Director of research from our laboratory. He has the considerable distinction of being the winner of the Max Planck Medal for 1998. LAPTH and LAPP are in the same building and this favour the close connections between theoreticians and experimentalists. LAPP is involve in physics at CERN with LHC but also in astrophysics with AMS (Anti Matter Spectrometer), VIRGO (the Virgo detector for gravitational waves is located within the site of the European Gravitational Observatory at Cascina) and HESS (High Energy Stereoscopic System). The close link to CERN, the dual specificity to a theoretical group leader in his field and an international particle physics laboratory lead naturally to participate to this Eramus Mundus in Astrophysics. In add LAPTH is involved in Dark matter studies, *A*nisotropies of diffuse cosmic background radiation, Type-la supernovae and cosmological parameters, Cosmology with extra dimensions, Gamma ray bursts, Cosmic rays of extreme energy.

Provide a short description of the organisation's specific role in the project *(max. 10 lines)*

Due to the experience in teaching at Master and Doctorate level, inside Université de Savoie, we could propose a large variety of courses in fundamental particle physics, astro-particle as well as specific training courses in languages programming. In add, some invited professors in LAPTH/LAPP give advanced lectures for the benefit of the students in the Erasmus Mundus program.

SHANGHAI ASTRONOMICAL OBSERVATORY
CHINESE ACADEMY OF SCIENCES

Add: 80 Nandan Road,Shanghai,China Tel: 0086-21-64386191 Fax: 0086-21-64384618
Postcode: 200030 http: //center.shao.ac.cn

April 10,2009

To whom it may concern,

Shanghai Astronomical Observatory (SHAO) will actively participate in the joint programme "Erasmus Mundus Joint Doctorate(EMJD) in Relativistic Astrophysics" as a non-European Institution Partner. I am aware that SHAO is involved in its application. The research and education required by the joint programme will be carried out by Key Laboratory of Research in Galaxies and Cosmology led by Professor Yipeng Jing. SHAO will provide all necessary support for this joint programme.

Sincerely yours,

ASTRONOMICAL OBSERVATORY CHINESE ACADEMY OF SCIENCES

Xiaoyu Dong
Director
Shanghai Astronomical Observatory

PART A: Identification of the applicant and other participating organisations

Parts A and B must be filled in separately for each organisation involved in the project (including associated members). **The application must be accompanied by copies of letters from the legal authority of each participating organisation** confirming their support to the joint programme and their agreement with the submitted application (*not necessary for associated members*)

A. 1 ORGANISATION

Role in the consortium *(leave the relevant role only)*	~~Applicant / Coordinating Organisation~~ Partner Organisation ~~Associated member~~				
Official name of the organisation:	**Shanghai Astronomical Observatory**				
If applicable, organisation's name in latin characters					
Acronym:	SHAO				
N° of the Erasmus University Charter (if applicable), for European Higher Education Institutions only					
Department, if applicable:					
Official Address	Nandan RD 80				
Postal Code:	200030	Town:	Shanghai		
Region:		Country:	China		
Internet address:	http://www.shao.ac.cn/				
Telephone 1: +862164386191		Telephone 2:		Fax	+862164384618

A.2. LEGAL REPRESENTATIVE

Name of the person entitled to legally commit the organisation (for the coordinating organisation only)

Last Name:	*Mr*	Hong	First Name:	Xiaoyu
Function:		Director		
Address (*Only if different from official address above)*:				

A.3. CONTACT PERSON / COORDINATOR

(responsable for the management of the project in the organisation)

Last Name:	*Mr*	Jing	First Name:	Yipeng
Function:		Professor		
ypjing@shao.ac.cn		Telephone: +862164410713	Fax number	+862164384618
Address (*Only if different from official address above)*:				

PART B: Description of the Organisation

B.1. NATURE OF THE ORGANISATION

Status: *(leave only the relevant status)*	✓ Public ✓ ~~Private~~ *(an organisation which has received over 50 % of its annual revenues from public sources over the preceding two years, or which is controlled by public bodies or their representatives can be declared as "public")*	
Type of organisation: *(leave only the relevant type(s))*	X Higher Education Institution ❑ X HE research centre/organisation ❑ Private research centre/organisation ❑ Public research centre/organisation (not HE) Graduate/Doctoral School ❑ Public authority (local) ❑ Public authority (national) ❑ Public authority (regional) ❑ Chamber of commerce / crafts	❑ Chamber of industry ❑ Enterprise large (> 500 employees) ❑ SME ❑ Professional associations ❑ Social partners (trade unions, etc) ❑ Assoc. of professors and researchers ❑ Assoc. of Universities / Research centres ❑ Other (please specify under B.2)

B.2.PURPOSE AND ACTIVITY OF THE ORGANISATION

Please provide a short presentation of your organisation in relation with the activities covered by the project and more particularly concerning its postgraduate (masters/doctorate level) and international cooperation activities *(max. 20 lines).*

Shanghai Astronomical Observatory is a Research Institute of the Chinese Academy of Sciences (CAS). The observatory provides Masters and Doctors postgraduate training, and has about 120 postgraduate students. The Key Laboratory of Research in Galaxies and Csomology is the department engaged in the current project. The Key Laboratory is a previliged research center supported by CAS, and is currently involved in a few key national research projects in astrophysics. For example, its director, Yipeng Jing, manages the Chinese State Key Research Project (also known as the "973 project")
on the "Formation and evolution of large scale structures and galaxies", which is the biggest research network in astrophysics in China,with about 50 senior researchers, 50 postdoc researchers and a large number of PhD students. Jing studied in Rome University, got his PhD degree in SISSA Trieste, did postdoctoral research at Max-Planck Institute for Astrophysics, and have had close collaborations with many EU astrophysics institues. The participation of Shanghai will give the European researchers the opportunity to forge new collaborations with the fastest growing research community in the world.

Provide a short description of the organisation's specific role in the project *(max. 10 lines)*

Shanghai Astronomical Observatory is actively working on Galaxy Formation, Large scale structures in the Universe, Modified Gravity, Black Hole detection, accretion theory of black holes, and high energy astrophysics. The Key Laboratory will participate in the joint research projects in these fields, and jointly supervise the PhD students.

Stockholms universitet

April 23, 2009

To whom it may concern,

Stockholm University will actively participate in the joint programme "Erasmus Mundus Joint Doctorate (EMJD) in Relativistic Astrophysics" as an European Institution Partner. I am aware that Stockholm University is involved in its application. The research and education required by the joint programme will be carried out by the Department of Physics led by professor Kjell Rosquist. Stockholm University will provide all necessary support for this joint programme.

Sincerely yours,

Ann-Caroline Nordström
Director, Head of Administration

Stockholms universitet

PART A: Identification of the applicant and other participating organisations

Parts A and B must be filled in separately for each organisation involved in the project (including associated members). **The application must be accompanied by copies of letters from the legal authority of each participating organisation** confirming their support to the joint programme and their agreement with the submitted application (*not necessary for associated members*)

A. 1 ORGANISATION

Role in the consortium *(leave the relevant role only)*	~~Applicant / Coordinating Organisation~~ Partner Organisation ~~Associated member~~				
Official name of the organisation: If applicable, organisation's name in latin characters	**Stockholm University**				
Acronym:	SU				
N° of the Erasmus University Charter (if applicable), for European Higher Education Institutions only	***29366-IC-1-2008-1-SE-ERASMUS-EUCX-1***				
Department, if applicable:	Department of Physics				
Official Address	AlbaNova University Center				
Postal Code:	106 91	Town:	Stockholm		
Region:		Country:	SWEDEN		
Internet address:	http:// www.physto.se				
Telephone 1: +46855378600		Telephone 2:		Fax	+46855378601

A.2. LEGAL REPRESENTATIVE

Name of the person entitled to legally commit the organisation (for the coordinating organisation only)

Last Name:	*Ms*	Nordström	First Name:	Ann-Caroline
Function:	Director, Head of Adminstration			
Address (*Only if different from official address above)*:	Stockholms universitet Universitetsförvaltningen 106 91 Stockholm			

A.3. CONTACT PERSON / COORDINATOR

(responsable for the management of the project in the organisation)

Last Name:	*Mr*	ROSQUIST	First Name:	KJELL
Function:	professor			
@ : kr@physto.se		Telephone: +46855378729	Fax number	+46855378601
Address (*Only if different from official address above)*:				

PART B: Description of the Organisation

B.1. NATURE OF THE ORGANISATION

Status: *(leave only the relevant status)*	❦ Public ❦ ~~Private~~ *(an organisation which has received over 50 % of its annual revenues from public sources over the preceding two years, or which is controlled by public bodies or their representatives can be declared as "public")*	
Type of organisation: *(leave only the relevant type(s))*	X Higher Education Institution ❑ HE research centre/organisation ❑ Private research centre/organisation ❑ Public research centre/organisation (not HE) Graduate/Doctoral School ❑ Public authority (local) ❑ Public authority (national) ❑ Public authority (regional) ❑ Chamber of commerce / crafts	❑ Chamber of industry ❑ Enterprise large (> 500 employees) ❑ SME ❑ Professional associations ❑ Social partners (trade unions, etc) ❑ Assoc. of professors and researchers ❑ Assoc. of Universities / Research centres ❑ Other (please specify under B.2)

B.2.PURPOSE AND ACTIVITY OF THE ORGANISATION

Please provide a short presentation of your organisation in relation with the activities covered by the project and more particularly concerning its postgraduate (masters/doctorate level) and international cooperation activities *(max. 20 lines).*

The Department of Physics at Stockholm University (SU) is part of the AlbaNova University Center which is a joint center with the Royal Institute of Technology. The SU physics department is large with some 30 full professors and a comprehensive education program covering basic physics and many research areas at the graduate level, both experimental and theoretical. The department has an active collaboration with the Department of Astronomy. The SU physics and astronomy departments are also collaborating with the AlbaNova based Physics department of the Royal Institute of Technology. Much of the research in astrophysics and cosmology is performed within the newly formed Oskar Klein Centre for Cosmo Particle Physics which has long term support from the Swedish Research Council.

The graduate programs at AlbaNova include the subjects of Astrophysics, Cosmology and Astroparticle physics, with both theoretical and observational specializations. The local expertise incorporates the areas of relativistic astrophysics (gamma-ray bursts, active galactic nuclei and general relativity), observational astrophysics and cosmology (gamma-ray observations, active galactic nuclei and supernova cosmology) and dark matter (candidate phenomenlogy). The ongoing research in these areas at AlbaNova involves in particular gamma-ray bursts, active galactic nuclei (massive black holes in the center of galaxies), theoretical cosmology and general relativity, gamma-ray observations (in particular with the Fermi Gamma-ray Space Telescope), supernova cosmology, and astroparticle physics with dark matter phenomenology.

Provide a short description of the organisation's specific role in the project *(max. 10 lines)*

Within the proposed graduate program, the Department of Physics at Stockholm University will provide graduate courses and student supervision. The plan is that this will be done in close collaboration with the partners at the Department of Astronomy (SU) and the Physics department at the Royal Institute of Technology. The courses will cover mainly High Energy Astrophysics and Advanced General Relativity for the benefit of the students within the program.

People:
Kjell Rosquist, Department of Physics, Stockholm University (local coordinator)
Claes-Ingvar Björnsson, Department of Astronomy, Stockholm University
Felix Ryde, Department of Physics, Royal Institute of Technology

TARTU OBSERVATOORIUM

TARTU OBSERVATORY

April 29, 2009

To whom it may concern,

Tartu Observatory will actively participate in the joint program "Erasmus Mundus Joint Doctorate (EMJD) in Relativistic Astrophysics" as an European Institution Partner.

I am aware of its application.

The research and education required by the joint program will be carried out within the research, curriculum and doctorate program in Astrophysics and Cosmology, led by Dr. Enn Saar. The research activity of graduate and doctorate students of this program will be carried out in Cosmology Department in collaboration with Tartu University. Tartu Observatory will provide all the necessary support for this joint program.

Sincerely yours,

Dr. Laurits Leedjärv
Director

Tõravere 61602 Tartumaa ESTONIA Phone:+372 741 0265 Fax:+372 741 0205 E-mail:aai@aai.ee Reg code 70003785

PART A: Identification of the applicant and other participating organisations

Parts A and B must be filled in separately for each organisation involved in the project (including associated members). **The application must be accompanied by copies of letters from the legal authority of each participating organisation** confirming their support to the joint programme and their agreement with the submitted application (*not necessary for associated members*)

A. 1 ORGANISATION

Role in the consortium *(leave the relevant role only)*	~~Applicant / Coordinating Organisation~~ Partner Organisation ~~Associated member~~				
Official name of the organisation: If applicable, organisation's name in latin characters	Tartu Observatory				
Acronym:	TO				
N° of the Erasmus University Charter (if applicable), for European Higher Education Institutions only					
Department, if applicable:	Cosmology				
Official Address	Tartu Observatory				
Postal Code:	EE-61602	Town:	Toravere		
Region:	Tartumaa	Country:	Estonia		
Internet address:	http://www.aai.ee				
Telephone 1: +372-7410265		Telephone 2:		Fax	+372-7410205

A.2. LEGAL REPRESENTATIVE

Name of the person entitled to legally commit the organisation (for the coordinating organisation only)

Last Name:	*Dr.*	LEEDJÄRV	First Name:	LAURITS
Function:	DIRECTOR			
Address (*Only if different from official address above)*:				

A.3. CONTACT PERSON / COORDINATOR

(responsable for the management of the project in the organisation)

Last Name:	*Prof.*	Einasto	First Name:	Jaan
Function:	Senior scientist of Cosmology Department			
@ : einasto@aai.ee		Telephone: +372-7410110	Fax number	+372-7410205

Address (*Only if different from official address above)*:	

PART B: Description of the Organisation

B.1. NATURE OF THE ORGANISATION

Status: *(leave only the relevant status)*	❦ Public ❦ ~~Private~~ *(an organisation which has received over 50 % of its annual revenues from public sources over the preceding two years, or which is controlled by public bodies or their representatives can be declared as "public")*	
Type of organisation: *(leave only the relevant type(s))*	X Higher Education Institution X No-profit research organisation	

B.2.PURPOSE AND ACTIVITY OF THE ORGANISATION

Please provide a short presentation of your organisation in relation with the activities covered by the project and more particularly concerning its postgraduate (masters/doctorate level) and international cooperation activities *(max. 20 lines).*

Tartu Observatory is a research and educational organization in Astrophysics, Cosmology and Atmospheric Physics. It participates in graduate and postgraduate programs in these fields in collaboration with Tartu University (teaching and supervision of master and doctoral theses, as well as post-doctoral studies). Research in cosmology is done in cooperation with astronomers in Valencia University (Spain), Potsdam Astrophysical Institute (Germany), ICRAnet (Italy) and other centres. Tartu Observatory takes part in the preparation of the GAIA Mission to study the structure of our Galaxy, in particular the merging history of the Galaxy, and the structure of Dark Halo. In collaboration with Turku Observatory (Finland) Tartu Observatory participates in the Planck Mission; our responsibility is, among other tasks, the preparation of the catalogue of superclusters to study the Sunyaev-Zeldovich effect in clusters and superclusters.

Provide a short description of the organisation's specific role in the project *(max. 10 lines)*

The Cosmology Department of Tartu Observatory will offer teaching and supervision in the problems of the large-scale structure of the Universe, both in the observational and statistical aspects, and in the numerical modeling of formation of structure. Tartu Observatory has a long experience and an outstanding list of results in this subject, and has fruitfully collaborated with ICRA in the study of fractal properties of structure in the Universe. Our specific role is in the study of the structure and morphology of superclusters, detailed modeling of the structure and evolution of galaxies of different morphological type, and evolution of the large-scale structure, including effects due to dark matter and dark energy.

IRAP PHD

CURRICULUM

1. BELINSKY Vladimir (ICRANet)
2. CHAKRABARTI Sandip (ISCP India)
3. CHARDONNET Pascal (University of Savoie)
4. COULLET Pierre (University of Nice Sophia Antipolis)
5. EINASTO Jaan (Tartu Observatory)
6. FRONTERA Filippo (University of Ferrara)
7. JING Yipeng (Shanghai Observatory China)
8. KLEINERT Hagen (Freie University of Berlin)
9. NICOLAI Hermann (Max Planck Institute for Gravitation)
10. NOVELLO Mario(CBPF Brazil)
11. PACHECO Jose (Observatoire de la Côte d'Azur)
12. ROSQUIST Kjell (University of Stockholm)
13. RUFFINI Remo (University of Roma La Sapienza & ICRANet)
14. RYDE Felix (University of Stockholm)
15. TITARCHUK Lev (University of Ferrara)
16. VAKILI Farrokh (Observatoire de la Côte d'Azur)

ANNEXES

1. Community grants of Nice University with codes numbers
2. Application Form of the PhD
3. Charter Thesis
4. Mobility
5. Lectures
6. Budget
7. IRAP Agreement
8. Villa Ratti
9. Agreement Nice-ICRANet
10. Kolkota Meeting

11. **Italian Korean Meeting**
12. **Sobral Meeting**
13. **Shanghai Meeting**
14. **Christchurch Meeting**
15. **Marcel Grossmann Meeting MG12 in Paris**
16. **Marcel Grossmann Awards**
17. **2008 Graduation Ceremony of IRAP PhD with Prof. Riccardo Giacconi, Nobel Laureate in 2002**

IRAP PHD

CURRICULUM

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9. *NICOLAI Hermann (Max Planck Institute for Gravitation)*
10. *NOVELLO Mario(CBPF Brazil)*
11. *PACHECO Jose (Observatoire de la Côte d'Azur)*
12. *ROSQUIST Kjell (University of Stockholm)*
13. *RUFFINI Remo (University of Roma La Sapienza & ICRANet)*
14. *RYDE Felix ((University of Stockholm)*
15. *TITARCHUK Lev (University of Ferrara)*
16. *VAKILI Farrokh (Observatoire de la Côte d'Azur)*

Curriculum Vitae, Vladimir BELINSKI,

Last update: April, 2009

Born: 26 March 1941 in USSR, original nationality Russian, now citizen of Italy

Profile: theoretical physicist specialized in General Relativity and Cosmology
Position: Faculty member of the International Network of Centres for Relativistic Astrophysics (ICRANET) in Pescara, Italy

Official address:

Prof. V.A.Belinski ,
International Network of Centres for Relativistic Astrophysics (ICRANET)
Piazza della Repubblica, 10
65122 Pescara (PE), Italy.
Office Tel: +39-085-23054202 (direct),
+39-085-23054200 (secretary)
Fax:+39-085-4219252
e-mail: , belinski@icra.it

Education:

1948/09-1958/05, elementary and high school
1958/09-1965/08, student at Moscow Engineering Phyisical Institute
1965/09-1968/09, postgraduate student at Moscow Phyisical-Technical Institute and Landau Institute for Theoretical Physics, Moscow

Experience:

1968/10-1969/10, engineer at Moscow Institute for Optical-Physical Measurements
1969/10, first scientific degree "Candidate of Physical-Mathematical Sciences" from Landau Institute
1969/11-1981/11, junior researcher, senior researcher at Landau Institute
1981/12, second scientific degree "Doctor of Physical-Mathematical Sciences" from Landau Institute
1981/12-1990/10, "Leading Researcher" at Landau Institute
1989/10-1990/10, Visiting Professor at Yukawa Institute for Theoretical Physics, Kyoto, Japan (on leave from Landau Institute)
1990/11- 2008/10, Research Supervisor at the National Institute for Nuclear Physics (INFN), Rome University, Italy
2008/10-up to now, Faculty member of International Network of Centres for Relativistic Astrophysics (ICRANET) in Pescara, Italy.

Teaching and Didactic activity:

1.The course of lectures in Cosmology for the post graduate students delivered in Physics Department, Rome University "La Sapienza" during 1990-1998.

2. Supervisor of studies for the students:
1. G.Montani (University Graduation, 1992)
2. W. Inglese (University Graduation, 1992)
3. A.D'Aquino (University Graduation, 1993)
4. F.Ferrante (University Graduation, 1996)
5. G.Montani (PhD degree, 1997)
6. M.Talevi (University Graduation, 1997)
7. A.Paolino (University Graduation, 1997)
8. A.Borreli (PhD degree, 1998)
9. D.Oriti (University Graduation, 1999)
10. M.Vella (University Graduation, 2000)
11. D.Colosi (University Graduation, 2000)
12. F.Briscese (University Graduation, 2003)
13. M.Pizzi (University Graduation, 2005)
14. M.Pizzi (PhD degree, 2008)
15. A.Paolino (PhD degree, 2009)

Fields of scientific interest:

Cosmology: The study of the general solution of gravitational equations with cosmological singularity of an oscillatory chaotic structure (the so-called BKL singularity). Investigation of the properties of this solution and of the influence of different kinds of matter on its character.

Astrophysics: Construction of exact solutions for the motions of gravitating shells and its intersections. Chaotic behaviour of the intersecting shells. Applications to the star models and stellar clusters.

Exact solutions of Einstein and Einstein-Maxwell equations: The theory of gravitational solitons and the mathematical aspects of the Inverse Scattering Method in General Relativity . Construction of the exact solutions of physical interest.

Quantum Fields: Analysis of the behaviour of the Quantum Fields in Black Hole space-time and in accelerated systems from the point of view of canonical and algebraic Quantum Field Theory.

Main publications:

1. V. Belinski and I. Khalatnikov "On the Nature of the singularities in the General Solution of the Gravitational Equations", Sov. Phys. JETP, 29, 911, (1969).

This was the first investigation of the homogeneous cosmological model of Bianchi IX type and it was the first discovery of the new type of cosmological singularity - oscillating cosmological regime. In the subsequent literature this model has been given the second name "mixmaster Universe".

2. V. Belinski and I. Khalatnikov "General Solution of the Gravitational Equations with a physical Singularity", Sov. Phys. JETP, 30, 1174, (1970).

In this paper was made the first statement that the oscillating cosmological regime of Bianchi IX model is the paradigm of the behaviour of the General cosmological Solution near singularity and that the General Solution with singularity really exist. Paper investigated a number of analytical properties of this Solution.

3. V. Belinski, I. Khalatnikov and E. Lifshitz "Oscillatory Approach to a Singular Point in the Relativistic Cosmology", Adv. in Phys., 19, 525, (1970).

The properties of the General Cosmological Solution near singularity was described. It was constructed the method for qualitative description of the oscillating cosmological evolution in terms of successively changing "Kasner epochs". It was described the statistical properties of the chaotic oscillating regime in ultra asymptotic region near singularity.

4. V. Belinski and I. Khalatnikov "Effect of scalar and Vector Fields on the nature of the cosmological singularity", Sov. Phys. JETP, 36, 591, (1973).

The effect of scalar and vector fields on the character of the cosmological singularity is investigated. The fields may either be gravitational (in the sense of the Brans-Dicke ideas) or extraneous physical fields which are sources of an ordinary gravitational field. It is shown that in the presence of only a scalar field the gravitational equations possess a monotonic power-law asymptotic for the general solution near the singular point in place of an oscillating form. However, if a vector field is included on the basis of five-dimension geometry concepts, the general solution becomes oscillatory again.

5. V. Belinski and I. Khalatnikov "Viscosity effects in isotropic cosmologies", Sov. Phys. JETP, 45, 1, (1977).

Some new types of evolution that arise in isotropic Friedmann cosmological models when allowance is made for bulk viscosity are described. The coefficient of viscosity is assumed to be a function of the energy density. For small and large values of its argument, this function is assumed to have a power law behaviour.

6. V. Belinski and V. Zakharov "Integration of the Einstein Equations by means of the inverse scattering problem technique and construction of exact soliton solutions", Sov. Phys. JETP, 48, 985, (1978).

First application of the inverse scattering method (ISM) to the General Relativity was described. It was shown that the Einstein equations for the case, when metric depends only on two variables, is completely integrable system. It was described the first examples of exact solitonic solutions in General Relativity.

7. V. Belinski and V. Zakharov "Stationary gravitational solitons with axial sym metry", Sov. Phys. JETP, 50, 1, (1979).

An application of the method of the inverse scattering problem to the integration of the gravitational equations is described. The case considered is that of stationary axially symmetric gravitational fields. The procedure for constructing soliton solutions is carried through for all metric coefficients. Axially symmetric solutions with an

arbitrary number of solitons are considered.

8. V. Belinski "One-soliton cosmological waves", Sov. Phys. JETP, 50, 623, (1979).

Exact solutions of the gravitational equations which describe the evolution of gravitational solitons on the background of Friedmann cosmological models with the equation of state e = p are derived and examined. The corresponding vacuum solution are given.

9. V. Belinski and I. Khalatnikov "On the influence of matter and Physical Fields upon the Nature of Cosmological Singularities", Soviet Physics Reviews, Harwood Acad. Publ., 3, 555, (1981).

It was investigated the influence of Yang-Mills fields and perfect liquid matter with unusual equations of state on cosmological singularities. It was shown that Yang-Mills fields do not change qualitatively the oscillating regime near singular point. The same is correct for perfect liquid in a wide range of equations of state with only one exception, namely, the stiff matter equation of state. In this case the asymptotic near singularity changes to the smooth Kasner-like (similar to the scalar field case) behaviour. For this case we constructed the general Cosmological Solution near the singularity in analytical form.

10. V. Belinski, I. Khalatnikov and E. Lifshitz "A general solution of the Einstein equations with a time singularity", Adv. in Phys., 31, 639, (1982).

This paper is a concluding review exposition of the investigations aimed at the construction of a general cosmological solution of the Einstein equations with a singularity in time (including the description of the new phenomenon of the rotations of Kasner axis). Thus it is a direct continuation of the previous (1970) paper by the authors in this Journal. A detailed description is given of the analysis which leads to the construction of such a solution, and of its properties.

11. V. Belinski, L. Grishchuk, I. Khalatnikov and Y. Zeldovich "Inflationary Stages in Cosmological Models with a scalar Field", Phys. Lett., 155B, 232, (1985).

Homogeneous isotropic cosmological models with a massive scalar field are studied. It is shown that inflationary stages of evolution are characteristic of most solutions in these models.

12. V.Belinski "Gravitational breather and topological properties of gravisolitons", Phys. Rev., D44, 3109, (1991).

It is shown that for a wide class of cosmological solutions of the vacuum Einstein equations the notions of gravisolitons and antigravisolitons with respect to some topological charge can be introduced. The presence of attractive forces between two gravitational solitons with the charges of opposite signs and repulsive forces between solitons of the same charges is shown. The construction of the Gravibreather as a bound state of the gravisoliton and antigravisoliton is described.

13. V.A. Belinski, B.M. Karnakov, V.D. Mur and N.B. Narozhny "Does the Unruh effect exist ?", JETP Letters, 65, 902 (1997).

It is shown that Fulling quantization in the Rindler manifold actually use boundary condition which are equivalent to the presence of an impenetrable wall on the spatial boundary of the Rindler patch. Therefore the Rindler space physically has no connection with Minkowski space and the state of the Rindler observer can not be described by the thermal density matrix corresponding to the Unruh-Fulling temperature. Therefore it is pointless to talk about an Unruh effect. The problem of the response of the accelerated physical detector in the Minkowski space-time remains open.

14. V. Belinski and E. Verdaguer, "Gravitational Solitons", Cambridge University Press, Cambridge Monographs on Mathematical Physics, 2001.

The book represents a self-contained exposition of the theory of gravitational solitons and provides a comprehensive review of exact soliton solutions to the relativistic gravitational equations. The text begins with a detailed discussion of the extension of the Inverse Scattering Method to the theory of gravitation, starting with pure gravity and then extending it to the coupling of gravity with the electromagnetic field. There follows a systematic review of the gravitational soliton solutions based on their symmetries. These solutions include some of the most interesting in gravitational physics such as those describing inhomogeneous cosmological models, cylindrical waves, the collision of exact gravity waves, the Schwarzschild and Kerr black holes.

15. N.B. Narozhny, A.M. Fedotov, B.M. Karnakov, V.D. Mur and V.A. Belinski "Boundary conditions in the Unruh problem", Phys. Rev. D65, 025004, (2002). (hep-th/9906181).

The paper represents the complete analysis of the so called Unruh effect both from the point of view of canonical and algebraic approach to the quantum field theory. It is shown that the quantization procedure proposed by Unruh implies setting a boundary condition for the quantum field operator and this changes drastically the topological properties and symmetry group of the spacetime which lead to the field theory in two disconnected left and right Rindler spacetimes instead of Minkowski spacetime. The double Rindler wedge is composed of two causally disjoint regions (R-and L-wedges of Minkowski spacetime) and the Unruh construction implies existence of zero boundary condition for the quantum field operator at the common edge of R- and L-sectors of Minkowski spacetime. Such boundary condition gives rise to a superselection rule prohibiting any correlations between right and left Unruh particles. Thus the part of the field from the L-wedge in no way can influence a Rindler observer living in the R-wedge and an integration out of the invisible left degrees of freedom will take no effect on him. Hence averaging over states of the field in one wedge can not lead to thermalization of the state in the other. This result is proved both in the standard and algebraic formulations of quantum field theory and conclusion is that principles of quantum field theory does not give any grounds for existence of the Unruh effect. Thus in spite of the work over last 25 years, there still remain serious gaps in grounding of the Unruh effect, and as of now there is no compelling evidence for the universal behaviour attributed to all uniformly accelerated detectors.

16. M.V. Barkov, V.A. Belinski and G.S. Bisnovatyi-Kogan, "An exact General Relativity solution for the Motion and Intersections of Self-Gravitating Shells in the Field of a Massive Black Hole", JETP 95, 371, (2002). (astro-ph/0210296).

It is found the complete exact solution in the General Relativity for the intersection process of two massive selfgravitating spherically symmetric shells (in general with tangential pressure). It is shown how one can calculate all shell's parameters after intersection in terms of the parameters before the intersection. The result is quite new, the solution of this kind was known only for the massless shells (Dray and t'Hooft, 1985). The solution was applied to the analysis of matter ejection effect from relativistic stellar clusters. It is shown that in relativistic case the matter ejection effect is stronger than in newtonian gravity.

17. V.A. Belinski, N.B. Narozhny, A.M. Fedotov and V.D. Mur "Unruh quantization in presence of a condensate", Phys. Lett. A331, 349, (2004). (hep-th/0306191).

It is shown that the Unruh quantization scheme can be realized in Minkowski spacetime in the presence of Bose-Einstein condensate containing infinite average number of particles in the zero boost mode and located basically inside the light cone. Unlike the case of an empty Minkowski spacetime the condensate provides the boundary conditions necessary for the Fulling quantization of the part of the field restricted only to the Rindler wedge of Minkowski spacetime.

18. V.Belinski "On the existence of black hole evaporation yet again", Phys. Lett. A354, 249 (2006). (gr-qc/0607137)

A new argument is presented confirming the point of view that a Schwarzshild black hole formed during a collapse process does not radiate.

19. V. Belinski "Quantum fields in black hole spacetime and in accelerated sistems", AIP Conference Proceedings, Ed. M.Novello and S. Bergliaffa, 910, 270, (2007).

The paper offers a synopsis of the five invited lectures delivered by the author at XII Brazilian School of Cosmology and Gravitation in Rio-de-Janeiro at September 2006. For the reader interested in a general understanding of the essence of the problems related to the so-called Unruh effect and to the black hole evaporation phenomenon the paper is complete and self-consistent.

20. G.Alekseev and V.Belinski ""Equilibrium configurations of two charged masses in General Relativity", Phys. Rev. D76, 021501(R), (2007). (gr-qc/0706.1981)

An asymptotically flat static solution of Einstein-Maxwell equations which describes the field of two Reissner - Nordstrom sources in equilibrium is presented. It is expressed in terms of physical parameters of the sources (their masses, charges and separating distance). Very simple analytical forms were found for the solution as well as for the equilibrium condition which guarantees the absence of any struts on the symmetry axis. This condition shows that the equilibrium is not possible for two black holes or for two naked singularities. However, in the case when one of the sources is a black hole and another one is a naked singularity, the equilibrium is possible at some distance separating the sources. It is interesting that for appropriately chosen parameters even a neutral Schwarzschild black hole can be "suspended" freely in the field of a naked singularity which phenomenon is due to the repulsive forces produced by a naked singularity.

IRAP PHD

CURRICULUM

1. *BELINSKY Vladimir (ICRANet)*
2. **CHAKRABARTI Sandip (ISCP India)**
3. *CHARDONNET Pascal (University of Savoie)*
4. *COULLET Pierre (University of Nice Sophia Antipolis)*
5. *EINASTO Jaan (Tartu Observatory)*
6. *FRONTERA Filippo (University of Ferrara)*
7. *JING Yipeng (Shanghai Observatory China)*
8. *KLEINERT Hagen (Freie University of Berlin)*
9. *NICOLAI Hermann (Max Planck Institute for Gravitation)*
10. *NOVELLO Mario(CBPF Brazil)*
11. *PACHECO Jose (Observatoire de la Côte d'Azur)*
12. *ROSQUIST Kjell (University of Stockholm)*
13. *RUFFINI Remo (University of Roma La Sapienza & ICRANet)*
14. *RYDE Felix ((University of Stockholm)*
15. *TITARCHUK Lev (University of Ferrara)*
16. *VAKILI Farrokh (Observatoire de la Côte d'Azur)*

Curriculum Vitae of Prof. S.K. Chakrabarti

Born: on Nov. 15th 1958, at Malda (WB), INDIA.
Marital Status: Married
Nationality: Indian

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Education:

Bachelor of Science (B.Sc.) in Physics Hons. from Calcutta University in 1979 with *First Class First* position.
Master of Science (M.Sc.) in Physics Hons. from Indian Institute of Technology, Kanpur in 1981 with *first division with distinction*.
Ph.D. from the Dept. of Physics, The University of Chicago, Thesis on "Rotating Wind Solution and the Acceleration of Cosmic Radio Jets", in July, 1985 (Supervisor: Prof. W. D. Arnett).

Positions held:

1) Research Assistant from Oct. 1981 to Sept. 1985 at the University of Chicago
2) *R. C. Tolman Fellow (1985-1987)* at the California Institute of Technology.
3) Postdoctoral Fellow (1987-1988), ICTP, Trieste.
4) Visiting Fellow (Nov. 1988 - July 1989) Tata Institute Of Fundamental Research, Bombay.
5) Fellow (Aug. 1989 - July 1994) TIFR, Bombay.
6) Reader (Aug. 1994 - Feb. 1998), TIFR, Bombay
7) Assoc. Professor (Dec. 1996 - Dec. 2003) S.N. Bose National Center for Basic Sciences
8) Professor, S.N. Bose National Centre for Basic Sciences, (2004 -2007)
9) Senior Professor, S.N. Bose National Centre for Basic Sciences (2008-) 10) In Charge, Academic Affairs and General Secretary: Indian Centre for Space Physics (1999 -)

Awards and Appointments:

1) *National Science Talent Search* (NSTS) Scholarship in 1975.
2) *National Science* (NS) Scholarship in 1975.
3) Research Assistant from Oct. 1981 to Sept. 1985 at the University of Chicago
4) Life Member: Indian Association of General Relativity and Gravitation.
5) Young Associate award from Indian Academy of Sciences (1990-1993).
6) Young Scientist award by the Indian National Science Academy (1990)

7) Regular Associate: International Center For Theoretical Physics, Trieste, Italy (1990-1997).
8) Member: International Astronomical Union (1991-)
9) A.K. Bose Award by Indian National Science Academy (1994)
10) INSA/DFG nomination to attend 44th Meeting of the Nobel Prize Winners in Lindau (1994)
11) Member: Executive Committee of Commission-28 (Galaxies) of International Astronomical Union (1994-2000)
12) Senior Research Associate (National Research Council, National Academy of Sciences) at NASA/Goddard Space Flight Centre (Oct.1994 - Oct.1995)
13) Member: American Astronomical Society (1996)
14) Acting Administrative Officer, S.N. Bose National Center for Basic Sciences (Apr. 1998 - Oct, 1998)
15) Sub-Editor (Astrophysics Section) of Indian Journal of Physics (1999-)
16) Honorary Professor, Indian Centre for Space Physics, Kolkata (2002-)
17) Senior Associate, Abdus Salam ICTP, Trieste, Italy (2003-)
18) Head of the Department, Astrophysics and Cosmology, SNBNCBS (2006-)
19) Member: American Astronomical Society (2007-)
20) Member Editorial Board: Open Astronomy Journal (Bentham) (2007-)
21) Member: International Society of the Study of the Origin of Life (ISSOL) (2008-)
Others: Member of the Expert Committee on Astrophysics: Indira Gandhi National Open University; Expert member: Italian Space Agency Proposal Review Committee (2001); Invited Professor, University of Paris (two months), 2002; Member: Project Monitoring Body of RT-2 payloads (2005-2008)

Research Experiences and Some of the Visits to Scholarly places:

1. Summer 1976: NSTS summer Research on 'Geomagnetic Micropulsation' under Dr. M.K. Rama Rao in the Physics Dept. of Andhra University, Waltair, AP, INDIA.
2. Summer 1978: NSTS summer Research on 'X-ray diffraction patterns of Fe-Co-Ni alloys' under Dr. A.K. Majumder in the Physics Dept. of Indian Institute of Technology, Kanpur (IIT/K), UP, INDIA.
3. Summer 1979: Literature Survey on Ferromagnetic Alloys under Dr. D.C. Khan in the Physics Dept. of IIT/K.
4. Feb. 1981: Visited Osmania University in relation to a conference.
5. Summer 1981: Follow up of my Master's Thesis work on the "Magnetic Bubbles" under Dr. D.C. Khan (IIT/K) and Dr. K.N. Swamy Rao (IIT/K).
6. Fall 1981 to Spring 1982: Teaching Assistant, Dept. of Physics (20 hrs/week), The University of Chicago for three quarters.

7. Summer 1982 - September 1985: Research Assistant, Dept. of Physics, University of Chicago.
8. April 1984: Visited University of Manchester in relation to AGN conference.
9. December 1984: Visited Hebrew University of Jerusalem in relation to 12th Texas Symposium.
10. June 1985: Visited Canadian Institute of Theoretical Astrophysics in relation to Relativistic Astrophysics Conference.
11. October 1985 - October 1987: R.C. Tolman Fellow at the California Institute of Technology.
12. July 1986: Visited Stockholm Observatory in relation to GR11 conference.
13. Oct. 1986: Visited George Meson University, Virginia, in relation to the conference on Supermassive Black Holes.
14. Jan. 1987: Visited University of California, at Santa Barbara.
15. July 1987: Visited TIFR, Bombay and Raman Research Institute, Bangalore.
16. November 1987 - October 1988: Post doctoral fellow at the International Center of Theoretical Physics.
17. Dec. 1987: Visited Torino Observatory.
18. Mar. 1988: Visited University of Tokyo in relation to the 20th Yamada Conference.
19. Summer 1988: Visited Osservatorio Astronomico, Rome; Max Planck Institute and University of Crete
20. Visited California Institute of Technology, University of Colorado, Princeton University and the Harvard University (June 29th to July 20th, 1989).
21. Summer 1990: Visited Leiden Observatory, University of Amsterdam and the Astrophysical Observatory in Paris.
22. Visited International Center for Theoretical Physics, Trieste, as an associated member of the Institute (Nov. 30th 1990 - Feb. 27th 1991).
23. Participated at the winter college on 'Multilevel Techniques in Computational Physics' at International Center for Theoretical Physics, Trieste, (21st Jan. 1991- 1st February 1991).
24. Visited Kyoto University as a guest scholar, (23rd June 1991 - 14th July 1991).
25. Visited Institute of Astronomy, Cambridge (Apr.20 - Apr.24), Georgia State University (Apr.25 - Apr.28), California Institute of Technology (Apr.29 - May 5), Univ. of California at Los Angeles (May 6 - May 8), ICTP (May 10 - Jun. 26), Univ. of Catania (Jun. 8 - Jun. 10), Univ. of Milano (Jun. 16 - Jun. 17), IAFE, Buenos Aires (Jul. 5 - Jul. 8) in 1992.
26. Participated at the school on 'Dynamical systems' at International Center for theoretical Physics, Trieste from 15th May to 29th May, 1992.
27. Nov. 1992: Visited Science College, Calcutta University.
28. Visited Inter-University Center for Astrophysics and Astronomy at Pune, from Nov. 30th to Dec.4th, 1992.
29. Mar. 1993: Visited Saha Institute of Nuclear Physics, Calcutta

30. Visited University of Palermo (Mar. 28th - Apr. 8th); Princeton University (Apr. 13th - Apr. 18th); Goddard Space Flight Center (Apr. 20th - Apr.23rd); STSCI (Apr. 24th - Apr. 26th); Washington University (Apr. 27th - Apr. 28th); University of Missouri (Apr. 29th - May 2nd); University of Texas at Denton, (May 3rd - May 5th); University of Texas at Austin (May 6th - May 11th); Rice University (May 12th); University of Waterloo, Canada (May 13th - May 15th); Ohio State University (May 17th - May 21st); University of California at Los Angeles (May 22nd- May 30th); Georgia State University, Atlanta (May 31st - Jun. 6th); Aspen Center for Physics, Colorado (Jun. 7th - Jun. 20th); High Altitude Observatory, Colorado (Jun. 20th - Jun. 22nd); University of Chicago (Jun. 22nd - Jul. 22nd); UNAM, Mexico City (Jul. 23rd - Jul. 31st); ICTP, Trieste (Aug. 2nd - Sep. 7th); Geneva Observatory (Aug. 29th - Sep. 4th) in 1993.

31. Visited Landessternwarte, Heidelberg from June 14th to 25th, 1994, Max-Planck-Institut für Astrophysik from July 1st to 31st, 1994, Institute of Theoretical Astrophysics, University of Heidelberg from August 1st to August 31st, 1994.

32. Visited Goddard Space Flight Center as a Senior Research Associate (National Academy of Sciences) Oct. 1994 to Oct. 1995.

33. Visited Arecibo Observatory, Marshall Space Flight Center, University of Kentucky, Space Telescope Science Institute, Univ. of Maryland, Univ. of California (Los Angeles), Jet Propulsion Laboratory, Calif. Institute of Technology, Harvard University, Columbia University, Princeton University during Oct. 94 - Oct. 95.

34. Visited Universities of Sydney and Melborne, Monash University (Melbourne), Australian National Telescope Facility (Sydney), Australian National University (Canberra) during July 4th -July 14th, 1996.

35. Visited Pusan National University (Korea), Kobe University and Osaka University during Aug. 15th to Sept. 4th., 1996.

36. Visited Goddard Space Flight Center (Maryland) and University of Chicago during Dec. 5th to Dec. 23rd, 1996.

37. Visited Physikzentrum at Bad Honnef, Germany, during 17th - 23rd August, 1997

38. Visited Dhaka University during Aug 28th - Sept. 1st, 1998.

39. Visited IUCAA during Nov. 15th - Nov. 21st, 1998.

40. Visited Mehta Research Institute, March 1999.

41. Visited Space Research Institute, Moscow, July (8-10) 1999.

42. Visited International Centre for Relativistic Astrophysics (ICRA), Pescara, (June 1999).

43. Visited University of Rome, July (22-23) 1999.

44. Visited Samarkhand State University, Aug. (14-20), 1999.

45. Visited Indian Space Research Organization and Indian Institute of Astrophysics, Oct (4-8), 1999.

46. Visited Delhi University, Physical Research Laboratory, TIFR (Feb.-March, 2000).

47. Visited Seoul National University, Chungnam National University, Korean Astro-

physical Observatory (April-May, 2000).
48. Visited ICTP to attend the Summer School on 'Astroparticle Physics and Cosmology' (June 2000).
49. Visited University of Rome as a participant and a Chairman of the Session 'Accretion On Black Holes' at the 9th Marcel Grossman Meeting (July 2000).
50. Visited Heidelberg as an Invited Lecturer at the High Energy Gamma Ray Astronomy and Landessternwarte, Königstuhl, (June 2000).
51. Visited Granada as an Invited speaker at the 3rd Micro-Quasar workshop (Sept. 2000)
52. Visited ICTP as a Chairman and an invited speaker for the workshop 'First Steps in the Origin of Life' (Sept. 2000)
53. Visited Indian Institute of Astrophysics, Raman Research Institute and Institute of Mathematical Science (Dec. 2000)
54. Visited Physical Research Laboratory facilities at Mt. Abu (March 2001)
55. Visited IGNOU HQ to structure the Astrophysics Syllabus for IGNOU students (March, 2001).
56. Visited Tata Institute of Fundamental Research (Sept. 2001)
57. Visited IUCAA (Feb. 2002)
58. Visited Bhopal University (Feb. 2002)
59. Visited Florida International University (Miami), University of Florida (Gainesville), Georgia State University (Atlanta) (March, 2002)
60. Invited as an expert in the joint meeting on the launching of the Israili satellite TAUVEX by GSAT-4 of ISRO at the Indian Institute of Astrophysics (April, 2002)
61. Visited Nainital Observatory (April, 2002)
62. Visited Indian Institute of Astrophysics to Participate in Discussions on Israili payload 'Tauvex'
63. Visited SACLAY, France and Cargese School, Corsica (May-June, 2002)
64. Visited Univ. of Rio, Brazil to Chair a on Astrophysical Black Holes at the 10th Marcel Grossman Meeting on General Relativity and Gravitation (July 2003)
65. Visited SACLAY, France; Strasbourg Obervatory and Univ. of Milano, (August-Sept., 2003)
66. Visited ICTP to Chair a Session on 'Astrochemistry' at the Origin of Life Conference.
67. Visited Hong-Kong University in May, 2004
68. Visited Tsinghua University, Beijing in June, 2004
69. Visited ICTP, Italy as a Senior Associate in April-May, 2006
70. Visited Princeton Univ., ICRA (Pescara), Free University (Berlin) (to Chair two sessions on Black holes at 11th Marcel Grossman Meeting on General Relativity and Gravitation conference), July 2006
71. Visited Space Research Institute (IKI), Russian Academy of Sciences and Moscow Space Research Institute (Oct. 1-Oct. 6, 2007); ICTP, Trieste, CNRS (Palermo), Univ.

of Palermo; INFN (Trieste), ICRA (Pescara), Univ. of Rome, (Oct/Nov. 2007)
72. Visited Princeton University, Louisana State University, George Mason University, University of Texas at Arlington (May-June, 2008)
73. Visited ICTP, Trieste and ICRANET, Pescara, Aug-Sept. (2008)

Research Publications:

(A) In Refereed Journals

J1. **S.K. CHAKRABARTI**, R.P. GEROCH and C. LIANG: Timelike Curves of Limited Acceleration in General Relativity, 1983, *Journal of Mathematical Physics,* **24**, 597.
J2. **S.K. CHAKRABARTI**: On Mass dependent Spheroidal Harmonics of Spin One half, 1984, *Proceedings of Royal Society of London, A,* **391**, 27.
J3. **S.K. CHAKRABARTI**: The Natural Angular Momentum Distribution in the Study of Thick Disks Around Black Holes, 1985, *Astrophysical Journal,* **288**, 1.
J4. **S.K. CHAKRABARTI**: Analytic Structure of Cosmic Radio Jets: A Preliminary Investigation, 1985, *Astrophysical Journal,* **288**, 7.
J5. **S.K. CHAKRABARTI**: Rotating Wind Solution and the Acceleration of the Cosmic Radio Jets, 1986, *Astrophysical Journal,* **303**, 582.
J6. **S.K. CHAKRABARTI**, L. JIN, and W.D. ARNETT: Nucleosynthesis Inside Thick Accretion Disks Around a Black Hole-I Thermodynamic Conditions And Preliminary Analysis, 1987, *Astrophysical Journal*, **313**, 674.
J7. **S.K. CHAKRABARTI**: Constraints on viscosity in Thick disks from X ray and gamma ray observation of SS433, 1988, *Astrophysical Journal* **324**, 391.
J8. **S.K. CHAKRABARTI**: Spacetime with Self Gravitating Thick Disk Around a Black Hole, 1988 *Journal of Astrophysics and Astronomy*, **9**, 49.
J9. **S.K. CHAKRABARTI**: Vortex Rings in the working surface of a Radio Jet, 1988, *Journal of Astrophysics and Astronomy*, **9**, 185.
J10. **S.K. CHAKRABARTI**: On the Damping of the Bending Wave in the Saturn's Rings, 1988 *Journal of Astrophysics and Astronomy*, **9**, 243.
J11. **S.K. CHAKRABARTI**: On the Dynamics of the Working Surface of Supersonic Radio Jets, 1988,*M.N.R.A.S.*, **235**, 33.
J12. L. JIN, W.D. ARNETT and **S.K. CHAKRABARTI**: Nucleosynthesis Inside Thick Accretion Disks Around Black Holes-II Results for Massive Black Holes, 1989, *Astrophysical Journal*, **336**, 572.
J13. **S.K. CHAKRABARTI**: Studying Shocks in Model Astrophysical Flows, 1989, *Astrophysical Journal (Letters)*, **337**, L89.
J14. **S.K. CHAKRABARTI**: Dynamics of Particles in Bending Waves of the Planetary Rings, 1989 *M.N.R.A.S.*, **238**, 1381.
J15. **S.K. CHAKRABARTI**: Standing Shocks in the Isothermal Rotating Winds and

Accretion, 1989, *M.N.R.A.S.*, **240**, 7.
J16. **S.K. CHAKRABARTI**: Multiple Shocks in the Adiabatic Rotating Winds from Self-Gravitating Thick Disks, 1989, *Journal Astrophysics Astronomy*, **10**, 261.
J17. **S.K. CHAKRABARTI**: A systematic study of the standing shocks in thin flows near compact objects, 1989, *Publication of the Astronomical Society of Japan*, **41**, No. 6, 1145.
J18. **S.K. CHAKRABARTI**: Standing Rankine-Hugoniot Shocks in the Hybrid Model Flows of Black Hole Accretion and Winds, 1989, *Astrophysical Journal*, **347**, 365.
J19. **S.K. CHAKRABARTI**: Standing Shocks in Rotating Winds and Accretion in Kerr Spacetime, 1990 *Astrophysical Journal* **350**, 275.
J20. **S.K. CHAKRABARTI**: Resolved and Unresolved issues in the Study of the Thick accretion disks, 1990, *Comments on Astrophysics*, **4**, 209.
J21. M. ABRAMOWICZ and **S.K. CHAKRABARTI**: Standing Shocks in the Adiabatic Black Hole accretion of Rotating Matter, 1990, *Astrophysical Journal*, **350**, 281.
J22. **S.K. CHAKRABARTI**: Standing Shocks in Isothermal Rotating Winds and Accretion II: Effects of Viscous Dissipation, 1990, *M.N.R.A.S.*, **243**, 610.
J23. **S.K. CHAKRABARTI**: Standing Rankine-Hugoniot Shocks in the hybrid model flows II: non-axisymmetric self-similar solution, 1990, *Astrophysical Journal*, **362**, 406.
J24. **S.K. CHAKRABARTI**: von Zeipel Surfaces, 1990, *M.N.R.A.S.*, **245**, 747.
J25. **S.K. CHAKRABARTI**: Weber-Davis Model Revisited: Standing Magnetohydrodynamic Shocks in Winds and Accretion, 1990, *M.N.R.A.S.*, **246**, 134.
J26. **S.K. CHAKRABARTI**: von Zeipel Surfaces II- A Catalogue, 1991, *M.N.R.A.S.*, **250**, 7.
J27. **S.K. CHAKRABARTI**: Production of Primordial Magnetic Field in Protogalactic Torus, 1991, *M.N.R.A.S.*, **252**, 246.
J28. **S.K. CHAKRABARTI** and P. BHASKARAN: On the Origin, Acceleration and Collimation of the Bi-polar Outflows and Cosmic Radio Jets, 1992, *M.N.R.A.S.*, **255**, 255.
J29. **S.K. CHAKRABARTI** and P.J. WIITA: Standing Shocks and the Spectrum of Active Galactic Nuclei, 1992, *Astrophysical Journal (Letters)*, **387**, L21
J30. **S.K. CHAKRABARTI** and T. MATSUDA: Spiral Shocks and the Sub-day Variability in SS433 System, 1992, *Astrophysical Journal*, **390**, 639.
J31. **S.K. CHAKRABARTI** and R. KHANNA: A Newtonian Description of the Geometry around a Rotating Black Hole, 1992, *M.N.R.A.S*, **256**, 300.
J32. R. KHANNA and **S.K. CHAKRABARTI**: Effects of a self-gravitating Disc on Test Particle Motion Around a Kerr Black Hole, 1992, *M.N.R.A.S*, **259**, 1.
J33. **S.K. CHAKRABARTI**: The properties of Oort Cloud and the Origin of Comets, 1992, *M.N.R.A.S*, **259**, 37
J34. **S.K. CHAKRABARTI**: Can Shocks form in Three Dimensional Accreting Flows? *M.N.R.A.S.*, 1992, **259**, 410
J35. **S.K. CHAKRABARTI** and K.S. KRISHNASWAMY: Is there a Comet Cloud

around PSR1257+12? *Astronomy and Astrophysics*, 1992, **263**, L1-L2.
J36. **S.K. CHAKRABARTI**: Reversal of force and energy coupling around a rotating black hole, *M.N.R.A.S*, 1993, **261**, 625.
J37. **S.K. CHAKRABARTI** and P.J. WIITA: Effects of Spiral Shocks on Disk Line Emission, *Astronomy and Astrophysics*, 1993, **271**, 216.
J38. **S.K. CHAKRABARTI**: When Gravitational Waves Collide! *International Journal of Modern Physics D*, 1992, **1**, 525.
J39. **S.K. CHAKRABARTI** and P.J. WIITA: Spiral Shocks In Accretion Disks As a Contributor To Variability In Active Galactic Nuclei, *Astrophysical Journal*, 1993, **411**, 602
J40. **S.K. CHAKRABARTI**: Binary Black Holes in Stationary Orbits and a test of the AGN Paradigm, *Astrophysical Journal*, 1993, **411**, 610.
J41. **S.K. CHAKRABARTI** and D. MOLTENI: Smoothed Particle Hydrodynamics Confronts Theory: Formation of Standing Shocks in Accretion and Wind around Black Holes, *Astrophysical Journal*, 1993, **417**, 671.
J42. **S.K. CHAKRABARTI** and SYDNEY D'SILVA: Magnetic Activity inside Thick Accretion Disks and Associated Observable Phenomena I. Flux Expulsion, *Astrophysical Journal*, 1994 **424**, 138.
J43. SYDNEY D'SILVA and **S.K. CHAKRABARTI**: Magnetic Activity inside Thick Accretion Disks and Associated Observable Phenomena II. Flux Storage, *Astrophysical Journal*, 1994, **424**, 149.
J44. D. MOLTENI, G. LANZAFAME and **S.K. CHAKRABARTI**: Simulation of Thick Accretion Disks which Include Shocks by Smoothed Particle Hydrodynamics, *Astrophysical journal*, 1994 **425**, 161
J45. **S.K. CHAKRABARTI** and P.S. JOSHI: Naked Singularities as Candidates for the Gamma-ray Bursters, *Int. J. Modern Physics D*, 1994, v.3, 647.
J46. **S.K. CHAKRABARTI**, R. ROSNER, and S.I. VAINSHTEIN, Possible Role of Massive Black Holes in the Generation of Galactic Magnetic Fields, 1994, *Nature*, **368**, 434 .
J47. **S.K. CHAKRABARTI** and P.J. WIITA: Variable Emission Lines As Evidence Of Spiral Shocks In Accretion Disks Around Active Galactic Nuclei, 1994, *Astrophysical Journal*, **434**, 518.
J48. D. MOLTENI, G. GERARDI and **S.K. CHAKRABARTI**, Simulation of Interactions of An Orbiting Compact Star with an Accretion Disk by Smoothed Particle Hydrodynamics, *Astrophysical J.*, 1994, **436**, 249.
J49. **S.K. CHAKRABARTI** and D. MOLTENI, Viscosity Prescriptions and the Evolution of Accretion Disks, 1995, M.N.R.A.S., 272, 80.
J50. **S.K. CHAKRABARTI**, Velocity Profile of the Ionized Disk in M87 and the Mass of the Black Hole, 1995, *Astrophys. J.*, 441, 576 .
J51. **S.K. CHAKRABARTI** and L.G. TITARCHUK, Spectral Properties of Galactic and Extragalactic Black Hole Candidates, 1995, *Astrophys. J.*, 455, 623.

J52. **S.K. CHAKRABARTI**, Accretion Processes On Black Holes, 1996, Physics Reports, v.266, No 5 & 6, p 229-392.
J53. D. MOLTENI, H. SPONHOLZ and **S.K. CHAKRABARTI**, Resonance Oscillation of Radiative Shock Waves in Accretion Disks Around a Black Hole, 1996, *Astrophys. J.* 457, 805
J54. K. EBISAWA, L. TITARCHUK & **S.K. CHAKRABARTI**, On the spectral slopes of hard X-ray Emission from Black Hole Candidates, Publ. Astron. Soc. Japan, 1996, v. 48 No. 1. 59
J55. **S.K. CHAKRABARTI**, Gravitational Waves from Binary Systems in Presence of Accretion Disks, 1996, *Phys. Rev. D.* v.53, 2901
J56. **S.K. CHAKRABARTI**, Grand Unification of Solutions of Accretions and Winds Around Black Holes and Neutron Stars: 1996, *Astrophys. J.*, 464, 664.
J57. **S.K. CHAKRABARTI**, L.G. TITARCHUK, D. KAZANAS & K. EBISAWA: Observational Signatures of the Boundary layer of Black Holes, *Astron. & Astrophys. Suppl. Series*, 1996, 120, 163-166
J58. D. MOLTENI, D. RYU & **S.K. CHAKRABARTI**, 1996, Numerical Simulations of Standing Shocks in Accretion Flows around Black Holes: A Comparative Study, *Astrophysical J.*, 470, 460.
J59. **S.K. CHAKRABARTI**, Solutions of Two Dimensional Viscous Accretion and Winds In Kerr Black Hole Geometry, 1996, *Astrophysical J.*, 471, 237
J60. **S.K. CHAKRABARTI**, Global Solutions of Viscous Transonic Flows in Kerr Geometry I: Weak Viscosity Limit, 1996, *M.N.R.A.S*, 283, 325.
J61. D. RYU, **S.K. CHAKRABARTI** & D. MOLTENI, 1997, Zero Energy Rotating Accretion Flows near a Black Hole, *Astrophysical J.*, 474, 378.
J62. **S.K. CHAKRABARTI** and S. SAHU, Bondi Flows on Compact Objects Revisited, *Astronomy & Astrophysics*, 1997, 323, 382.
J63. **S.K. CHAKRABARTI**, Spectral Properties of Accretion Disks Around Black Holes II: Sub-Keplerian Flows with and Without Shocks, 1997, *Astrophys. J.*, 484, 313.
J64. G. LANZAFAME, D. MOLTENI, & **S.K. CHAKRABARTI**, Smoothed Particle Hydrodynamic Simulations of Viscous Accretion Discs Around Black Holes, 1998, *MNRAS*, V. 299, 799
J65. **S.K. CHAKRABARTI**, Identification of Astrophysical Black Holes (Review), 1998, Indian Journal of Physics, V. 72B, p183-223 (astro-ph/9803227)
J66. **S. K. CHAKRABARTI**, Spectral Softening due to Winds in Accretion Disks, 1998, Indian Journal Of Physics, v. 72B, No. 6, 565-569 (astro-ph/9810412)
J67. **S.K. CHAKRABARTI** & B. MUKHOPADHYAY, 1999, Neutron Disks Around Black Holes, Astronomy and Astrophysics, 344, 105 (astro-ph/9904342)
J68. B. MUKHOPADHYAY & **S.K. CHAKRABARTI**, Semi-analytical Solution of Dirac Equation in Schwarzschild Geometry 1999, *CQG*, v. 16, 3165 (gr-qc/9907100)
J69. T. DAS & **S.K. CHAKRABARTI**, Mass Outflow Rates from Accretion Disks Around Compact Objects, 1999, *Classical and Quantum Gravity*, v. 16, No. 19, 3879

(astro-ph/9912493)

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P153 Debnath, D., Nandi, A., Pal, P. S., Chakrabarti, S. K., 2008, QPO Evolution in 2005 Outburst of the Galactic Nano Quasar GRO J1655-40, AIP conference proceedings, 1053, 171

P154. Dutta, Broja G., Chakrabarti, Sandip K., Pal, Partha S., 2008, Evolution of QPOs in XTE J1550-564 in 1998 outburst: a Case of Quasi Outburst? AIP conference

proceedings, 1053, 165

P155. Choudhury, A. K.; Chatterjee, A. K.; Bari, W.; Chakrabarti, S. K., 2008, Live Coverage of Class Transitions in the Nano Quasar GRS 1915+105, AIP conference proceedings, 1053, 161

P156. Basu, Prasad, Chakrabarti, Sandip K., 2008, Gravitational wave emission from a companion black hole in presence of an accretion disk around a super-massive Kerr black hole, AIP conference proceedings, 1053, 33.

(C) Books

B1. S.K. CHAKRABARTI: **Theory of Transonic Astrophysical Flows:** World Scientific Publishing Co., Singapore (1990).
B2. S.K. CHAKRABARTI: **Observational Evidence for Black Holes in the Universe** , Edited Volume (Kluwar Academic Publishing Co.), (1998)
B3. S.K. CHAKRABARTI (Editor) Proceedings of 'Young Scientists of Todays India' Indian Journal of Physics, 73B(6), 1999
B4. S.K. CHAKRABARTI (Guest Editor) 'Frontiers in Astrophysics (Vol-II)' a Celebratory volume to commemorate 125th anniversary of Indian Association for the Cultivation of Science and 75th year of the Indian Journal of Physics (Allied Publishers) (2002)
B5. S.K. Chakrabarti, S. Das, B. Basu and M. Khan (Eds.) 'Recent Trends in Astro and Plasma Physics in India', 2003, (CSP: Kolkata)
B6. S.K. CHAKRABARTI: 'Compact Stars' for IGNOU Astronomy Course
B7. S.K. CHAKRABARTI: 'Active Galaxies' and 'Milky Way' for IGNOU Astronomy Course
B8. S.K. CHAKRABARTI and S. DAS: **Theory of Advective Astrophysical Flows:** (in preparation).
B9. S.K. CHAKRABARTI and A.S. MAJUMDAR: **Observational Evidence for Black Holes in the Universe** , Edited Volume (AIP Publishers, NY), (2008)

(D) Popular Science

PS1. S.K. CHAKRABARTI: 'Introduction of Astronomy and Astrophysics in the University Syllabus', 1997, Physics Teachers, v. 39, p.25
PS2. S.K. CHAKRABARTI: 'My encounter with Chandra', In News Bulletin of the Calcutta Mathematical Society, Vol. 20, No. 10 (1997)
PS3. S.K. CHAKRABARTI: 'Mahabiaswe-o-Aami' in the Bulletin of the Indian Centre

for Space Physics 'Mahaviswa O Aami' (June 2000)
PS4. S.K. CHAKRABARTI: Editor of the Bulletin of the Indian Centre for Space Physics 'Mahaviswa-O-Aami' (Nov. 2000)

(E) Book Reviews

BR1. Edwin Hubble-Mariner of the Nebulae by Gale E. Christianson, in Ind. J. Phys. V. 79(12), p. 1427, 2005

BR2. Space Plasma Physics by A.C. Das, in Ind. J. Phys. v. 78(12), 1405, 2004

BR3. The Universe in Gamma Rays by Volker Schonfelder in Ind. J. Phys v. 77B(4), 473, 2003

BR4. Interplanetary Dust by E. Gruen et al. in Ind. J. Phys., v. 77B(5), 583, 2003

(F) News Media

N1. 'MahaViswe Black Hole'er Osthitwa kee Kolkatatey Nirupito Hobe?' in Aajkal (26th of November, 1997), A Bengali Daily Newspaper.
N2. 'Mysterious Black Holes' in The Statesman (22nd of Dec. 1997), An English Newspaper.
N3. Participated at the Discussion of 'Year-2000 problem' broadcast (AIR) on the 22nd of December, 1997, in Yubabani.
N4. *All India Radio* broadcast a six minutes programme based on the Interview with Prof. P. J. Wiita, Prof. H.M. Lee and Prof. S.K. Chakrabarti (2nd January, 1998)
N5. *All India Radio* broadcast of a 15 minutes discussion on black holes based on the Interview with Prof. S.K. Chakrabarti and Prof. C.K. Majumdar (15th January, 1998).
N6: 'A night too soon' a ten minutes interview broadcast in Doordarshan (Aug. 1999).
N7. Script Writer of a 12 minutes Television Programme on 'Mysterious Black Holes' produced by Educational Media Research Center (Calcutta). Broadcasting was done several times in Doordarshan Channel (in 2001).
N8-N9: Television broadcast of interviews at Space Science Symposia (Nov. 2000) and National Conference on Black Hole Astrophysics (March 2001)
N10-N11. Letters to the Editor in *Telegraph* and *Ananda Bazzar Patrika* on Black Holes and Gramma Ray Bursts respectively.
N12-N13: Discussed my work in special section 'Faces of Bengal' by Anandabazar Patrika and 'Carrier Guide' in Sananda magazine.
N14-N25 'Black Holes Food Habits' A discussion on my work with comments from experts throughout the world: in 'The Telegraph' Newspaper (Feb. 2002).
Numerous reports on my work in Scientific American (1989), Science (1994, 1998), Discovery (1994), Nature (News and Views, 1994), New Scientist (2000), Anandamela (Feb 2000), Science Reporter (March 2000), Down to Earth (2005-2007), etc. and in various News Papers (1997-2005; too many to cite). Live expert comments on Space Shuttle Atlantis landing (for 2.30hours) in TV channel '24 Ghanta' (24 hours) and Video conferencing of Astronaut Ms. Sunita Willams at United States Information Service. Expert

comments for several All India Radio programmes. Several articles on Chandrayaan-I mission came in Telegraph newspaper (Oct. 2008). Interviewed for four hours in '24 Ghanta' channel and 'Times now' channel.

Current Ph.D. Students

1. A. Das, SRF (submitting Thesis in 2008)
2. K. Giri, JRF
3. D. Debnath, SRF
4. H. Ghosh, JRF
5. B. G. Dutta, SRF
6. P. S. Pal, SRF

Summer students supervised

1. Nimisha Kantharia (Gujrat University) on 'Transonic Accretion Flows in presence of self-gravitating disk'
2. P. Sandhu (Delhi University) on 'Trajectories of photons in curves space time'
3. S. Sahu (Hyderabad. Univ.) on 'Bondi flow on Black Holes and neutron stars'
4. Samik Dasgupta (Pune University) on 'Solution of Navier Stokes' Equation away from equatorial plane'
5. Debashis Das (Biswabharati University) on 'Dark Matter of the Universe'
6. Sabyasachi Pal (Calcutta Univ.) 'Two temperature Solution of Spherical Accretion Flow'
7. Kinshuk Acharya (Calcutta Univ.) 'Wind Induced Instability of Accretion Flows'
8. W. M. Chenglei (Delhi Univ.) 'The Study of Gravitational Waves'
9. D. Mankane (Mumbai University) Spectra from Keplerian Disks
10. P. Agrawal (North Bengal University) Production of jets.
11. A. Saha (Post B.Sc. Integrated Ph.D. at SNBNCBS).
12. A. Pal (Post B.Sc. Integrated Ph.D. at SNBNCBS).
13. Partha S. Pal (IIT/Madras).

Lectures/Posters and Other activities:

MAR. 1978: Talk on 'Modification of β-decay theory' at Indian Association for the College Going Scientists conference at the St. Xavier's College, Calcutta.
FEB. 1980: Participated in experiments during a total solar eclipse (February 16th. 1980, in southern India) conducted by an 18 member research team from Indian Insti-

tute of Technology, Kanpur.
FEB. 1981: Attended the XIIth National Conference on Structure of Matter held at the Osmania University (AP). The talk was given by Professor K.N.S. Rao. The paper was on "A Perspective Study of Crystal Structure of Gernets" by Prof. K.N.S. Rao, S.K. Chakrabarti and Prof. D.C. Khan.
FEB. 1984: Talk presented on "Theory of Fat Disks around a Black Hole and the Numerical Simulation" at the Astrophysics Department Seminar of the University of Chicago.
APR. 1984: Talk presented on "Some Exactly Solvable Models of Thick Disks and Radio Jets Near Black Holes" at the International Conference on Active Galactic Nuclei held at the University of Manchester, UK.
OCT. 1984: Talk presented on "Analytic Theory of Thick Disk and Radio Jets Near Black Hole" at the relativity seminar of the University of Chicago.
DEC. 1984: Poster paper presented on "Understanding Jet Formation" at the 12th Texas Symposium on Relativistic Astrophysics, Jerusalem.
JUN. 1985: Talk presented on "Rotating Winds and Acceleration of Jets" at the Conference "Jets from Stars and Galaxies", Toronto.
OCT. 1985: Relativity seminar on "More on Thick Disks and Jets" at Caltech.
JAN. 1986: Thesis Talk presented on "On the Physics of Thick Disks and Inner Jets" at the 167th Meeting of the American Astronomical Society, Houston, Texas.
MAR. 1986: Talk presented on "Renormalization Group Approach to Sunspot Statistics" at the Astrophysics Dept. of the University of Chicago.
MAR. 1986: Invited talk presented on "Nucleosynthesis in the Neighborhood of a Black Hole" at the XXIst Moriond Meeting on "Accretion on the Compact Objects", Les Arcs, France.
APR. 1986: Journal club talks 'On Colliding Plane Gravitational Waves', 'Summary of VIth Moriond Conference on "Accretion onto compact Objects" ' and "The Magnetic fields in Cygnus A" at Caltech.
JUL. 1986: Talk presented on "Theory of Rotating Winds and the Acceleration of the Radio Jets in SS433 and Cyg X3" at the GR11 meeting at Stockholm.
AUG. 1986: Poster paper presented on "Renormalization group approach to Sunspot Statistics" at the Workshop on Solar Cycle at the Big Bear Solar Observatory.
OCT. 1986: Talk presented on "Consequences of Nucleosynthesis in a thick disk around Supermassive Hole" at the Third George Mason Fall workshop on Supermassive Blackholes: at George Mason Univ.
DEC. 1986: Talk presented on "Nucleosynthesis in the Disk around SS433 and observation of Fe line by EXOSAT" at the SS433 meeting at the Washington University, St. Louis.
DEC. 1986: Talk presented on "Nucleosynthesis in the Thick Disks around Black Holes" at the 13th Texas symposium at Chicago.
JAN. 1987: Talk presented on "Nucleosynthesis Around Black Holes" at the 169th AAS meeting at Pasadena.

JAN. 1987: Talk presented on "Nature of the Working Surface of a Radio jet: The Predictions and Verification with Existing Numerical Results" at the Active Galactic Nuclei Meeting at Santa Barbara.
JUL. 1987: Talks presented on "Thick Accretion Disks" at Tata Institute of Fundamental Research and the Raman Research Institute.
DEC. 1987: Talks on "Nucleosynthesis in disk around SS433" and "Fluid dynamics at the working surface of a Supersonic jet" were presented at Torino Observatory.
DEC. 1987: Talks on "Nucleosynthesis in Thick disks" and "Spacetime with self-gravitating Thick disks" were presented at the International School of Advanced Studies (SISSA).
MAR. 1988: Contributed talk on "Element Productions in Thick Accretion Disks" at the 20th Yamada Conference in Tokyo (28th March-2nd April).
MAY 1988: Talk presented on "Standing Shocks in Black Hole Accretion" at the University of Crete, Greece.
MAY 1988: Talk presented on "Status of Nucleosynthesis Works in Thick Accretion Disks" at the Osservatorio Astronomico, Rome.
JUN. 1988 Journal club talk on 'Binary black hole OJ-287' at ICTP, Trieste.
JUL. 1988: Talk presented on "Status of Nucleosynthesis Works in Thick Accretion Disks" at the *High Energy Astrophysics and Cosmology* workshop, at ICTP, Trieste.
JUL. 1988: Talk presented on "Standing Shocks in Black Hole Accretion" at SISSA, Trieste.
SEP. 1988: Talk presented on "Standing Shocks in Rotating Winds and Accretions" at the Max Plank Institute, Munich.
NOV. 1988: Talk on "Standing Shocks in Model Astrophysical Flows" at Tata Inst. of Fundamental Research.
JAN. 1989: Talk on "Bending Waves of Saturn's Rings" at Tata Inst. of Fundamental Research.
MAR-APR. 1989: Seven lectures on "Transonic astrophysical flows" at Tata Institute of Fundamental Research.
JUN. 1989: Invited talk on "Transonic Astrophysical Flows" at the 13th meeting of the Astronomical Society of India at Srinagar.
JUL. 1989: Two posters on "Classical forces in Kerr geometry" and "Studying Shocks in the hybrid model flows in Accretion and Winds around the black holes" presented at the 12th international conference on the general relativity and gravitation, Boulder, Colorado.
JUL. 1989: Astrophysics Seminar on"Transonic Astrophysical Flows" at the Center for Astrophysics, Harvard University.
AUG. 1989: Talk on "General Relativistic Transonic Flows" at the Saha Institute of Nuclear Physics, Calcutta, in the Indian Physical Society Meeting.
NOV. 1989: Invited Talk on "Role of Angular momentum in Relativistic Astrophysics" at the General Relativity and Gravitation (IAGRG) meeting (North Bengal University).
MAR. 1990: Journal club talk on 'Self-consistent shocks in Radiation Dominated Flows'

at TIFR.
JUN. 1990: Poster on "Properties of Spiral Shocks" in the IAU 144 meeting on 'Disk-Halo Interaction' held in Lieden observatory (June 18th-22nd), Holland.
JUN. 1990: Colloquium on "Transonic Astrophysical flows" in the University of Amsterdam.
JUL. 1990: Posters on (a) Transonic Isothermal Flows, (b) High and Low states in Self-similar Spiral Flows, (c) Standing MHD shocks in Accretion and Wind, (d) Solving Time Dependent Problems–the brute force approach, in IAU129/IAP 6 meeting on 'Structure and emission properties of accretion disks' (Paris: 1-6th July)
AUG. 1990: 'Summary of IAU129/IAP Meeting in Paris' at TIFR.
SEPT. 1990: Physics colloquium "Astrophysical Flows Around Black Holes" at Tata Inst. of Fundamental Research.
DEC. 1990: Posters on 'Production of Primordial Magnetic Field in Giant Ion Tori' and 'On the origin of Optical Micro-variability and X-Ray Flickering' at the 15th Texas Symposium/CERN/ESO conference at Brighton, Sussex.
FEB. 1991: Physics Colloquium on " Transonic Flows Around Black Holes" at the University of Padova.
FEB. 1991: Astrophysics Seminar on "Transonic Astrophysical Flows" at SISSA, Trieste.
APR. 1991: Astronomy and Astrophysics Seminar on "Production of Primordial Magnetic field in Protogalactic Torus" at the Tata Inst. of Fund. Res.
JUN. 1991: Contributed talk on "Production of Primordial Magnetic Field in the Universe by Thermal Battery Effect" at the 6th Marcel Grossman Meeting held in Kyoto.
JUN. 1991: Poster papers on 'von Zeipel Surfaces' and 'Forces on a Charged Particle orbiting around a Kerr-Newman Black hole' at the 6th Marcel Grossman Meeting held in Kyoto.
JUL. 1991: Astrophysics Seminar on "Production of Primordial Magnetic Fields in Protogalactic Tori" at the Astrophysics Dept., Kyoto University.
JUL. 1991: Special Colloquium on " Astrophysical Flows Around Black Holes" at the Aeronautical Engineering Dept., Kyoto University.
APR, 1992: Astrophysics seminar on 'Shocks in Accretion Flows and AGN spectra' at Institute of Astronomy, Cambridge.
APR, 1992: Physics Colloquium on 'Shocks in Accretion Flows' at the Georgia State University.
APR, 1992: Poster on 'Planetesimals around nearby Millisecond Pulsars': at the 'Planets around Pulsars' held at California Inst. of Technology.
MAY, 1992: Astrophysics Seminar on 'N-body simulation of the Evolution of Oort cloud' at Jet Propulsion Laboratory, Caltech.
MAY, 1992: Astrophysics seminar on 'Stationary and Non-stationary Shocks in Accretion flows' at Univ. of California and Los Angeles.
MAY, 1992: Astrophysics seminar on 'Comet clouds around the Sun and the pulsars' at

SISSA, Trieste.
JUN, 1992: Special High Energy Physics Seminar on 'Origin of Primordial Magnetic Field in the Universe — A classical Dynamical Approach' at ICTP, Trieste.
JUN 1992: Astrophysics Seminar on 'Shocks in Higher Dimensional Flows' at University of Catania, Sicily.
JUN 1992: Astrophysics Seminar on 'Shocks in Accretion Flows' at the University of Milano.
JUN 1992: Presented talk on 'Effects of Shocks on AGN Spectrum' at the 13th International Conference on General Relativity and Gravitation held in Cordoba, Argentina.
JUN 1992: Poster papers on 'Production of primordial magnetic field in the universe', 'Binary black holes in stationary orbits' and 'Reversal of forces on an orbiting particle around a black hole' at the 13th International Conference on General Relativity and Gravitation held in Cordoba, Argentina.
JUL 1992: Presented a talk on 'Production of Primordial Magnetic field in the Universe– A Classical Dynamical Approach' at the mini conference 'Cosmologia' at Institute of Astrophysics and Space Science, Buenos Aires.
JUL 1992: Astrophysics Seminar on 'Periodic X-ray Flares of NGC-6814– A case of gravitational lensing?' at TIFR, Bombay.
AUG 1992: Informal discussion on 'Naked Singularities as Possible Candidates for Gamma-ray Bursters' at TIFR, Bombay.
OCT. 1992: Invited talk on 'Astrophysics Around Black Holes', in the workshop on 'Space Astronomy' at TIFR, Bombay.
NOV. 1992: 'Galactic Center' a popular talk at the Amateur Astronomical Society meeting at St. Xaviers College, Bombay.
NOV. 1992: 'Astrophysics Around Black Holes', at the University Science College, Calcutta University.
NOV.-DEC. 1992: A series of six lectures on 'Accretion Disks and Jets' at DST-SERC school on Active Galaxies at IUCAA, Pune
DEC. 1992: 'Mysterious Black holes' a popular talk at the Physical Society meeting of Jai Hind College, Bombay.
DEC. 1992: 'Real Centrifugal Force around Black Holes' — physics colloquium at TIFR.
DEC. 1992: Poster on 'Binary Black Holes in Stationary Orbits' presented (in absentia) at the TEXAS/PASCOS Meeting, Berkeley.
JAN. 1993: Poster on 'Binary Black Holes in Stationary Orbits' presented (in absentia) at the American Astronomical Society meeting at Phoenix, Arizona.
MAR. 1993: 'Discontinuous' Flows around black holes: at Saha Institute of Nuclear Physics, Calcutta.
MAR. 1993: 'Mysterious Black holes' a popular talk at the R.K.M.R. College, Narendrapur, Calcutta.
APR. 1993: 'Discontinuous Flows Around Black Holes' at the University of Palermo, Italy.

APR. 1993: Astrophysics Seminar on 'Discontinuous Flows Around Black Holes' at the Goddard Space Flight Center, USA.
APR. 1993: Astrophysics Seminar on 'Shock Formation is Accretion Disks Around Black Holes' at the Space Telescope Science Institute, USA
MAY 1993: Contributed talk on 'Mathematical Properties of Standing Shocks in Accretion Flows Around Black Holes' at the 3rd Midwest Geometry conference, University of Missouri.
MAY 1993: Colloquium on 'Astrophysical Flows Around Black Holes', at the University of North Texas, Denton.
MAY 1993: Colloquium on 'Discontinuous Flows Around Black Holes', at the University of Texas at Austin.
MAY 1993: Astrophysics seminar on 'Transonic Flows Around Black Holes' at the Rice University, Houston.
MAY 1993: Contributed talk at 'How to Keep Two Black Holes in Stationary Orbits' at the 5th Canadian Conference on the Relativistic Astrophysics at the University of Waterloo.
MAY 1993: Astrophysics Colloquium on 'Discontinuous Flows Around Black Holes' at the Ohio State University.
JUN 1993: Physics Colloquium on 'Two Topics in Astrophysics Around Black Holes' at the Georgia State University at Atlanta.
JUN 1993: Astrophysics Seminar on 'A Few Interesting Topics in Astrophysics Around Black Holes' at the Aspen Workshop on 'Gravitational Problems in Relativistic Astrophysics.
JUN 1993: Astrophysics seminar on 'Discontinuous Flows Around Black Holes' at the High Altitude Observatory, Boulder, Colorado.
JUL 1993: Astrophysics seminar on 'Transonic Flows Around Black Holes' at the University of Chicago.
JUL 1993: Invited Review talk on 'Accretion Disks in Astrophysics' at the UNAM-CRAY International conference on Numerical Astrophysics (July 25th - Aug. 30th) in Mexico City.
JUL 1993: Posters on 'N-Body Simulation of the Oort cloud', 'Dynamics of Particles in the Planetary Rings' and the 'Numerical Simulation of the co-planer Star-disk interactions' at the UNAM-CRAY International conference on Numerical Astrophysics (July 25th - Aug. 30th) in Mexico City.
AUG 1993: Poster paper on 'Disk Models with Stationary and Non-stationary shock waves' at the IAU symposium (No. 159) at the Geneva Observatory.
NOV. 1993: Invited talk on 'Astrophysics Around Black Holes', in the workshop on 'Space Astronomy' at TIFR, Bombay.
FEB. 1994: Astronomy Seminar on 'Model of variable double peaked emission from AGN' and 'Origin of galactic magnetic field' at TIFR, Bombay.
JUN 1994: SFB Seminar of 'Discontinuous Flows around a Black Hole' and astronomy

seminar on 'Assorted Problems in Astrophysics' at the Landessternwerte, Konigstuhl, Heidelberg.
JUL 1994: Seminar on 'Determination of the Mass of the Black Hole in M87 from the Recent HST observations' at European Southern Observatory, Garching
JUL 1994: Astrophysics seminar on 'Shocks in Accretion disks and the Observable Consequences' at the Max-Planck-Institute für Astrophysik, at Garching b. München.
AUG 1994: 'How Massive is the Black Hole in M87?' a contributed talk at the IAU general assembly in den Haag, Nederlands.
DEC. 1994: 'Model of Temporal and Spatial Line Emission Profiles in AGNs' at GSFC/NASA.
DEC. 1994: 'Are AGN Disks Really Keplerian?' an invited talk at the 17th Texas Symposium in Munich.
JAN. 1995: 'How Massive is the Black Hole in M87?' a poster paper presented at the 185th AAS meeting
FEB. 1995: 'Astrophysics Around Black Holes' a popular talk at the Univ. of Puerto Rico, Humacao
FEB. 1995: 'On Grand Unification of Accretion Disk Models' at the Arecibo Observatory, Arecibo, Puerto Rico.
JUN. 1995: 'Grand Unified Description of Accretion Disks' at the Space Telescope Science Institute.
JUN. 1995: 'Spectral Properties of Accretion Disks around Galactic and Extragalactic Black Holes' at the Goddard Space Flight Center.
SEP. 1995: 'Spectral Properties of Accretion Disks around Galactic and Extragalactic Black Holes' at the Marshall Space Flight Center.
SEP. 1995: 'Spectral Properties of Accretion Disks around Galactic and Extragalactic Black Holes' at University of Kentucky
SEP. 1995: 'Observational Evidence of sub-Keplerian Accretion Disks: from Gravity Waves to Gamma Rays' at University of Maryland.
OCT. 1995: 'Spectral Properties of Accretion Disks around Galactic and Extragalactic Black Holes' at California Institute of Technology
OCT. 1995: 'Spectral Properties of Accretion Disks around Galactic and Extragalactic Black Holes' at Jet Propulsion Laboratory
OCT. 1995: 'Spectral Properties of Accretion Disks around Galactic and Extragalactic Black Holes' at Univ. California at Los Angeles
OCT. 1995: 'Spectral Properties of Accretion Disks around Galactic and Extragalactic Black Holes' at Princeton University Observatory
OCT. 1995: 'Spectral Properties of Accretion Disks around Galactic and Extragalactic Black Holes' at Columbia University
OCT. 1995: 'Spectral Properties of Accretion Disks around Galactic and Extragalactic Black Holes' at Harvard University FEB. 1996: 'Aspects of Black Hole Accretion Flows' at the 18th conference of the Indian Association of General Relativity and Gravitation, Madras.

MAR. 1996: 'Accretion Flows Around Black Holes' at the Theory Physics Seminar at Tata Institute of Fundamental Research.
JUL. 1996: 'Numerical Studies of Accretion and Winds Around Black Holes' and 'Peculiarities of General Relativistic Advective Flows Around Black Holes and Neutron Stars' at the Monash University, Australia.
JUL. 1996: 'Consequences of non-Keplerian Accretion Disks Around a Black Hole: From Gamma rays to Gravity Waves' at the University of Melbourne, and Sydney University, Australia.
JUL. 1996: 'Grand Unification of Accretion Disk Models Around Black Holes and Neutron Stars' at the Australian National Telescope Facility, Sydney, and Australian National University, Canberra.
JUL. 1996: 'Unification of Accretion Disk Models and the formation of Jets' an invited review talk at the IAU163 meeting on 'Accretion Phenomena and Related Outflow', Port Douglus, Australia.
JUL. 1996: Poster paper presented on 'Numerical Simulation of Advective Disks Around Compact Objects' at the IAU163 meeting on 'Accretion Flows and Related Phenomena', Port Douglus, Australia.
AUG. 1996: 'Accretion Flows on Black Holes' an invited review talk at the International Colloquium on 'Perspective in High Energy Astrophysics', TIFR, Mumbai.
AUG. 1996: 'Spectral Properties of Galactic and Extragalactic Black Hole Candidates' an invited review talk at the IAU Asia-Pacific Regional meeting at Pusan National University, Korea
AUG. 1996: 'Summary of Posters on AGNS, High Energy Astrophysics, Theoretical Astrophysics' an invited talk at the IAU Asia-Pacific Regional meeting at Pusan National University, Korea
AUG. 1996: Poster papers on 'Numerical Simulations of Advective Disks' and 'New Twists in the Study of Gravity Wave Emission in Systems with Massive Black Holes' at the IAU Asia-Pacific Regional meeting at Pusan National University, Korea
SEP. 1996: 'Astrophysical Flows around Black Holes' a series of two talks at the Kobe University, Japan.
DEC. 1996: Seminar on 'Quasi-Periodic Oscillation and Spectral Properties of Black Hole Accretion' at the Goddard Space Flight Center.
DEC. 1996: Contributed talk on 'Recent Progresses in Accretion Disk Models Around Galactic and Extragalactic Black Holes' at the 18th Texas Symposium (Chicago).
Jan. 1997: Invited talks on 'Solar Wind', ' Astrophysical Flows Around Black Holes' and 'Our Galactic Center' at the Winter School of Eastern Center for Research In Astrophysics (ECRA) at Science College.
Jan. 1997: Welcome Address at the 1st Winter School of ECRA on 'Basics of Astrophysics' at the Science College, Calcutta, and invited address at the ECRA Training Programme on 'Millimeter Wave Physics'.
Feb. 1997: Invited talk on 'Introduction of Astrophysics in the University Teaching' at

the Jadavpur University.
Mar. 1997: Invited talk on 'Astrophysics of Black Holes' at the Symposium of West Bengal Academy of Science at the Indian Association for the Cultivation of Science.
Apr. 1997: 'Stable and Unstable Oscillation of Advective Disks Around Black Holes' at the Mini-Symposium at S.N.B.N.C.B.S., Calcutta.
May. 1997: 'Astrophysics Around Black Holes' a popular talk the Birla Planetarium, Calcutta.
Aug 1997: 'Astrophysical Flows around Galactic and Extragalactic Black Holes': a set of three lectures at the Physikzentrum, Bad Honnef.
Aug 1997: 'Definite Proofs of Existence of Black Holes' participated at the panel discussion at the Physikzentrum, Bad Honnef.
Sep 1997: 'Astrophysics Around Black Holes' a Theoretical Physics Seminar Circuit seminar at the Biswabharati University, Shantiniketan.
Sep 1997: New Twist in Gravitational Wave Studies from Coalescing Binaries' at the S.N.B.N.C.B.S.
Jan. 1998: A Crash Course on Advective Accretion Disks (three lectures) at the International Workshop at the S.N.B.N.C.B.S. on 'Multiwavelength Studies of Stars and Compact Objects'
Jan. 1998: Non-axisymmetric and Magnetized Advective Flows, at the S.N.B.N.C.B.S. at the International Workshop at the S.N.B.N.C.B.S. on 'Multiwavelength Studies of Stars and Compact Objects'
Jan. 1998: Accretion Disk Models Around Black Holes: Twenty Five Years Later, at the S.N.B.N.C.B.S. at the International Conference on 'Observational Evidence for Black Holes in the Universe'
Mar 1998: 'Mysterious Black Holes' at Bethun College
Apr. 1998: 'Electrons as tracers of Black Holes' at the symposium on '100 years of electrons, 50 years of pions and 25 years of asymptotic freedom', Jadavpur University
Apr. 1998: 'Our Galactic Center' at Presidency College, Calcutta
Jun. 1998: 'The Universe', a set of two lectures at the Kendriya Vidyalaya at the Post-Graduate Inservice Course Meeting, Salt Lake
Aug. 1998: 'Astrophysical Flows around Black Holes' and 'Mathematical properties of Black Hole Accretion' at the Department of Mathematics, Dhaka University, Bangladesh
Dec. 1998: 'Uncertainties in Astrophysics: from large scale to small' at the one day symposium on 'Leonids-98' at the S.N. Bose National Centre for Basic Sciences.
Mar. 1999: 'Identification of Astrophysical Black Holes' at Mehta Research Institute
Mar. 1999: 'Latest Trend of Accretion Disk Models Around Black Holes and Neutron Stars', at YATI conference, SNBNCBS, 1999
Jul. 1999: 'Identification of Astrophysical Black Holes' at Space Research Institute, Moscow
Jul. 1999: 'Formation of Outflows from Accretion disks around Compact objects' a series of two lectures at the 3rd workshop of the International Centre for Relativistic

Astrophysics, Pescara
July 1999: 'Solution of Dirac Equation in Kerr Geometry' at 3rd workshop of the International Centre for Relativistic Astrophysics, Pescara, July (12-23), 1999
Aug. 1999: 'Gravitational Experiments Near a Black Hole' at the 'Gravitation Frontiers', A symposium on 'Experimental Gravitation' held a Samarkhand, Uzbekistan, Aug. (16-21), 1999
Oct. 1999: 'Latest Trend of Black Hole Astrophysics' a Colloquium at the Indian Institute of Astrophysics, Bangalore.
Nov. 1999: 'Do Astrophysical black holes exist?' a Colloquium at the Saha Institute of Nuclear Physics, Calcutta
Feb. 2000: 'Search for Astrophysical Black Holes', Physics Dept. Seminar at Delhi University
Feb. 2000: 'Quasi-Periodic Oscillations of X-rays from Black Holes' at Physical Research Laboratory, Ahmedabad
Feb. 2000: 'Modern Developments in Theory of Accretion Disks and Jets around Black Holes' TPSC Seminar at Tata Institute of Fundamental Research, Mumbai
Mar. 2000: 'Our Universe' at the Space Science Symposium at RKMR College
Apr. 2000: 'Astrophysical Jets' at the Physics Dept. of Jadavpur University
Apr. 2000: 'Advective Accretion Disks: Ten Years Later' at Seoul National University
Apr. 2000: 'Jets, Disks and Spectral States of Black Holes' at the Korean Physical Society
May. 2000: 'Advective Accretion Disks: Ten Years Later' at Korean Astrophysical Observatory
Jun. 2000: 'Constituents of the Universe and ourselves' at the Space Science Symposium, Malda College
Jun. 2000: 'Identification of Astrophysical Black Holes' at the 'Summer School on Astroparticle physics and Cosmology' ICTP
Jun. 2000: 'Outflow Rates of Jets' in the 'High Energy Gamma-Ray Astronomy Symposium' June (26-30), 2000
Jul. 2000: 'Why Bulk Motion Comptonization Should Explain Hard Tail in Soft States?' at 9th Marcel Grossman Meeting in Rome
Jul. 2000: 'State of the Art Models of Accretion and Winds around Black Holes' at 9th Marcel Grossman Meeting in Rome
Jul. 2000: 'Effect of Accretion Disks on GW wave Signal' at 9th Marcel Grossman Meeting in Rome
Jul. 2000: 'Correlation between the QPO frequency and the duration' at 9th Marcel Grossman Meeting in Rome
Jul. 2000: Chairman of the Session of 'Astrophysical Black Holes' at 9th Marcel Grossman Meeting in Rome
Sep. 2000: Chairman of the Session 'Astrochemistry' at 'First Steps in the Origin of Life' conference at ICTP (Sept. 2000)

Sep. 2000: 'Can DNA form during the molecular cloud collapse?' at the conference on 'First Steps in the Origin of Life' at ICTP (Sept. 2000)
Sep. 2000: 'Accretion Disks and Winds' at the 3rd Micro-Quasar conference at Granada (Sept. 2000)
Oct. 2000: 'Stellar Evolution' at Bongyo Bigjan Parishad
Nov. 2000: 'Constituents of the Universe' at the Space Science Symposium at Serampore College
Dec. 2000: 'Modern Developments of Accretion Disk Physics Around Black Holes' a colloquium at the Indian Institute of Astrophysics
Dec. 2000: 'Formation of Biomolecules in Collapsing Interstellar Cloud' a seminar at the Raman Research Institute
Dec. 2000: 'Black Hole Astrophysics' a seminar at the Indian Institute of Mathematical Science, Chennai
Dec. 2000: 'Can Biomolecules form in Collapsing Interstellar Clouds?' A Colloquium at the Indian Institute of Mathematical Science, Chennai.
Jan-Feb. 2001: 'Mysterious Black Holes' at UCB School, Bharatiya Sanskriti Sansad and Midnapore College.
March 2001: Invited Review talk on 'Accretion Disks Around Black Holes' at the Gamma Ray Astronomy Conference at Mt. Abu
March 2001: Invited talks (2) on 'Accretion Processes and Jet Formation' in the National Workshop on Black Hole Astrophysics, Calcutta.
April 2001: 'Plasma Astrophysics Around Black Holes' at the National Conference on 'Recent Trends in Plasma Physics', Calcutta
Sept. 2001: Gave invited talk on 'Transonic Astrophysical Flows' at International Conference on 'Multiwavelength Experiments Through Astronomical Satellite', TIFR, Mumbai
Sept. 2001: 'Do Astrophysical Black Holes Exist?' S.P. Chatterjee Memorial Lecture at Institute of Theoretical Physics
Oct. 2001: 'Constituents of the Universe' At Raiganj School at the Districtwise Space Science Symposium
Dec. 2001: 'Problem of the Identification of Black Holes': Invited review talk at the conference 'Three Generation of Space Physicists'
Feb. 2002: "Saturn's Rings: How Thick are they?" Invited review talk at the Annual Meeting of the Astronomical Society of India, Pune
Feb. 2002: "Stellar Mass Black Holes" Invited review talk at the National Space Science Symposium (NSSS-2002), Bhopal
Mar. 2002: "SS433: 25 years after discovery" Invited Review talk at the 187th IAU Colloquium at Florida International University
Mar. 2002: "Identification of Black Hole" Colloquium at the Dept. of Astrophysics at University of Florida, Gainesville
Mar. 2002: " Recent Developments in Advective Accretion Flows" Colloquium at the

Dept. of Astrophysics, Georgia State University, Atlanta
Mar. 2002: "Our Universe" at the Districtwise Space Science Symposium, B.D. High School.
Apr. 2002: "Variabilities of Galactic and Extra-galactic Black Holes" at the Nainital Observatory
May 2002: "Advective Accretion Flows" a Colloquium at Service d' Astrophysique, SACLAY (France)
May 2002: "Two Component Advective Flow Paradigm" Talk at the 4th Microquasar Conference at Cargese (Corsica)
Jul. 2002: "Types of Data Obtained Through Astrophysical Observations" Invited talk at the Workshop on 'Techniques of Satellite Data Analysis' at CSP.
Oct. 2002: "Advective Accretion Disks", at National Centre for Radio Astrophysics, Pune
Oct. 2002: "Developments in Modern Astrophysics" at Positional Astronomy Center, Alipore, Kolkata
Oct. 2002: "Mysterious Black Holes" at the Silver Jubilee celebration of the Sky Watcher's Association.
Dec. 2002: "Modern Astrophysics" A series of two lectures at the Refresher Course for University teachers at Calcutta University.
Jan. 2003: 'Mysterious Universe' and 'Mysterious Black Holes' at the Districtwise Space Science Symposium at Khakurdaha High School
Apr.-July 2003: A full lecture course on Introduction of Astrophysics at SNBNCBS
July 2003: 'Advective Accretion Flows' a Colloquium at SNBNCBS
July 2003: Space Science – The Final Frontier? At the meeting 'Aerospace Technology: Infinite Potential and Prospects' by Institution of Engineers (India)
July 2003: Chairman of the Session of 'Astrophysical Black Holes' at the 10th Marcel Grossman Meeting in Rio de Janeiro
July 2003: Invited talk on 'Multiwavelength Campaign Of SS433' at 10th Marcel Grossmann meeting at Rio
July 2003: Invited talk on 'Review: Role of Disk models in Identifying Astrophysical Black Holes' at 10th Marcel Grossmann meeting at Rio
July 2003: Invited talk on 'Spectral Properties of Two Component and Two-temperature Accretion Flows Around Black Holes' at 10th Marcel Grossmann meeting at Rio
July 2003: Invited talk on 'QPOs from radial and vertical oscillation of shocks in advective accretion flows' at 10th Marcel Grossmann meeting at Rio
August 2003: 'Recent Developments in Advective Flow Physics' at SACLAY, France
Sept. 2003: 'Advective Accretion Disks' at Meudon Observatory, Paris and Starsbourg Observatory, France and University of Milan, Mirate
Sept. 2003: 'Fate of Glycine during the collapse of molecular clouds and Star Formation' at the 'Origin of Life Conference' in Trieste, ICTP
Sept. 2003: 'Effect of an Accretion Disk on Gravitation Wave Emission from a Binary

Black Hole System' at the 'Gravitation Wave' Conference in Trieste, ICTP
Jan. 2004: 'Mysterious Universe' at the Malda Town Hall
Feb. 2004: 'Mysterious Black Holes' at the Ravindra Bhawan, Coochbehar
June, 2004: 'Spectral Properties Of Galactic And Extra-Galactic Black Holes In Gamma Rays' A review talk at the 'The Multiwavelength Approach To Unidentified Gamma-Ray Sources' conference held at Hong Kong University.
June, 2004: Poster paper on 'Identification For Shocks In Spectra From Black Hole Candidates' at the 'The Multiwavelength Approach To Unidentified Gamma-Ray Sources' conference held at Hong Kong University.
June, 2004: 'Class Transitions in Microquasars' A review tatk at the 'Fifth Microquasar Workshop' at Tsinghua National University, Beijing.
June, 2004: 'Quasi-Periodic Oscillations reproduced by Numerical Simulations' a Contributed talk at the 'Fifth Microquasar Workshop' at Tsinghua National University, Beijing.
October 2004: 'Plasma Physics Around Black Holes' an invited talk at the Seminar on 'Recent Advances on Modern Plasma Physics' at the Centre for Plasma Studies, Jadavpur University.
Nov. 2004: Mysterious Universe at the Platinum Jubilee celebration of B.N.K.N.C.M. High School, Hooghly
Dec. 2004: Invited talk at the Mt. Abu Conference at PRL, Ahmedabad, on 'Multiwavelength Campaign of the Galactic Black Hole Candidate SS433'
Feb. 2005: Talk on 'Progress Report on the nature of the emitted radiation from accretion flows around compact objects' at Pondicherry
Feb. 2005: Invited talk on 'Mysterious Black Holes' at Sonamukhi College, Bankura
Feb. 2005: Invited talks on 'Mysterious Universe' at Ravindra Bhawans of Bankura and Purulia Districts at the Districtwise Space Science Symposium
Mar. 2005: Invited talk on 'Mysterious Black Holes at St. Xavier's College
June. 2005: Invited talk on 'Galaxies and Extra-Galactic Objects' at Jadavpur University
October, 2005: Posters on 'SS433: Results of a recent Multi-Wavelength campaign' and 'Unusual Sunset Terminator behaviour of VLF signals at 17KHz during the Earthquake episode of December 2004' at the General Assembly of URSI in New Delhi
November, 2005: "Evolving view of Observable Universe" an invited talk for the Year of Physics celebration at R.K.M. Vidyamandir, Belur.
November, 2005: "Astrophysical Flows Around Black holes" an invited talk in the Astrophysics Workshop, St. Xavier's College.
February, 2006: "Mysterious Black Holes" at the Districtict wise Space Science Symposia in Dakshin Dinajpur and Darjeeling districts organized by Indian Centre for Space Physics
March, 2006: "Can we Observe QPOs in UV using Tauvex?" at the Indo-Israeli Tauvex meet at Indian Institute of Astrophysics, Bangalore

March, 2006: "Analytical and Numerical Simulation of QPOs in black hole candidates" at the Physical Research Lab., Ahmedabad.
April, 2006: Poster presentations on (a) "Time dependent Chemical Evolution of Molecular Clouds" by A. Das, S.K. Chakrabarti, K. Acharyya and S. Chakrabarti; (b) Can Amino Acids be Formed during Molecular Cloud Collapse?? by K. Acharyya, S.K. Chakrabarti, A. Das and S. Chakrabarti; (c) Monte-Carlo Simulation of the Production of Hydrogen Molecules on Grain Surfaces by S.K. Chakrabarti, A. Das, K. Acharyya and S. Chakrbarti in 'Faraday Discussion 133' held at St. Jacut De La Mar, Brittany
May, 2006: Poster Presentations on (a) "Time dependent Chemical Evolution of Molecular Clouds" by A. Das, S.K. Chakrabarti, K. Acharyya and S. Chakrabarti; (b) Can Amino Acids be Formed during Molecular Cloud Collapse?? by K. Acharyya, S.K. Chakrabarti, A. Das and S. Chakrabarti; (c) Monte-Carlo Simulation of the Production of Hydrogen Molecules on Grain Surfaces by S.K. Chakrabarti, A. Das, K. Acharyya and S. Chakrabarti in 'Complex Molecules in Space Present status and prospects with ALMA' held at Aarhus, Denmark
July, 2006: Talk on 'Spectral and Timing Properties of Two Component advective Flows around black holes' at the 'Physics and Astrophysics of Supermassive Black holes' conference at Santa Fe, USA
July, 2006: 'Spectral and Timing Properties of Two Component advective Flows around black holes' at Princeton University
July, 2006: 'Spectral and Timing Properties of Two Component advective Flows around black holes' at the ICRANET at Pescara, Italy
July, 2006: 'Astrophysical black holes: Do they have boundary layers?' Rapporteur talk at the APT1 session at the 11th Marcel Grossman meeting, Berlin
July, 2006: 'Shocking story of Quasi-Periodic Oscillations in Black Hole Candidates' Rapporteur talk at the APT1 session at the 11th Marcel Grossman meeting, Berlin
July. 2006: Chairman of the Sessions on 'Astrophysical Black Holes' and 'Theoretical Models of Observations of black hole candidates' at the 11th Marcel Grossman Meeting in Berlin
Sept. 2006: Chairman of the Session on 'Microquasars at TeV energies' at the 6th Microquasar workshop in Como, Italy
Sept. 2006: Contributed talk on 'Theoretical Studies of Timing and Spectral Properties of Quasars to Nano-quasars till a few MeV' at the 6th Microquasar workshop in Como, Italy
Sept. 2006: Posters and brief presentations on 'Spectral and timing properties of GRO J1655-40 during March 2005 outburst' and 'Spiral Shocks Oscillations and the QPOs with 3:2 ratio' at the 6th Microquasar workshop in Como, Italy
October, 2006: Colloquium on 'Establishing Cosmology as a precise science - the Nobel Prize of 2006' at the S.N. Bose National Centre for Basic Sciences.
December, 2006: Attended the Project Monitoring Board Member Meeting of the Indo-Russian Satellite "CORONAS-PHOTON" at VSSC, Trivandrum.

February, 2007: Colloquium on 'Shocking Story of Black Hole Accretion" in the Dept of Physics, Indian Institute of Science, Bangalore
February, 2007: Two lectures on 'Accretion Flows: Some issues and problems' at the Mini-school on 'Hydrodynamic and Radiative Processes in Astrophysics', SNBNCBS
February, 2007: Invited talk at Sri Ramatosh Sarkar Memorial lecture on 'Wonderful Astronomy' at Bongyo Bijnan Porishad
March, 2007: Talks at PMB meeting in Bangalore and RESPOND meeting at PRL, Ahmedabad
May, 2007: 'Mysterious universe', two invited talks at the 14th and 15th Districtwise Space Science Symposium held in Burdwan and Suri.
May, 2007: 'Continuous Spectrophotometry of Black Holes' at ISRO, ADCOS meeting, Bangalore
May, 2007: Invited talk on 'Search for planets with strong magnetic field as a pulsating source' at the Brainstorming session on ESA COSMIC-Vision 2017 project, Bangalore
June, 2007: Presented a talk on 'VLF Astronomy as Earthquake/Tsunami prediction' at the National Disaster Management meeting in New Delhi
August, 2007: Invited 'Continuous Spectro-photometry of Black Holes' at ISRO, Bangalore
August, 2007: Invited talk at TIFR on 'Zone plates as X-ray imaging device' at the Preliminary Design Review (PDR) of RT-2/CZT payload.
August, 2007: Invited talk on 'X-ray and Gamma-Ray Astronomy from Moon' at the PLANEX meeting on Chadrayaan-II at PRL, Ahmedabad
Oct., 2007: Invited talk on 'Zone plates as the X-ray Imaging Device' at the 'Space Week' meeting (MePhi) at the 50th Anniversary of Sputnik mission.
Oct. 2007: 'Correlation Between ionospheric activities with earthquakes by monitoring Very Low Frequency(VLF) signals' at the Earthquake workshop (SMR1864)
Oct., 2007: Invited talk on the 'Hydrodynamic and Spectral properties of Transonic Astrophysical Flows Around Black Holes' at the SMR1865 Workshop on 'Astrophysical Fluid Dynamics' at ICTP, Italy
Oct., 2007: 'Spectral Properties of shocked advective flows at high energy' and 'Zone plates as X-ray imaging device', at the forthcoming BEPPO/SCARSI meeting in Palermo
Oct., 2007: Invited talk on 'Theoretical and Observational Evidence of the Boundary Layer of Black Hole' at ICRA, University of Rome
Oct. 2007: Invited talk on 'Synthesis of Biomolecules in the Interstellar Medium' at the Physics of the Living State, Applied Physics Scientific Section Seminar at ICTP
Dec. 2007: Invited talk on 'Do we SEE black holes?' at the Platinum Jubilee Commemorative conference of ISI, Kolkata
Dec. 2007: Invited talk on 'Space Explorations: The Indian Perspective' organized by Paschimbanga Bijnan Mancha at Seoraphuli, Hoogley. January 2008: Invited talks on 'Mysterious Universe' at Districtwise Space Science Symposia in Murshidabad and Nadia Districts

February 2008: Invited talk on 'Black Hole Accretion' at the Second Kolkata meeting on 'Observational Evidence for Black Holes in the Universe', Kolkata
March 2008: Invited talk on 'Can we form biomolecules during Star Formation?' at the 'Astrobiology' Conference at IIT/Roorkee
March 2008: Invited talk on 'Stellar Evolution and Black Hole Formation' at the Taki Govt. College
May. 2008: Talks on 'Accretion processes of black holes' at George Mason University, Luisiana State University, University of Texas at Arlington and 212th AAS meeting at St. Louis
August, 2008: Poster presentations on Evolution of pre-biotic molecules during collapse of Interstellar clouds and Monte Carlo Simulation of Water and Methanol on Grain Surfaces at the 15th ISSOL meeting, Florence.

Other Conferences Attended:

FEB. 1986: Stevens meeting on General Relativity and Gravitation: at the University of California, Santa Barbara.
JUN. 1986: Star formation in Galaxies: at Caltech.
MAR. 1989: Supernovae: at Goa.
JUNE 1994: 44th Meeting of the Nobel Prize Winners in Lindau (Nominated for Participation by Indian National Science Academy and Deutsch Forschungsgemeinschaft).
DEC. 1996: Attended S. Chandrasekhar Memorial Lecture at the University of Chicago.
Nov. 1998: Participated in the workshop on 'Image Processing and Data Analysis' at IUCAA (Nov 15th - 21st, 1998).
Jul. 2000: 'Perspectives of Relativistic Astrophysics' at Pescara

Organization of Conferences

C1. Convener of the workshop on 'Multiwavelength Studies of Stars and Compact Objects' (Jan. 1st - Jan. 17th, 1998) and of the Conference 'Observational Evidence for Black Holes in the Universe' (Jan. 11th - Jan. 17th, 1998).
C2. Convener of the Conference on 'Leonids 98 - A postmortem' held at the SNBNCBS (December 20th, 1998).
C3. Convener of "Young Astrophysicists of Today's India" conference at the S.N. Bose National Centre for Basic Sciences (March 24-27th, 1999)
C4. convener of "Districtwise Space Science Symposium" (Malda district) organized by Indian Centre for Space Physics (June, 2000).
C5. Convener of "Districtwise Space Science Symposium" and 'Astrophysical Flows Around Black Holes' organized by Indian Centre for Space Physics at Serampore Col-

lege (November, 2000).
C6. Convener of "Young Astrophysicists of Today's India-2001" and "Black Hole Astrophysics" organized by Indian Centre for Space Physics (March, 2001)
C7. Convenor of "Districtwise Space Science Symposium" (North Dinajpur; Oct. 2001)
C8. Convenor of "Three Generations of Space Physicists of Kolkata" (Dec. 2001)
C9. Convenor of "Districtwise Space Science Symposium" (North 24 Paraganas; Mar. 2002)
C10. Convenor of "Districtwise Space Science Symposium" (East/West Medinipur Districts; Jan. 2003)
C11. Convenor of "Districtwise Space Science Symposium" (Coochbehar/Jalpaiguri Districts; Feb. 2004)
C12. Convenor of "Districtwise Space Science Symposium" (Bankura/Purulia Districts; Jan/Feb. 2005)
C13. Convenor of "Districtwise Space Science Symposium" (Dinajpur (D) and Darjeeling Districts; Feb. 2006)
C14. Convenor of "Districtwise Space Science Symposium" (Birbhum and Bardhaman Districts; May, 2007)
C15. Joint Convenor of "Second Kolkata Conference on Observational Evidence for Black Holes in the Universe"; Feb. 2008 and the Satellite SNB-ICRANet Meeting on 'Black Holes, Neutron Stars and Gamma Ray Bursts' (Feb. 2008)

Table 1: Students who completed/submitted Ph.D. Thesis and Their present Status

Name	Title of Thesis	Year	Present Status
Tapas K. Das	Modeling The Origin Of Astrophysical Outflows From Accretion Disks Around Compact Objects	2000	Faculty of HRI (Phys.)
B. Mukhopadhyay	Interaction Of Charged Fluid With Astrophysical Black Holes	2001	Faculty of IISc (Phys.)
A. Bhattacharyya	Collective Effects in the Planetary Ring Particle Dynamics	2001[1]	Faculty at BARC, Mumbai
I. Chattopadhyay	Studies of the Hydrodynamic and Radiative Acceleration Processes of Cosmic Radio Jets and Bipolar Outflows From Compact Objects	2002	Faculty at ARIES (Nainital)
S. Manickam	Quasi Periodic Oscillations in the X-ray Emission from Black Hole Candidates	2003	Res. Assoc. (ISRO/HQ)
Anuj Nandi	Spectral and timing properties of accretion flows around black holes from observational data	2005	Scientist at ISRO-HQ/ICSP
Santabrata Das	Analytical studies of standing shocks in accretion flows around compact objects	2005	Post-Doc at ICA(KASSI), Korea
Sabyasachi Pal	Radio Properties of Compact Galactic Objects	2006[2]	Post-Doc at NCRA, Pune
Samir Mandal	Theoretical studies of spectral properties of two-component advective flows around black holes	2006	Fast Track Young Scientist (DST) at ICSP
Soumen Mondal	Accretion Processes Around Kerr Black Holes	2007	Faculty at RKMR College Narendrapur
K. Acharyya	Formation of Complex Molecules during Star Formation	2007[3]	Tenure Track position at SNBNCBS
P. Basu	Effects of Accretion Disks on Gravitational Waves from Binary	2008[1]	Post Doc at IISc, Bangalore
A. Das	Hydrodynamic Simulation of the formation of Protostars ..	2008[3]	Greenberg Fellow Leiden Observatory

1 Joint supervisor: Dr. A. M. Basu of Jadavpur University; 2 Joint supervisor: Dr. K. Goswami of Jadavpur University; 3 Joint supervisor: Dr. Sonali Chakrabarti of MMC College/Indian Centre for Space Physics

IRAP PHD

CURRICULUM

1. *BELINSKY Vladimir (ICRANet)*
2. *CHAKRABARTI Sandip (ISCP India)*
3. **CHARDONNET Pascal (University of Savoie)**
4. *COULLET Pierre (University of Nice Sophia Antipolis)*
5. *EINASTO Jaan (Tartu Observatory)*
6. *FRONTERA Filippo (University of Ferrara)*
7. *JING Yipeng (Shanghai Observatory China)*
8. *KLEINERT Hagen (Freie University of Berlin)*
9. *NICOLAI Hermann (Max Planck Institute for Gravitation)*
10. *NOVELLO Mario(CBPF Brazil)*
11. *PACHECO Jose (Observatoire de la Côte d'Azur)*
12. *ROSQUIST Kjell (University of Stockholm)*
13. *RUFFINI Remo (University of Roma La Sapienza & ICRANet)*
14. *RYDE Felix ((University of Stockholm)*
15. *TITARCHUK Lev (University of Ferrara)*
16. *VAKILI Farrokh (Observatoire de la Côte d'Azur)*

CURRICULUM VITAE
Pascal CHARDONNET

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BORN : May 21, 1964, in Moûtiers (Savoie)
Married to Anna Chiappinelli , August 1992
Children : Angelo (14 years) , Ornella (10 years)

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9 Chemin de Bellevue
BP 110
F-74941 Annecy-le-Vieux Cedex
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Fax : +33 4 50 27 94 95

EDUCATION :

- 2006 : Professor of Physics, University of Savoie
- 2002 : HDR with title « Phénomènes très énergétiques en astrophysique : sursauts gamma et rayons cosmiques d'énergie extrême »
- 1992 : Maître de Conférences at University of Savoie
- 1992 : PhD in Science, « On the role of neutrinos in Astrophysics and Cosmology », with « mention très honorable »
- 1990-1992 : « Assistant moniteur normalien » at University of Chambéry and preparation of my PhD Thesis
- 1989-1990 : Military duty as scientist in Saclay
- 1988 : Agrégation de Physique
- 1985-1989 : Ecole Normale Supérieure de Cachan

POSITION HELD :

- University of Savoie : Professor of Physics, University of Savoie / Member of International Center for Relativistic Astrophysics Pescara (Italy)
- 2000-2001 : Délégation CNRS – Collaboration with Remo Ruffini at Roma University « La Sapienza »
- NATO Grant : 2001
- 1999-2000 : Délégation CNRS – Collaboration with Venya Berezinsky at Assergy Laboratory – Gran Sasso
- University of Savoie : Maître de Conférences 1992-1999

ADVISING :

- Supervise doctoral researcher Walter Ferrara (2008-)
- Supervise doctoral researcher Valentino Lacquaniti (2005-2008)
- Supervise post-doctoral researcher Dr.Anton Baushev
- Supervise doctoral researcher Alvise Mattei (2003-2006)
- Advised undergraduates students (Laurea) : Alvise Mattei
- Advised middle school students from Annecy

TOPICS RESEARCH:

- The gamma ray burst : in collaboration with Prof. Ruffini we have developed a new candidate for the GRBs. We have numerous publications in Astrophysical Journal Letters and other reviews. We have developed a numerical code involving General Relativity and Hydrodynamics. We are able to compute all the parameters during the expansion of the plasma. This effort permits us to test quantitatively our prediction with experiments. In add we have proposed new idea like the induced supernova collapse of a nearby star by the GRB flash.
- The Ultra High Energy Cosmic Ray : with my PhD student Alvise Mattei we have developed a complete propagation code for UHECRs in the intergalactic medium including all losses and modelization of magnetic halo of galaxies. We have also proposed new possible sources from GRB.
- The Galactic Center : recently in collaboration with Lev Titarchuk from NRL we have proposed a new interpretation of the 511 keV annihilation line. It could be due to small mass black holes. The pairs e+e- are produced by interaction of the X ray background in the Galactic Center with the 10 Mev photon produced by the small mass black holes accretion disk. This is in add a new candidate for invisible matter.

TEACHING AND OUTREACH EXPERIENCE:

- Responsible of second year cycle in Science at University of Savoie.
- Responsible of "Faites de la Science" at University of Savoie
- Lecture of General Relativity in ENS Lyon Master 2, Theoretical Physics
- Lecture at the International PhD Program in Relativistic Astrophysics : IRAP PhD
- Lecture : « Classical Mecanics and Electromagnetism » , « Introduction to quantum mechanics» and « Special Relativity in Chambéry
- Lecture in third year University « Story of Science : optics» in Chambéry
- Responsible of « Licence de Sciences Physiques »
- Responsible of Laboratory of « Licence de Sciences Physiques »
- Responsible of « CAPES » in 1998-1999
- Numerous exercises and lectures in CAPES, Option Concours, Licence et DEUG
- Practical conception and realization of a series of laboratory exercises for 40 hours.
- Président de Jury de Bac
- Lecture in summer School: Gif 1992 et Gif 1999

PUBLICATION:

REFEREE JOURNALS

[P30] –Small mass black holes in Kaluza-Klein

P. Chardonnet and V. Lacquaniti

en préparation pour Astrophysical Journal Letters

[P29] –On the Pair-Instability Supernoave and Gamma-Ray Burst Phenomena

P. Chardonnet, V. Chechetlkin and L. Titarchuk; to be published in Astrophysics and Space Science

[P28] – Electric charge estimation of a new-born black hole

P. Chardonnet, A. Baushev; to be published in Int. Journal of Modern Physics

[P27] –GRB050315 : a step toward the uniqueness of the overall GRB struture

R. Ruffini, M.G. Bernardini, C.L. Bianco, P. Chardonnet, F. Fraschetti, R. Guida and S.S. Xue ; in Astrophysical Journal Letters (2006) **645**, 109

[P26] –The Ultra High Energy Cosmic Ray : A New Frontier ?

P. Chardonnet and A. Mattei ; à paraître dans International Journal of Modern Physics D

[P25] –On the role of galactic magnetic halo in the ultra high energy cosmic rays propagation

P. Chardonnet and A. Mattei ;in the Astrophysical Journal Letters (2006) **645**, 121

[P24] –The Observed Galactic Annihilation Line. Possible Signature of the Cluster for Accreting Small Mass Black Holes

L. Titarchuk and P. Chardonnet; astro-ph/0511333 Astrophysical Journal **641** (2006) 293

[P23] –Theoretical Interpretation of the Luminosity and Spectral Properties of GRB031203

R. Ruffini, M.G. Bernardini, C.L. Bianco, P. Chardonnet, F. Fraschetti and S.S. Xue ; astro-ph/0510270 and Astrophysical Journal Letters **634** (2005) 29

[P22] –Extracting energy from black holes : « long » and « short » GRBs and their astrophysical settings

R. Ruffini, M.G. Bernardini, C.L. Bianco, P. Chardonnet, F. Fraschetti, V.Gurzadyan,L. Massimiliano, L. Vitagliano and S.S. Xue ; astro-ph/0505166 and Nuovo Cim. 28C (2005) 589-596

[P21] –Evidence for isotropic emission in GRB991216

R. Ruffini, M.G. Bernardini, C.L. Bianco, P. Chardonnet, F. Fraschetti, and S.S. Xue ; astro-ph/0503268 to appear on Advances in Space Research

[P20] –Emergence of a Filamentary Structure in the Fireball from GRB Spectra

R. Ruffini, M.G. Bernardini, C.L. Bianco, P. Chardonnet, F. Fraschetti, V. Gurzadyan and S.S. Xue ; astro-ph/0411760 International Journal of Modern Physics D, Volume 14, Issue 01, pp. 97-105 (2005)

[P19] –On the Instantaneous Spectrum of Gamma-Ray Bursts

R. Ruffini, M.G. Bernardini, C.L. Bianco, P. Chardonnet, F. Fraschetti, V. Gurzadyan and S.S. Xue ;
astro-ph/0405284 and International Journal of Modern Physics D, Volume 13, Issue 05, pp. 843-851 (2004).

[P18] –GRB980425, SN1998bw and the EMBH model

R. Ruffini, M.G. Bernardini, C.L. Bianco, P. Chardonnet, F. Fraschetti, and S.S. Xue ;
astro-ph/0306246 and Advances in Space Research, Volume 34, Issue 12, p. 2715-2722 (2004)

[P17] –The emission of Ultra High Energy Cosmic Rays from Electromagnetic Black Holes

P. Chardonnet, A. Mattei, R. Ruffini, and S.S. Xue ;
Il Nuovo Cimento B, vol. 118, Issue 10, p.1063 (2003)

[P16] –On the structure of the burst and the afterglow of gamma-ray bursts

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[P7] –The gas deficiency of the galactic halo

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[P6] –Galactic diffusion and the antiproton signal of supersymmetric dark matter

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XXV International Cosmic Ray Conference July-August 97 Durban - South Africa

[C8] - The Galactic Antideuterium Production in a Diffusion Model

P.Chardonnet, J. Orloff and P.Salati

XXV International Cosmic Ray Conference July-August 97 Durban - South Afric

[C7] - Galactic diffusion and Antiproton Signal of Supersymmetric Dark Matter

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[C2] – The Gamma-ray line signature of the elusive neutrino;

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POPULAR MAGAZINES

- **Pour La Science – Avril 2002 : Les sursauts gamma**

R. Ruffini, P. Chardonnet, C.L. Bianco, F. Fraschetti and S.S. Xue

- **La Recherche – Mai 2002 : Les trous noirs sources d'énergie**

R. Ruffini, C.L. Bianco, F. Fraschetti , S.S. Xue and P. Chardonnet

- **Le Scienze – Giugno 2002 : Impulsi gamma**

R. Ruffini, P. Chardonnet, C.L. Bianco, F. Fraschetti and S.S. Xue

- **Sapere - Giugno 2002 – Bucchi Neri Sorgente di energia**

R. Ruffini, P. Chardonnet, C.L. Bianco, F. Fraschetti and S.S. Xue

SCHOOLS

- **Did we already observed small mass black holes ?** P. Chardonnet in XII Brazilian School of Cosmolgy and Gravitation
- **Le neutrino et les grandes structures,** P. Chardonnet

Cours de l'école de Gif : Le neutrino a-t-il une masse ? Grenoble (1999)

- **Mystère des Neutrinos mystère de l'Univers,** P. Chardonnet

Cours de l'Ecole de Gif : Le neutrino et ses mystères, Montpellier (1992

IRAP PHD

CURRICULUM

1. *BELINSKY Vladimir (ICRANet)*
2. *CHAKRABARTI Sandip (ISCP India)*
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4. **COULLET Pierre (University of Nice Sophia Antipolis)**
5. *EINASTO Jaan (Tartu Observatory)*
6. *FRONTERA Filippo (University of Ferrara)*
7. *JING Yipeng (Shanghai Observatory China)*
8. *KLEINERT Hagen (Freie University of Berlin)*
9. *NICOLAI Hermann (Max Planck Institute for Gravitation)*
10. *NOVELLO Mario(CBPF Brazil)*
11. *PACHECO Jose (Observatoire de la Côte d'Azur)*
12. *ROSQUIST Kjell (University of Stockholm)*
13. *RUFFINI Remo (University of Roma La Sapienza & ICRANet)*
14. *RYDE Felix ((University of Stockholm)*
15. *TITARCHUK Lev (University of Ferrara)*
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Etudes :

Lycée Masséna puis Faculté des Sciences à l'Université de Nice.
1973 D.E.A. de Physique Théorique (Université de Nice).
1975 Thèse de troisième cycle (Université de Nice).
1981 Thèse d'Etat (Université de Nice).

Carrière Académique :

1975-1986 : "Chargé de Recherche" au C.N.R.S.
1986-1987 : "Directeur de Recherche" au C.N.R.S.
1987- : Professeur (Université de Nice, classe exceptionnelle depuis 1995).
1995- 2002 : Directeur d'une unité mixte CNRS-Université, "l'Institut Non-Linéaire de Nice").
1995- : Membre senior de l'Institut Universitaire de France (IUF).
2005- : Directeur de l'Institut Robert Hooke de Culture Scientifique.

Distinctions :

1990 : Prix "Langevin" de la Société Française de Physique.
1991 : Prix "C.S. de Freycinet" de l'Académie des Sciences.
1993 : Médaille d'argent du CNRS (Département Sciences Physiques et Mathématiques).
1999 : Membre de l'Académie des Sciences Chilienne.
2000 : Prix Humbolt (Allemagne).
2001 : Prix Holweck ("Institute of Physics" et Société Française de Physique).

Affiliations :

1975-1986 : Laboratoire de Physique Statistique (Nice).
1987-1991 : Laboratoire de Physique Théorique (Nice).
1991- 2007 : Institut Non-Linéaire de Nice, Sophia Antipolis.
2007- : Laboratoire Jean-Alexandre Dieudonné.

Activités d'Enseignement :

Responsable de l'enseignement de "Dynamique" en licence (L1, L2 et L3) et Master (M1 et M2). J'enseigne actuellement le cours de "Dynamique" dans les cinq années universitaires.

Activités Editoriales :

Editeur associé de "Journal of Bifurcations and Chaos" et "Journal of Turbulence".

Administration :

Président du jury ”Science Fondamentale” du prix Descartes de l'EU de 1999 à 2004.
Expert du comité ”Physique” du programme ”Réseau de formation et de recherche” de la Communauté Européenne depuis 1999.
Membre du Jury Junior de l'Institut Universitaire de France (1999-2003).
Membre du Bureau de l'Institut Universitaire de France (1999-2003).
Membre du Grand Jury du prix Descartes de la Communauté Européenne depuis 2005.
Membre du Conseil d'Administration de la Chancellerie de l'Académie de Nice-Toulon depuis 2003.
Membre du Conseil d'UFR Science depuis 2002.
Membre du Conseil Scientifique de l'Université depuis 2003.
Chargé de mission auprès du Président de l'Université depuis 2003 (Culture Scientifique et Rayonnement International).
Premier Vice-Président de l'Unviersité de Nice-Sophia Antipolis depuis 2008

Activité d'organisation :

Création 1990, avec G. Iooss (professeur à l'Université de Nice), l'INLN, un laboratoire associé au CNRS. L'Institut Non-Linéaire de Nice est situé à Sophia-Antipolis. Il regroupe 80 enseignants-chercheurs et chercheurs travaillant dans le domaine de la complexité. J'en ai assuré la direction de 1995 à 2002. J'ai organisé une vingtaine de conférences internationales. J'ai été responsable de 8 contrats Européens. J'ai lancé depuis 2004, le projet d'un centre de conférence Européen à Saint-Etienne de tinée et je suis co-responsable d'un contrat Européen qui permet d'organiser les trois premières écoles d'été. J'ai dirigé la première Ecole en 2005. Une construction est en cours d'étude par la municipalité de Saint-Etienne. L'ouverture à des séminaires universitaires et à la formation des enseignants est envisagée dans le futur centre. Je dirige un Institut Universitaire de Culture Scientifique (L'institut Robert Hooke) que j'ai crée en 2004.

Activités Scientifiques :

Etude de la transition vers le Chaos, Systèmes Dynamiques, Turbulence et formation de structures organisées (Mécanique des Fluides, Optique, Cristaux liquides, Réactions chimiques, Modèles Biologiques, ...)

Longs séjours à l'étranger :

New-York (2 ans, postdoc), Weizmann (6 mois), Santiago (1 an), Bayreuth (6 mois), Cambridge(3 mois), Bruxelles (4 mois), Chicago (2 mois), Tucson (4 mois), Madrid (6 mois). J'ai participé à plus de 60 manifestations internationales dans lesquelles j'ai donné une conférence.

Liste de Publications :

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C. Tresser, P. Coullet, "Critical transition to stochasticity" in "Intrinsic stochasticity in plasmas" G.Laval and D. Gresillon Eds. Edition de Physique, 365 (1979).

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P. Coullet, C. Tresser, "Critical transition to stochasticity for some dynamical systems.", J. Physique Lettres 41, 255 (1980).

C. Tresser, P. Coullet, "Preturbulent states and renormalization group for simple model." Rep. Math. Phys. 17, 189 (1980).

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P. Coullet, C. Tresser, A. Arneodo, "Transition to turbulence for quasiperiodic flows" Phys. Lett. 77A, 327 (1980).

W. E. Langford, A. Arneodo, P. Coullet, C. Tresser, J. Coste, "A mechanism for soft mode instability" Phys. Lett. 78A, 11 (1980).

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G. Iooss, A. Arnéodo, P. Coullet, C. Tresser, "Simple computation of bifurcating invariant circles for mappings" Sringer Lecture Notes in Maths., 898, 192 (1981)

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Career

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Author of hundreds of refereed papers. Included among the highly cited researchers in Space Sciences by ISI Thomson (see http://hcr3.isiknowledge.com/search_author.pl).

Responsible of the High Energy Astrophysics group at the Physics Department of the Ferrara University, where both observational (e.g., study of GRB and compact objects) and experimental (e.g., Laue lens development) researches in X-ray astronomy are carried out.

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Filippo Frontera

April 2009

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276. Amati, Lorenzo; Guidorzi, Cristiano; Frontera, Filippo; Della Valle, Massimo; Finelli, Fabio; Landi, Raffaella; Montanari, Enrico,
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Monthly Notices Royal Astron. Soc., 391, 577–584 (2008).

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279. Montanari, Enrico; Titarchuk, Lev; Frontera, Filippo,
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CURRICULUM

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CURRICULUM VITAE of Y.P. JING

PERSONAL DATA

Name:	Yipeng JING
Position:	Professor, Shanghai Observatory
Date of birth:	09 Jan. 1964
Place of birth:	Zhejiang, P.R. China
Nationality:	P.R. China

INSTITUTION and ADDRESS FOR CORRESPONDENCE

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Professional Preparation:

Hangzhou University/China)	Theoretical physics	B.S. 1984
Int. Sch. Advanced Studies (SISAA), Italy	Astrophysics	M.S. 1991
Int. Sch. Advanced Studies (SISAA), Italy	Astrophysics	Ph.D. 1992

Professional Employment:

2000 - Professor
Head, the Cosmology Group of National Observatories
Shanghai Observatory
2003– Chairman, the Scientific Advisory Committee for Shanghai Observatory
2005– Director, the Joint Center for Cosmology and Galaxy with USTC
2006– Director, Center for Cosmology and Galaxy, SHAO

Synergistic Activities:

–Project Chief Scientist, the National Key Project (973) of China "The formation and evolution of the large-scale structures in the Universe and of galaxies"(2007-2012);

–Member of the Advisory Committee, the National Key Project (973) of China "The formation and evolution of galaxies"(1999-2005);

–Head of Shanghai Node, EC-RTN project "Astrophysics Network for Galaxy Lensing Studies" (2003—).

–co-PI of The CAS key project "Institute for Theoretical Astrophysics" (2004—)

Honors & Awards

–Chinese Young Scientist Award 2006

–The Second Prize Winner of National Natural Science Awards 2005

–Outstanding Scientist of Shanghai 2005

–The First Prize Winner of Shanghai Natural Science Awards 2004

–The Sate Achievement Award for Returned Overseas Chinese Scientists (2003)

–The State Outstanding Young Researcher (2001)

Thesis Advisor and Postgraduate–Scholar Sponsor:

Supervising 10 students at Shanghai Observatory and the University of Science and Technology of China in Hefei. Seven got PhD

Recent Publications (Referred Journals, 2005-2007 only)

30. Kang, X., F. C. van den Bosch, X. Yang, S. Mao, H. J. Mo, C. Li, and **Y. P. Jing**; "The alignment between satellites and central galaxies: theory versus observations"; Monthly Notices of the Royal Astronomical Society; (2007); 378, 1531-1542.

29. Li, G. L., S. Mao, **Y. P. Jing**, W. P. Lin, and M. Oguri; "Properties of wide-separation lensed quasars by clusters of galaxies in the Sloan Digital Sky Survey"; Monthly Notices of the Royal Astronomical Society; (2007); 378, 469-481.

28. Faltenbacher, A., C. Li, S. Mao, F. C. van den Bosch, X. Yang, **Y. P. Jing**, A. Pasquali, and H. J. Mo; "Three Different Types of Galaxy Alignment within Dark Matter Halos"; Astrophysical Journal; (2007); 662, L71-L74.

27. Li, C., **Y. P. Jing**, G. Kauffmann, G. Börner, X. Kang, and L. Wang; "Luminosity dependence of the spatial and velocity

distributions of galaxies: semi-analytic models versus the Sloan Digital Sky Survey"; Monthly Notices of the Royal Astronomical Society; (2007); 376, 984-996.

26. **Jing, Y. P.**, Y. Suto, and H. J. Mo; "The Dependence of Dark Halo Clustering on Formation Epoch and Concentration Parameter"; Astrophysical Journal; (2007); 657, 664-668.

25. Wang, H. Y., H. J. Mo, and **Y. P. Jing**; "Environmental dependence of cold dark matter halo formation"; Monthly Notices of the Royal Astronomical Society; (2007); 375, 633-639.

24. Yang, X., H. J. Mo, F. C. van den Bosch, **Y. P. Jing**, S. M. Weinmann, and M. Meneghetti; "Weak lensing by galaxies in groups and clusters - I. Theoretical expectations"; Monthly Notices of the Royal Astronomical Society; **373**(2006); 1159-1172.

23. Li, C., G. Kauffmann, L. Wang, S. D. M. White, T. M. Heckman, and **Y. P. Jing**; "The clustering of narrow-line AGN in the local Universe"; Monthly Notices of the Royal Astronomical Society; **373**(2006); 457-468.

22. Li, G.-L., S. Mao, **Y. P. Jing**, X. Kang, and M. Bartelmann; "Smoothing Algorithms and High-Order Singularities in Gravitational Lensing"; Astrophysical Journal; **652**(2006); 43-55.

21. Lin, W. P., **Y. P. Jing**, S. Mao, L. Gao, and I. G. McCarthy; "The Influence of Baryons on the Mass Distribution of Dark Matter Halos"; Astrophysical Journal; **651**(2006); 636-642.

20. Li, G. L., S. Mao, **Y. P. Jing**, H. J. Mo, L. Gao, and W. P. Lin; "The giant arc statistics in the three-year Wilkinson Microwave Anisotropy Probe cosmological model"; Monthly Notices of the Royal Astronomical Society; **372**(2006); L73-L77.

19. Kang, X., **Y. P. Jing**, and J. Silk; "Massive and Red Objects Predicted by a Semianalytical Model of Galaxy Formation"; Astrophysical Journal; **648**(2006); 820-825.

18. Yang, X., F. C. van den Bosch, H. J. Mo, S. Mao, X. Kang, S. M. Weinmann, Y. Guo, and **Y. P. Jing**; "The alignment between the distribution of satellites and the orientation of their central galaxy"; Monthly Notices of the Royal Astronomical Society; **369**(2006); 1293-1302.

17. Li, C., **Y. P. Jing**, G. Kauffmann, G. Börner, S. D. M. White, and F. Z. Cheng; "The dependence of the pairwise velocity dispersion on galaxy properties"; Monthly Notices of the Royal Astronomical Society; **368**(2006); 37-47.

16. Li, C., G. Kauffmann, **Y. P. Jing**, S. D. M. White, G. Börner, and F. Z. Cheng; "The dependence of clustering on galaxy properties"; Monthly Notices of the Royal Astronomical Society; **368**(2006); 21-36.

15. **Jing, Y. P.**, P. Zhang, W. P. Lin, L. Gao, and V. Springel; "The Influence of Baryons on the Clustering of Matter and Weak-Lensing Surveys"; Astrophysical Journal; **640**(2006); L119-L122.

14. Zhu, G., Z. Zheng, W. P. Lin, **Y. P. Jing**, X. Kang, and L. Gao; "The Dependence of the Occupation of Galaxies on the Halo Formation Time"; Astrophysical Journal; **639**(2006); L5-L8.

13. Wang, H. Y., **Y. P. Jing**, S. Mao, and X. Kang; "The phase-space distribution of infalling dark matter subhaloes"; Monthly Notices of the Royal Astronomical Society; **364**(2005); 424-432.

12. Li, G.-L., S. Mao, **Y. P. Jing**, M. Bartelmann, X. Kang, and M. Meneghetti; "Is the Number of Giant Arcs in ΛCDM Consistent with Observations?"; Astrophysical Journal; **635**(2005); 795-805.

11. Lee, J., **Y. P. Jing**, and Y. Suto; "An Analytic Model for the Axis Ratio Distribution of Dark Matter Halos from the Primordial Gaussian Density Field"; Astrophysical Journal; **632**(2005); 706-712.

10. Yang, X., H. J. Mo, F. C. van den Bosch, S. M. Weinmann, C. Li, and **Y. P. Jing**; "The cross-correlation between galaxies and groups: probing the galaxy distribution in and around

dark matter haloes"; Monthly Notices of the Royal Astronomical Society; **362**(2005); 711-726.

9. Kang, X., **Y. P. Jing**, H. J. Mo, and G. Börner; "Semianalytical Model of Galaxy Formation with High-Resolution N-Body Simulations"; Astrophysical Journal; **631**(2005); 21-40.

8. van den Bosch, F. C., S. M. Weinmann, X. Yang, H. J. Mo, C. Li, and **Y. P. Jing**; "The phase-space parameters of the brightest halo galaxies"; Monthly Notices of the Royal Astronomical Society; **361**(2005); 1203-1215.

7. Lee, J., X. Kang, and **Y. P. Jing**; "The Intrinsic Alignment of Dark Halo Substructures"; Astrophysical Journal; **629**(2005); L5-L8.

6. Kang, X., S. Mao, L. Gao, and **Y. P. Jing**; "Are great disks defined by satellite galaxies in Milky-Way type halos rare in ΛCDM?"; Astronomy and Astrophysics; **437**(2005); 383-388.

5. Yang, X., H. J. Mo, **Y. P. Jing**, and F. C. van den Bosch; "Galaxy occupation statistics of dark matter haloes: observational results"; Monthly Notices of the Royal Astronomical Society; **358**(2005); 217-232.

4. Yang, X., H. J. Mo, F. C. van den Bosch, and **Y. P. Jing**; "The two-point correlation of galaxy groups: probing the clustering of dark matter haloes"; Monthly Notices of the Royal Astronomical Society; **357**(2005); 608-618.

3. Yang, X., H. J. Mo, F. C. van den Bosch, and **Y. P. Jing**; "A halo-based galaxy group finder: calibration and application to the 2dFGRS"; Monthly Notices of the Royal Astronomical Society; **356**(2005); 1293-1307.

2. **Jing, Y. P.**; "Correcting for the Alias Effect When Measuring the Power Spectrum Using a Fast Fourier Transform"; Astrophysical Journal; **620**(2005); 559-563.

1. Hou, Y. H., **Y. P. Jing**, D. H. Zhao, and G. Börner; "The Nonlinear Evolution of the Bispectrum in Scale-free N-Body Simulations"; Astrophysical Journal; **619**(2005); 667-677.

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VITA

Name: Hagen Michael K L E I N E R T
Birth: June 15, 1941, Festenberg, Germany
Nationality: German
Family: married, one son

Studium und Diplome:

1960 - 1963: TH Hannover; there 1962 - BS with fist class honors
1963 - 1964: Georgia Institute of Technology, Atlanta, Georgia, USA;
there 1964 - Master of Science
Fall 1964: Washington University, St. Louis, USA
Spring 1965: University of Wisconsin, Madison, USA
1965 - 1967: University of Colorado, Boulder, Colorado, USA;
there 1967 - Ph. D.
Spring 1969: Habilitation at the Free University Berlin

Positions:

Fall 1963 – Research Assistant at EURATOM, Ispra, Italy
June 1967 – Research Associate at the University of Colorado
Jan. 1968 – Assistant Professor at the University of Montana
Oct. 1969 – Associate Professor at the Free University Berlin
Okt. 1976 – Full Professor at the Free University Berlin

Since 1965 – Numerous invited lectures at summer schools and conferences
Since 1968 – Numerous visiting professorships,
in particular:

CERN – summer 1968, spring 1970, summer 1970, spring 1971,
summer 1971, spring 1972,
California Institute of Technology – winter 1973/1974, spring 1977,
spring 1980, spring 1983, spring 1986
Los Alamos – winter 1976/77
University of Kioto – winter 1979
Berkeley – spring 1980
UC Santa Barbara – winter und spring 1982/83
UC San Diego – winter und spring 1985/86
University of Miami – winter und spring 1989/90
Princeton University – winter und spring 1993

Received 4 offers for Full Professor positions at various universities.

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University Education and Career

1971 - 1975	Studied Physics at the University of Karlsruhe (Diploma)
1978	PhD in Physics (University of Karlsruhe)
01.10.1978 - 30.09.1979	Assistant (Theoretical Physics) at the University of Heidelberg
01.10.1979- 30.03.1986	Fellow and Staff Member CERN, Theory Devision
01.04.1986- 30.04.1988	Professor (C3) of Theoretical Physics, University of Karlsruhe
01.05.1988 - 28.02.1997	Professor (C4) of Theoretical Physics, University of Hamburg
since 01.03.1997	Director and Scientific Member at the Max-Planck-Institut für Gravitationsphysik in Potsdam-Golm

Scientific awards/honours/memberships (selection):

Otto Klung Prize for Physics (1991)

Member of the Scientific Council DESY (1993-1995)

Member of the Deutsche Physikalische Gesellschaft (German Physics Society)

Editor in Chief for the IOPP Journal "Classical an Quantum Gravity" 1998-2003

Member of the Editorial Board of "Communications in Mathematical Physics", 1997-2002

Honorary Professor, Humboldt University Berlin, since 22.04.1999

Honorary Professor, Hannover University, since 01.06.2005

Member of the Governing Board of the School of Theoretical Physics, Dublin Institute for Advanced Studies, Dublin, Ireland, since 01.07.2005

Editor-in-Chief of the journal "General Relativity and Gravitation", since 01.01.2006

Member (representative of the Max Planck Society) of the Conseil d' Administration of the Institute des Hautes Etudes Scientifiques (I.H.E.S.), Bures-sur-Yvette, France

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Mario Novello

Bolsista de Produtividade em Pesquisa do CNPq - Nível 1A

Links para Outras Bases:
Diretório de grupos de pesquisa

Possui graduação em Fisica pela Universidade de Brasília (1965) e pela Universidade Federal do Rio de Janeiro (1964), mestrado em Física pelo Centro Brasileiro de Pesquisas Físicas (1968) e doutorado em Fisica - Université de Génève (1972). Atualmente é pesquisador titular do Centro Brasileiro de Pesquisas Físicas. Tem experiência na área de Física, com ênfase em Gravitação e Cosmologia. Criou em 1976 o grupo de Cosmologia e Gravitação no CBPF, inaugurando em nosso país o estudo sistemátco da Cosmologia. Recentemente em 2003 criou o Instituto de Cosmologia Relatividade e Astrofisica (ICRA) que foi alocado pelo Ministério da Ciência e Tecnologia sob o guarda-chuva institucional do CBPF. Recebeu em 2004 o titulo de Doutor Honoris Causa pela Universidade de Lyon (França) por seus estudos sobre modelos cosmológicos sem singularidade. Recebeu em 2006 um prêmio do Centro Brasileiro de Pesquisas Fisicas por ter sido o cientista que mais orientou Teses de mestrado e doutorado na história do CBPF. Elaborou em 1979 o primeiro modelo cosmológico com solução analitica que possui "bouncing" (ricochete), isto é, neste modelo o Universo possui uma fase anterior de colapso, onde o volume total do espaço diminuiu com o tempo, atingido um valor minimo e, depois, passado a se expandir. Escreveu, entre outros livros, "O que é Cosmologia?" pela Editora Jorge Zahar, onde identifica a função da Cosmologia como uma re-fundação da Fisica. Foi nomeado em 2008 "Cesare Lattes ICRANet Professor" pelo Comitê Científico do International Center for Relativistic Astrophysics (ICRANet), presidido pelo Premio Nobel da Física (2002) Riccardo Giacconi.
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Formação acadêmica/Titulação

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University of Oxford, UO, Inglaterra.
Grande área: Ciências Exatas e da Terra / *Área:* Física / *Subárea:* Cosmologia / *Especialidade:* Gravitação.
Grande área: Ciências Exatas e da Terra / *Área:* Física / *Subárea:* Cosmologia / *Especialidade:* Interação Fraca.

1969 - 1972 Doutorado em Fisica.
University of Génève, UNIGE, Suiça.
Título: Algebre de l'espace-temps, *Ano de Obtenção:* 1972.
Orientador: Josef Maria Jauch.
Bolsista do(a): Coordenação de Aperfeiçoamento de Pessoal de Nível Superior, CAPES, Brasil.
Palavras-chave: Space-time.
Grande área: Ciências Exatas e da Terra / *Área:* Física / *Subárea:* Cosmologia / *Especialidade:* Gravitação.
Setores de atividade: Outros setores.

1966 - 1968 Mestrado em Física.
Centro Brasileiro de Pesquisas Físicas, CBPF, Brasil.
Título: Teoria das distribuições no eletromagnetismo clássico, *Ano de Obtenção:* 1968.
Orientador: Jose Leite Lopes.
Bolsista do(a): Coordenação de Aperfeiçoamento de Pessoal de Nível Superior, CAPES, Brasil.
Palavras-chave: Electrodynamics.
Grande área: Ciências Exatas e da Terra / *Área:* Física / *Subárea:* Áreas Clássicas de Fenomenologia e suas Aplicações / *Especialidade:* Eletricidade e Magnetismo; Campos e Partículas Carregadas.
Setores de atividade: Outros setores.

1964 - 1965 Graduação em Fisica. Universidade de Brasília, UNB, Brasil.

1962 - 1964 Graduação em Física. Universidade Federal do Rio de Janeiro, UFRJ, Brasil.
Bolsista do(a): Centro Latino Americano de Física, CLAF, Brasil.

Atuação profissional

Centro Brasileiro de Pesquisas Físicas, CBPF, Brasil.

Vínculo institucional

1973 - Atual Vínculo: Servidor Público, Enquadramento Funcional: Pesquisador Titular III, Carga horária: 40, Regime: Dedicação exclusiva.

Atividades

2005 - Atual Direção e administração, ICRA - Coordenadoria de Cosmologia, Relatividade e Astrofísica, .

Cargo ou função
Chefe de Departamento.

1972 - Atual Pesquisa e desenvolvimento , Lafex, Laboratório de Cosmologia e Física Experimental de Altas Energias.

Linhas de pesquisa
Cosmologia
Gravitação

2003 - 2003 Direção e administração, ICRA - Coordenadoria de Cosmologia, Relatividade e Astrofísica, .

Cargo ou função
Fundador do Instituto de Cosmologia, Relatividade e Astrofísica (ICRA-Brasil).

1973 - 2000 Ensino, Física, Nível: Pós-Graduação.

Disciplinas ministradas
Cosmologia
Cosmologia não-singular
Gravitação

1973 - 2000 Outras atividades técnico-científicas , Lafex, Laboratório de Cosmologia e Física Experimental de Altas Energias.

Atividade realizada
Divulgação científica.

1994 - 1996 Direção e administração, Lafex, Laboratório de Cosmologia e Física Experimental de Altas Energias.

Cargo ou função
Chefe de Departamento.

1985 - 1994 Direção e administração, Departamento de Relatividade e Partículas, Drp.

Cargo ou função
Chefe de Departamento.

1985 - 1985 Direção e administração, Direção, .

Cargo ou função
Vice-Diretor do CBPF.

1984 - 1985 Direção e administração, Cfc, Coordenação de Formação Científica.

Cargo ou função
Coordenador.

1983 - 1985 Direção e administração, Departamento de Relatividade e Partículas, .

Cargo ou função
Vice-Coordenador do DRP / CBPF.

1981 - 1983 Direção e administração, Departamento de Relatividade e Partículas, .

Cargo ou função
Chefe de grupo.

1975 - 1975 Direção e administração, Departamento de Física Teórica, .

Cargo ou função
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1973 - 1974 Direção e administração, Departamento de Ensino, .

Cargo ou função
Chefe do Departamento de Relatividade e Partículas (DRP) do CBPF.

Linhas de Pesquisa

1. Cosmologia
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1. *Grande área:* Ciências Exatas e da Terra / *Área:* Física / *Subárea:* Cosmologia / *Especialidade:* Gravitação.
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Idiomas

Francês Compreende Bem, Fala Bem, Lê Bem, Escreve Bem.

Inglês Compreende Bem, Fala Bem, Lê Bem, Escreve Bem.

Italiano Compreende Bem, Fala Bem, Lê Bem, Escreve Bem.

Espanhol Compreende Bem, Fala Bem, Lê Bem, Escreve Bem.

Prêmios e títulos

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116. NOVELLO, M. . Non-linear Lagrangian and Cosmology. 1972. (Apresentação de Trabalho/Congresso).

117. NOVELLO, M. . Behaviour of matter near a singularity. 1972. (Apresentação de Trabalho/Congresso).

Produção técnica

Demais tipos de produção técnica

1. NOVELLO, M. . Teoria da Gravitação. 2001. .
2. NOVELLO, M. . Courbes fermées dans l'espace-temps. 2000. (Curso de curta duração ministrado/Especialização).
3. NOVELLO, M. . Ciências e Genética: Autonomia ou Dependência?. 2000. (Coordenação de sessão).
4. NOVELLO, M. . O mito científico da criação do mundo. 2000. (Artigo).
5. NOVELLO, M. . The Program of the Eternal Universe. 1999. (Relatório de pesquisa).
6. NOVELLO, M. . Curso de Cosmologia. 1992. .
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Demais trabalhos

1. NOVELLO, M. . XI Brazilian School of Cosmology and Gravitation - XI BSCG. 2004 (Escola Internacional).
2. NOVELLO, M. ; OLIVEIRA, H. P. ; MAKLER, M. ; BARCELLOS, R. K. ; LORENCI, V. A. . II Escola de Cosmologia e Gravitação - II ECG. 2004 (Curso).
3. NOVELLO, M. ; BERGLIAFFA, S. E. P. . II Workshop Brasileiro de Gravitação e Cosmologia. 2004 (Curso).
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Bancas

Participação em bancas examinadoras

Dissertações

1. NOVELLO, M.. Participação em banca de Cristina Furnaleto. Implicações cosmológicas de um campo escalarcom ação de Born-Infeld estendida. 2008. Dissertação (Mestrado em Física) - Centro Brasileiro de Pesquisas Físicas.

Teses de doutorado

1. PEREIRA, J. G.; SOARES, I. D.; ALDROVANDI, R.; ABRAMO, L. R. W.; NOVELLO, M.. Participação em banca de Juan Pablo Beltran Almeida. Aspectos algébricos e geométricos do espaço de de Sitter e aplicações na cosmologia. 2006. Tese (Doutorado em Física) - Universidade Estadual Paulista Júlio de Mesquita Filho.

Participação em bancas de comissões julgadoras

Professor titular

1. PEREIRA, J. G.; SOARES, I. D.; ALDROVANDI, R.; ABRAMO, L. R. W.; NOVELLO, M.. Aspectos algébricos e geométricos do espaço de de Sitter e aplicações na Cosmologia. 2006. Universidade Estadual Paulista Júlio de Mesquita Filho.
2. GAZEAU, J.; MOSCHELLA, U.; MOURAD, J.; BUCHER, M.; RENAUD, J.; NOVELLO, M.. Sur la théorie des champs dans l'espace-temps de de Sitter. 2003. Universite de Paris VIII.

Outras participações

1. VASCONCELLOS, C. A. Z.; COELHO, H. T.; ZIEBELL, L. F.; BOUDINOV, H.; NOVELLO, M.. Transição de Fase em Estrelas de Nêutrons e a Emissão de Ondas Gravitacionais. 2003. Universidade Federal do Rio Grande do Sul.

2. NOVELLO, M.. Programa de Incentivo à Produção Científica, Técnica e Artística. 2002. Universidade Estadual do Rio de Janeiro.

Eventos

Participação em eventos

1. Fifth International Conference on Mathematical Methods in Physics - IC 2006.The Cosmological Constant and the Mass of the Graviton. 2006. (Congresso).
2. XII Brazilian School of Cosmology and Gravitation.Faked inflation. 2006. (Congresso).
3. XIV Congresso Nacional da Associação Junguiana do Brasil - Mundus Imaginalis: Arte, Ciência e Espiritualidade.O mito científico da criação do Universo. 2006. (Congresso).
4. Fourth International School on Field Theory and Gravitation.The Cosmological Constant and the Mass of the Graviton. 2006. (Congresso).
5. The International Relativistic Astrophysics Ph. D..Cosmological effects of nonlinear field theories. 2006. (Congresso).
6. Ciclo XX. O Século do Imaginável.Ciência do Século XX. 2006. (Simpósio).
7. Física: Horizontes & Perspectivas.Modos de Criação do Universo. 2006. (Simpósio).
8. Ciclo XX. O Século do Imaginável.Ciência do Século XX. 2006. (Encontro).
9. O que é cosmologia?.Física: Horizontes & Perspectivas. 2006. (Encontro).
10. International School on High Energy Physics - LISHEP.Astroparticle and Cosmology. 2006. (Outra).
11. GR-12-RUS - 12 Russian Gravitational Conference: International Conference on Gravitation, Cosmology and Astrophysics.12 Russian Gravitational Conference: GR-12-RUS. 2005. (Congresso).
12. Seminário Ítalo-Brasileiro sobre Cooperação Científica e Tecnológica.ICRA-BR e ICRA Net: uma cooperação em Astrofísica Relativista e Cosmologia. 2005. (Seminário).
13. Seminário Astronomia IAG / USP.Uma nova interpretação da Constante Cosmológica. 2005. (Seminário).
14. Simpósio Internacional Terra Habitável.A relatividade, a física das partículas e as origens do universo. 2005. (Simpósio).
15. III Workshop Brasileiro em Gravitação e Cosmologia.Massa do Gráviton e a constante cosmológica. 2005. (Outra).
16. Congresso de Transdisciplinaridade - Artes, Ciências e Tradições.Questões Atuais dos Modos Científicos de Criação do Universo. 2004. (Congresso).
17. Congresso de Transdisciplinaridade - Arte, Ciências e Tradições.Matéria, Energia, Espaço e Tempo. 2004. (Congresso).
18. III Mostra de Pós-Graduação.Cosmologia no Século XX. 2004. (Seminário).
19. VII Escola de Cosmologia.Efeitos Cosmológicos das Teorias não-lineares de Campos. 2004. (Oficina).
20. III Mostra de Pós-Graduação.O Que é a Constante Cosmológica?. 2004. (Encontro).
21. XXV Encontro Nacional de Física de Partículas e Campos.Revisão da Cosmologia nos últimos 20 anos. 2004. (Encontro).
22. Café Filosófico da Livraria Cultura.O Mito Científico da Criação do Universo. 2004. (Outra).
23. Séminaire Interactions Fondamentales.Non linear electrodynamics and the acceleration of the universe. 2003. (Seminário).
24. Seminários do Instituto de Ciências.A Constante Cosmológica e a Massa do Gráviton. 2003. (Seminário).
25. IV Encontro de Jovens Pesquisadores no IFGW.Big-bang versus universo eterno. 2003. (Simpósio).
26. International Workshop on Astronomy and Relativistic Astrophysics.The Cosmological Constant and the Mass of the Graviton. 2003. (Oficina).
27. International Workshop on Astronomy and Relativistic Astrophysics - IWARA 2003.The Cosmological Constant and the Mass of the Graviton. 2003. (Oficina).
28. IV Encontro de Jovens Pesquisadores no IFGW.IV Encontro de Jovens Pesquisadores no IFGW. 2003. (Encontro).
29. International Conference on Gravitation and Astrophysics of Asian-Pacific Countries.International Conference on Gravitation and Astrophysics of Asian-Pacific Countries. 2003. (Encontro).

30. Palestras da COPPE.Modos de Criação do Universo. 2002. (Seminário).
31. Série Encontros com A Scientific American - Café Filosófico da Livraria Cultura.Viagens no Tempo. 2002. (Seminário).
32. Seminário - Extra do LAFEX.A Constante Cosmológica e a Massa do Gráviton. 2002. (Seminário).
33. Seminários - LAFEX.Uma Formulação Consistente de Campo de Spin-2 em Espaço-Tempo Curvo. 2002. (Seminário).
34. Workshop em Homenagem ao Professor Mário Novello.Workshop em Homenagem ao Professor Mário Novello. 2002. (Oficina).
35. A Constante Cosmológica e a Massa do Gráviton.A Constante Cosmológica e a Massa do Gráviton. 2002. (Outra).

Organização de eventos

1. BLAIR, D. ; NOVELLO, M. . VIII Asia-Pacific International Conference on Gravitation an Astrophysics (ICGA 8). 2007. (Congresso).
2. NOVELLO, M. . Godel: Logic and Time. 2007. (Congresso).
3. NOVELLO, M. ; SALIM, J. M. ; PINTO NETO, N. ; GOULART, E. ; Marcela Campista . I Conferencia de Cosmologia, Relatividade e Astrofísica de Sobral. 2007. (Congresso).
4. NOVELLO, M. ; RUFFINI, R. . I Cesare Lattes Workshop on gamma-rays. 2007. (Congresso).
5. NOVELLO, M. . IV Escola Brasileira de Cosmologia. 2007. (Outro).
6. NOVELLO, M. ; BERGLIAFFA, S. E. P. . XII Brazilian School of Cosmology and Gravitation. 2006. (Congresso).
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21. NOVELLO, M. . I Escola Brasileira de Cosmologia e Gravitação. 1978. (Outro).
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Orientações

Orientações em andamento

Dissertação de mestrado

1. Maria Borba. Propriedades da Teoria Spinorial da Gravitação. Início: 2007. Dissertação (Mestrado em Física) - Centro Brasileiro de Pesquisas Físicas, Coordenação de Aperfeiçoamento de Pessoal de Nível Superior. (Orientador).

Tese de doutorado

1. Aline Nogueira de Araujo. Propriedades dos Universos Ciclicos. Início: 2008. Tese (Doutorado em Física) - Centro Brasileiro de Pesquisas Físicas, Coordenação de Aperfeiçoamento de Pessoal de Nível Superior. (Orientador).
2. Vicente Antunes. Universos com bouncing (ricochete). Início: 2008. Tese (Doutorado em Doutorado em Física-CBPF) - Centro Brasileiro de Pesquisas Físicas. (Orientador).
3. Erico Goulart de Oliveira Costa. A aceleração do universo e a eletrodinâmica não-linear. Início: 2004. Tese (Doutorado em Física) - Centro Brasileiro de Pesquisas Físicas, Conselho Nacional de Desenvolvimento Científico e Tecnológico. (Orientador).

Orientações de outra natureza

1. Herman Mosquera Cuesta. Neutrinos e ondas gravitacionais. Início: 2007. Orientação de outra natureza. Centro Brasileiro de Pesquisas Físicas. Conselho Nacional de Desenvolvimento Científico e Tecnológico. (Orientador).
2. Santiago E Perez Bergliaffa. Cosmological consequences of non-linear Electrodynamics. Início: 2007. Orientação de outra natureza. Centro Brasileiro de Pesquisas Físicas. Fundação de Amparo à Pesquisa do Estado do Rio de Janeiro. (Orientador).

Supervisões e orientações concluídas

Dissertação de mestrado

1. ALINE NOGUEIRA DE ARAUJO. UNIVERSO MAGNÉTICO CICLICO. 2008. Dissertação (Mestrado em Física) - Centro Brasileiro de Pesquisas Físicas, . *Orientador:* Mario Novello.
2. VICENTE ANTUNES. PROPAGAÇÃO DE ONDAS GRAVITACIONAIS EM COSMOLOGIAS TIPO FRW SINGULAR E NÃO-SINGULAR. 2007. Dissertação (Mestrado em Física) - Universidade Federal do Rio Grande do Sul, Conselho Nacional de Desenvolvimento Científico e Tecnológico. *Orientador:* Mario Novello.
3. Erico Goulart de Oliveira Costa. A aceleração do universo e a eletrodinâmica não-linear. 2004. Dissertação (Mestrado em Física) - Centro Brasileiro de Pesquisas Físicas, Conselho Nacional de Desenvolvimento Científico e Tecnológico. *Orientador:* Mario Novello.
4. Carla Ribeiro da Fonseca. Construção de wormholes utilizando correção quântica de Euler-Heisenberg para a eletrodinâmica clássica. 2000. 0 f. Dissertação (Mestrado em Física) - Centro Brasileiro de Pesquisas Físicas, Conselho Nacional de Desenvolvimento Científico e Tecnológico. *Orientador:* Mario Novello.
5. Guilherme Berredo. Teoria de Campo da Gravitação em três dimensões. 1997. 0 f. Dissertação (Mestrado em Física) - Centro Brasileiro de Pesquisas Físicas, Conselho Nacional de Desenvolvimento Científico e Tecnológico. *Orientador:* Mario Novello.
6. Sérgio Eduardo de Carvalho Jorás. Perturbações escalares no universo de Friedman-Robertson-Walker. 1994. 0 f. Dissertação (Mestrado em Física) - Centro Brasileiro de Pesquisas Físicas, Conselho Nacional de Desenvolvimento Científico e Tecnológico. *Orientador:* Mario Novello.
7. Renato Klippert Barcellos. Teoria de perturbações vetoriais e tensoriais no universo de Friedman. 1994. 0 f. Dissertação (Mestrado em Física) - Centro Brasileiro de Pesquisas Físicas, Conselho Nacional de Desenvolvimento Científico e Tecnológico. *Orientador:* Mario Novello.
8. Vitório Alberto De Lorenci. Teoria não local de um monopólo magnético. 1994. 0 f. Dissertação (Mestrado em Física) - Centro Brasileiro de Pesquisas Físicas, Conselho Nacional de Desenvolvimento Científico e Tecnológico. *Orientador:* Mario Novello.
9. Martha Christina Motta da Silva. Construção de Modelos para um Universo Globalmente Causal a partir da Solução de Gödel. 1992. 0 f. Dissertação (Mestrado em Física) - Centro Brasileiro de Pesquisas Físicas, Conselho Nacional de Desenvolvimento Científico e Tecnológico. *Orientador:* Mario Novello.
10. Vinícius Moll de Castro Pereira. Acoplamento Não Mínimo e Cosmologia Quântica: Um modelo. 1991. 0 f. Dissertação (Mestrado em Física) - Centro Brasileiro de Pesquisas Físicas, . *Orientador:* Mario Novello.
11. Maria Emília Xavier Guimarães. Sistemas Sincrônicos de Coordenadas no Universo de Gödel. 1991. 0 f. Dissertação (Mestrado em Física) - Centro Brasileiro de Pesquisas Físicas, Conselho Nacional de Desenvolvimento Científico e Tecnológico. *Orientador:* Mario Novello.
12. Helder Couto. Novas leis de conservação para o campo gravitacional livre. 1989. 0 f. Dissertação (Mestrado em Física) - Centro Brasileiro de Pesquisas Físicas, Conselho Nacional de Desenvolvimento Científico e Tecnológico. *Orientador:* Mario Novello.
13. Sergio Luiz Schubert Duque. Transição de fase auto-reduzida pela gravitação. 1989. 0 f. Dissertação (Mestrado em Física) - Centro Brasileiro de Pesquisas Físicas, Conselho Nacional de Desenvolvimento Científico e Tecnológico. *Orientador:* Mario Novello.
14. Stefan Dieter Jorda. Os diversos modos de acoplamento não-mínimo entre eletromagnetismo e gravitação. 1988. 0 f. Dissertação (Mestrado em Física) - Centro Brasileiro de Pesquisas Físicas, Conselho Nacional de Desenvolvimento Científico e Tecnológico. *Orientador:* Mario Novello.
15. Abílio Valério Tozini. Modelos do Universo em Rotação. 1984. 0 f. Dissertação (Mestrado em Física) - Centro Brasileiro de

Pesquisas Físicas, Conselho Nacional de Desenvolvimento Científico e Tecnológico. *Orientador:* Mario Novello.

16. Nami F Svaiter. Fótons não-lineares no Universo de Bianchi-I. 1984. 0 f. Dissertação (Mestrado em Física) - Centro Brasileiro de Pesquisas Físicas, Conselho Nacional de Desenvolvimento Científico e Tecnológico. *Orientador:* Mario Novello.

17. Nelson Pinto Neto. Equações Alternativas de Gravitação. 1983. 0 f. Dissertação (Mestrado em Física) - Centro Brasileiro de Pesquisas Físicas, Conselho Nacional de Desenvolvimento Científico e Tecnológico. *Orientador:* Mario Novello.

18. Regina Celia Arcuri. Buracos Brancos. 1981. 0 f. Dissertação (Mestrado em Física) - Centro Brasileiro de Pesquisas Físicas, Conselho Nacional de Desenvolvimento Científico e Tecnológico. *Orientador:* Mario Novello.

19. E. Ruckert. Fótons não-lineares. 1981. 0 f. Dissertação (Mestrado em Física) - Centro Brasileiro de Pesquisas Físicas, Conselho Nacional de Desenvolvimento Científico e Tecnológico. *Orientador:* Mario Novello.

20. J Duarte. Propriedades duais do tensor de Weyl. 1980. 0 f. Dissertação (Mestrado em Física) - Centro Brasileiro de Pesquisas Físicas, Conselho Nacional de Desenvolvimento Científico e Tecnológico. *Orientador:* Mario Novello.

21. Ruben Araújo. Análise Qualitativa de Modelos Cosmológicos. 1979. 0 f. Dissertação (Mestrado em Física) - Centro Brasileiro de Pesquisas Físicas, Conselho Nacional de Desenvolvimento Científico e Tecnológico. *Orientador:* Mario Novello.

22. Marcelo J Reboucas. Cosmologia fora do equilíbrio: Universo com rotação. 1977. 0 f. Dissertação (Mestrado em Física) - Centro Brasileiro de Pesquisas Físicas, Conselho Nacional de Desenvolvimento Científico e Tecnológico. *Orientador:* Mario Novello.

23. J M Salim. Monopólos Gravitacionais. 1976. 0 f. Dissertação (Mestrado em Física) - Centro Brasileiro de Pesquisas Físicas, Conselho Nacional de Desenvolvimento Científico e Tecnológico. *Orientador:* Mario Novello.

24. Lígia Maria C. S. Rodrigues. Um modelo de solução cosmológica não singular. 1974. 0 f. Dissertação (Mestrado em Física) - Centro Brasileiro de Pesquisas Físicas, Conselho Nacional de Desenvolvimento Científico e Tecnológico. *Orientador:* Mario Novello.

25. C A P Galvão. Criação de Partículas em um Universo em expansão: a questão da isotropização do cosmos. 1974. 0 f. Dissertação (Mestrado em Física) - Centro Brasileiro de Pesquisas Físicas, Conselho Nacional de Desenvolvimento Científico e Tecnológico. *Orientador:* Mario Novello.

Tese de doutorado

1. ERICO GOULART DE OLIVEIRA COSTA. EXCITAÇÕES DO TENSOR DE WEYL NA COSMOLOGIA E QUESTÕES DE ESTABILIDADE. 2008. Tese (Doutorado em Física) - Centro Brasileiro de Pesquisas Físicas, . *Orientador:* Mario Novello.

2. Ronaldo Penna Neves. Campos de spin-2 e a teoria da gravitação. 1999. Tese (Doutorado em Física) - Centro Brasileiro de Pesquisas Físicas, Conselho Nacional de Desenvolvimento Científico e Tecnológico. *Orientador:* Mario Novello.

3. Martha Christina Motta da Silva. Teoria das Perturbações Tensoriais em Geometrias Bianchi-I: o caso do Universo de Kasner. 1998. 0 f. Tese (Doutorado em Física) - Centro Brasileiro de Pesquisas Físicas, Conselho Nacional de Desenvolvimento Científico e Tecnológico. *Orientador:* Mario Novello.

4. Vitório Alberto De Lorenci. Teoria de Campo da Gravitação. 1998. 0 f. Tese (Doutorado em Física) - Centro Brasileiro de Pesquisas Físicas, Conselho Nacional de Desenvolvimento Científico e Tecnológico. *Orientador:* Mario Novello.

5. Renato Klippert Barcellos. Teoria das Perturbações Vetoriais e Tensoriais no Universo de Friedmann. 1997. 0 f. Tese (Doutorado em Física) - Centro Brasileiro de Pesquisas Físicas, Conselho Nacional de Desenvolvimento Científico e Tecnológico. *Orientador:* Mario Novello.

6. Luciane Rangel de Freitas. Campos de Spin-2 Variáveis Fundamentais: A Proposta de Fierz. 1991. 0 f. Tese (Doutorado em Física) - Centro Brasileiro de Pesquisas Físicas, Conselho Nacional de Desenvolvimento Científico e Tecnológico. *Orientador:* Mario Novello.

7. Nelson Pinto Neto. Teoria da Gravitação em termos das Variáveis de Fierz-Lanczos. 1989. 0 f. Tese (Doutorado em Física) - Centro Brasileiro de Pesquisas Físicas, Conselho Nacional de Desenvolvimento Científico e Tecnológico. *Orientador:* Mario Novello.

8. Nami F Svaiter. Teoria Quântica de Campos em Sistemas de Coordenadas Curvilíneas no Espaço-Tempo de Minkowiski e Curvos. 1989. 0 f. Tese (Doutorado em Física) - Centro Brasileiro de Pesquisas Físicas, Conselho Nacional de Desenvolvimento Científico e Tecnológico. *Orientador:* Mario Novello.

9. Luiz Alberto Rezende de Oliveira. Acoplamento não-mínimo com a Gravitação e Espaços de Weyl Integráveis. 1988. 0 f. Tese (Doutorado em Física) - Centro Brasileiro de Pesquisas Físicas, Conselho Nacional de Desenvolvimento Científico e Tecnológico. *Orientador:* Mario Novello.

10. Carlos Augusto Romero Filho. Análise Qualitativa de Modelos Cosmológicos na Teoria de Brans-Dicke. 1988. 0 f. Tese (Doutorado em Física) - Centro Brasileiro de Pesquisas Físicas, Conselho Nacional de Desenvolvimento Científico e Tecnológico. *Orientador:* Mario Novello.

11. Jose M Salim. Equações Quase-Maxwellianas da Gravitação: Aplicação ao Universo de Friedmann. 1982. 0 f. Tese (Doutorado em Física) - Centro Brasileiro de Pesquisas Físicas, Conselho Nacional de Desenvolvimento Científico e Tecnológico. *Orientador:* Mario Novello.

12. Marcelo J Reboucas. Modelos do Universo com Rotação Dependente do Tempo. 1981. 0 f. Tese (Doutorado em Física) - Centro

Brasileiro de Pesquisas Físicas, Conselho Nacional de Desenvolvimento Científico e Tecnológico. *Orientador:* Mario Novello.

13. Ivano Damião Soares. Um Estudo da Interação Gravitação-Neutrino. 1976. 0 f. Tese (Doutorado em Física) - Centro Brasileiro de Pesquisas Físicas, Conselho Nacional de Desenvolvimento Científico e Tecnológico. *Orientador:* Mario Novello.

14. C A P Galvão. Gravitação e Cosmologia em Espaços com Torção. 1976. 0 f. Tese (Doutorado em Física) - Centro Brasileiro de Pesquisas Físicas, Conselho Nacional de Desenvolvimento Científico e Tecnológico. *Orientador:* Mario Novello.

Outras informações relevantes

-Nomeado pelo Ministro da Ciência e Tecnologia Sergio Rezende para representar o Brasil no "board" da rede internacional de Institutos de Astrofisica Relativista ICRANet (2008) - Convidado pelo presidente da FAPERJ, em 26 de abril de 2006, a participar do Banco Nacional de Consultores AD HOC das FAPs (Fund. de Apoio à Pesquisa).- - Membro do Comitê de Especialistas para a escolha do novo Diretor do Observatório Nacional, nomeados pelo Ministro da Ciência e Tecnologia, Eduardo Campos em 2004. - O artigo "The mass of the graviton and the cosmological constant", publicado em Classical & Quantum Gravity, vol. 20, i.6 (2003) foi um dos "Top 30", ou seja, um dos 30 artigos mais acessados e reproduzidos do ano..

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Curriculum Vitae

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1 Informations Personnelles

Nom: **De Freitas Pacheco, José Antonio**

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2 Diplômes et Titres Universitaires

B.Ph. - Université de S.Paulo - 1965

Docteur es Sciences Physiques - Université de Nice - 1971

Professeur Adjoint - Université de S.Paulo - 1977

Professeur Titulaire - Université de S.Paulo - 1985

Astronome Titulaire - Observatoire de la Côte d'Azur - 1995

3 Fonctions dans le Service Public

Chef du Département d'Astronomie - Université de S. Paulo (USP) - 1973/1976

Président de la Commission du DEA en Astronomie et Géophysique USP - 1973/1977 and 1987/1989

Président de la Societé Astronomique Brésilienne 1974 (premier président et fondateur) et 1978/1982

Président du Comité National d'Astronomie pour l'UAI - 1974/1979 et Vice-Président de 1980 to 1982

Directeur de l'Observatoire de Rio de Janeiro - 1979/1981

Directeur du Départment d'Astrophysique - ON (Rio de Janeiro) - 1981/1984

Président de la Commission du DEA en Astronomie de l'Observatoire de Rio de Janeiro - 1981/1986

Directeur de l'Institut d'Astronomie et de Géophysique (IAG) de l'Université de S.Paulo" - 1989/1993

Directeur de l'Observatoire de la Côte d'Azur - 1994/1999

4 Participation aux Commissions Académiques

Conseil de l'IAG - 1972/1979 et 1985/1994

Membre du Conseil d'Administration de l'Institut National de Recherches Spatiales (INPE) - 1977/1980 and 1993/1995

Membre du Comité d'Astronomie et de Physique - Conseil National de la Recherche (CNPq/Brsil) - 1983/1984

Membre du Conseil de l'Université de S.Paulo - 1989/1993

Membre du Conseil Deliberatif du CNPq - 1990/1992

Prsident de la Commission des Sciences de l'Ingnieur, de la Matire et de l'Univers de la Rgion Provence-Alpes-Côte d'Azur - 1996/1999

Membre du Conseil de l'Unit de Recherche Geoscience Azur - Universit de Nice-Sophia Antipolis - 1997/1999

Membre du Conseil Scientifique du Laboratoire d'Astrophysique de l'UNSA - 2000 - 2007

Membre du Conseil Rgional de la Valorisation Scientifique et Technique de la Rgion PACA - 1996 - 2006

Membre du Advisory Committe of the Regional Centre for Space Science and Technology Education for Latin America and the Caribbean (CRECTEALC) of the United Nations

5 Membre des Associations

Académie Brésilienne des Sciences

Académie des Sciences de l'État de S.Paulo

Union Astronomique International

Académie Européenne des Arts et des Sciences

6 Distinctions

- Médaille de la Societé Brésilienne pour le Progrès de la Science (1975)
- Médaille du Mérite Scientifique (Gouvernement Brésilien -1995)
- Grand-Croix du Mérite Scientifique (Gouvernement Brésilien - 2000)

7 Thèses Dirigées (M.Sc.)

1. Luiz Arakaki - "Evolution of the Galactic Disk and the Light Elements" - Instituto Tecnológico de Aeronáutica - 1972

2. José R. Bonilha - "Wave Propagation in Relativistic Plasmas" - Universidade de S.Paulo - 1973

3. Ronaldo E. Souza - "Evolution of Fossil HII Regions" - Universidade de Minas Geraes - 1973

4. Joel C.C. Filho - " The Production of Light Elements in the Interstellar Medium" - Universidade de S.Paulo - 1974

5. Maria F. Nave - "Some Problems in X-Ray Astronomy" - Universidade de S.Paulo - 1974

6. J.E. Steiner - " A Model for Cygnus X-1" - Universidade de S.Paulo - 1975

7. A.Damineli Neto - "The Binary Source Her X-1" - Universidade de S.Paulo - 1976

8. Laerte S. Junior - "The Masses of Binary X-Ray Sources" - Universidade de S.Paulo - 1976

9. F.Jablonsky - " A Study on Cataclismic Variables" - Universidade de S.Paulo - 1981

10. L.Viadana - "Mass Loss from Central Stars of Planetary Nebulae" - Observatório Nacional - 1983

11. S. dos Anjos - "Some Problems Related with the Evolution of Galaxy Clusters" - Universidade de S.Paulo - 1984

12. T.C.C. da Silva - "Environmental Effects in the Morphology of Galaxies" - Observatório Nacional - 1986

13. S.Junqueira - "Dynamics of Binary Galaxies" - Observatório Nacional - 1986

14. M.A.Gaya - "A Model for the Infrared Emission of NGC 7027" - Universidade de S.Paulo - 1986

15. V.P.Bichara - "A Burst Model for Cen A" - Observatório Nacional - 1987

16. M.A.Machado - "Carbon Abundances in WC Stars" - Observatório Nacional - 1988

17. O.D.Miranda - "Galactic Winds and X-Ray Emission from Elliptical Galaxies" - Universidade de S.Paulo - 1992

18. M.Catelan - "Synthetic Models for the Horizontal Branch Morphology of Globular Clusters" - Universidade de S.Paulo - 1992

19. Tania Regimbau - " Les Pulsars: Etude Statistique et Modelisation " - Mémoire de DEA - Université de Nice-Sophia Antipolis - 1998

20. Enrica Fornero - " Effeti del Vento Gallattico Sull'Evoluzione Chimica delle Galassie Ellittiche " - Tesi di Laurea - Universitá degli Studi di Torino - 1998

21. Julien Frmaux - "Evolution de Restes de Supernovae: l'influence du milieu interstellaire" - Mémoire de DEA - Université de Nice-Sophia Antipolis - 2002

22. Stéphane Vincent - "Formation de Systémes Doubles d'Etoiles Neutrons" - Mémoire de DEA - Université de Nice-Sophia Antipolis - 2002

23. Sébastien Peirani - "Recherche de Supernovae Proches" - Mémoire de DEA - Université de Nice-Sophia Antipolis - 2002

24. Fabrice Durier - "Accrétion versus Fusion dans un Univers Dominé par la Matière Noire - Mémoire de DEA - Université de Nice-Sophia Antipolis - 2002

25. David Gherson - "Croissance de Semences des Trous Noirs Primordiaux" - Mémoire de DEA - Université de Lyon - 2004

26. Nicolas Juan - "Croissance Non-Adiabatique de Trous Noirs Supermassifs" - Mémoire de DEA - Université de Nice-Sophia Antipolis - 2004

27. Charline Filloux - "Processus de Croissance des Trous Noirs" - Mémoire Master - Université de Nice-Sophia Antipolis - 2005

8 Thèses Dirigées (Ph.D.)

1. S.J. Codina - "Formation of Interstellar Grains" - Universidade de S.Paulo - 1977

2. J.E. Steiner - "Accretion Disks in Compact Stars" - Universidade de S.Paulo - 1979

3. R.E. de Souza - "Environmental Effects in Groups and Clusters of Galaxies" - Universidade de S.Paulo - 1983

4. Horácio A. Dottori - "Absorption Spectra, Optical Continuum and Reddening of Normal and Active Nuclei of Spiral Galaxies" - Universidade Federal do Rio Grande do Sul - 1983 (co-direction avec E. Rocha Vieira)

5. M.L.Q. Tancetti - "Evolution of Stellar Population II Systems" - Universidade de S. Paulo - 1987

6. A.Damineli Neto - "Circumstellar Matter around Be Stars" - Universidade de S.Paulo - 1988

7. V.G.Ortega - "Hydrodynamical Models for Elliptical Galaxies" - Observatório Nacional" - 1989

8. D.F.Lopes - "Peculiar Luminous Stars" - Observatório Nacional - 1989

9. F.X. de Araújo - "Axi-Symmetric Radiative Driven Winds" - Observatório Nacional - 1990

10. R.Bruno - "A New Determination of the Density Parameter" - Observatório Nacional - 1992

11. W.F.Velloso - "A Contribution to the VIRGO Project" - Universidade de S.Paulo - 1992

12. S.Junqueira - "Tidal Effects in Binary Galaxy Systems" - Observatório Nacional - 1993

13. A.C.Borges - "Spectral Evolution of Elliptical Galaxies" - Universidade de S.Paulo - 1993

14. R.D.D.Costa -"Chemical Abundances in Planetary Nebulae and Symbiotic Systems" - Universidade de S.Paulo - 1993

15. T.P.Idiart - "Calibration of Metallicity Indices: Application to the Galactic Bulge and Bulge of Spirals " - Universidade de S.Paulo - 1995

16. M. Catèlan - " Evolutionary Studies of Population II Systems: The Horizontal Branch " - University of S.Paulo - 1996

17. Tania Regimbau - "Etoiles Neutrons et Ondes Gravitationnelles" - Universite´ de Nice - Sophia Antipolis - 2001

18. Éric Lagadec - "Apport des Observations Infrarouges pour l'Étude de la Perte de Masse des Étoiles Évoluées" - Université de Nice-Sophia Antipolis - 2005 (co-direction avec D. Mekarnia).

19. Sébastien Peirani - "Aspects Dynamiques et Physiques de la Matire Noire" - Universite´ de Nice-Sophia Antipolis - 2005

20. Stéphane Vincent - "Fréquences d'Oscillation des Modes Axisymétriques des Étoiles à Neutrons - Université de Nice-Sophia Antipolis - 2008

9 Articles Scientifiques

1. Phase Integrals in Pulsation Theory of Variable Stars. Anais da Academia Bras.de Ciencias 39, 413, 1967

2. Oscillations Radiales Traitées par la Méthode des Integrales de Phase. C.R.Acad.Sc.Paris 266, 1170, 1968

3. Thermal Instability in the Interstellar Gas. A&A 3, 368, 1969

4. Galactic X-Ray Background Component. Nature 227,1270, 1970

5. Synchroton Emission from High Energy Cosmic-Ray Electrons as an Explanation of the Cosmic X-Ray Excess. A&A 8, 420, 1970

6. X-Ray Emission at 1/4 keV by Bremssthahlung Suprathermal Protons. Nature Phys.Sc. 229, 84, 1971

7. The Propagation of Cosmic Ray Nuclei. A&A 13, 58, 1971

8. On the Heating of the Interstellar Gas. Rev.Bras.de Fisica 2, 29, 1972

9. Extragalactic Cosmic Rays and the Production of Light Elements. A&A 18, 450, 1972

10. A Phenomenological Study of Cosmic Ray Propagation. A&A 23, 337, 1973. J.A.de Freitas Pacheco and F. LeGuet

11. Supernova Remnants and Gamma-Ray Sources. Astrophys.Letters 13, 97,1973

12. The Origin of Cosmic Rays. Astrophys.Letters 15, 155, 1973

13. A Model for the Binary X-Ray Source 2U1700-37. Nature 249, 637, 1974

14. Possible Variations in the Secondary Minimum of HD153919=2U1700-37. A&A 33, 131, 1974. J.A.de Freitas Pacheco, J.E.Steiner and G.R.Quast

15. Photoelectric Observations of 2U0900-40. A&A 35, 301, 1974. J.A.de Freitas Pacheco and G.R.Quast

16. Origin of the Optical Emission from Sco X-1. Nature 253, 699, 1975

17. Masses of Binary X-Ray Sources. Astrophys.Sp.Sci. 32, 205, 1975

18. The Spectrum of Cyg X-1:A Theoretical Model. Astrophys.Sp.Sci. 39, 487, 1976. J.A.de Freitas Pacheco and J.E.Steiner

19. Characteristics of Nova Scuti 1975. Rev.Bras.de Fisica 5, 397, 1975

20. A Revisited Model for the Binary X-Ray Source 3U1700-37 = HD152919. A&A 50, 385, 1976

21. The Electromagnetic Emission from Sco X-1. A&A 55, 111,1977. J.A.de Freitas Pacheco, J.E.Steiner and A.Damineli Neto

22. The Chemical Composition of Nova Cephei 1971. MNRAS 181, 421, 1977

23. On the He Abundance of Nova Cephei 1971 Ejecta. MNRAS 186, 617, 1979

24. The Physical Parameters of HD152667=OAO 1653-40. A&A 70, L49, 1978.

25. The Ionization of the Shell of Novae: A Time Dependent Model. Astrophys.Sp.Sci. 61, 91, 1979. L.Sodré and J.A. de Freitas Pacheco

26. Search for Black-Holes: The Nature of the Unseen Companions of HD152667 and HD72754.

Rev.Bras.de Fisica 8, 418, 1978

27. Observational Aspects of Black-Holes (**Invited Paper**). Proc.First IAU Regional Latin American Meeting-1978,eds. A.Moreno and H.Moreno,pg 203

28. Astronomical Observations with the Optical Multichannel Analyser of the University of S.Paulo. Rev.Bras.de Fisica 9, 45, 1979. S.J.Codina and J.A. de Freitas Pacheco

29. Mass Loss from Hot Stars (**Review Paper**). Rev.Mex.Astron. y Astrof. 6, 181, 1981

30. Infrared Excess and Line Emission from Be Stars. MNRAS 198,659,1982. A. Damineli Neto and J.A. de Freitas Pacheco

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2. Galactic Evolution and Nucleosynthesis. Proc. Braz. Symp. on Relativistic Astrophysics - eds. E.Scalise - SAB 1976, p.29 (text in portuguese)

3. Compact Configurations in the Universe. 28th Annual Meeting of the Braz.Soc.Prog.Sci. - 1976,p.93 (text in portuguese)

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2. "As Galáxias". Ciência Hoje na Escola , edição 1996, pag. 6
3. "A Teoria do Big-Bang e o Deutério Interestelar". Ciência Hoje, 2, 22
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Teaching assistant at the Dept of Physics, Stockholm University (1975-1982)
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Research assistant at the Dept of Physics, Stockholm University (1983-1984)
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Professor at the Dept of Physics, Stockholm University (2000-)
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Scientific secretary of the 11th International Conference on General Relativity and Gravitation (GR11) (1986)
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Teaching experience from several courses from the basic undergraduate level to the advanced graduate level.
Refereeing of numerous articles in reputable journals such as Physical Review and Classical and Quantum Gravity.

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Research in Theoretical cosmology, Relativistic Astrophysics, Gravitational waves and Dynamical systems (chaotic and integrable).
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SCIENTIFIC PUBLICATIONS

Global Rotation
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J. Math. Phys. **48** (2007) 112903 (with G. Pucacco).

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in Proceedings of the 11th Marcel Grossmann Conference on General Relativity, World Scientific, 2008, p.1475.

Some physical consequences of the multipole structure of the Kerr and Kerr-Newman solutions
in Proceedings of the 11th Marcel Grossmann Conference on General Relativity, World Scientific, 2008, p.2294.

A link between general relativity and quantum mechanics
in Proceedings of the 11th Marcel Grossmann Conference on General Relativity, World Scientific, 2008, p.2634.

Carter's constant revealed
Int. J. Mod. Phys. D, in press (2009) (E-print arXiv:0710.4260)
(with T. Bylund and L. Samuelsson).

Some consequences of gravitationally induced electromagnetic effects in microphysics
J. Korean Phys. Soc., in press (2009) (E-print arXiv:0802.2914).

A unifying coordinate family for the Kerr–Newman metric
Gen. Rel. Grav. in press (2009)

SCIENTIFIC REPORTS

Global Rotation in a Class of Space-Time Homogeneous Cosmologies in General Relativity, University of Stockholm, USIP Report 79-01, 1979.

Trigonometric Parallaxes in Cosmology, Essay, Received honorable mention in the 1986 Gravity Research Foundation contest.

The Bianchi Identities and Generalized (Lie-Bäcklund) Gauge Symmetries of the Einstein Equations, Report 1988.

Mechanical Curvature in Cosmology, (1989) University of Stockholm, In USIP Report 89-04 in honour of professor Bertel Laurent on his 60th birthday, pp.48–58.

Minisuperspace Kil ling vectors for relativistic star models, University of Stockholm, USIP Report 95-01, 1995 (with J. M. Goliath).

PEDAGOGICAL PAPERS

Problems in Theoretical Physics. Classical Field Theory. Compendium (with I. Frick), Stockholm University, 1978.

Lecture notes in General Gelativity and Cosmology, Compendium (with L. Bergström and C. Fransson), Stockholm University, 1993.

POPULAR PUBLICATIONS (in Swedish)

Time Travel in a Rotating Universe, Forskning och Framsteg no.1 (1983) pp.9–13, (with E. Sviestins).

Cosmic Riddles, Astronomisk Årsbok 1985, Bokförlaget Inova 1984, pp.84–89.

The Gravitational Radiation of the Universe: Sooner or Later It Will Be Discovered!, Forskning och Framsteg no.2 (1988) pp.8–13.

Cosmological Distance Measurements, Astronomisk Årsbok 1990, Bokförlaget Inova 1989, pp.92–96.

From the Lab to the Frontiers of Science, Aurora, August/September (1992) pp.12–14.

Mathematics for the universe, NFRs årsbok (Yearbook of the Swedish Natural Sciences Research Council) 1993, pp.71–79.

A black hole in the laboratory?, Fysik-Aktuellt (the Swedish Physical Society journal) (September 2000).

IRAP PHD

CURRICULUM

1. *BELINSKY Vladimir (ICRANet)*
2. *CHAKRABARTI Sandip (ISCP India)*
3. *CHARDONNET Pascal (University of Savoie)*
4. *COULLET Pierre (University of Nice Sophia Antipolis)*
5. *EINASTO Jaan (Tartu Observatory)*
6. *FRONTERA Filippo (University of Ferrara)*
7. *JING Yipeng (Shanghai Observatory China)*
8. *KLEINERT Hagen (Freie University of Berlin)*
9. *NICOLAI Hermann (Max Planck Institute for Gravitation)*
10. *NOVELLO Mario(CBPF Brazil)*
11. *PACHECO Jose (Observatoire de la Côte d'Azur)*
12. *ROSQUIST Kjell (University of Stockholm)*
13. **RUFFINI Remo (University of Roma La Sapienza & ICRANet)**
14. *RYDE Felix ((University of Stockholm)*
15. *TITARCHUK Lev (University of Ferrara)*
16. *VAKILI Farrokh (Observatoire de la Côte d'Azur)*

Curriculum Vitae REMO RUFFINI

Remo Ruffini is Professor of Theoretical Physics at the University of Rome "La Sapienza" since 1978. He is President of the International Centre for Relativistic Astrophysics (ICRA) and he created an international organization in which several states collaborate in the field of astrophysics (ICRANet). He also initiated the International Relativistic Astrophysics Ph.D (IRAP), a common graduate school program of several European universities for the education of theoretical astrophysicists.

Biography

After his degree in 1966, he was post-doctoral fellow at the Mainz Academy of Sciences working with Pasqual Jordan, in Germany. Then, he was member of the Institute for Advanced Study, in Princeton and later became instructor and assistant professor at Princeton University. In 1975, he was visiting Professor at the Universities of Kyoto (Japan) and of Western Australia, Perth. In the years 1975-78, he cooperated with NASA being member of the task force on the scientific use of space stations. In 1976 he became Professor of Theoretical Physics at the University of Catania and in 1978 he was appointed Professor at the University "Sapienza". In 1985, he was elected President of the International Center for Relativistic Astrophysics (ICRA)In 1984 he was cofounder, with Abdus Salam, of the Marcel Grossmann Meetings. In 1987, he became co-chairman of the Italian-Korean Meetings on Relativistic Astrophysics. In the years 1989-93, he was President of the Scientific Committee of the Italian Space Agency. He is Editor of a variety of Scientific Journals. He is married to Anna Imponente and has a son, Iacopo.

His theoretical work led to the concept of Boson Stars[1]. His article with Wheeler introduced the astrophysical concept of the "Black Hole"[2]. With Demetrios Christodoulou he has established the reversible and irreversible transformations of a Black Hole and given the formula for a Kerr-Newmann Black Hole endowed of charge, mass and angular momentum[3]. His work led to the identification of the first Black Hole in our Galaxy.

Together with his student C. Rhoades[4], he established the absolute upper limit to the mass of neutron stars and, with his student Robert Leach[5], he used such a result for fixing the paradigm which enabled the identification of the first Black Hole in our Galaxy: Cygnus X1. This result was made possible by the splendid data of the Uhuru satellite of Riccardo Giacconi and his group [6], [7].

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[1] *R. Ruffini and S. Bonazzola (1969). Systems of Self-Gravitating Particles in General Relativity and the Concept of an Equation of State. Phys. Rev.* ***187****: 1767-1783.*

[2] *R. Ruffini and J.A. Wheeler (1971). Introducing the Black Hole. Physics Today: 30039.*

[3] *D. Christodoulou, R. Ruffini (1971). Reversible Transformations of a Charged Black Hole. Phys. Rev. D* ***4****: 3552-3555*

[4] *C. Rhoades and R. Ruffini (1974). Maximum Mass of a Neutron Star. Phys. Rev. Lett* ***32****: 324*

[5] *R. Leach and R. Ruffini (1973). On the Masses of X-Ray Sources. Ap. J. Letters* ***180****: L-15*

[6] *R. Giacconi (2003). Nobel Lecture: The dawn of x-ray astronomy. Rev. Mod. Phys. 75, 995-1010*

[7] *R. Giacconi (2005) An Education in Astronomy, Annual Review of Astronomy & Astrophysics, vol. 43, pp. 1-30*

With his students Calzetti, Giavalisco, Song and Taraglio he has developed the role of fractal structures in Cosmology [8], [9].

With Thibault Damour[10], he suggested the applicability of the Heisenberg-Euler-Schwinger process of pair creation in Black Hole physics and then identified the dyadosphere where these processes take place. Gamma Ray Bursts seem to give the observational evidence of such pair creation process in astrophysics, prior to the observation of such phenomenon in Earth based experiments and represent the first evidence of the energy extraction process from Black Holes (the blackholic energy)[11].

Books

He is co-author of 21 books, including:

- R. Giacconi and R. Ruffini, eds. and co-authors "Physics and Astrophysics of Neutron Stars and Black Holes", LXXV E. Fermi Summer School, SIF and North Holland (1978), also translated into Russian.
- R. Gursky and R. Ruffini eds. and co-authors, "Neutron Stars, Black Holes and Binary X Ray Sources", H. Reidel (1975).
- H. Ohanian and R. Ruffini "Gravitation and Spacetime", W.W. Norton, N.Y. (1994) also Translated into Italian (Zanichelli, Bologna, 1997) and Korean (Shin Won, Seoul, 2001).
- R. Gursky-R. Ruffini Neutron Stars, Black Holes and Binary X Ray Sources, H. Reidel (1975)
- Bardeen-Carter-Gursky-Hawking-Novikov-Thorne-Ruffini Black holes, Ed. de Witt, Gordon and Breach, New York, 1973
- M. Rees-J.A. Wheeler-R. Ruffini Black Holes, Gravitational Waves and Cosmology, Gordon and Breach N.Y. 1974
- H. Sato-R. Ruffini Black Holes, Tokyo 1976
- L.Z. Fang-R. Ruffini Basic Concepts in Relativistic Astrophysics, Science Press, Beijing 1981
- F. Melchiorri-R. Ruffini Gamow Cosmology, North Holland Pub. Co., Amsterdam, 1986

Awards

- Cressy Morrison Award, from the New York Academy of Sciences (1972)
- Alfred P. Sloan Fellow Foundation (1974)
- Space Scientist of the Year (1992)

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[8] *D. Calzetti, M. Giavalisco, R. Ruffini (1988). The normalization of the correlation functions for extragalactic structures. Astron. Astrophys. 198*

[9] *R. Ruffini, D.J. Song, S. Taraglio (1988). The 'ino' mass and the cellular large-scale structure of the universe. Astron. Astrophys. 190*

[10] *T. Damour and R. Ruffini (1975). Quantum Electrodynamical Effects in Kerr-Newmann Geometries. Phys. Rev. Lett 35: 463*

[11] *R. Ruffini et al. (2008). Gamma Ray Burst. Proceedings XI Marcel Grossmann Meeting, World Scientific, Singapore*

IRAP PHD

CURRICULUM

1. *BELINSKY Vladimir (ICRANet)*
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5. *EINASTO Jaan (Tartu Observatory)*
6. *FRONTERA Filippo (University of Ferrara)*
7. *JING Yipeng (Shanghai Observatory China)*
8. *KLEINERT Hagen (Freie University of Berlin)*
9. *NICOLAI Hermann (Max Planck Institute for Gravitation)*
10. *NOVELLO Mario(CBPF Brazil)*
11. *PACHECO Jose (Observatoire de la Côte d'Azur)*
12. *ROSQUIST Kjell (University of Stockholm)*
13. *RUFFINI Remo (University of Roma La Sapienza & ICRANet)*
14. **RYDE Felix ((University of Stockholm)**
15. *TITARCHUK Lev (University of Ferrara)*
16. *VAKILI Farrokh (Observatoire de la Côte d'Azur)*

CURRICULUM VITAE

1. Preliminaries

1.1 *Name:* Felix Max Folke RYDE

1.2 *Date and place of birth:* 2 January, 1970 in Täby, Sweden.

1.3 Male

1.4 *Home address:*
Alphyddevägen 47
131 35 Nacka – SWEDEN

1.5 *Office address:*
Department of Physics,
Royal Institute of Technology,
AlbaNova universitetscenter
Roslagstullsbacken 21
SE-106 91 Stockholm – SWEDEN
Telephone : +46 (08) 5537 8545
Fax: +46 (08) 5537 8510
E-mail address : felix@astro.su.se
WWW address : www.astro.su.se/∼felix

1.6 *Current Employment:* Researcher at the Department of Physics, the Royal Institute of Technology, Stockholm, from 1 January 2007. Financed by a särskild forskartjänst at the Swedish National Space Board.

1.7 *Previous Employments:*

- Doktorandtjänst (Graduate Student Fellowship) 1 November, 1994 – 31 October, 1999.
- Tutorial Assistant in Astronomy (20 % of full time) 1 January, 1995 – 31 December, 2000.
- Post-doctoral Researcher at Stockholm Observatory, 1 July, 2000 – 31 December, 2000.
- Post-doctoral Visiting Scholar at Stanford University, CA, USA, 1 January, 2001 – 31 December 2002 (STINT[1] post doc: 83 successful applicants out of 352).
- Visiting Scholar at Rice University, TX, USA. 1 July, 2001 - 31 December 2002, (in parallel to the previous item).
- Forskarassistent (Assistent Professor) at Stockholm Observatory, financed by Vetenskapsrådet[2] (VR), 1 January, 2003 - 31 December, 2006. 80% research.
- Visiting Scholar at Penn State University, University Park, Pennsylvania, USA. 13 February - 13 March, 2006.
- Researcher at the Department of Astronomy, Stockholm University, financed by the Bendixson stipend at Stockholm university, 2007-01-01–2007-02-28.

1.8 *Other:* Swedish citizenship.

[1] STINT - Swedish Foundation for International Cooperation in Research and Higher Education
[2] Vetenskapsrådet - Swedish Research Council

2. Degrees and Evaluations

2.1 *University Degrees:*

- Civilingenjörsexamen (M.Sc.) in Engineering Physics (teknisk fysik 180p), Lund Institute of Technology (LTH), 7 June, 1994. Master thesis in Nuclear Astrophysics.
- Filosofie doktorsexamen (Doctor of Philosophy) in Astronomy, Stockholm University, 22 June, 2000. "Aspects of the Spectral Evolution of Cosmic Gamma-Ray Bursts" (Edsbruk: Akademitryck). Supervisor Professor Roland Svensson.

2.2 *Docent:* Docent in Astronomy at Stockholm University 28 April 2005.

2.3 *Other:*

- Leading a gamma-ray group consisting of Felix Ryde, Milan Battelino (grad student), Sinead McGlynn (post doc), Nick Barkas (exjobb), Christoffer Lundman (exjobb), and Wlodek Klamra (researcher; part time)
- Studentexamen (Matriculation) 10 June, 1988, Natural Science Programme at the Cathedral School of Lund. Average grade 5.0 (max 5.0).

3. Research Profile

- *Independence:*
Most of my publications are related to projects that I have lead. This is the case for all papers of which I am the first author, as well as a few of which I am the second author, projects where I acted as supervisor. I have in total 30 published papers in international, refereed journals, of which 3 are published in the most prestigious astronomical journal *the Astrophysical Journal Letters*. I have acted referee on 31 papers in the same journals. I have presented my research in 33 formal scientific talks at conferences and at foreign institutes. I have also made 32 research visits to foreign institutes, among others Aspen Center for Physics (CO, USA) and the Institute for Theoretical Physics (ITP) in Santa Barbara (CA, USA).

- *Leadership:*
I was the main organizer of the *GLAST* LAT collaboration meeting 2006 (120 participants; `http://www.astro.su.se/glast2006`), and been on the scientific organization committee for another two. I am the lead of the GRB research at KTH and am a deputy work package leader in the Oskar Klein Center. I have hosted scientific visits of 14 colleagues, among others Professor A. Mészáros (Charles University, Prague) for a visit of a total of 12 months. I am also the principle holder of several research grants from VR and Wenner-Gren Stiftelserna and the Royal Swedish Academy of Sciences.

- *Research Keywords:*

Gamma-Ray Bursts: γ-rays, Spectral Evolution, Empirical Correlations, Pulse Profiles, Variability, Physical Interpretations: thermal emission, synchrotron radiation, acceleration mechanisms. Observations: *SWIFT*, *GLAST*, HESS

Gamma-ray Polarization: Detection of Gamma-ray polarization with *PoGO*.

Active Galactic Nuclei: Multi wavelength observations (APEX, Fermi, HESS), X-rays, Seyfert 2 Galaxies, Spectroscopical Analysis, NGC 7172.

Galactic Black Hole Candidates: X/γ-rays, Accretion, Non-Thermal Radiation, Cyg X-1, binary dynamics.

PUBLICATIONS

Docent Felix Ryde, 700102-0275

1 List of Publications

The ten most important publications are marked by a ∗-sign. The citations of my publications generate an "h-index" of 13 (200904184, Astrophysics Data System, ADS). The citation information is given by ADS `http://adsabs.harvard.edu/abstract_service.html` from where the publications also can be retrieved.

1 Refereed Publications in Journals:

1. D. Band, et al. 2009, "Prospects for GRB science with the Fermi Large Area Telescope", *Astrophysical Journal*, accepted for publication

   Responsibility: Responsible for and contributed to the initial draft of the paper and to the section on theoretical models. I have also together with Milan Battelino made simulations of GBM+LAT GRBs, results of which are included here.

   Number of citations: -

2. ∗ **F. Ryde**, & A. Pe'er 2009, "Quasi-blackbody component and radiative efficiency of the prompt emission of gamma-ray bursts" *Astrophysical Journal*, submitted, arXiv:0811.4135

   Responsibility: Main part of the project. All analysis and writing.

   Number of citations: 2

3. A. Abdo, et al. 2009, "The Fermi Gamma-Ray Space Telescope observations of GRB080916c" *Science*, **322**, 1218

   Responsibility: Participated in discussion and analysis.

   Number of citations: 2

4. J.Greiner, A. Iyudin, G. Kanbach, A.Zoglauer, R.Diehl, **F.Ryde** and 53 coauthors 2009, "Gamma-ray burst investigation via polarimetry and spectroscopy (GRIPS)", *Experimental Astronomy*, **23**, 91

   Responsibility: Discussions on outline of project and assisted with writing of paper.

   Number of citations: 1

5. T. Kamae et al. 2008 "PoGOLite - A High Sensitivity Balloon-Borne Soft Gamma-ray", *Astroparticle Physics*, **30**, 72 – (arXiv:07090.1278)

   Responsibility: Contributed through the diploma theses I supervised, the results of which are included in the paper. Also contributed to the Aurora discussion.

   Number of citations: 1

6. Z. Bagoly, I. Horvath, L.G. Balazs, L. Borgonovo, S. Larsson, A. Meszaros, **F. Ryde**, 2007 "Principal Component Analysis of Gamma-Ray Bursts' Spectra", submitted arXiv:0705.0249

   Responsibility: Planning of paper and science discussions.

   Number of citations: 0

7. M. Axelsson, O. Engdegård, **F. Ryde**, et al. 2007 "Measuring energy dependent polarization using a Compton Technique", *Astroparticle Physics*, **28**, 327–337

   Responsibility: *Paper is based on the exjobb by Olle Engdegård, whom I supervised. Magnus Axelsson contributed most of the writing.*

   Number of citations: *1*

8. ∗ A. Pe'er, **F. Ryde**, P. Mészáros, R. Wijers, M. Rees 2007 "A new method to determine the bulk Lorentz factor in gamma-ray bursts", *Astrophysical Journal Letters*, **664**, 1–4

   Responsibility: *Main part of the work was done by Pe'er and Ryde. The others had a consulting role.*

   Number of citations: *19*

9. ∗ **F. Ryde**, C.-I. Björnsson, Y. Kaneko, P. Mészáros, R. Preece, M. Battelino 2006, "Gamma-Ray Burst Spectral Correlations: Photospheric and Injection Effects", *Astrophysical Journal*, **652**, 1400 – 1415

   Responsibility: All writing, all analysis. Discussed with CIB and PM about the theory. YK & RP helped with the discussion on the observations, especially the asymptote discussion and one of the figures. MB was a diploma student who helped with some of the analysis (minor contribution)

   Number of citations: *13*

10. Z. Bagoly, A. Mészáros, L. Borgonovo, **F. Ryde**, S. Larsson, S. Klose, L. G. Balázs, I. Horváth 2006, "On the Darkness of Long Gamma-ray Bursts", *Astronomy & Astrophysics*, in press

    Responsibility: *Written the theory sections, contributed to the outline of the project, and commented extensively on the manuscript.*

    Number of citations:

11. Z. Bagoly, A. Mészáros, L.G. Balázs, I. Horváth, S. Klose, S. Larsson, P. Mészáros, **F. Ryde**, G. Tusnády, 2006 "The Swift satellite and redshifts of long gamma-ray bursts ", *Astronomy & Astrophysics*, **453**, 797 – 800

    Responsibility: *Participated in the research work leading to the results. Contributed with a few sections of the text.*

    Number of citations: *11*

12. I. Horváth, L. G. Balázs, Z. Bagoly, **F. Ryde**, A. Mészáros 2006, "A New Definition of the Intermediate Group of Gamma-Ray Bursts", *Astronomy & Astrophysics*, I., **447**, 23 – 30

    Responsibility: *Contributed to the science discussion and participated in the writing of the manuscript.*

    Number of citations: *23*

13. ∗ **F. Ryde** 2005, "Is Thermal Emission in Gamma-Ray Bursts Ubiquitous?", *Astrophysical Journal Letters*, **625**, L95 – L98

    Responsibility: *All*

    Number of citations: *42*

14. **F. Ryde**, D. Kocevski, Z. Bagoly, N. Ryde, A. Mészáros 2005, "Interpretations of Gamma-Ray Burst Spectroscopy II. Bright BATSE bursts", *Astronomy & Astrophysics*, **432**, 105 – 116

    Responsibility: In principle all. D. Kocevski made a few lag measurements, Z. Bagoly made the sky plot and analysis, N. Ryde and A. Mészáros contributed on the cosmology section.

    Number of citations: 11

15. ∗ **F. Ryde** 2005, "Interpretations of Gamma-Ray Burst Spectroscopy I. Analytical and numerical study of spectral lags", *Astronomy & Astrophysics*, **429**, 869 – 879

    Responsibility: All

    Number of citations: 18

16. N. Ryde, A. J. Korn, M. J. Richter, **F. Ryde** 2004, "The Zeeman-Sensitive Emission Lines of Mg I at 12 Micron in Procyon", *Astrophysical Journal*, **617**, 551 – 558

    Responsibility: Contributed on the key ideas for the Zeeman effect. Contributed to the text.

    Number of citations: 2

17. ∗ **F. Ryde** 2004, "The Cooling Behavior of Thermal Pulses in Gamma-Ray Bursts", *Astrophysical Journal*, **614**, 827 – 846

    Responsibility: All

    Number of citations: 43

18. **F. Ryde**, L. Borgonovo, S. Larsson, N. Lund, A. v. Kienlin, & G. Lichti 2003, "Gamma-ray bursts observed by the INTEGRAL-SPI anticoincidence shield: a study of individual pulses and temporal variability", *Astronomy & Astrophysics*, **411**, L331 – L342

    Responsibility: Initiater, leader, got some help of LB and SL on specific tasks. NL, AvK and GL are responsible for the instrument and only commented on the manuscript.

    Number of citations: 12

19. ∗ D. Kocevski, **F. Ryde**, & E. Liang 2003, "Search for Relativistic Curvature Effects in GRB Pulses", *the Astrophysical Journal*, **596**, 389 – 400

    Responsibility: Supervised the project and the writing. Wrote more than 50% and responsible for important parts of the work, for instance analytical calculations. EL only read the manuscript.

    Number of citations: 46

20. ∗ **F. Ryde** & V. Petrosian 2002, "Gamma-Ray Burst Pulses as Signatures of a Relativistic Expanding Plasma", *Astrophysical Journal* **578**, 290 – 303

    Responsibility: Initiated, performed the research and wrote the manuscript. Close collaboration with VP with whom I discussed the project continuously. VP read the manuscript carefully.

    Number of citations: 45

21. ∗ S. Kobayashi, **F. Ryde**, & A. MacFadyen 2002, "Luminosity and Variability of Collimated Gamma-ray Bursts", *Astrophysical Journal* **577**, 302 – 310

    Responsability: Initiator of the physical model and development of it. SK wrote the main part of the manuscript and performed the numerical calculations. AM participated in the discussion and only wrote a few paragraphs and read the manuscript.

    Number of citations: 37

22. ∗ **F. Ryde** & R. Svensson 2002, "On the Variety of the Spectral and Temporal Behaviors of Long Gamma-Ray Burst Pulses", *Astrophysical Journal* **566**, 210 – 228

    Responsibility: Initiated, performed the research and wrote the manuscript. RS read the manuscript carefully.

    Number of citations: 31

2. Refereed Publications in Conference Proceedings:

23. Kiss, M., et al. 2008, "The PoGOLite balloon-borne soft gamma-ray polarimeter", *American Institute of Physics Conference Series*, **1054**, 225

24. Pe'er, A. & **F. Ryde** 2007, "New method to measure the Lorentz factor of GRBs", in proceedings of the Amsterdam meeting

25. Petrosian, V., Bouvier, A. & **F. Ryde** 2007, "Cosmology with GRBs?", in proceedings of the Amsterdam meeting

26. Battelino, M., **Ryde, F.**, Omodei, N. & Band, D. 2007, "Simulation of prompt emission from GRBs with a photospheric component and its detectability by GLAST", in proceedings of the first GLAST science symposium, AIP Conf. Series, **921**, 478

27. Batellino, M., **Ryde, F.**, Omodei, N., & Francesco Longo 2007, "Simulation of prompt emission from GRBs with a photospheric component and its detectability by GLAST", in proc. of "Discussions on Gamma-Ray Bursts in Anticipation of GLAST", eds. M. Axelsson & F. Ryde, AIP Conf. Series, **906**, 28

28. Omodei, N., Battelino, M., Longo, F., McEnery, J., Norris, J., & **Ryde, F.** 2007, "GRB simulations in GLAST", in proc. of "Discussions on Gamma-Ray Bursts in Anticipation of GLAST", eds. M. Axelsson & F. Ryde, AIP Conf. Series, in press

29. Iyudin, A.F., Battelino, M., Greiner, J., Larsson, S., **Ryde, F.** 2007, "GRB Redshifts from Prompt Emission SED", in proc. of "Discussions on Gamma-Ray Bursts in Anticipation of GLAST", eds. M. Axelsson & F. Ryde, AIP Conf. Series, in press

30. Komin, N. et al. 2006, "Spectral Analysis of Gamma-Ray Bursts in GLAST Data Challenge 2 Simulated Gamma-Ray Sky", Venice, Il Nuovo Cimento, in press

31. Piron, F. et al. 2006, "GRB observations with GLAST and TeV experiments", Venice, Il Nuovo Cimento, in press

32. Omodei, N. et al. 2006, "Gamma-ray burst observations with GLAST", Venice, Il Nuovo Cimento, in press

33. P. Veres, I. Horváth, Z. Bagoly, L.G. Balázs, A. Mészáros, G. Tusnády, **F. Ryde** 2006, "Model Independent Methods of Describing GRB Spectra Using BATSE MER Data", Venice, Il Nuovo Cimento, in press

34. I. Horváth, **F. Ryde**, L. Balász, Z. Bagoly, A. Mészáros, 2006, "Properties of the intermediate type of gamma-ray bursts", in proc. of *the 16th Annual October Astrophysics Conference in Maryland: Gamma Ray Bursts in the Swift Era*, eds. Holt, S. S., Gehrels, N., & Nousek, J. A., AIP Conf. Series, **836**, 125 – 128

35. N. Omodei et al. 2006 "The *GLAST* mission, LAT and GRBs", in proc. of *the 16th Annual October Astrophysics Conference in Maryland: Gamma Ray Bursts in the Swift Era*, eds. Holt, S. S., Gehrels, N., & Nousek, J. A., AIP Conf. Series, **836**, 716 – 719 (astro-ph/0603762)

36. **F. Ryde** 2005 "Thermal emission during the prompt phase of gamma-ray bursts", in proc. of *the 22nd Texas Symposium on Relativistic Astrophysics*, invited talk, eConf **C041213**, 107, 1 – 4.

37. V. Andersson et al. 2005, "Large-area balloon-borne polarized gamma-ray observer (PoGO)", in proc. of *the 22nd Texas Symposium on Relativistic Astrophysics*, eConf **C041213**, 2508.

38. **F. Ryde** & M. Battelino 2005, "The conspicuous gamma-ray burst of 30 May 1996", *Il Nuovo Cimento C*, **28:3**, 335 – 338

39. A. Mészáros, Z. Bagoly, S. Klose, **F. Ryde**, S. Larsson, L.G. Balázs, I. Horváth 2005, "On the origin of the dark gamma-ray bursts", *Il Nuovo Cimento C*, **28:3**, 311 – 314

40. Z. Bagoly, I. Horváth, L. Balasz, L. Brogonovo, S. Larsson, A. Mészáros, **F. Ryde** 2005, "Principal-Component Analysis of Gamma-Ray Bursts' Spectra", *Il Nuovo Cimento C*, **28:3**, 295 – 298

41. S. Larsson, **F. Ryde**, L. Borgonovo, Z. Bagoly, A. Mészáros, M. Pearce, N. Lund, A v. Kienlin, & G. Lichti 2004, "The Background of the Integral-SPI Anticoincidence Shield and the Observations of GRBs", in *the 5th Integral Workshop, the Integral Universe*, eds. V. Schönfelder, G. Lichti, & C. Winkler (Noordwijk: ESA Publication Division), SP-**552**, 649 – 652

42. D. Kocevski, **F. Ryde** & E. Liang 2004, "Relativistic Curvature Effects in GRBs" in *Gamma-Ray Bursts in the Afterglow Era: 3rd Workshop*, eds. M. Feroci et al. (San Francisco: ASP), ASP Conf. Series, Vol. **312**, 86 – 89

43. L. Borgonovo, & **F. Ryde** 2004, "Light Curves of Short GRB Pulses", in *Gamma-Ray Bursts in the Afterglow Era: 3rd Workshop*, eds. M. Feroci et al. (San Francisco: ASP), ASP Conf. Series, Vol. **312**, 67 – 70

44. **F. Ryde**, D. Kocevski, & E. Liang 2003, "Analytical Description of GRB Pulses", in *GRBs and Afterglow Astronomy 2001*, ed. G. R. Ricker, & R. K. Vanderspek (New York: AIP), AIP Conf. Proc., **662**, 286 – 288

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3. Other publications

Invited Reviews:

48. **F. Ryde**, 2008, "On the Origin of Gamma-Ray Bursts, *Philosophical Transactions A*, **366**, 4405–4416

49. **F. Ryde**, 1999, "Spectral Aspects of the Evolution of Gamma-Ray Bursts", in *Gamma-Ray Bursts: The First Three Minutes*, Astronomical Society of the Pacific Conf. Series, **190**, 103–132

    Responsibility: Full.

Editor of Proceedings:

50. *Gamma-ray Bursts – Prospects for GLAST*, Edited by M. Axelsson and **F. Ryde**, American Institute of Physics Conference Series (166 pages). Berlin: Springer, 2007. ISBN: 978-0-7354-0413-7

    Responsibility: 50%.

Pedagogical Publications:

51. **Felix Ryde** & Elisabeth Rachlew, 2008, *Student interview of two students on course SH2402 Astrophysics.* KTH Learning Lab.

    Responsibility: 50%.

Theses:

- **F. Ryde** 1993, 'On the Study of Abundances of Elements in the Universe', Thesis (M.Sc.) Lund Institute of Technology, Lund-MPh-93/16 (December, 1993)
- **F. Ryde** 2000, 'Aspects of the Spectral Evolution of Cosmic Gamma-Ray Bursts', Thesis (Ph.D.) Stockholm University, ISBN 91-7265-106-7 (May, 2000)

Authorship as part of a colaboration:

52. T. Mizuno et al. 2009 "A Monte Carlo Method for Calculating the Energy Response of Plastic Scintillators to Polarized Photons below 100 keV", *Nuclear Inst. and Methods in Physics Research*, doi:10.1016/j.nima.2008.11.148

53. Abdo, A. A., et al. 2008, "The Fermi Gamma-Ray Space Telescope Discovers the Pulsar in the Young Galactic Supernova Remnant CTA 1" *Science*, **322**, 1218

54. Y. Kanai et al. 2007 "Beam test of a prototype phoswich detector assembly for the PoGOLite astronomical soft gamma-ray polarimeter", *Nucl. Inst. and Meth.*, **A570**, 61.

6. Popular Publications/Reports:

55. **Ryde, F.** 2008, "What is the origin of cosmological gamma-rays?", Nordic Space, in press

56. Larsson, S., **Ryde, F.** et al. 2007, "Aurora and PoGOLite", Visby, May 2007.

57. **F. Ryde** 2006, "Report from the 1st workshop for the ASPERA roadmap, Valencia, Spain, 7-8 November, 2006", presented to Vetenskapsrådet, November 2006

58. **F. Ryde**, S. Larsson, N. Ivchenko, M. Pearce 2006, "X-ray emission from aurora", PoGOLite internal report, November 2006

59. **F. Ryde** 2005, "Gammablixtarna kommer från 1 miljard grader heta källor", Teknik & Vetenskap, **no**

60. C. Björnsson, **F. Ryde**, S. Larsson, L. Borgonovo, M. de Vall Borro, A. Mészáros 2004, "Roland Svensson (1950 – 2003), in Memoriam", *Baltic Astron.*, **13**, 329 – 332

61. B. Leibundgut, J. Sollerman, C. Kozma, C. Fransson, P. Lundqvist, **F. Ryde**, & P. Woudt 2000, "The Late Phase of SN 1998bw" *ESO messenger* No. 99, March 2000, 36 – 38

62. **F. Ryde** 1993-1997 and 2005, A number of articles published in the Swedish National Encyclopedia, Publ: Bra Böckers Bokförlag.

IRAP PHD

CURRICULUM

1. *BELINSKY Vladimir (ICRANet)*
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3. *CHARDONNET Pascal (University of Savoie)*
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8. *KLEINERT Hagen (Freie University of Berlin)*
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13. *RUFFINI Remo (University of Roma La Sapienza & ICRANet)*
14. *RYDE Felix ((University of Stockholm)*
15. **TITARCHUK Lev (University of Ferrara)**
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Personal Profile **Lev G. Titarchuk**

Research Activity

Lev Titarchuk graduated from the Moscow State University, Department of Mechanics and Mathematics in 1969. His thesis of the master degree was related to the problem of non-linear Hydrodynamics. The particular interest was the analysis of the mixed --initial and boundary-- problem for the system of the nonlinear equations.

His advisor was Prof. A. Kalashnikov. Lev Titarchuk took courses giving by Profs. Vladimir Arnold, Eugine Landis, Vladimir Tihomirov, Sergey Novikov, Grigorij Barrenblatt, Yakov Sinai and Yakov Zel'dovich.

Being a graduate student (1969-1972) in the Space Research Institute of Academy of Sciences of the USSR Lev Titarchuk started studying the radiative transfer theory with applications to the Space Science and Nuclear Physics. His scientific adviser was Prof. Vladimir Kurt and his consultant was Prof. Viktor Sobolev. The Degree of Candidate of Physic – Mathematical Sciences (equivalent to Ph.D. degree) in Mathematical Physics and Astrophysics was received in 1972. The title of the thesis: ``Multiple light scattering in spherical planetary atmospheres''. In his Ph.D. thesis Lev Titarchuk elaborated a new approach in solving Radiative Transfer problems dealing with a high anisotropic radiation field. He demonstrated that the Bolzmann kinetic equation with a strong anisotropic phase function can be reduced to the specific diffusion (Fokker-Planck) equation.

He offered a new analytical method of the solution of this problem. In addition, he investigated various asymptotic regimes of the problem and derived asymptotic analytical formulae for angular distribution of the emergent radiation. The analytic results allowed to determine the radiation field in the medium with high anisotropy (e.g. clouds, hazes in the Earth and Venus atmospheres).

Another topic of the research was related to the formation of the resonance spectral lines in clouds of different geometric configurations. In some cases the kinetic equations (integro-differential equations) assume an inversion and thus the problem is reduced to the boundary problem of the differential equation of the second order. These results were applied to the determination of the hydrogen, helium and oxygen abundances in the upper atmosphere of the Earth, Venus and Mars.

The results were published in Soviet Space Research Journal (1972-1973), in Astrophysics and Space Science (1974), and Icarus (1973-1974). After the defense of the Ph. D. thesis Lev Titarchuk started working in High Energy Astrophysics and X-ray Astronomy.

In 1989 Dr. Titarchuk took a position of the full professor of the Applied Mathematics and Theoretical Physics in Moscow State University of Transportation (MIIT).

In 1992 Lev Titarchuk was awarded by National Research Council-NASA Senior Research Associateship and came to U.S.A to work as a senior researcher (equivalent of the full Professor position) in NASA Goddard Space Flight Center (GSFC). From 1992 to 1998 he shared his time between MIIT (Russia) being the full professor there and GSFC (USA).

Lev Titarchuk has published more than 100 papers in the refereed journals.
The total citation index of these papers according to NASA Astrophysics Data is more than 3500 citations. He also was invited to give talks in various meetings and conferences more than 50 times.

Statement of Research

Theoretical Astrophysics of neutron stars and black holes and their timing and spectral appearances. X-ray and Gamma-ray spectroscopy. Formation of hard X-ray and Gamma-ray spectra of radiation of the compact objects. Theory of the resonance spectral line formation and the annihilation line formation. Theory of Comptonization of radiation in stellar atmospheres, and accretion disk coronae. General Relativity. AGN models. Theory of oscillations. Radiative Transfer Theory. Analytical and numerical techniques for solving the related Radiative Transfer problems, improvement of the radiative transfer computer codes. Mathematical kinetic theory. Nonlinear problems of Hydrodynamics and Magneto-hydrodynamics. Celestial Mechanics.

Teaching activity

Introductory courses of the Relativity Theory for undergraduate and graduate levels. A review course of the modern state of art in a study of compact objects (theory and observations). A course of the oscillation theory of with applications to a study of timing characteristics of neutron star, black hole sources. A course of the methods of the applied Mathematics and Mathematical Physics with applications to X-ray Astronomy and High Energy Astrophysics problems**.** Mathematical courses: calculus, differential equations, theory of probability, liniear algebra and analytical geometry, theory of functions of complex variables.

Professor Lev G. Titarchuk

Vita

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Dr.of Sc. (Astrophysics and Theoretical Physics)
Leningrad State University, Leningrad, June 1989
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DISSERTATION and TITLE for Doctor Science Degree:
``Radiative Transfer Problems and Formation of the Spectra in X-Ray Sources"

TEACHING EXPERIENCE:
Professor of Astrophysics and
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University of Ferrara, Italy 2006-2007,
Professor of Astrophysics and
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George Mason University, Virginia, USA, 1995-2006,
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Moscow State University of Transportation,
Moscow, 1989-1998
Associate Professor of Mathematics, Applied
Mathematics Chair,
Moscow State University of Transportation, Moscow,
1973-1990
Lectrured a course of the Radiative Processes in Astrophysics,
Lectured at least three undergraduate level courses each semester,
including Calculus, Analytical and Differential Geometry,
Differential Equations, Numerical methods and Computer Science
Lectured two graduate level courses every semester,
including Mathematical and Theoretical Physics and
Differential Equations

RESEARCH EXPERIENCE:
Researh Professor, CEOSR of GMU
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July 2000-2007
Visiting Professor of Astrophysics and Theoretical Physics ,
University of Ferrara, Italy 2006-2007 which position was supported by Italian Ministry of Education, University and Research (MIUR)

Visting Scientist, Astrophysics Division
Goddard Space Flight Center, NASA March 1995-2007
National Research Council, Laboratory for High Energy Astrophysics,
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Senior Research Associate, High Energy X-Ray Group,
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August 1974-March 1992
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& Space Research Institute (IKI), Moscow,
August 1972-August 1974
& Graduate Research Assistant, Ultraviolet
Radiation Group
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August 1969-August 1972

PRESENT POSITION:
Professor of Physics, George Mason University and
Visiting scientist in the Naval Research Laboratory and
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AWARDS:
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in 2003 and 2004 (Internationally recognized award)
National Research Council-NASA Research Associateship Award, 1991 (Internationally recognized award)

PROFESSIONAL SOCIETY
MEMBERSHIP:
American Astronomical Society

CURRENT SUPPORT:
NASA GRANT ``Radiative Shock Instabilities: Novel Laboratory Astrophysics Approach
There are a number of proposals submitted to NASA and NSF
PAST SUPPORT:
Project:Bursts from 4U 1820-30: NS Mass and Radius Determination
Source of Support: NASA
Location of the Project: George Mason University
Project:Laboratory for Coordinated Hazardous Atmospheric Release Modeling (CHARM)
Source of Support: US Department of Defense
Location of the Project: George Mason University

Project:Research and Development in Support of Image and GIFTS
Source of Support: Office of Naval Research
Location of the Project: George Mason University
Participation in quite a few approved CGRO and RXTE
Guest Investigation Programs

PUBLICATIONS IN REFEREED JOURNALS IN THE PERIOD OF 1972-1988

1. 1972 L. G. Titarchuk ``Radiation transfer in the spherical one-layer atmosphere of the planet" 1972, Kosmicheskij issledovaniy (Soviet Space Research Journal), vol. 10, p. 905
2. 1973 L. G. Titarchuk ``Radiation transfer in the spherical many-layer atmosphere of the planet" 1973, Kosmicheskij issledovaniy (Soviet Space Research Journal), vol. 11, p. 130
3. 1973 L. G. Titarchuk ``Optical properties in the lower Venus atmosphere. Interpretation of the observation of ``Venera-8")" 1973, Kosmicheskij issledovaniy (Soviet Space Research Journal), vol. 11, p. 524
4. 1973 N. N. Dement'eva, V. G. Kurt, A. S. Smirnov, L. G. Titarchuk, S. D. Chuvachin ``Preliminary results of U.V. emission scattered in the Mar's upper atmosphere" 1973, Icarus, vol. 17, p. 475
5. 1974 M. M. Basko, R. A. Sunyaev & L. G. Titarchuk, ``Reflection and reprocessing of X-ray source radiation by the atmosphere of the normal star in a binary system" 1974, Astron.& Astrophys., vol. 31, p. 249
6. 1974 V. G. Kurt, A. S. Smirnov, L. G. Titarchuk, S. D. Chuvachin ``Observation OI 1300 A emission in the Mar's atmosphere" 1974, Icarus, vol. 21, p. 35
7. 1975 L.G.Titarchuk ``Discrete frequency scattering in spherical layer surrounding point source " 1975, Astrophys. & Space Sci. vol. 35, p. 137
8. 1976 V. G. Kurt, E. I. Moskalenko, L. G. Titarchuk, E. K. Sheffer ``Observation of the X-ray source A0620-00 on the board of the station Salut-4" 1976, Pis'ma Astron.Zh. (Sov. Astron. Lett.), vol. 2, p. 107
9. 1976 V. G. Kurt, E. I. Moskalenko, M. I. Klimuk, V. I. Sevost'yanov, E. K. Sheffer, L. G. Titarchuk ``Observation of the powerful flashes of X-ray radiation from Cyg X-1" 1976, Pis'ma Astron.Zh. (Sov. Astron. Lett.), v. 2, p. 235
10. 1976 V. G. Kurt, E. I. Moskalenko, E. K. Sheffer, L. G. Titarchuk, I. A. Golovanov ``Observation of Sco X-1 from

the board of the station Salut-4" 1976, Pis'ma Astron. Zh.
(Sov. Astron. Lett.), vol. 2, p. 167
11. 1976 V. G. Kurt, E. I. Moskalenko, M. I. Klimuk, V. I. Sevost'yanov,
E. K. Sheffer, L. G. Titarchuk ``Variability of radiation of
Sco X-1 from the observation on the board of the station Salut-4" 1976,
Pis'ma Astron.Zh. (Sov. Astron. Lett.) vol. 2, p. 331
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V. I. Sevost'yanov, E. K. Sheffer, L. G. Titarchuk ``Observation of Cir X-1
from the board of the station Salut-4" 1976, Pis'ma Astron.Zh.
(Sov. Astron. Lett.), vol. 2, p. 403
13. 1977 V. G. Kurt, E. I. Moskalenko, M. I. Klimuk,
V. I. Sevost'yanov, E. K. Sheffer, L. G. Titarchuk
``Observation of Cyg X-1 from the board of the station Salut-4" 1977,
Pis'ma Astron.Zh. (Sov. Astron. Lett.), vol. 3, p. 63
14. 1980 R. A. Sunyaev & L. G. Titarchuk,`` Comptonization
of X-rays in plasma cloud. Typical radiation spectra" 1980, Astron.&
Astrophys., vol. 86, p. 121
15. 1983 V. G. Kurt, A. S. Smirnov, L. G. Titarchuk, M. L. Berto,
V. M. Lepin ``Scattering resonance lines in the upper
Venus atmosphere according to U.V. data of Venera
11, 12." 1983, Kosmicheskij issledovaniy (Sov.Space Research Journal),
vol. 21, p. 545
16. 1983 Yu. P. Vlasov & L. G. Titarchuk ``Monte Carlo calculations
of resonance line formation in flat layers" 1983, Pis'ma Astron.Zh. (Sov.
Astron. Lett.), vol. 8, p. 163
17. 1985 R.A. Sunyaev, & L. G. Titarchuk, ``Comptonization
of low-frequency radiation in accretion disks: angular
distribution and polarization of hard radiation."
1985, Astron.& Astrophys., vol. 142, p. 374
18. 1985 I. I. Lapidus, R. A. Sunyaev, & L. G. Titarchuk,
``Angular distribution and polarization of X-ray radiation
of the bursters." 1985, Astrofizika (Astrophysics), vol. 23, p. 503
19. 1986 I. I. Lapidus,R. A. Sunyaev, & L. G. Titarchuk,
``Comptonization and X-ray burst spectra" 1986, Pis'ma Astron.Zh. (Sov.
Astron. Lett.), vol. 12, p. 918
20. 1986 R. A. Sunyaev, & L. G. Titarchuk, ``On spectra of
X-ray bursters." 1986, Pis'ma Astron.Zh. (Sov. Astron. Lett.), vol. 12, p.
857}
21. 1987 L. G. Titarchuk `` The spectra formation of X-ray radiation
in close binary system. Reflection effects." 1987, Astrofizika

(Astrophysics), vol. 26, p. 97}
22. 1988 L. G. Titarchuk, ``Comptonization of the free- free radiation in an isothermal medium of constant density." 1988, Astrofizika (Astrophysics), vol. 29, p. 369
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24. 1988 L. G. Titarchuk & E. K. Sheffer ``Light curve of the pulsar of Her X-1 & reflection effect from the inner edge of the accretion disk" 1988, Pis'ma Astron. Zh. (Sov. Astron. Lett.), vol. 14, p. 503

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2. 1992 E.K.Sheffer, I.F.Kopaeva, M.B.Averintsev, L.G.Titarchuk et al. ``X-ray studies of the Hercules X-1 pulsar with the ASTRON satellite", Astr.Zhurnal (Soviet Astronomy), 36, 41
3. 1994 L.G.Titarchuk ``On spectra of X-ray bursters. Explosion and contraction stages", ApJ., 429, 340
4. 1994 L.G.Titarchuk & A. Mastichiadis ``Hard X-ray from NGC 4151: A Thermal Origin?" ApJLetters, 433, L33
5. 1994 L.G.Titarchuk ``Generalized Comptonization Models and Application to the Recent High Energy Observations stages", ApJ., 434, 570
6. 1995 Xin-Min Hua & L.G.Titarchuk `` Comptonization Models and Spectroscopy of X-ray and Gamma-ray sources ", ApJ., 449, 188
7. 1995 F.Haberl & L.G.Titarchuk ``On the distance and mass-radius relation of neutron stars in X-ray burst sources", A &A., 299, 414
8. 1995 L.G.Titarchuk & Yu. Lyubarskij ``Power law spectra as a result of Comptonization of soft radiation in a plasma cloud ", ApJ., 450, 876
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10. 1995 S. Chakrabarti & L.G.Titarchuk ``Spectral Properties

of Accretion Disks Around Galactic and Extragalactic Black Holes"
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``Spherical accretion onto neutron stars and black holes",
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12. 1996 S. K. Chakrabarti, L.G.Titarchuk, D. Kazanas
& K. Ebisawa
``Observational signature of the ``boundary layer" of galactic
and extragalactic black holes",
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13. 1996 S. N. Zhang, B.A. Harmon, W.S. Paciesas,

G.J. Fishman, J.E. Grindlay, D. Barret, M. Tavani, P. Kaaret, P. Bloser,
E. Ford & L.G.Titarchuk
``Low state hard X-ray outburst from the X-ray burster 4U 1608-522
observed by BATSE/CGRO ", Astronomy and Astrophysics. Supplement
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14. 1996 K. Ebisawa, L.G.Titarchuk, & S. Chakrabarti
``On spectral slopes of Hard X-ray Emission from Black Hole Candidates",
PASJ, 48, 59
15. 1996 Xin-Min Hua & L.G.Titarchuk `` Time Variation
of Emission from Comptonization Sources ", ApJ., 469, 280
16. 1996 W. Zhang, Lapidus, I., White, N.E, & L.G.Titarchuk
`` Kilohertz Quasi-Periodic Intensity Oscillations from 4U1636-536",
ApJLetters, 469, L17
17. 1996 T.E. Strohmayer, Zhang, W., Swank, J.H., Smale, A.,
Titarchuk, L.G. Day, C., & Lee, U. `` Milisecond X-ray Variability from an
Accreting Neutron Star System" ApJLetters, 469 L9
18. 1997 D. Kazanas, Xin-Min Hua & L.G.Titarchuk
`` Temporal and Spectral Properties of Comptonized Radiation and Its
Applications", ApJ., 480, 735
19. 1997 Xin-Min Hua, D. Kazanas, & L.G.Titarchuk
`` Phase Difference and Coherence as Diagnostic
of Accreting Compact Sources Applications", ApJLetters., 482, L57
20. 1997 K. Chen, J.P. Halpern, & L.G.Titarchuk
`` Polarization of Line Emission from an Accretion Disk and
Applications to Arp 102B", ApJLetters, 483, 194
21. 1997 E. Ramos, Kafatos, M., Fruscione, A.,
Bruhweiler, F.C., McHardy, I.M., Hartman, R.C., Titarchuk, L.G. &
von Montigny, C `` Contemporaneous IUE, EUVE and

High Energy Observations of 3C 273", ApJ., 482, 167
22. 1997 L.G.Titarchuk, & Muslimov, A.
``Rotational splitting effect in neutron star QPOs", &A, 323, L5}
23. 1997 L.G.Titarchuk, A. Mastichiadis s& N. Kylafis
``X-Ray Spectral Formation In Converging Fluid Flow:
Spherical Accretion Into Black Holes",
ApJ., 487, 834
24. 1998 L.G.Titarchuk, & T. Zannias
`The Extended Power Law As Intrinsic Signature For a Black Hole ",
ApJ., 493, 863
25. 1998 D. Kazanas, L.G. Titarchuk, & X.M. Hua
``The Time Duration-Energy Relation of Gamma Ray Bursts and Its
Interpretation ", ApJ., 493, 708
26. 1998 L.G.Titarchuk, Lapidus, I.I. & Muslimov, A.
``Mechanisms of High-Frequency QPO in Neutron Star Binaries", ApJ.,
499, 315
27. 1998 C. Shrader & L.G.Titarchuk
``The High-Energy Spectra of Accreting Black Holes:
Observational Evidence for Bulk-Motion Infall", ApJLetters, 499, L31
28. 1998 J.E. Grove, M.S. Strickman, S.M. Matz,
X.-M. Hua, D. Kazanas, & L.G.Titarchuk
``Timing Noise Properties of GRO J0422+32", ApJletters, 502, L45}
29. 1998 W. Cui, E.H. Morgan & L.G.Titarchuk
``Soft Phase Lags of Pulsed Emission from Millisecond X-ray
Pulsar SAX J 18808.4-3658", ApJletters, 504, L27
30. 1999 Ph. Laurent & L.G.Titarchuk
``The Converging inflow spectrum is an intrinsic signature
or a black hole: Monte-Carlo simulations of Comptonization
on free-falling electrons", ApJ., 511, 289
31. 1999 M. Bautista & L.G.Titarchuk
``H-like Iron Emission in Narrow Line Seyfert 1 (NLS1) Galaxies
as Temperature Diagnostic of Accretion Flows", ApJ., 511, 105
32. 1999 K. Borozdin, M., M. Revnivtsev, S. Trudolyubov,
C. Shrader, & L.G.Titarchuk
``Do the Spectra of Soft X-ray Transients Reveal Bulk Motion In flow
Phenomenon", ApJ., 517, 367
33. 1999 Titarchuk, L.G. & Osherovich, V.
``Correlations Between Kilohertz Quasi-Periodic Oscillations and
Low-Frequency Features Attributed to Radial Oscillations and Diffusive
Propagation in the Viscous Boundary Layer around a Neutron Star",

ApJLetters, 518, L95
34. 1999 Osherovich, V. & Titarchuk, L.G.
``Kilohertz QPO in Neutron Star Binaries modeled as Keplerian Oscillations in a Rotating Frame of Reference '', ApJLetters, 522, L113
35. 1999 Osherovich, V. & Titarchuk, L.G.
``Interpretation of ~ 35 Hz QPO in atoll source 4U 1702-42 as a low branch of the Keplerian oscillations under the influence of the Coriolis force'', ApJLetters, 523, L73
36. 1999 C. Shrader & L.G.Titarchuk
``Mass determination of Black hole in LMC X-1 and Nova Muscae 1991 from their high-energy spectra'', ApJLetters, 521, L121
37. 1999 L.G.Titarchuk, V.A. Osherovich & S. I. Kuznetzov
`` Timing spectroscopy of Quasi-Periodic Oscillations in the Low-Mass X-ray Neutron Star Binaries'', ApJLetters, 525, L129}
38. 2000 L.G.Titarchuk, & V.A. Osherovich ``delta-invariant for Quasi-periodic Oscillations and Physical Parameters of 4U 0614+09 binary'', ApJLetters, 537, L39
39. 2000 L.G.Titarchuk, & V.A. Osherovich ``The global normal disk oscillations and the persistent low-frequency QPOs in X-ray binaries'', ApJLetters, 542, L111
40. 2001 M. Still, O'Brien, K. Horne, B. Boroson, L.G.Titarchuk, et al. ``Atmospheric reflection during anomalous low state of Hercules X-1'' ApJ., 554, 352
41. 2001 L.G.Titarchuk, & V.A. Osherovich
``Classification of power density spectrum features and estimation of the delta-invariant value for the Z source GX 340+0 '', ApJLetters, 555, L55
42. 2001 L.G.Titarchuk, C.F. Bradshaw, B.J. Geldzahler & E.B. Fomalont
``Normal-branch QPOs in Sco X-1: Viscous Oscillations of a Spherical Shell near the Neutron star '', ApJLetters, 555, L45
43. 2001 L.G. Titarchuk, C.F. Bradshaw, & K.S. Wood
``B-field determination from magnetoacoustic oscillations in kilohertz quasi-periodic oscillation neutron star binaries: Theory and observations'' ApJLetters, 560, L55
44. 2001 P. Laurent, L. Titarchuk
``Timing and spectral properties of X-ray emission from the converging flows onto a black hole: Monte Carlo simulations'' ApJLetters, 562, L67
45. 2001 K.S. Wood, L. Titarchuk, P.S. Ray P.S. et al.

``Disk diffusion propagation model for the outburst of XTE J1118+480" ApJ., 563, 246
46. 2002 N. Shaposhnikov, & L. Titarchuk
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Publications on discovery of a new method of black hole mass determination

1. NASA Press Release, May 16 , 2007, http://www.nasa.gov/centers/goddard/news/topstory/2007/blackhole_weight.html

NASA Scientists Pioneer Technique for "Weighing" Black Holes
05.09.07

Two astrophysicists at NASA's Goddard Space Flight Center in Greenbelt, Md., Nikolai Shaposhnikov and Lev Titarchuk, have successfully tested a new method for determining the masses of black holes.

This elegant technique, which Titarchuk first suggested in 1998, shows that the black hole in a binary system known as Cygnus X-1 contains 8.7 times the mass of our sun, with a margin of error of only 0.8 solar mass.

Cygnus X-1 was the first compelling black hole candidate to emerge in the early 1970s. The system consists of a blue supergiant star and a massive but

invisible companion. Optical observations of the star's wobble have suggested that the invisible object is a black hole containing about 10 solar masses. "This agreement gives us a lot of confidence that our method works," says Shaposhnikov.

"Our method can determine a black hole's mass when alternative techniques fail," adds Titarchuk, who is also a research professor at George Mason University, Arlington, Va., also works at the Naval Research Laboratory, Washington. Shaposhnikov works for the Universities Space Research Association, a part of the Center for Research and Exploration in Space Science and Technology within NASA Goddard.

Working independently, Tod Strohmayer and Richard Mushotzky of Goddard and four colleagues used Titarchuk's technique to estimate that an ultra-luminous X-ray source in the small, nearby galaxy NGC 5408 harbors a black hole with a mass of about 2,000 suns.

"This is one of the best indications to date for an intermediate-mass black hole," says Strohmayer. This type of black hole fills in a huge gap between black holes such as Cygnus X-1, which come from collapsing massive stars and contain perhaps 5 to 20 solar masses, and monster black holes containing millions or even billions of solar masses, which lurk in the cores of large galaxies.

Titarchuk's method takes advantage of a relationship between a black hole and the surrounding disk of matter spiraling into it, called an accretion disk. Gas orbiting in these disks eventually falls into the black hole. When a black hole's accretion rate increases to a high level, material piles up near the black hole in a hot region that Titarchuk likens to a traffic jam. Titarchuk has shown that the distance from the black hole where this congestion occurs is on a direct scale with the mass of the black hole. The more massive the black hole, the farther this congestion occurs from the black hole, and the longer the orbital period.

In his model, hot gas piling up in the congestion region is linked to observations of X-ray intensity variations that repeat on a nearly but not perfectly periodic basis. These quasi-periodic oscillations (QPOs) are observed in many black hole systems. The QPOs are accompanied by simple, predictable changes in the system's spectrum as the surrounding gas heats and cools in response to the changing accretion rate. Precise timing observations from NASA's Rossi X-ray Timing Explorer (RXTE) satellite have shown a tight

relationship between the frequency of QPOs and the spectrum, telling astronomers how efficiently the black hole is producing X-ray radiation. Using RXTE, Shaposhnikov and Titarchuk have applied this method to three stellar-mass black holes in our Milky Way Galaxy, and showed that the derived masses from the QPOs concur with mass measurements from other techniques. The paper outlining their results is scheduled to appear in the July 1 issue of Astrophysical Journal.

Using the European Space Agency's XMM-Newton X-ray observatory, Strohmayer, Mushotzky, and their colleagues detected two QPOs in NGC 5408 X-1. This object is the brightest X-ray source in the irregular galaxy NGC 5408, 16 million light-years from Earth in the constellation Centaurus. The QPO frequencies, as well as the luminosity and spectral characteristics of the source, implies that it is powered by an intermediate-mass black hole.

"We had two other ways of estimating the mass of the black hole, and all three methods agree within a factor of two," says Mushotzky. "We don't have proof this is an intermediate-mass black hole, but the preponderance of evidence suggests that it is."

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GREENBELT, Md. - Using a new technique, two NASA scientists have identified the lightest known black hole. With a mass only about 3.8 times greater than our Sun and a diameter of only 15 miles, the black hole lies very close to the minimum size predicted for black holes that originate from dying stars.

"This black hole is really pushing the limits. For many years astronomers have wanted to know the smallest possible size of a black hole, and this little guy is a big step toward answering that question," says lead author Nikolai Shaposhnikov of NASA's Goddard Space Flight Center in Greenbelt, Md.

Shaposhnikov and his Goddard colleague Lev Titarchuk are presenting their results on Monday, March 31, at the American Astronomical Society High-Energy Astrophysics Division meeting in Los Angeles, Calif. Titarchuk also works at George Mason University in Fairfax, Va., and the US Naval Research Laboratory in Washington, DC. They will describe their results in more detail in

a media telecon on April 1 at 1:30 p.m. EDT.

The tiny black hole resides in a Milky Way Galaxy binary system known as XTE J1650-500, named for its sky coordinates in the southern constellation Ara. NASA's Rossi X-ray Timing Explorer (RXTE) satellite discovered the system in 2001. Astronomers realized soon after J1650's discovery that it harbors a normal star and a relatively lightweight black hole. But the black hole's mass had never been measured to high precision.

The method used by Shaposhnikov and Titarchuk has been described in several papers in the Astrophysical Journal. It uses a relationship between black holes and the inner part of their surrounding disks, where gas spirals inward before making the fatal plunge. When the feeding frenzy reaches a moderate rate, hot gas piles up near the black hole and radiates a torrent of X-rays. The X-ray intensity varies in a pattern that repeats itself over a nearly regular interval. This signal is called a quasi-periodic oscillation, or QPO.

Astronomers have long suspected that a QPO's frequency depends on the black hole's mass. In 1998, Titarchuk realized that the congestion zone lies close in for small black holes, so the QPO clock ticks quickly. As black holes increase in mass, the congestion zone is pushed farther out, so the QPO clock ticks slower and slower. To measure the black hole masses, Shaposhnikov and Titarchuk use archival data from RXTE, which has made exquisitely precise measurements of QPO frequencies in at least 15 black holes.

Last year, Shaposhnikov and Titarchuk applied their QPO method to three black holes whose masses had been measured by other techniques. In their new paper, they extend their result to seven other black holes, three of which have well-determined masses. "In every case, our measurement agrees with the other methods," says Titarchuk. "We know our technique works because it has passed every test with flying colors."

The measurement of the black hole's mass is due to high-precision timing observations made by NASA's Rossi X-ray Timing Explorer satellite.
When Shaposhnikov and Titarchuk applied their method to XTE J1650-500,

they calculated a mass of 3.8 Suns, with a margin of uncertainty of only half a Sun. This value is well below the previous black hole record holder with a reliable mass measurement, GRO 1655-40, which tips the scales at about 6.3 Suns.

Below some unknown critical threshold, a dying star should produce a neutron star instead of a black hole. Astronomers think the boundary between black holes and neutron stars lies somewhere between 1.7 and 2.7 solar masses. Knowing this dividing line is important for fundamental physics, because it will tell scientists about the behavior of matter when it is scrunched into conditions of extraordinarily high density.

Despite the diminutive size of this new record holder, future space travelers had better beware. Smaller black holes like the one in J1650 exert stronger tidal forces than the much larger black holes found in the centers of galaxies, which make the little guys more dangerous to approach. "If you ventured too close to J1650's black hole, its gravity would tidally stretch your body into a strand of spaghetti," says Shaposhnikov.

Shaposhnikov adds that RXTE is the only instrument that can make the high-precision timing observations necessary for this line of research. "RXTE is absolutely crucial for these black hole mass measurements," he says.

NEWS COVERAGE: PRESS RELEASE: 08-28
NASA SCIENTISTS IDENTIFY SMALLEST KNOWN BLACK HOLE
Issue date: April 1, 2008, 1:30 p.m. EDT
http://www.nasa.gov/centers/goddard/news/topstory/2008/smallest_blackhole.html

This story received **EXCELLENT** coverage. Agence France-Presse, Australian Broadcasting Corp., Discovery Channel, Fox News, Mirror (UK), MSNBC News, National Geographic, New Scientist, Philly Inquirer, Register –UK, Reuters, Science Daily, Scientific American, SpaceFlightNow, United Press International Wire, USA Today, Xinhau Chinese News Service. There are literally HUNDREDS of blogs that mention this story (not included below). The wire services also provide stories to countless newspaper, TV and radio stations, which are also not included here.
INTERNATIONAL COVERAGE: Australia, Bulgaria, Canada, China, Estonia, France, Germany, India, Indonesia, Iran, Malaysia, New Zealand, Pakistan, Philippines, Scotland, South Africa, Taiwan, Tasmania, U.K., United Arab Emirates

DETAILED COVERAGE: *(Blogs not included, and not all inclusive coverage)*
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Mini-black hole is smallest ever but still strong
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IRAP PHD

CURRICULUM

1. *BELINSKY Vladimir (ICRANet)*
2. *CHAKRABARTI Sandip (ISCP India)*
3. *CHARDONNET Pascal (University of Savoie)*
4. *COULLET Pierre (University of Nice Sophia Antipolis)*
5. *EINASTO Jaan (Tartu Observatory)*
6. *FRONTERA Filippo (University of Ferrara)*
7. *JING Yipeng (Shanghai Observatory China)*
8. *KLEINERT Hagen (Freie University of Berlin)*
9. *NICOLAI Hermann (Max Planck Institute for Gravitation)*
10. *NOVELLO Mario(CBPF Brazil)*
11. *PACHECO Jose (Observatoire de la Côte d'Azur)*
12. *ROSQUIST Kjell (University of Stockholm)*
13. *RUFFINI Remo (University of Roma La Sapienza & ICRANet)*
14. *RYDE Felix ((University of Stockholm)*
15. *TITARCHUK Lev (University of Ferrara)*
16. **VAKILI Farrokh (Observatoire de la Côte d'Azur)**

Curriculum Vitae of Farrokh VAKILI

A) Research Topics

-stellar physics : fondamental parameter of stars, variability, magnetism, mass-loss and rapid rotation

-direct détection od extra-solar planets and their spectral characterization in serach of habitable zones and bio-signatures

-aperture synthesis, optical interferometry, adpative optics and stellar coronagraphy : concepts, construction, opération and observation

B)Principal responsibilities and positions

-director of H. Fizeau laboratory at the University of Nice and CNRS : 2002-2009

-director of Observatoire de la Côte d'Azur (OCA) since arpil 2009

-member of scientific working groups of the European Space Agency (ESA), European Southern Observtaory (ESO) and the interferometry working group of the international astronomical union (IAU)

-organizer of 2 IAU colloquia (1993 & 2005) and SOC member of 3 other ones (ESA, EU)

-13 PhD supervised

-summer and winter schools : France, Brazil, Canada, Iran

-more than 20 thesis jurys

D) Manuscripts

F. Vakili, "Traitement de l'information optique par transformation de Fourier rapide et observation rapide à haute résolution angulaire d'enveloppes stellaires polarisées", thèse de 3e cycle, direction A. Labeyrie, président F. Roddier, UNS, Nice, mai 1979

F. Vakili, "Interférométrie optique à grande base : résultats astrophysiques et perspectives", thèse d'Etat, direction A. Labeyrie, président C. Aime, UNS, Nice, mars 1990

E) Refereed papers

1)"Use of rapid Fourier transformation for calculation of the diffraction figure of large telescope mirrors."
Vakili, F.
C. R. Acad. Sci. Paris, Sér. B, Tome 288, p. 61 - 63

2)"Phase effect detection at the CERGA stellar interferometer, application to Capella's orbital motion"
Koechlin, L.; Bonneau, D.; Vakili, F.
Astronomy and Astrophysics, vol. 80, no. 3, Dec. 1979, p. L13, L14.

3)"Study of stellar polarization with the CERGA interferometer"
Vakili, F.
Astronomy and Astrophysics, vol. 101, no. 3, Sept. 1981, p. 352-355.

4)"Stellar diameter measurements by two-telescope interferometry in optical wavelengths"
Bonneau, D.; Koechlin, L.; Oneto, J. L.; Vakili, F.
Astronomy and Astrophysics, vol. 103, no. 1, Nov. 1981, p. 28-34.

5)"Stellar interferometry - Diameters and effective temperatures of five giant stars"
Faucherre, M.; Bonneau, D.; Koechlin, L.; Vakili, F.
Astronomy and Astrophysics (ISSN 0004-6361), vol. 120, no. 2, April 1983, p. 263-268.

6)"Ultraviolet resolution of large mirrors via Hartmann tests and two-dimensional fast Fourier transform analysis."
Dame, L.; Vakili, F.
Optical Engineering, Vol. 23, No. 6, p. 759 - 765

7)"On the upper limit of the angular diameter of gamma Cassiopeiae with the two-telescope interferometer at CERGA"
Vakili, F.; Granes, P.; Bonneau, D.; Noguchi, M.; Hirata, R.
Publications of the Astronomical Society of Japan (ISSN 0004-6264), vol. 36, no. 2, 1984, p. 231-237.

8)"Speckle interferometric measurements of binary stars. III"
Bonneau, D.; Balega, Y.; Blazit, A.; Foy, R.; Vakili, F.; Vidal, J. L.
Astronomy & Astrophysics Suppl. Ser. (ISSN 0365-0138), vol. 65, no. 1, July 1986, p. 27-32.

9)“Optical interferometric measurements of Gamma Cassiopeiae's envelope in the H-alpha line”
Thom, C.; Granes, P.; Vakili, F.
Astronomy and Astrophysics (ISSN 0004-6361), vol. 165, no. 1-2, Sept. 1986, p. L13-L15.

10)“The GI2T interferometer on Plateau de Calern”
Mourard, D.; Tallon-Bosc, I.; Blazit, A.; Bonneau, D.; Merlin, G.; Morand, F.; Vakili, F.; Labeyrie, A.
Astronomy and Astrophysics (ISSN 0004-6361), vol. 283, no. 2, p. 705-713

11)“Estimation of visibility amplitude by optical long-baseline Michelson interferometry with large apertures”
Mourard, D.; Tallon-Bosc, I.; Rigal, F.; Vakili, F.; Bonneau, D.; Morand, F.; Stee, P.
Astron. Astrophys. 288, 675-682 (1994)

12)“γ Cassiopeiae revisited by spectrally resolved interferometry”
Stee, P.; de Araujo, F. X.; Vakili, F.; Mourard, D.; Arnold, L.; Bonneau, D.; Morand, F.; Tallon-Bosc, I.
Astronomy and Astrophysics, v.300, p.219

13)“Dispersed fringe tracking with the multi-r0 apertures of the grand interferometre a 2 telescopes”
Koechlin, L.; Lawson, P. R.; Mourard, D.; Blazit, A.; Bonneau, D.; Morand, F.; Stee, P.; Tallon-Bosc, I.; Vakili, F.
Applied Optics, Vol. 35, No. 16, p. 3002 - 3009

14)“Jet-like structures in β Lyr: results of optical interferometry, spectroscopy & photometry”
Harmanec, P.; Morand, F.; Bonneau, D.; Jiang, Y.; Yang, S.; Guinan, E. F.; Hall, D. S.; Mourard, D.; Hadrava, P.; Bozic, H.; Sterken, C.; Tallon-Bosc, I.; Walker, G. A. H.; McCook, G. P.; Vakili, F.; Stee, P.; Le Contel, J. M.
Astronomy and Astrophysics, v.312, p.879-896

15)“Polarization effects in stellar interferometry”.
Rousselet-Perraut, K.; Vakili, F.; Mourard, D.
Opt. Eng., Vol. 35, No. 10, p. 2943 - 2955

16)“The mean angular diameter of δ Cephei measured by optical long-baseline interferometry.”
Mourard, D.; Bonneau, D.; Koechlin, L.; Labeyrie, A.; Morand, F.; Stee, P.; Tallon-Bosc, I.; Vakili, F.
Astronomy and Astrophysics, v.317, p.789-792

17)“Polarization effects in aperture synthesis arrays”
Rousselet-Perraut, K.; Mourard, D.; Vakili, F.
Optical Engineering, Vol. 36, No. 4, p. 980 - 987

18)“Attempt to detect polarization effects in the envelope of g Cas with GI2T interferometer”
Rousselet-Perraut, K.; Vakili, F.; Mourard, D.; Morand, F.; Bonneau, D.; Stee, Ph.
Astron. & Astrophys., Supplement series, Vol. 123, May II 1997, 173-177.

19)“Subtle structures in the wind of P Cygni”
Vakili, F.; Mourard, D.; Bonneau, D.; Morand, F.; Stee, P.
Astronomy and Astrophysics, v.323, p.183-188

20)“On the inner envelope of the Be star gamma Cassiopeiae”
Stee, Ph.; Vakili, F.; Bonneau, D.; Mourard, D.
Astronomy and Astrophysics, v.332, p.268-272 (1998)

21)“Removing the photon-centroiding hole in optical stellar interferometry”
Berio, P.; Vakili, F.; Mourard, D.; Bonneau, D.
Astronomy and Astrophysics Supplement, v.129, p.609-615

22)“Evidence for one-armed oscillations in the equatorial disk of zeta Tauri from GI2T spectrally resolved interferometry”
Vakili, F.; Mourard, D.; Stee, Ph.; Bonneau, D.; Berio, P.; Chesneau, O.; Thureau, N.; Morand, F.; Labeyrie, A.; Tallon-Bosc, I.
Astronomy and Astrophysics, v.335, p.261-265 (1998)

23)“Present performance of the dark-speckle coronagraph”
Boccaletti, A.; Moutou, C.; Labeyrie, A.; Kohler, D.; Vakili, F.
Astronomy and Astrophysics Supplement, v.133, p.395-402

24)“Spectrally resolved Michelson stellar interferometry. I. Exact formalism in the multispeckle mode.”
Berio, P.; Mourard, D.; Bonneau, D.; Chesneau, O.; Stee, P.; Thureau, N.; Vakili, F.; J. Opt. Soc. Am. A, Vol. 16, No. 4, p. 872 - 881

25)“Interferometric insight into gamma Cassiopeiae long-term variability”
Berio, P.; Stee, Ph.; Vakili, F.; Mourard, D.; Bonneau, D.; Chesneau, O.; Le Mignant, D.; Thureau, N.; Hirata, R.
Astronomy and Astrophysics, v.345, p.203-210 (1999)

26)“Optical configuration for a micro-arcsecond astrometric interferometer in space”
Thomas, E.; Robbe, S.; Viard, T.; Segransan, D.; Vakili, F.; Krawczyk, R.
Astronomy and Astrophysics Supplement, v.138, p.147-154

27)“Spectro-polarimetric interferometry (SPIN) of magnetic stars”
Rousselet-Perraut, K.; Chesneau, O.; Berio, Ph.; Vakili, F.
Astronomy and Astrophysics, v.354, p.595-604 (2000)

28)“Adaptive optics imaging of P Cygni in Halpha”
Chesneau, O.; Roche, M.; Boccaletti, A.; Abe, L.; Moutou, C.; Charbonnier, F.; Aime, C.; Lantéri, H.; Vakili, F.
Astronomy and Astrophysics Supplement, v.144, p.523-532 (2000)

29)“The achromatic phase knife coronagraph”
Abe, L.; Vakili, F.; Boccaletti, A.
Astronomy and Astrophysics, v.374, p.1161-1168 (2001)

30)“Interferometric-Doppler imaging of stellar surface structure”
Jankov, S.; Vakili, F.; Domiciano de Souza, A., Jr.; Janot-Pacheco, E.
Astronomy and Astrophysics, v.377, p.721-734 (2001)

31)“Modelling rapid rotators for stellar interferometry”
Domiciano de Souza, A.; Vakili, F.; Jankov, S.; Janot-Pacheco, E.; Abe, L.
Astronomy and Astrophysics, v.393, p.345-357 (2002)

32)“Phase Knife Coronagraph. II - Laboratory results”
Abe, L.; Domiciano de Souza, A., Jr.; Vakili, F.; Gay, J.
Astronomy and Astrophysics, v.400, p.385-392 (2003)

33)“The spinning-top Be star Achernar from VLTI-VINCI”
Domiciano de Souza, A.; Kervella, P.; Jankov, S.; Abe, L.; Vakili, F.; di Folco, E.; Paresce, F.
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34)“Stellar differential rotation and inclination angle from spectro-interferometry”
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Astronomy and Astrophysics, v.418, p.781-794 (2004)

35)“Interferometric Remapped Array Nulling”
Vakili, F.; Aristidi, E.; Abe, L.; Lopez, B.
Astronomy and Astrophysics, v.421, p.147-156 (2004)

36)“Gravitational-darkening of Altair from interferometry”
Domiciano de Souza, A.; Kervella, P.; Jankov, S.; Vakili, F.; Ohishi, N.; Nordgren, T. E.; Abe, L.
Astronomy and Astrophysics, Volume 442, Issue 2, November I 2005, pp.567-578

37)“First sky validation of an optical polarimetric interferometer”
Rousselet-Perraut, K.; Le Bouquin, JB.; Mourard, D.; Vakili, F.; Chesneau, O.; Bonneau, D.; Chevassut, JL.; Crocherie, A.; Glentzlin, A.; Jankov, S.; Ménardi, S.; Petrov, R.; Stehlé, C.
Astronomy and Astrophysics, Volume 451, Issue 3, June I 2006, pp.1133-1137

38)“On-sky observations with an achromatic hybrid phase knife coronagraph in the visible”
Abe, L.; Beaulieu, M.; Vakili, F.; Gay, J.; Rivet, J.-P.; Dervaux, S.; Domiciano de Souza, A.
Astronomy and Astrophysics, Volume 461, Issue 1, January I 2007, pp.365-371

39)“AMBER, the near-infrared spectro-interferometric three-telescope VLTI instrument”
Petrov, R. G.; Malbet, F.; Weigelt, G.; Antonelli, P.; Beckmann, U.; Bresson, Y.; Chelli, A.; Dugué, M.; Duvert, G.; Gennari, S.; Glück, L.; Kern, P.; Lagarde, S.; ..
Astronomy and Astrophysics, Volume 464, Issue 1, March II 2007, pp.1-12

40)“Optical configuration and analysis of the AMBER/VLTI instrument”
Robbe-Dubois, S.; Lagarde, S.; Petrov, R. G.; Lisi, F.; Beckmann, U.; Antonelli, P.; Bresson, Y.; Martinot-Lagarde, G.; Roussel, A.; Salinari, P.; Vannier, M.; Chelli, A.; ..
Astronomy and Astrophysics, Volume 464, Issue 1, March II 2007, pp.13-27

41)"Interferometric data reduction with AMBER/VLTI. Principle, estimators, and illustration"
Tatulli, E.; Millour, F.; Chelli, A.; Duvert, G.; Acke, B.; Hernandez Utrera, O.; Hofmann, K.-H.; Kraus, S.; Malbet, F.; Mège, P.; Petrov, R. G.; Vannier, M.; ..
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42)"Disk and wind interaction in the young stellar object MWC 297 spatially resolved with AMBER/VLTI"
Malbet, F.; Benisty, M.; de Wit, W.-J.; Kraus, S.; Meilland, A.; Millour, F.; Tatulli, E.; Berger, J.-P.; Chesneau, O.; Hofmann, K.-H.; Isella, A.; Natta, A.; Petrov, R. G.; ..
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43)"Constraining the wind launching region in Herbig Ae stars: AMBER/VLTI spectroscopy of HD 104237"
Tatulli, E.; Isella, A.; Natta, A.; Testi, L.; Marconi, A.; Malbet, F.; Stee, P.; Petrov, R. G.; Millour, F.; Chelli, A.; Duvert, G.; Antonelli, P.; Beckmann, U.; Bresson, Y.; Dugué, M.; Gennari, S.; Glück, L.; Kern, P.; Lagarde, S.; Le Coarer, E.; Lisi, F.; Perraut,..
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44)"An asymmetry detected in the disk of κ Canis Majoris with AMBER/VLTI"
Meilland, A.; Millour, F.; Stee, P.; Domiciano de Souza, A.; Petrov, R. G.; Mourard, D.; Jankov, S.; Robbe-Dubois, S.; Spang, A.; Aristidi, E.; Antonelli, P.; Beckmann, U.; .....
Astronomy and Astrophysics, Volume 464, Issue 1, March II 2007, pp.73-79

45)"Near-infrared interferometry of η Carinae with spectral resolutions of 1 500 and 12 000 using AMBER/VLTI"
Weigelt, G.; Kraus, S.; Driebe, T.; Petrov, R. G.; Hofmann, K.-H.; Millour, F.; Chesneau, O.; Schertl, D.; Malbet, F.; Hillier, J. D.; Gull, T.; Davidson, K.; Domiciano de Souza, A.; .....
Astronomy and Astrophysics, Volume 464, Issue 1, March II 2007, pp.87-106

46)"Direct constraint on the distance of γ2 Velorum from AMBER/VLTI observations"
Millour, F.; Petrov, R. G.; Chesneau, O.; Bonneau, D.; Dessart, L.; Bechet, C.; Tallon-Bosc, I.; Tallon, M.; Thiébaut, E.; Vakili, F.; ..
Astronomy and Astrophysics, Volume 464, Issue 1, March II 2007, pp.107-118

47)"AMBER/VLTI interferometric observations of the recurrent Nova RS Ophiuchii 5.5 days after outburst",
Chesneau, O.; Nardetto, N.; Millour, F.; Hummel, C.; Domiciano de Souza, A.; Bonneau, D.; Vannier, M.; Rantakyrö, F.; Spang, A.; Malbet, F.; Mourard, D.; Bode, M. F.; O'Brien, T. J.; Skinner, G.; Petrov, R. G.; Stee, P.; Tatulli, E.; Vakili, F.
Astronomy and Astrophysics, Volume 464, Issue 1, March II 2007, pp.119-126

48)"A scene model of exosolar systems for use in planetary detection and characterisation simulations"
Belu, Adrian; Thiébaut, Eric; Ollivier, Marc; Lagache, Guilaine; Selsis, Franck; Vakili, F.
Astronomy and Astrophysics, Volume 476, Issue 2, December III 2007, pp.1005-1018

49) "On the determinaion of the rotational oblateness of Achernar"
Carciofi, A.C., Domiciano de Souza, A., Magalhaes A.M., Bjorkman, J.E., Vakili, F.
The Astrophysical Journal, Volume 676, Issue 1, pp. L41-L44.

50)"New Generation Photon-Couning cameras: Algol and CPNG"
Blazit A., Rondeau X., Thiébaut E., Abe L., Bernengo J-C, Chevassut J-L, Clausse JM, Dubois M, Foy R., Mourard D., Patru F., Spang A., Tallon-Bosc I., Tallon M., Tourneur Y, Vakili F.
Applied Optics IP, vol. 47, Issue 8, pp.1141-1151

51)"Diameter and photospheric structures of Canopus from AMBER/VLTI interferometry"
A.C. Domiciano de Souza, P. Bendjoya, F. Vakili, F. Millour, R. Petrov
Astronomy and Astrophysics, Volume 489, Issue 2, 2008, pp.L5-L8

52)" An Alternative Approach for Imaging in Optical Interferometry" Menut, J.-L.; Valat, *B.; Lopez, B.; Schmider, F.-X.; Vakili, F.; Jankov, S.; Bresson, Y.; Lagarde, S.; Petrov, R. G.; Domiciano, A.; Mosoni, L.; Danchi, W. C.*
The Astrophysical Journal, Volume 686, Issue 2, pp. 1514-1522.

53)"First light from the Dome C (Antarcica) of a phase knife stellar coronagraph"
Guerri, G., Abe, L., Daban, JB., Aristifi E., Bendjoya, Ph., Rivet, JP., Vakili, F.
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54)"ACIA: Asymmetric Achromatic Interferential Coronagraph for direct exoplanet detection" *F. Allouche, A. Glindemann, E. Aristidi, F. Vakili*, Astron. Astrophys, under press, 2009

55)" Spatially resolving the inhomogeneous structure of the dynamical atmosphere of Betelgeuse with VLTI/AMBER"
K. Ohnaka1 , K.-H. Hofmann , M. Benisty, A. Chelli, T. Driebe1, F. Millour, R. Petrov, D. Schertl, Ph. Stee, F. Vakili, and G. Weigelt, Astronomy& Astrophysics, under press, 2009.

F)Published conributed papers

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3)"Performance of Present and Next Generation Stellar Interferometers"
Koechlin, L.; Vakili, F.
"Solar instrumentation: What's next?" Proceedings of a Conference, held in Sunspot, New Mexico, October 14-17, 1980. Edited by Richard B. Dunn. Sunspot, New Mexico: Sacramento Peak National Observatory, 1981., p.236

4)"High angular resolution observation of single and close binary stars with the CERGA interferometer"
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5)"The CERGA small stellar interferometer - Results and projects"
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IN: "Instrumentation in astronomy V"; Proceedings of the Fifth Meeting, London, England, September 7-9, 1983 (A85-25360 10-89). Bellingham, WA, SPIE - The International Society for Optical Engineering, 1984, p. 484-489.

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10)"First Measurements of γ Cassiopeae's Hydrogen Envelope"
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11)"Aperture Synthesis in Space - Overview and Results from the ESA Study Group"
Faucherre, M.; Greenaway, A. H.; Merkle, F.; Noordam, J. E.; Perryman, M. A. C.; Roussel, P.; Vakili, F.; Volonte, S.; Weigelt, G. P.
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12)"CHARON, the French stellar imaging project."
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13)"Steps Towards an Optical Very Large Array"
Labeyrie, A.; Lemaitre, G.; Thom, C.; Vakili, F.
NOAO-ESO Conference on "High-Resolution Imaging by Interferometry: Ground-Based Interferometry at Visible and Infrared Wavelengths", Garching bei München, Germany, Mar. 15-18, 1988. Edited by F. Merkle, ESO Conference and Workshop Oroceedings No. 29, p.669.

14)"On Line Image Processing with the Stellar Interferometer 12T"
Percheron, I.; Dugue, M.; Vakili, F.
NOAO-ESO Conference on "High-Resolution Imaging by Interferometry: Ground-Based Interferometry at Visible and Infrared Wavelengths", Garching bei München, Germany, Mar. 15-18, 1988. Edited by F. Merkle, ESO Conference and Workshop Oroceedings No. 29, p.725,

15)"Optical Simulation of a 5 Aperture Spectro Interferometer for Imaging"
Cruzalebes, P.; Schumacher, G.; Vakili, F.; Dugue, M.; Koechlin, L.; Rabbia, Y.
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16)"Image Reconstruction in Optical Long Baseline Interferometry Using Spectral Visibility Fitting"
Vakili, F.; Rabbia, Y.; Percheron, I.
NOAO-ESO Conference on "High-Resolution Imaging by Interferometry: Ground-Based Interferometry at Visible and Infrared Wavelengths", Garching bei München, Germany, Mar. 15-18, 1988. Edited by F. Merkle, ESO Conference and Workshop Oroceedings No. 29, p.769,

17)"Tilt Correction in Stabilized Interferometry - Difficulties and Remedies"
Faucherre, M.; Dame, L.; Decaudin, M.; Boutry, P.; Chirouze, M.; Jegoudez, G.; Lagardere, H.; Rabbia, Y.; Terrier, G.; Vakili, F.
NOAO-ESO Conference on "High-Resolution Imaging by Interferometry: Ground-Based Interferometry at Visible and Infrared Wavelengths", Garching bei München, Germany, Mar. 15-18, 1988. Edited by F. Merkle, ESO Conference and Workshop Oroceedings No. 29, p.1093, 1988

18)"Aperture synthesis in space"
Faucherre, M.; Greenaway, A. H.; Merkle, F.; Noordam, J. E.; Perryman, M. A. C.; Rousel, P.; Vakili, F.; Volonte, S.; Weigelt, G.
Conference on "New Technologies for Astronomy" in Conjunction with the 2. International Congress on Optical Science and Engineering (ECO-2), p. 101 - 108

19)"Beam combination in aperture synthesis from space: field of view limitations and (u,v) plane coverage optimization".
Faucherre, M.; Merkle, F.; Vakili, F.
Conference on New Technologies for Astronomy in Conjunction with the 2. International Congress on Optical Science and Engineering (ECO-2), p. 138 - 145

20)"Aperture synthesis in space - Computer fringe blocking"
Vakili, Farrokh; Koechlin, Laurent
"New technologies for astronomy"; Proceedings of the Meeting, Paris, France, Apr. 25, 26, 1989 (A90-37976 16-89). Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1989, p. 109-116.

21)"Beam combination in aperture synthesis from space - Field of view limitations and (u,v) plane coverage optimization"
Faucherre, M.; Merkle, F.; Vakili, F.
"New technologies for astronomy"; Proceedings of the Meeting, Paris, France, Apr. 25, 26, 1989 (A90-37976 16-89). Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1989, p. 138-145.

22)"On the Possibility to Detect NRP's by Optical Interferometry"
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Programme ou initiative	Numéro d'identification/contrat	Organisation contractante	Titre du projet
TEMPUS	CD_JEP-27237-2006 (UA)	Université de Nice –Sophia Antipolis	Computing Curricula for Ukrainian Universities (CC4U2)
TEMPUS	UM_JEP-27247-2006 (UA)	Université de Nice –Sophia Antipolis	ICT based learning and personal development services for students (CLIP)
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TEMPUS	CD-JEP-40094-2005	Université de Nice –Sophia Antipolis	HERBS - Higher Education Reform of Biological Sciences
TEMPUS	UM_JEP-26219-2005 (KG)	Université de Nice –Sophia Antipolis	Resource Sharing Network of Academic and Research Libraries of Kyrgyzstan (KYR-LIB-NET)
Erasmus Mundus "External Cooperation Window"	Contrat n° 132860-EM-1-2007-1-FR-ERA MUNDUS-ECW	Université de Nice –Sophia Antipolis	IMAGEEN (International MAGhreb-Europe Education Network)
Erasmus Mundus "External Cooperation Window"	Contrat n° 2008 - 1799 / 001 - 001 MUN-ECW	Universiteit Gent (Belgique)	BASILEUs (Balkans Academic Scheme for the Internationalisation of Learning in cooperation with EU universities)
Erasmus Mundus "External Cooperation Window"	Contrat n° 2008 - 4950 / 001 - 001 - ECW	Université de Nice –Sophia Antipolis	EMMA (Erasmus Mundus Mobility with Asia)
SOCRATES-ERASMUS Réseaux Thématiques	230393-CP-1-2006-1-FR-ERASMUS-TN	Ecole Supérieure de Chimie physique électronique de Lyon	ECTN4 - Chemistry in European Higher Education Area
SOCRATES-ERASMUS Réseaux Thématiques	227942-CP-1-2006-1-IT-ERASMUS-TN	Alma Mater Studorium Università di Bologna	ACUME2 - Interfacing sciences, Literature and the Humanities
ERASMUS-MUNDUS Action 1 Cours de Master Erasmus Mundus	2006-1672/001-001 MUN-MUNB37	Université de Nice –Sophia Antipolis	EUROAQUAE - Euro hydro-informatics and water management
ERASMUS-MUNDUS Action 1 Cours de Master Erasmus Mundus	NC	Università degli studi di l'Aquila (Italie)	MATHMODS – Mathematical Modelling in engineering: theory, numerics, applications
ERASMUS-MUNDUS Action 1 Cours de Master Erasmus Mundus	NC	Université Libre de Bruxelles (Belgique)	Master conjoint en Etude du spectacle vivant
GRUNDTVIG	134450-2007-GR-GRUNDTVIG-GMP	University of Pireus Research Centre (Grèce)	FINALIST Financial Literacy Stimulation
Programme Jean Monnet Chaire Jean Monnet	141180-LLP-1-2008-1-FR-AJM-CH	Université de Nice –Sophia Antipolis	Chaire Union Européenne-Pays de l'Est
Programme Jean Monnet Soutien à des actions d'informations et de recherche	2007-1728/001-001 JEA JEINF	Université de Nice –Sophia Antipolis	Seminars on Europe

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6/05/09

Ecole Doctorale Sciences Fondamentales et Appliquées

APPLICATION FORM FOR IRAP PHD ERASMUS MUNDUS

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Curriculum of Student and the Laboratory
Letter of motivation of the candidate.
Two letters of recommendations of professors well acquainted with the historical scientific background of the candidate

SURNAME
NAME

HOST LABORATORY

Ecole Doctorale SFA – UNSA, Parc Valrose 06108 Nice cedex 2
MATHEMATIQUES-PHYSIQUE-SCIENCES DE L'UNIVERS-CHIMIE
http://www.unice.fr/EDSFA

Directeur : Pr. G.L. LIPPI
Tél : 04 92 07 63 26
e-mail : dir-edsfa@unice.fr

Secrétaire : Mme M.F. Gallorini
Tél : 04 92 07 65 00
e-mail gallorin@unice.fr

STUDENT

SURNAME …… **NAME**……

…… **Gender : Female ☐ Male ☐**

DATE OF BIRTH _ _ / _ _ / 19 _ _ **NATIONALITY :**

ADDRESS:……..……

CITY: ……..…….. **POST CODE:** …….

EMAIL : ……..…

PHONE NUMBER: …….

SUBJECT OF PHD THESIS

ACADEMIC CURSUS

Please fill this document with precision.
Please indicate the all marks obtained the last academic year

DIPLOMA

■ **MASTER 1 or other equivalent diploma**

Mention « …… »

INSTITUTION ……..……

DATE _ _ / _ _ / _ _

AVERAGE MARK:

CLASSIFICATION _ _ / _ _

■ **MASTER 2 or other equivalent diploma**

Mention « …… »

Spécialité « ……..…… »

INSTITUTION ……..……

DATE _ _ / _ _ / _ _

AVERAGE MARK:

CLASSIFICATION _ _ / _ _

OTHERS (IF NEEDED) :

LETTER OF MOTIVATION OF THE CANDIDATE

JUDGMENT OF THE PROFESSOR RESPONSABLE OF MASTER 2

LETTER OF THE RESPONSABLE OF THE MASTER'S THESIS

TITLE OF THE MASTER'S THESIS :

INSTITUTION :

NAME OF THE RESPONSABLE :
QUALITY :

- **Autonomy of the candidate and spirite of enterprise**
  ☐ Insufficient ☐ Satisfactory ☐ Good ☐ Very Good ☐ Exceptionnal
- **Capacity to work in team**
  ☐ Insufficient ☐ Satisfactory ☐ Good ☐ Very Good ☐ Exceptionnal
- **Scientific level of the work produced**
  ☐ Insufficient ☐ Satisfactory ☐ Good ☐ Very Good ☐ Exceptionnal
- **Quality of the oral presentation**
  ☐ Insufficient ☐ Satisfactory ☐ Good ☐ Very Good ☐ Exceptionnal
- **General comment on the candidate:**

OTHER COMMENTS :

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Université Nice SOPHIA ANTIPOLIS

Charter of Thesis of the Erasmus Mundus International Relativistic Astrophysics

Foreword :

- On the occasion of the first registration of the IRAP PhD, a free agreement between the PhD student, his supervisor, the Director of the Institution where the thesis will be done and the director of the IRAP PhD must be signed.
- This agreement defines the rights and duties of all the parts written in the articles below. The objective of this Charter is to make aware, to inform and to give responsibilities to the different actors and to define the role and the responsibilities of everyone.

This text will be publicized for the students in Master 2 degree who wish to candidate to our PhD.

Article 1 : Information for the PhD student

1.1 Before the enrollement

During the first semester of the Master 2, the director of the Faculty must inform the student by **written brochures** about :

- the activities of the EMJDs PhD School (role, regulation)
- the team of PhD students (flow chart, number of PhD thesis, list of arguments discussed in the last three years);
- the criteria to stand as a candidate (English as language of PhD, ability to follow research activities) .

1.2 During the PhD registration

The PhD supervisor must inform his student about the number of other PhD students under his responsibilities. And also the PhD thesis presented in the last three years.

Article 2 : Subject of PhD thesis

The PhD super and the PhD student define in a common agreement the topic of the thesis, as well as the host laboratory where the thesis will be done. They must take into account the legal duration of three years which is our reference.

In order to facilitate the beginning of the research, the PhD supervisor will give his student some references in bibliography and also some information.

Article 3 : Career

The preparation of the thesis will be part of a professional and personal project for the PhD student. In order to prepare the career of the PhD student, the student is recommended to discuss this aspect early in his thesis. The Faculty will inform the PhD students about the possibilities to be enrolled in academic or non academic institutions. During the last year of PhD thesis, the Faculty has organized an Institutional visit to all Students in order to prepare the career of their PhD students.

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Article 4. Duration

The duration of the PhD thesis is 3 years as the employment contract. At the end of the second year, during audition of the PhD students, the faculty will prepare the PhD defense for each students in collaboration with the PhD supervisor.

An exceptional delay could be possible after submission to the Faculty.

In any case the PhD thesis must be accompanied to the annual registration to the University of Nice as EMJD Doctorate in Ecole Doctorale de Nice Sciences Fondamentales et Appliquees.

Article 5. Supervision of the PhD thesis

a) The PhD supervisor will dedicate a meaningful part of his time to his PhD student. The principle of regular discussion will be decided on the occasion of the signature of the present document. He will follow regularly the progress of his student and will inform the PhD student to the future direction he could choose according to the work already done. He must inform his student about the positive or negative response that his work could caused during the PhD defense.

b) The PhD student must get involved and must give his supervisor some notes related to his progress and must present his work to the laboratory seminar. He must also inform his PhD supervisor about the difficulties he encounters and about the advancement of his thesis.

c) The PhD student must follow the rule edited by the Faculty. He must follow all the lecture and seminars proposed by the Faculty.

Article 6. Inside the laboratory host

The supervisor must define all the need in order to assure the success of the PhD thesis of his student. In this case the student is part of the laboratory where his thesis will be developed. He is a non-permanent PhD student. He will benefit of the same facilities as the researcher in order to realized his work: computer connection, documentation, possibilities to attend seminar; in the limit of the possibilities of the laboratory. The PhD student, on the other hand, must respect the rule of the laboratory where he is hosted.

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Article 7. Development of the PhD thesis

The PhD supervisor encourages his student to present his work during seminars and conference and also to publish his result in scientific revues.

Article 8. Activities of the EMJD PhD School

In order to facilitate the professional employment, the PhD student will received lectures on high scientific level, two languages courses (English and a local language), and also transversal activities during all the period of the PhD thesis.

Article 9. Post-thesis

In order to provide information about job opportunities to future students, each student will inform the supervisor as well as the responsible for the PhD, about his career during a period of 5 years after the PhD thesis.

Signature of the PhD supervisor:

Signature of the PhD student:

IRAP PHD

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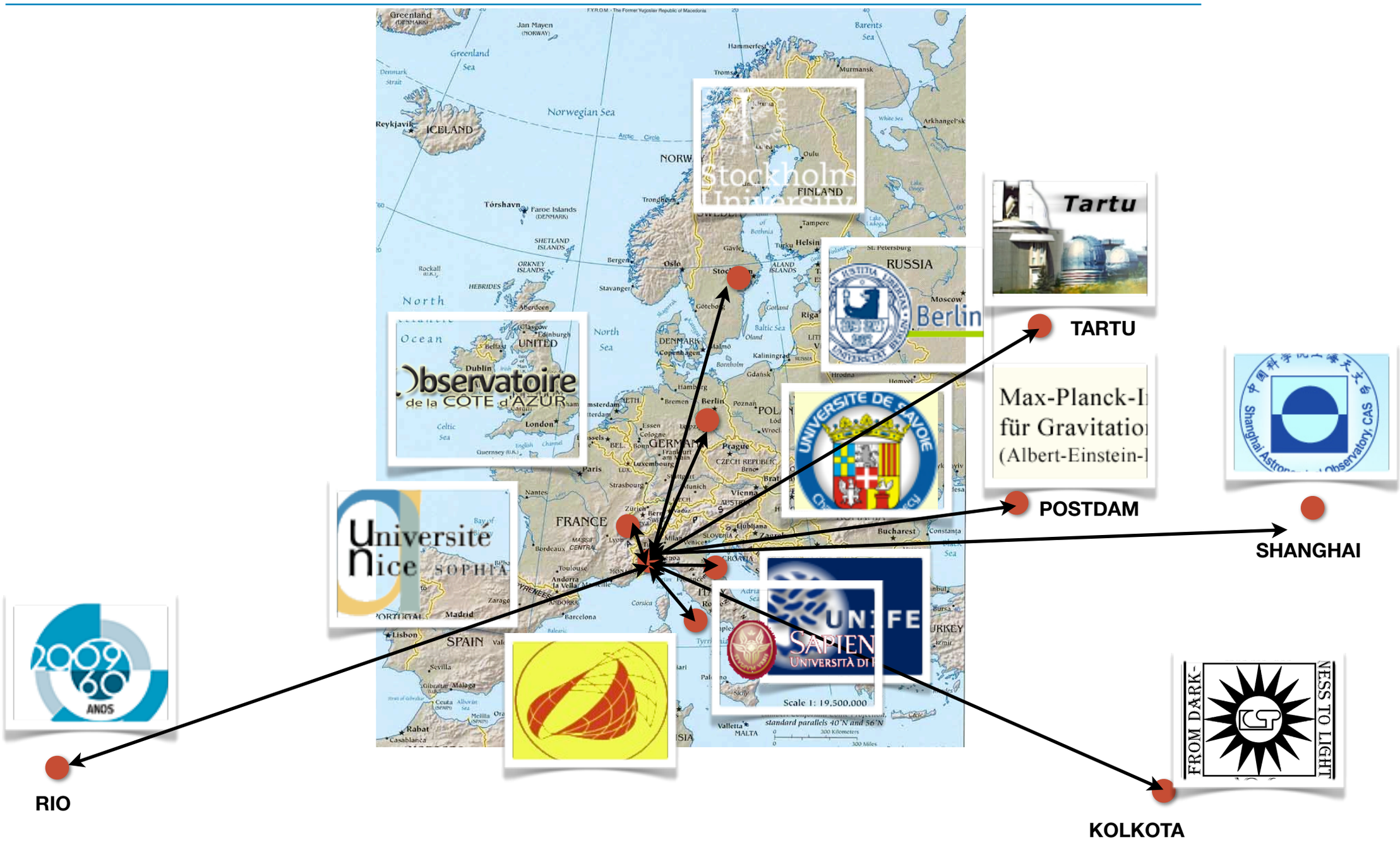
IRAP PHD MOBILITY

ACTIVITY LIST



YEAR	PERIOD	ACTIVITIES	LOCATION	DURATION	NOTES	MARK
First	Begin	High Level Courses	Roma	1 month	Lectures on relativistic astrophysics	10%
First	Middle	High Level Courses	Nice	1 month	Lectures on astrophysics and professional courses	10%
First	End	High Level Courses	Berlin	1 month	Quantum Field Theories and cosmology	10%
First	every week	Language Courses	Each Institution	1 hour	Local Language in each Instituttion	5%
Second	every week	Language Courses	Each Institution	1 hour	Local Language in each Instituttion	5%
Second	Begin	Project Management + Courses	OCA + Ferrara	1 month	Planetology, Extragalactic Astronomy, Data Analysis	10%
Second	Middle	High Level Courses	Rome	1 month	Lectures on relativistic astrophysics	10%
Second	End	High Level Courses	Stockholm	1 month	General relativity and gravitational collapse	10%
Third	every week	Language Courses	Each Institution	2 hours	Local Language in each Instituttion	10%
Third	End	Pre-post doc	one institution/ one student	1 month	Presentation of research activities in an other lab	20%

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LECTURES PROPOSED IN ERASMUS MUNDUS IRAP PHD

Panel of high level courses (10 hours each) for the PhD students within Professors of our Network Institutions
The Faculty will organized the training weeks for the PhD Students choosing inside these possibilities

CORE LECTURES

COURSES	PROFESSORS	YEAR PHD
ULTRA HIGH ENERGY GAMMA RAY SOURCES	Felix AHARONIAN (ICRANET & MAX PLANCK)	FIRST
THE APPROACH TO THE SINGULARITY	Vladimir BELINSKI (ICRANET)	FIRST
RELATIVISTIC EFFECTS IN GRBS	Carlo BIANCO (ICRANET)	FIRST
ACCRETIONS ON BLACK HOLES AND NEUTRONS STARS	Sandip CHAKRABARTI (Indian Centre for Space Physics)	FIRST
PARTICLE PHYSICS APPLIED TO ASTROPHYSICS	Pascal CHARDONNET (SAVOIE UNIVERSITY)	FIRST
EXOBIOLOGY	Sandip CHAKRABARTI (IINDIAN CENTRE FOR SPACE PHYSICS)	SECOND
GENERAL RELATIVITY	Thibault DAMOUR (ICRANET & IHES)	FIRST
LARGE SCALE STRUCTURE OF THE UNIVERSE	Jaan EINASTO (ICRANET AND TARTU OBSERVATORY)	SECOND
SIGNAL TREATMENT	Andrea FERRARI (NICE UNIVERSITY)	SECOND
X-RAYS AND GAMMA RAYS ASTRONOMY	Filippo FRONTERA (FERRARA UNIVERSITY)	FIRST
X RAYS CLUSTERS	Riccardo GIACCONI (ICRANET)	SECOND
PLANETOLOGY	Tristan GUILLOT (OBSERVATOIRE DE LA COTE D'AZUR)	SECOND
FORMATION OF GALAXIES	Ypeng JING (SHANGHAI OBSERVATORY)	SECOND
ON THE KERR SOLUTION	Roy KERR (ICRANET)	FIRST
RELATIVISTIC FIELD THEORY	Hagen KLEINERT (FREIE UNIVERSITY BERLIN)	FIRST
PLANETOLOGY	Alessandro MORBIDELLI (OBSERVATOIRE DE LA COTE D'AZUR)	SECOND
DEVELOPMENT ON BKL WORK	Hermann NICOLAI (EINSTEIN INSTITUTE POTSDAM)	SECOND
NON SINGULAR COSMOLOGY	Mario NOVELLO (CBPF BRAZIL)	FIRST
EXTRAGALACTIC ASTROPHYSICS	Jose PACHECO (OBSERVATOIRE DE LA COTE D'AZUR)	FIRST
GRAVITATIONAL WAVES	Tania REGIMBAU (OBSERVATOIRE DE LA COTE D'AZUR)	SECOND
SINGULARITIES AND GENERAL RELATIVITY	Kjell ROSQUIST (STOCKHOLM UNIVERSITY)	SECOND
BLACK HOLES AND FUNDAMENTAL PHYSICS	Remo RUFFINI (ICRANET AND ROMA LA SAPIENZA)	FIRST
THERMALIZATION AND COLLECTIVE EFFECTS IN ASTROPHYSICS	Gregory VERESHCHAGIN (ICRANET)	SECOND
GRAVITATIONAL WAVES	Jean-Yves VINET (OBSERVATOIRE DE LA COTE D'AZUR)	SECOND
ULTRA RELATIVISTIC ELECTRON POSITRON PLASMA	She-Sheng XUE (ICRANET)	SECOND

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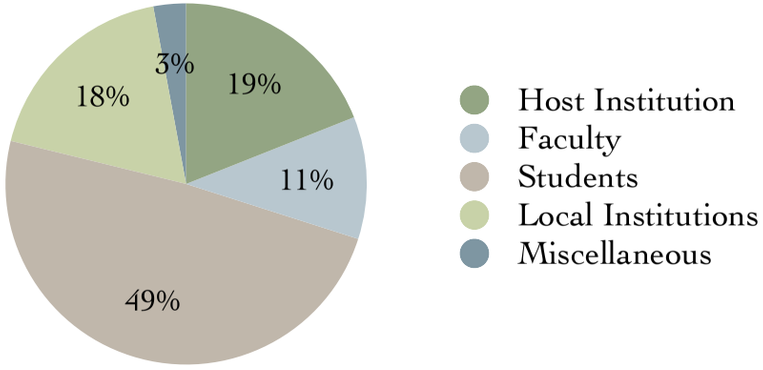
FINANCIAL BALANCE IRAP PHD

Expenditure by Category



ACCOUNT CATEGORIES

Category	Amount	
Host Institution	€	(26,000.00)
Faculty	€	(15,000.00)
Students	€	(67,000.00)
Local Institutions	€	(25,000.00)
Miscellaneous	€	(4,000.00)
Total	**€**	**(137,000.00)**

TRANSACTIONS

			Beginning Balance		**€136,400.00**
Type	**Description**	**Category**	**Amount**		**Balance**
101	Secretary	Host Institution	€	(26,000.00)	€ 110,400.00
102	Faculty Administration/Research	Faculty	€	(13,000.00)	€ 97,400.00
103	Quality Board	Faculty	€	(2,000.00)	€ 95,400.00
104	Mobility Students	Students	€	(30,000.00)	€ 65,400.00
105	Transversal Activities Students	Students	€	(30,000.00)	€ 35,400.00
105	Courses Students	Students	€	(2,000.00)	€ 33,400.00
100	Insurance Students	Students	€	(5,000.00)	€ 28,400.00
106	Communication PhD	Miscellaneous	€	(2,000.00)	€ 26,400.00
107	Administrative management	Miscellaneous	€	(2,000.00)	€ 24,400.00
108	Refund to Network Organization	Local Institutions	€	(25,000.00)	€ (600.00)

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INTERNATIONAL AGREEMENT ON INTERUNIVERSITY COOPERATION

Between the following institutions :

- **University of Rome "La Sapienza" (Italy),**
- **"Free University" of Berlin (Germany),**
- **University of Savoie (France),**
- **ETH of Zurich (Switzerland),**
- **University of Nice Sophia Antipolis (France),**
- **Côte d'Azur Observatory - Nice (France).**

- **Given that qualified cultural and scientific exchange is indispensable to universities in developing their educational and research activities,**

- **Given that, for the above stated purpose, it is necessary to promote and encourage direct cultural agreements between institutions of higher learning in different countries,**

- **Having considered the University central role in developing European cultural dimension and increasing the international competitiveness of the European higher education system,**

- **In accordance with the laws of the countries involved and, in particular, as regards Italy, with D.P.R. N° 382 / 1980 and specifically with article 91 as modified by article 12 of law 705 / 1985 and with the Interministerial Decree of February 10, 1988 on the question of international cooperation, with the law 168/89, and with the guidelines given by the Italian ministry of University and Technological Research with letter n° 1581 of July 27, 2001,**

- **Taking into account the Bologna Declaration of June 19, 1999 and the Prague Declaration of 19 May 2001.**

THE FOLLOWING TERMS OF AGREEMENT ARE STIPULATED :

Article I **The contracting parties, by means of this Agreement, commit themselves to carry out jointly the Project "International Ph. D. Program in Relativistic Astrophysics (IRAP Ph.D.", whose statute is the object of a Special Agreement, here enclosed. The coordinator of this Project is Professor Remo Ruffini of the University of Rome "La Sapienza" and President of the International Center for Relativistic Astrophysics (ICRA).**

Article II In accordance to article I the contracting parties may undertake :

1- Exchange visits between members of the teaching, research and administrative staff involved in the project. This exchange aims at promoting seminars, courses, conferences, lectures, at carrying out joint research projects, at discussing experiences in fields of common interest.

2- The exchange of publications and informations on the specific fields of study involved in this agreement and on any other subject of relevant interest.

3- The exchange of Ph.D.students for the purpose of attending courses, participating in professional training programs, specializing or performing other educational or training activities.

Ph.D. students who participate in courses, training programs, specialization programs, or other educational or training activities will receive full recognition as expressed in the joint Special Agreement.

Article III Each of the parties, in conformity with its own laws and regulations, will provide the Ph. D students sent by the other party in accordance with the terms of this agreement, with all possible assistance and facilities in the host country to enable them to carry out the activities agreed upon.

Article IV It is necessary for the foreign PhD student to acquire an insurance policy according to rules in force at the host University

Article V The present Agreement will become effective from the date of signature of all parties approval and will be tacitly extended until the conclusion of the Project.

Article VI Should any disputes arise, the problem will be entrusted to a board of arbiters composed of one member chosen by each of the parties and one member chosen by common consent.

Article VII If necessary, the present Agreement can be integrated by specific Annexes.

This Agreement is written in English and French, both versions being equally faithful.

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ACCORD DE COOPERATION INTERUNIVERSITAIRE

INTERNATIONALE

entre

les établissements suivants :

- **Université de Rome "La Sapienza" (Italie),**
- **Université Libre de Berlin (Allemagne),**
- **Université de Savoie (France),**
- **ETH de Zurich (Suisse),**
- **Université de Nice Sophia Antipolis (France),**
- **Observatoire de la Côte d'Azur - Nice (France).**

- **Etant donné que les échanges culturels et scientifiques sont nécessaires pour que les universités puissent développer leurs activités d'éducation et de recherche,**

- **Etant donné que , pour l'objectif énoncé ci-dessus, il est nécessaire de promouvoir et d'encourager des accords culturels directs entre des institutions de niveau universitaire dans les différents pays,**

- **Ayant considéré le rôle central joué par les universités dans le développement d'une dimension culturelle européenne et dans la croissance de la compétitivité internationale du système d'éducation européen de haut niveau,**

- **En accord avec les lois des pays contractants, particulièrement en ce qui concerne l'Italie, avec la D.P.R. n° 382 / 1980 et spécialement avec l'article 91, modifié par l'article 12 de la loi 705 / 1985, et avec le Décret interministériel du 10 Février 1988 sur la question de la coopération internationale, avec la loi 168/89 et avec les lignes directrices données par le Ministère Italien des Universités et de la Recherche Technologique avec la lettre n° 1581 du 27 Juillet 2001,**

- **Prenant en compte la Déclaration de Bologne du 19 Juin 1999 et la Declaration de Prague du 19 May 2001,**

LES POINTS SUIVANTS DE L'ACCORD SONT STIPULES :

<u>Article I</u> **Les parties contractantes, au moyen de cet accord, s'engagent à réaliser ensemble le Projet "Doctorat International en Astrophysique Relativiste (IRAP Ph.D.)" dont le statut est prévu par une convention particulière ci-jointe. Le coordinateur de ce projet est le professeur Remo Ruffini de l'Université de Rome "La Sapienza" et Président du Centre International d'Astrophysique Relativiste (ICRA).**

Article II En accord avec l'article I les parties contractantes peuvent entreprendre :

1- Des visites d'échange entre les membres des équipes d'enseignement, de recherche et administratives afin de favoriser la promotion de séminaires, de cours, de conférences, de réaliser des projets de recherche en commun, de discuter des expériences dans des domaines d'intérêt commun.

2- L'échange de publications et d'information dans les domaines spécifiques d'étude mentionnés dans cet accord et sur tout autre sujet en rapport.

3- L'échange d'étudiants de Ph. D. ou 3ème Cycle pour qu'ils puissent suivre des cours, participer à des programmes de formation professionnelle, se spécialiser ou effectuer d'autres activités d'éducation ou de formation.

Les étudiants de Ph. D. ou 3ème Cycle bénéficiant d'échanges pour suivre des cours ou participer à des programmes de formation ou de spécialisation vont recevoir les crédits académiques pour leurs études comme prévue dans la convention particulière ci-jointe

Article III Chaque partie, en conformité avec ses propres lois et règles, fournira aux étudiants de Ph. D. ou 3ème envoyés par une autre partie conformément aux termes de cet accord, toute l'assistance possible et toutes les facilités dans le pays hôte pour réaliser les activités convenues ci-dessus.

Article IV Il est indispensable que les étudiants étrangers bénéficient d'une couverture sociale selon les règles en vigueur dans le pays de l'Institution d'Accueil

Article V Le présent accord deviendra effectif à la date de signature de toutes les parties et sera reconduit tacitement jusqu'à la fin du Projet.

Article VI En cas de désaccord, le problème sera confié à un comité d'arbitres composé d'un membre choisi par chacune des parties et d'un membre choisi par consentement mutuel.

Article VII Si nécessaire, le présent accord sera intégré dans des annexes spécifiques.

Rédigé en français et anglais, les deux langues officielles de référence.

-=-=-=-=-=-=-=-=-=-=-=-=-=-

- The Rector of the University of Rome "La Sapienza"

- The Rector of the "Free University" of Berlin

- The President of the University of Savoie

Pour le Président et par délégation,
le Vice-Président du Conseil Scientifique,

Laurent FOULLOY

- The Rector of the ETH of Zurich

- The President of the University of Nice Sophia Antipolis

- The Director of the Côte d'Azur Observatory

Observatoire de la Côte d'Azur
Le Directeur,

Jacques COLIN

Special Agreement on the
International PhD Program in Relativistic Astrophysics.
(IRAP PhD)

Preamble

The Free University of Berlin, under the Presidency of Prof. P. Gaethgens, represented by Prof. H. Kleinert,

The ETH of Zurich, under the Rectorate of Prof. K. Osterwalder represented by Prof. Demetrios Christodoulou,

The University of Nice Sophia Antipolis represented by the President Prof. G. Gourdet,

The Observatoire de la Côte d'Azur represented by the Director Prof. J. Colin,

The University of Rome "La Sapienza", under the Rectorate of Prof. G. D'Ascenzo, represented by Prof. R. Ruffini,

The University of Savoie, under the Presidency of Prof. J. P. Perrot represented by Dr. P. Chardonnet ,

These institutions, in the following indicated as the "Member institutions",

in consideration of the enclosed agreement, of the common scientific interests and of the benefits for all institutions deriving from a scientific and educational collaboration,

aiming to the realization of a common International Relativistic Astrophysics Programme PhD" (IRAP PhD),

recognizing that the IRAP PhD will be organized in three years cycles ending with the academic PhD title delivered and recognized by all Member Institutions,

decide to sign this Agreement of academic and scientific co-operation, containing the following clauses:

Art. 1
Purpose and duration of the agreement of scientific and educational co-operation.

i) The Member Institutions collaborate to realize IRAP PhD starting from the academic year 2002-2003,

ii) Each IRAP PhD cycle will be organized as follows: three years dedicated to research and course work. The teaching activities will be located in one of the Member institutions in the following indicated as "host Institution".

iii) Each IRAP PhD student will, in principle, spend from six to eighteen months in at least two Member Institutions different from the host Institution in order to accomplish his research program.

Art. 2
The Faculty of the IRAP PhD.

i) The Faculty will be composed by at least one representative of each Member Institution, with University professor or equivalent teaching title (for example HDR).

ii) The Faculty meetings are held at the host Institution; if necessary, the meeting can be also held through electronic mail;

iii) the Faculty decides with a majority vote the host Institution for each cycle, chosen among the candidate Member Institutions;

iv) the Faculty will decide on the activities of the IRAP PhD and on the career of the students; in particular:
    a) deliberates on the teaching courses to activate, and on the teachers of the courses
    b) at the beginning of each academic year, approves the annual research program presented by the students;
    c) in relation with the research program approved for each student nominates a tutor belonging to a Member Institution;
    d) at the end of each academic year, on the basis of the tutor report, decides on the pursuit or on the exclusion of the student from the IRAP PhD; in case of motivated exclusion, the fellowship cannot more be bestowed;
    e) decides on the admission of the student to the final examination on the ground of reports on the study activities and research results pursued by the candidate. Such a report is written by the tutor and by two professors belonging to Universities located in countries different from the one of the host institution;

Art. 3
Number of fellowships.

The member institutions agree:

1. The optimal number of students in the IRAP PhD program is of the order of ten. Each students will be supported by a three years fellowship

2. They will each commit to find the financial support for half of the fellowships.

3. They will jointly find financial support for the remaining fellowships via regional, national, and supranational institutions

Art. 4
Supervision

Each party will optimize the working environment along the local standard procedures of supervising the research

Art. 5
Admission requirements.

i) In order to be admitted at the IRAP PhD, applicants must possess a DEA or Master of Research (France), a Laurea or a Laurea Specialistica (Italy), a Physikdiplom (Germany or Switzerland) or equivalent.

ii) the equivalence of the academic title possessed by the applicant is validated by the Faculty.

iii) Applicants must enclose at least one recommendation letter signed by an internationally recognized scientist.

Art. 6
Admission deadline.

Complete applications should be received at the host Institution by October 15 of each Year.

Art. 7
Admission procedure

i) The committee for the admission and the award of the fellowships, proposed by

the Faculty, is formed by three members belonging to the Member Institutions. It is nominated by the Rector or President or Director of the host Institution;

ii) The committee examine the applications, verify their validity and fixes the day of the examination of the students selected, within 30 days from the nomination of the committee.

iii) The procedure consists of an oral interview with the purpose of verifying, the scientific background of the applicant.

iv) The committee proposes a list of fellowships on the bases of the qualifications of the applicants.

Art. 8
Ph.D. thesis defense and Ph.D. diploma delivery.

i) The PhD thesis defense is held in the host Institution.The examination Committee for each student, is formed by the tutor, four Professors of the Member Institutions and an expert from a University or a Research Center from a country different from the one of the host institution. The examination Committee is appointed by the Faculty.

ii) The judgement of the examination Committee is transmitted to the Rector, the President or the Director of the host Institution. In case of positive judgement, the candidate receives the PhD degree from all the Member Institutions.

Art. 9
Official language.

English and French are the official languages of the IRAP PhD. The thesis is written in the language of the host Institution. The student during the discussion of the thesis has to show the knowledge of at least an additional language different from the one of the host Institution.

Art. 10
Medical assistance and Insurance.

It is necessary for the foreign PhD student to acquire an insurance policy according to rules in force in the country of the host University.

Art. 11
Duration of the agreement.

The present agreement has a duration of three years from the date it is signed,

and is automatically renewed, unless the explicit expression of the contrary by a Member Institution.

Art. 12
Arbitration.

In case of disagreements wich could occur in applying the present agreement, the parties will find an amicable solution.

Signed in Nice the 24 May 2002

For the President of free University of Berlin

For the Rector of ETH of Zurich

For the President of University of Nice Sophia-Antipolis

UNIVERSITE DE NICE-SOPHIA ANTIPOLIS 1.1.1996

For the Director of Observatoire de la Côte d'Azur

For the Rector of University of Roma "La Sapienza"

For the President of University of Savoie

Convention particulière du
Doctorat International en Astrophysique Relativiste
(IRAP PhD)

Préambule

L' Université Libre de Berlin, sous la présidence du Prof. P.Gaethgens, représentée par le Prof. H. Kleinert,

L' Institut ETH de Zurich, sous la présidence du Prof. K.Osterwalder, représenté par le Prof. D. Christodoulou,

L' Université de Nice Sophia Antipolis, représentée par Madame la Présidente G. Gourdet,

L' Observatoire de la Côte d'Azur, représenté par Monsieur le Directeur J.Colin,

L' Université de Rome "La Sapienza", sous le Rectorat du Prof. G. D'Ascenzo, représentée par le Prof. R. Ruffini,

L' Université de Savoie, sous la présidence du Prof. J.P. Perrot, représentée par le Dr. P. Chardonnet,

Ces institutions indiquées ci-après comme "Institutions Membres",

En référence à la convention cadre ci-jointe et au vu d'un intérêt scientifique commun et au vu du bénéfice provenant d'une collaboration scientifique et en matière d'enseignement dans la réalisation d'un Doctorat International en Astrophysique Relativiste (désigné ci-après comme "Doctorat IRAP"),

étant reconnu que le Doctorat IRAP sera organisé en un cycle de trois années sanctionné par un diplôme de Doctorat reconnu par toutes les Institutions Membres,

décident de signer le présent accord de coopération scientifique et en matière d'enseignement supérieur contenant les clauses suivantes:

Art. 1
Objectif et durée de cet accord de coopération scientifique et d'éducation

i) Les Institutions Membres collaborent dans le but de mettre en place ce Doctorat International IRAP qui débutera à la rentrée universitaire 2002-2003;

ii) Le cycle du Doctorat IRAP est organisé de la façon suivante : trois années seront dédiées aux activités de recherche. Des cours, répartis sur ces trois années, auront lieu dans l'un des centres des Institutions Membres, désignée ci-après comme "Institution d'Accueil".

Art. 2
Le collège des professeurs du Doctorat IRAP.

i) Ce collège sera composé au moins par un membre de chaque institution participant au programme de doctorat international comme professeur d'université ou avec un grade équivalent (par exemple HDR).

ii) Les réunions du collège des professeurs se tiendront dans l'Institution d' Accueil ou éventuellement par courrier électronique.

iii) Le collège des professeurs décide à la majorité des voix le choix de l'Institution d'Accueil pour chaque cycle, parmi les Institutions Membres.

iv) Le collège des professeurs décidera du programme du Doctorat IRAP ainsi que la scolarité des étudiants, en particulier :

a) délibèrera sur le choix des cours et des enseignants
b) en début de chaque année universitaire, il approuvera le programme de recherche présenté par les étudiants.
c) en liaison avec le programme de recherche de chaque étudiant, il nommera un tuteur appartenant à une des Institutions Membres.
d) à la fin de chaque année universitaire, sur la base des rapports de ces deux tuteurs, le collège des professeurs décidera le maintien ou non de l'étudiant à l'intérieur du Doctorat IRAP, dans des cas motivés d'exclusion, la bourse ne sera plus attribuée.
e) il décidera de l'admission des étudiants à l'examen final et, dans le cas de réussite des étudiants, préparera un rapport sur les cours suivis et les résultats de recherche des candidats. Ce rapport sera écrit par le tuteur et par deux professeurs appartenant à des Universités situées dans des pays différents de l'Institution d'Accueil.

Art. 3

Nombre de Bourses.

Les signataires conviennent:

1. Le nombre optimal d'étudiants dans le doctorat IRAP est de l'ordre de dix. Chaque étudiant aura une bourse de trois ans.
2. de s'engager à trouver les financements nécessaires pour la moitié de ces bourses
3. de s'engager à chercher en commun le reste des financements auprès d'institutions régionales, nationales et supra-nationales.

Art. 4
Conditions d' accueil

Chacune des parties optimisera les conditions d'accueil selon les règles locales en vigueur.

Art. 5
Sélection des candidats

i) Dans le but d'être inscrit au Doctorat IRAP, les candidats doivent être titulaires d'un diplôme universitaire de DEA ou Master Recherche (France), Laurea ou Laurea Specialistica (Italie), Physikdiplom (Allemagne, Suisse) ou équivalent,

ii) l'équivalence des titres universitaires possédés par les candidats est reconnue par le collège des professeurs.

iii) les candidats doivent joindre à leur dossier au moins une lettre de recommandation émanant d'une personnalité scientifique reconnue.

Art. 6
Date limite de dépôt des dossiers

Les dossiers complets doivent arriver à l'Institution d'Accueil avant le 15 Octobre de chaque année.

Art. 7
Commission d'admission

i) La commission d'admission et d'attribution des bourses, composée de trois membres appartenant aux Institutions Membres, proposée par le collège des professeurs, est mise en place par le Président ou le Recteur ou Directeur de l'Institution d'Accueil.

ii) La commission examine les dossiers, vérifie leur validité et procède à l'audition des candidats retenus, dans les trente jours suivant sa constitution.

iii) L'entretien de sélection a pour but de vérifier les connaissances scientifiques des candidats.

iv) La commission rédige la liste des bénéficiaires des bourses attribuées par ordre de mérite des candidats.

Art. 8
Soutenance de la thèse IRAP et délivrance des diplômes

i) La soutenance de la thèse IRAP a lieu dans l'Université de l'Institution d'Accueil. Le jury de thèse est composé du tuteur, de quatre professeurs des Institutions Membres, d'un expert d'une Université ou d'un centre de recherche d'un pays différent de celui de l'Institution d'Accueil. Le jury est choisi par le collège des professeurs

ii) Le rapport de soutenance de thèse est transmis au Président, Recteur ou Directeur de l'Institution d'Accueil. Dans le cas favorable, le candidat reçoit son diplôme de Doctorat de toutes les Institutions Membres.

Art. 9
Langues Officielles

Les langues officielles sont l'anglais et le français. La thèse est écrite dans la langue du pays de l'Institution d'Accueil. Lors de sa soutenance, le candidat doit montrer la connaissance d'une langue différente de celle du pays de l'Institution d'Accueil.

Art. 10
Assurance et assistance médicale

Il est indispensable que les étudiants étrangers bénéficient d'une couverture sociale selon les règles en vigueur dans le pays de l'Institution d'Accueil.

Art. 11
Durée de la convention

La présente convention a une durée de trois ans à partir de la date de signature et est automatiquement renouvelé pour une durée identique, sauf choix contraire d'une des Institutions Membres.

Art. 12
Arbitrage.

En cas de contentieux, les parties conviennent de régler à l'amiable les difficultés ou désaccords pouvant naitre dans l'application de cette convention.

Fait à Nice le 24 Mai 2002,

- Pour le Président de l' Université Libre de Berlin

- Pour le Recteur de l'ETH de Zurich

- La Présidente de l'Université de Nice Sophia Antipolis

- Le Directeur de l'Observatoire de la Côte d'Azur

- Pour le Recteur de l'Université de Rome "La Sapienza"

- Pour le Président de l'Université de Savoie

IRAP PHD

ANNEXES

1. Community grants of Nice University with codes numbers
2. Application Form of the PhD
3. Charter Thesis
4. Mobility
5. Lectures
6. Budget
7. IRAP Agreement
8. Villa Ratti
9. Agreement Nice-ICRANet
10. Kolkota Meeting
11. Italian Korean Meeting
12. Sobral Meeting
13. Shanghai Meeting
14. Christchurch Meeting
15. Marcel Grossmann Meeting
16. 2008 Graduation Ceremony of IRAP PhD

IRAP PHD

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1. Community grants of Nice University with codes numbers
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CONVENTION ENTRE LE RESEAU INTERNATIONAL DE CENTRES D'ASTROPHYSIQUE RELATIVISTE (ICRANET) ET L'UNIVERSITE' DE NICE SOPHIA ANTIPOLIS

Préambule

- Considérant que les Universités sont le Centre principal de la recherche scientifique nationale et qu'il est de leur devoir d'élaborer et de transmettre de façon critique les connaissances scientifiques ainsi que de promouvoir des formes de collaboration avec des Institutions extra-universitaires de recherche, financées, en tout ou en partie, par l'Etat ou par des Organismes préposés au financement public de la recherche ;

- Considérant que, depuis 1985, auprès du Département de Physique de l'Université de Rome, « La Sapienza », œuvre le Consortium International d'Astrophysique Relativiste (ICRA) dont sont membres : l'Université de Nice Sophia Antipolis, le Space Telescope Institute de Baltimore (USA), l'International Center for Theoretical Physics (ICTP) de Trieste, la Third World Academy of Sciences (TWAS) de Trieste, la Specola Vaticana di Castelgandolfo (Cité du Vatican), la Stanford University de Stanford, Californie (USA), la Washington University of Seattle (USA), l'Université de Hofei (République Populaire de Chine) ;

- Considérant que ICRA a obtenu la reconnaissance de la personnalité juridique avec décret ministériel du 22 novembre 1991, enregistré à la Cour des Comptes le 24 juillet 1992, registre n°12, Université et recherche, feuille n°256 ;

- Considérant que, selon la Loi n° 31 du 10 février 2005 publiée dans la 3gazetto Ufficiale » n° 53 du 5 mars 2005, ICRANet est un Organisme de recherche ayant une personnalité juridique de droit public international, dont les membres fondateurs, outre la République d'Arménie, la République Italienne et l'Etat de la Cité du Vatican, sont les Universités d'Arizona et de Stanford aux Etats-Unis et l'ICRA en Italie;

- Considérant que, selon les articles 1 et 3 de son statut, ICRANet a comme but de promouvoir et d'exercer des activités de recherche au niveau national et international dans le domaine de l'Astrophysique relativiste, de l'étude des interactions physiques fondamentales et de leurs applications aux observations et expérimentations traitées dans l'espace, sur la Terre et dans des Laboratoires souterrains, et de promouvoir également le développement technologique ainsi que les coopérations et les échanges dans ces secteurs avec des réalités scientifiques, nationales et internationales ;

- Considérant que, selon l'art. 3 de son statut, ICRANet exerce aussi une activité de formation dans des disciplines d'intérêt, s'occupant de l'organisation et de la gestion d'écoles doctorales et de recherche post-doctorat, de séminaires, colloques et autres activités de support didactique et de diffusion des connaissances ;

- Considérant que ICRANet, selon l'art. 3 de son statut, prévoit le développement de nouveaux niveaux de communication électronique entre les Centres de Recherche ainsi que la coopération scientifique et le transfert technologique vers l'industrie ;

- Considérant que ICRANet cofinance le Doctorat International d'Astrophysique Relativiste (IRAP-PhD) auquel participent l'ETH Zurich, la Freie Universität Berlin, l'Observatoire de la Côte d'Azur, l'Université de Nice Sophia Antipolis, l'Università di Roma « La Sapienza », l'Université de Savoie et dont le statut a été souscrit par les Recteurs / Présidents respectifs ;

- Considérant que les activités de l'Université de Nice Sophia Antipolis, dans le domaine de l'astrophysique relativiste, de la physique astroparticulaire et de leurs interactions fondamentales, ainsi que la recherche et le développement technologique nécessaires à l'activité dans de tels secteurs, se déroulent essentiellement dans le Département de Physique ;

- Considérant que l'Université et ICRANet ont reconnu l'intérêt de la présence d'une section ICRANet au sein des Départements de Physique et de Mathématiques, afin d'assurer aux activités universitaires une contribution de haut niveau de la recherche scientifique avancée exercée par ICRANet et de favoriser leur coordination avec les activités de l'Université ;

- Tenu compte du fait que ICRANet s'engage à maintenir au plus haut degré scientifique et technique ses propres sections, à hauteur des moyens financiers dont il dispose, favorisant le développement des équipements et garantissant leur efficacité opérationnelle ;

- Considérant l'intérêt que l'Université accorde à l'activité de recherche expérimentale et théorique dans le domaine de l'astrophysique relativiste, de la physique astroparticulaire et de leurs interactions fondamentales, ainsi qu'à la recherche et au développement technologique nécessaires à l'activité dans de tels secteurs, exercée en son sein avec l'apport de ICRANet pour la réalisation de recherches auprès de la Section locale, le siège de Pescara, et les sièges associés auprès de la Cité du Vatican, de la République d'Arménie, de la République du Brésil et de l'Université d'Arizona et de Stanford aux USA;

- Tenu compte du fait que ICRANet entend favoriser la promotion et le développement des activités didactiques par des actions de soutien et de renforcement, en accordant une attention particulière aux doctorats de recherche auprès du Département de Physique, et contribuer ainsi à la préparation de figures professionnelles hautement qualifiées à travers le soutien aux cours de diplôme, de maîtrise, de perfectionnement, aux écoles de spécialisation et aux masters, et que cette action se réalisera grâce à l'emploi de ses propres ressources et laboratoires ainsi qu'à l'acquisition de ressources sur des programmes nationaux, internationaux et communautaires ;

ENTRE

l'Université de Nice Sophia Antipolis (ci-après désignée par Université) – en la personne de son Président M. Albert MAROUANI, né a Tunis le 30.12.1943 , autorisé par une délibération du Conseil d'Administration du 6 juillet 2006.

ET

Le Réseau International de Centres pour l'Astrophysique (ci-après désigné par ICRANet) en la personne de son Directeur M. Remo Ruffini, né à Briga Marittima (CN) le 17.05.1942, autorisé par une délibération du Comité de Direction du 23 mai 2006.

IL EST CONVENU DE CE QUI SUIT :

ART.1

1.1 – L'Université accueille la Section locale d'ICRANet (ci-après désigné par Section) au sein de son Département de Physique.

ART.2

2.1 – L'exécution de la présente convention est confiée, en ce qui concerne le Département, à son Directeur et, en ce qui concerne ICRANet, à son Directeur.

ART.3

3.1 – Les programmes annuels de recherche de la Section sont approuvés et financés par les Organismes de Direction de ICRANet, sur avis favorable du Directeur du Département en ce qui concerne la disponibilité de personnel, d'équipement et de locaux selon ce qui est prévu aux art.5 et 6 ci-après. La responsabilité de leur réalisation est confiée au Directeur de ICRANet.

ART.4

4.1 – Le Directeur de ICRANet communique chaque année au Directeur du Département les programmes de recherche approuvés et financés par ICRANet qui se dérouleront dans le cadre du Département.

4.2 – Au cas où le Département ou l'Université décideraient de réaliser des projets de recherche et d'organiser des laboratoires ou des centres pour exercer des activités ayant trait aux objectifs institutionnels de ICRANet avec un personnel et des fonds propres, ils s'engagent à le communiquer à la Section, dans le cadre de la présente convention, et à se consulter pour d'éventuelles réalisations communes.

ART.5

5.1 – Pour favoriser le développement de l'activité de recherche, avec l'accord préalable de son Directeur et dans la mesure où ses propres exigences de recherche le lui permettent, ICRANet permet au Département d'utiliser à titre gratuit ses équipements scientifiques et techniques et ses services techniques locaux, nationaux et internationaux.

5.2 – De même, dans la mesure où ses exigences didactiques et de recherche le lui permettent, le Directeur du Département permet à la Section d'utiliser les équipements scientifiques et techniques, les services techniques, le mobilier, les installations et les locaux appartenant àl'Université.

5.3 – L'utilisation, de la part de la Section et du Département, de ce qui est prévu aux alinéas précédents, est réglementée par les articles suivants.

5.4 – Les services techniques et les équipements scientifiques et techniques d'ICRANet mis à la disposition du Département sont indiqués dans l'Annexe n.1.

5.5 - Les services techniques et les équipements scientifiques et techniques, le mobilier, les installations du Département mis à la disposition d'ICRANet sont indiqués dans l'Annexe n.2.

5.6 – D'éventuelles variations aux Annexes 1 et 2 seront apportées conformément aux exigences de la Section et du Département avec l'accord préalable entre le Président et leDirecteur .

5.7 – Si, lors du développement de ses programmes, ICRANet devait estimer opportune l'installation au sein de l'Université de moyens de recherche nouveaux et importants ou d'instruments d'une grande importance technique et scientifique, les Parties se consulteront en vue d'une éventuelle réalisation commune des nouvelles initiatives, toujours après l'avis favorable du Président de l'Université.

5.8 – L'accomplissement d'interventions structurales, de mises aux normes ou d'entretien, nécessaires pour assurer, selon les lois en vigueur, la sécurité des infrastructures et des installations confiés à ICRANet, est à charge de l'Université.

Sans préjudice des responsabilités dont il est question aux points précédents, là où les Parties reconnaissent l'intérêt réciproque à procéder à la réalisation des interventions dont il est question dans cet alinéa à travers des actions conjointes, elles pourront établir les modalités d'intervention à travers des Accords spécifiques.

5.9 – Sans préjudice des autorisations requises réglementairement, l'Université peut consentir à ICRANet d'effectuer, avec l'accord formel préalable du Président et, éventuellement même aux frais de ICRANet, des modifications de destination d'usage et/ou des travaux de restauration de locaux, d'équipements et de mobilier mis à la disposition de la Section, afin d'une meilleure utilisation au profit de l'activité de recherche.

Dans ce cas, ICRANet est responsable de la sécurité relative à la phase de réalisation des travaux mentionnés ci-dessus, dans les lieux de travail et installations relatives, et à la fin des travaux, il est tenu de fournir à l'Université les déclarations nécessaires et certificats de conformité des équipements, les certificats de bon fonctionnement et toute autre documentation établie par les normes en vigueur.

ART. 6

6.1 – L'Université permet à la Section, selon le précédent art.5, l'utilisation des locaux indiqués dans l'Annexe n.3.

6.2 – D'éventuelles variations à l'Annexe 3 seront adoptées conformément aux exigences de la Section et du Département avec l'accord préalable entre le Président et le Directeur.

6.3 – ICRANet garantit la couverture d'une assurance pour les locaux dont il est question dans l'Annnexe 3, contre les risques de vol et incendie pour ses propres biens, ainsi que pour les risques de responsabilité civile.

ART.7

7.1 – L'Université met à la disposition d' ICRANet les services et utilités indiqués dans les Annexes n. 4 et n.5. D'éventuelles variations à ces Annexes seront adoptées conformément aux exigences de la Section et du Département avec l'accord préalable entre le Président et le Directeur.

7.2 – ICRANet versera au Département :

a) le remboursement des frais de téléphone effectués dans l'intérêt et pour le compte d'ICRANet sur présentation de pièces justificatives ;

b) le remboursement selon les tarifs en vigueur pour les groupes de recherche universitaires, des frais d'utilisation des moyens de calcul dont l'Université est entièrement propriétaire ;

c) le remboursement des frais pour l'utilisation de photocopieuses de l'Université, sur la base du nombre de copies effectuées ;

d) une contribution annuelle pour la bibliothèque, conformément aux pratiques en vigueur à l'université ; une telle contribution sera destinée à l'achat de livres et revues intéressant ICRANet et pourra être augmentée, d'année en année, d'une valeur moyenne égale à l'éventuelle augmentation du prix des livres et des périodiques intéressant les Parties, avec l'accord préalable entre le Département et la Section ;

e) une contribution annuelle restant à définir pour l'utilisation des services et utilités indiqués dans les Annexes n. 4 et n. 5 et pour les nécessités communes en matière d'hygiène et sécurité; cette contribution pourra être augmentée d'année en année, sur la base d'un taux d'inflation programmé, avec l'accord préalable entre l'Université et la Section ;

f) une contribution supplémentaire pour le cofinancement d'éventuels programmes de recherche, d'un intérêt national ou international élevé, impliquant un personnel universitaire associé, selon l'art. 10 ci-dessous, chargé de recherche, proposés par l'Université;

g) une contribution annuelle pour le financement de bourses de doctorat supplémentaires ;

h) une contribution annuelle pour le cofinancement, ne dépassant pas 50% du montant des bourses postdoctorales pour la collaboration à des activités de recherche, d'une durée non supérieure à 4 ans que l'Université délibère chaque année dans des secteurs d'intérêt pour ICRANet.

7.3 – Les remboursements et les contributions dont il est question dans cet article ne pourront cependant aucunement dépasser le montant annuel inscrit dans les chapitres respectifs du budget d' ICRANet.

ART.8

8.1 – Le montant des contributions dont il est question au précédent alinéa art.7.2, lettres g) et h), est déterminé chaque année par les Organismes de direction d' ICRANet, il est communiqué par le Directeur de ICRANet au Président de l'Université et ne comprend pas les coûts éventuels pour l'activation, l'accès ou la fréquentation de cours de doctorat ou de bourses d'études pour la recherche.

8.2 – Les montants versés afférents aux bourses de doctorat ou aux bourses d'études pour la recherche qui n'auront pas été activées ou qui, de toute façon, n'auront pas été octroyées entièrement ou en partie, seront restitués à ICRANet ou déduits du montant à verser l'année suivante, au choix de ICRANet.

8.3 – ICRANet assure, dans tous les cas, la couverture des bourses de doctorat et, à hauteur de sa quote-part, des bourses d'études pour la recherche activées selon cet article, même après l'échéance de la présente convention.

8.4 – Les Parties procèderont chaque année à stipuler des accords locaux sur tous les aspects afférents aux bourses d'études pour la recherche et aux bourses de doctorat activés avec la

contribution financière de ICRANet, et non expressément prévues par la loi ou par la présente convention.

ART.9

9.1 – L'Université constate qu'ICRANet développe ses propres programmes en employant son propre personnel ou un personnel dépendant d'autres Organismes en mission chez ICRANet.

9.2 – La liste du personnel dont il est question dans ce présent article, ainsi que toute variation, est transmise, le cas échéant, par le Directeur de ICRANet au Président de l'Université.

9.3 – L'Université permet au personnel d'ICRANet et au personnel dépendant d'autres Organismes en mission chez ICRANet, d'accéder au siège Universitaire selon les mêmes règles en vigueur pour le personnel universitaire.

ART.10

10.1 – Étant donné que les programmes de recherche d'ICRANet peuvent être d'un grand intérêt pour l'activité didactique se déroulant dans l'Université et pour le fonctionnement de l'activité institutionnelle de recherche du personnel universitaire affecté ainsi que pour l'activité didactique afférent, ICRANet pourra attribuer chaque année, au personnel susmentionné, avec l'accord de l'intéressé et l'avis favorable préalable l'Université, des fonctions de recherche, d'association et de collaboration technique gratuites, pour ses propres activités de recherche selon les modalités présentes dans le Règlement ICRANet.

10.2 – L'exécution des fonctions de recherche, d'association et de collaboration technique doit être compatible avec le plein accomplissement de la part des intéressés de leurs propres devoirs envers l'Université, dans le respect des dispositions en vigueur, sauf exonération de la fonction didactique selon le Règlement universitaire spécifique.

10.3 – ICRANet prévoit que son propre personnel, et le personnel dépendant d'autres Organismes en mission chez ICRANet, dans le respect des normes spécifiques de la Convention Collective National du Travail en vigueur, et sur demande de l'intéressé, puisse collaborer à l'activité didactique et scientifique de l'Université, selon les modalités réglementaires en vigueur.

10.4 – L'Université peut utiliser, dans le respect des normes en vigueur, le personnel ICRANet et le personnel dépendant d'autres Organismes en mission chez ICRANet, comme support à sa propre activité scientifique et didactique, sur autorisation préalable du Directeur de ICRANet et l'accord de l'intéressé.

10.5 – Dans le cadre de sa propre activité institutionnelle et dans le respect des dispositions en la matière, le personnel chercheur d'ICRANet, et le personnel dépendant d'autres Organismes en mission chez ICRANet, peut enseigner à l'Université selon les normes prévues par le reglèment de l'Université et peut faire partie des commissions d'examens et du jury de l'examen final des cours de licence, de maîtrise, de spécialisation et de doctorat de recherche. Il peut également faire partie des conseils de doctorat ainsi que des commissions d'admission au doctorat et des concours pour les bourses d'études pour la recherche.

Les Statuts universitaires déterminent les modalités selon lesquelles le personnel susdit participe aux délibérations relatives à la programmation des activités didactiques et scientifiques.

L'Université et ICRANet peuvent établir des conventions pour organiser des cours de formation permanente et/ou récurrente post-universitaire ou dans le cadre de la formation intégrée supérieure.

10.6 – Les professeurs et chercheurs de l'Université peuvent être détachés auprès d'ICRANet pour exercer, à des périodes prédéterminées, des activités de recherche, sur acceptation préalable de la structure d'accueil et l'autorisation des instances de l'université. Lors de la période de détachement, le personnel universitaire :

remplit ses fonctions didactiques et accadémiques selon ce qui est établi par l'Université ;

conserve son statut juridique, son traitement économique et le droit à la progression de sa carrière universitaire ;

il est tenu au respect des normes en vigueur dans la structure d'accueil en appliquant, dans ce but, les correspondances entre assistant, professeur adjoint et professeur universitaires et les catégories correspondantes prévues par les Nations Unies qui ont été adptées par ICRANet ;

il peut bénéficier de fonds de recherche de la structure d'accueil et peut participer à ses projets de recherche et d'activités de transfert technologique ;

il peut assumer des responsabilités d'organisation et de coordination d'activités de recherche auprès de la structure d'accueil.

Le personnel de recherche d'ICRANet peut être détaché auprès de l'Université pour exercer, lors de périodes prédéterminées, des activités de recherche non institutionnelles mais d'intérêt pour ICRANet, sur acceptation préalable de la structure d'accueil et autorisation d'ICRANet à laquelle il est attaché. Pendant cette période de détachement, le personnel d'ICRANet :

garde son statut juridique, son traitement économique et le droit de progression de carrière d'ICRANet ;

il est tenu au respect des normes en vigueur dans la structure d'accueil, appliquant dans ce but, les correspondances entre les catégories prévues par les Nations Unies qui ont été adoptées par ICRANe et celles d'assistant, de maître de conférence et de professeur universitaire ;

il peut bénéficier de fonds de recherche de la structure d'accueil et peut participer à ses projets de recherche et d'activités de transfert technologique ;

il peut assumer des responsabilités d'organisation et de coordination d'activités de recherche auprès de la structure d'accueil.

ART.11

11.1 – ICRANet identifie en son Directeur l'employeur auquel revient les obligations prévues par la la règlementation en vigueur pour ce qui concerne la sécurité et l'hygiène sur les lieux de travail.

De la même façon, l'Université identifie l'employeur en son Président. Les employeurs de l'Université et d'ICRANet, même par l'intermédiaire des responsables respectifs des services de prévention et de protection, échangent leurs informations sur les données rapportées dans les documents de sécurité à la suite de l'évaluation des risques.

ART.12

12.1 - ICRANet et l'Université s'engagent réciproquement à mentionner l'autre Partie dans toutes les oeuvres ou publications scientifiques relatives à leurs programmes d'activités exercés auprès d'une des Parties ou avec son concours dans le cadre la présente convention.

ART.13

13.1 - Les éventuelles controverses qui pourraient naître de l'application de la présente convention seront, de toute façon, réglées par un Collège arbitral composé du Recteur/Président de l'Université, du Directeur de ICRANet et d'un troisième membre nommé de commun accord.

ART.14

14.1 - La présente convention a une durée de 5 ans à commencer de la date de sa signature et pourra être renouvelée sur accord préalable des Parties.

ART.15

15.1 - Les Parties pourront résilier la présente convention au cas où interviendraient des faits ou des mesures qui changeraient les conditions qui ont été acceptées et rendraient impossible la réalisation des activités prévues.

ART.16

16.1 - La présente convention est rédigée en deux exemplaires originaux et ne sera enregistrée que, le cas échéant, par la Partie intéressée.

Fait à Nice, en deux exemplaires, le 4 septembre 2006

Le Président de l'Université
de Nice Sophia Antipolis

UNIVERSITE DE NICE - SOPHIA ANTIPOLIS 1996

Albert MAROUANI

Le Directeur d'ICRANet

Remo RUFFINI

ICRANet

Annexe n°1

Équipements scientifiques et techniques et Services techniques

d'ICRANet mis à la disposition du Département

a) Accès aux réseaux informatiques gérés par ICRANet
b) Accès aux centres de recherche et aux services techniques nationaux et internationaux d'ICRANet

Annexe n°2

Équipements scientifiques et techniques et Services techniques Mobilier et Installations

du Département mis à la disposition d'ICRANet

a) Mobilier des locaux mis à la disposition d'ICRANet
b) Entrepôt
c) Photocopieuses
d) Accès aux réseaux informatiques

Annexe n°3

Locaux du Département mis à la disposition d'ICRANet

Tous les locaux indiqués comme étant de la compétence d'ICRANet dans les planimétries ci-jointes.

Annexe n°4

Services du Département mis à la disposition d'ICRANet

a) Bibliothèque
b) Maintenance électrique
c) Nettoyage des locaux
d) Service de vigilance et de conciergerie (durant les heures d'ouverture du Département)
e) Documentation

Annexe n°5

Utilités du Département mis à la disposition d'ICRANet

a) Énergie électrique
b) Chauffage et climatisation
c) Installation téléphonique.

IRAP PHD

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Second Kolkata Conference on Observational Evidence of Black Holes in the Universe

Kolkata, February 10-17, 2008

Satellite Meeting jointly with ICRANET on

Black Holes, Neutron Stars and Gamma Ray Bursts

February 16-17th, 2008

After a very successful conference on the same topic in Kolkata ten years ago, it is time to update our knowledge on black holes. With that in mind, we are happy to announce the organization of the second meeting here again during Feb. 10th-15th, 2008. The present meeting is expected to be in a much bigger scale inviting workers from all cross-sections, who have anything to do with quantification or qualification of black holes (from quantum scale to quasars), theoretically or observationally. Thus, the conference will cover all aspects of the theoretical and observational results pertaining to the astrophysical stellar mass, intermediate mass and super-massive black holes, primordial black holes in cosmology, and mini-black holes in accelerators.
Kolkata, the popularly known as the City of Joy, also presented the community the most suitable phrase, namely, 'black hole' for these enigmatic objects.

The conference is organized by the Department of Astrophysics and Cosmology of S.N. Bose National Centre for Basic Sciences. To let visitors have a taste of Kolkata and surrounding regions amidst natural beauty, we are holding first three days of the conference in Vedic village and the last two days at Radisson Ffort, both being very attractive, and luxurious spa and resorts. On the way from one to the other we will have a short tour of the City of Joy and have a poolside Banquate at the Radisson fFort.

Following this meeting we will have a satellite meeting on Black Holes, Neutron Stars and Gamma Ray Bursts during 16-17th February. There will be a ~24 hr trip to Sundarban, the Delta of Ganges on the West Bengal Tourism boats.

Local Organizing Committee

Prof. S. K. Chakrabarti, SNBNCBS (Joint Convenor)
Dr. D. Gangopadhyay, SNBNCBS
Dr. A.S. Majumdar, SNBNCBS (Joint Convenor)
Dr. Kinsuk Acharayya, SNBNCBS
Dr. Samir Mandal, CSP
Dr. Anuj Nandi, CSP
Dr. Vipin Yadav, CSP

National Advisory Body

Prof. S.K. Chakrabarti (SNBNCBS)
Dr. D. Gangopadhyay (SNBNCBS)
Dr. A. S. Majumdar (SNBNCBS)
Prof. D. Bhattacharyya (IUCAA)
Dr. B. Mukhopadhyay (IISc)
Dr. I. Chattopadhyay (ARIES)
Dr. T. Das (HRI)

International Advisory Body

Prof. R.D. Blandford
Prof. F. Mirabel
Prof. R. Sunyeav
Prof. D. Molteni
Prof. K. Thorne
Prof. A. R. Rao
Prof. T. Belloni

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11TH ITALIAN-KOREAN SYMPOSIUM ON RELATIVISTIC ASTROPHYSICS

Year of Astronomy 2009 in Korea

THE SUN, THE STARS, THE UNIVERSE and GENERAL RELATIVITY

November 2-4, 2009 - Sogang University, Seoul Korea

This series of biannual symposia since 1987 has been boosting exchange of information and collaborations between Italian and Korean astrophysicists on new and hot issues in the field. This year's symposium will have a particular meaning to astrophysicists of both countries, celebration of two giants of each country in the early history of astronomy.

2009 is the 4th centennial anniversary for Galileo's celestial search using his invented telescope and two years ago Koreans also celebrated four hundred years for Hwang Lee, one of the most famous Confucius scholars, who used a celestial globe to understand the universe. It is needless to say that 2009 is the International Year of Astronomy endorsed by UN.

The symposium will cover astrophysics and cosmology, such as gamma ray bursts and compact stars, high energy cosmic rays, dark energy and dark matter, general relativity, black holes, and new physics related to cosmology. The organizers wish this symposium to deepen understanding not only astrophysics and cosmology but also culture.

Organizers:

- Sang Pyo Kim (Kunsan National University)
- Bum Hoon Lee (Sogang University)
- Remo Ruffini (Universita di Roma "Sapienza", ICRANet)
- George Smoot* (Ewha Womans University, IEU) **to be confirmed*

Local Organizing Committee:

- Changrim Ahn (Ewha Womans University)
- Inyong Cho (Seoul National University of Technology)
- Hangbae Kim (Hanyang University)
- Hyung Chan Kim (Chung Ju National University)

- Wontae Kim (Sogang University)
- Yoonbai Kim (Sungkyunkwan University)
- Hyung Won Lee (Inje University)
- Il Heung Park (Ewha Womans University)

Sponsoring Institutes and Organizations:

- Asia Pacific Center for Theoretical Physics (APCTP)
- Center for Quantum Space and Time (CQUeST)
- International Center for Relativistic Astrophysics Network (ICRANet)
- Institute for the Early Universe (IEU)
- Korea Astronomy and Space Science Institute (KASI)
- Consiglio Nazionale delle Ricerche (CNR)
- Italian Embassy
- Korea Science and Engineering Foundation (KOSEF)

IRAP PHD

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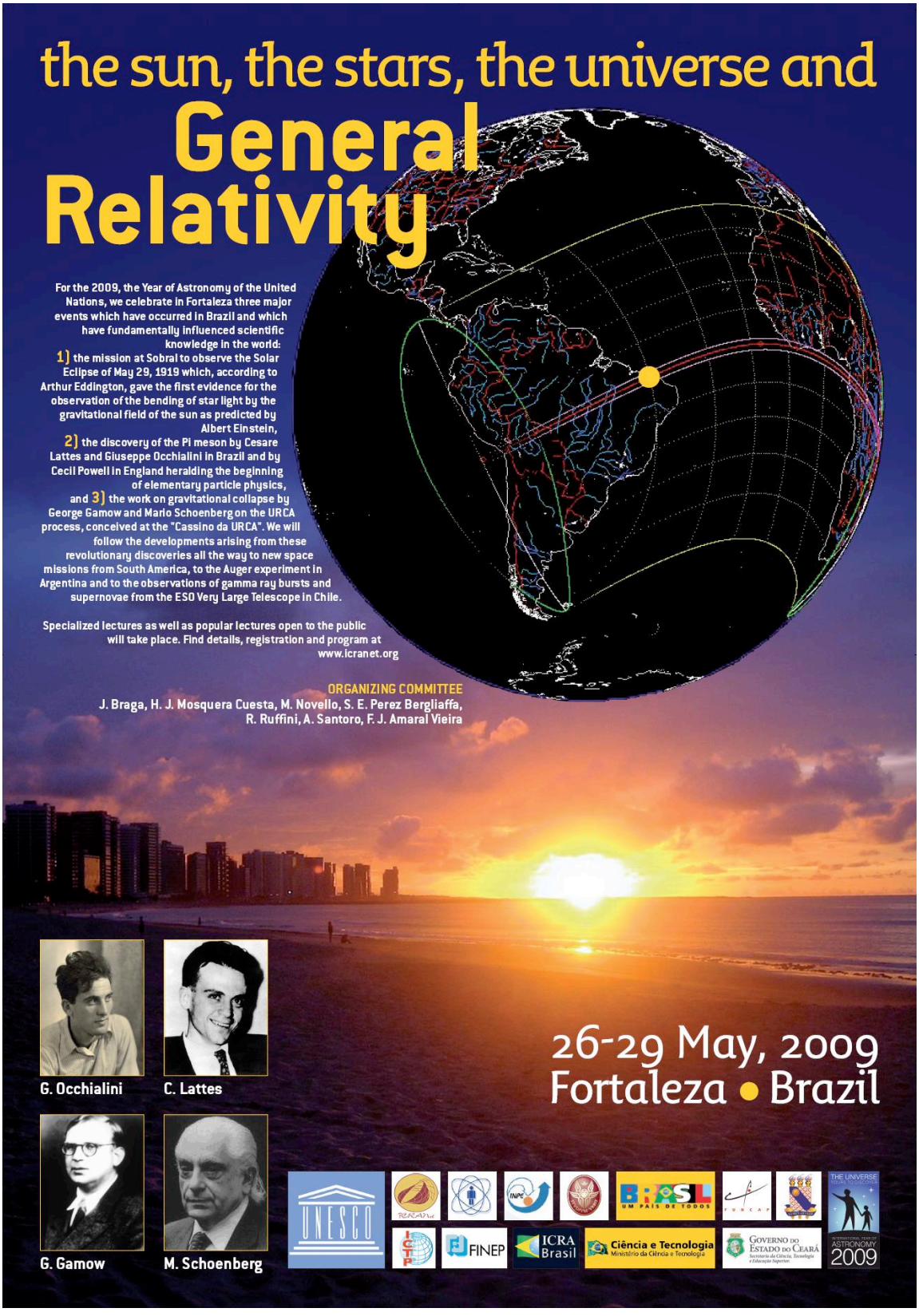
SOBRAL MEETING, MAY 26-29, 2009, FORTALEZA (CEARÁ), BRAZIL

Year of Astronomy 2009 in Brazil

THE SUN, THE STARS, THE UNIVERSE and GENERAL RELATIVITY

International Conference



For the 2009, the Year of Astronomy of the United Nations, we celebrate in Fortaleza (capital of the State of Ceará, Brazil) three major events which have occurred in Brazil and which have fundamentally influenced scientific knowledge in the world:

1. the mission at Sobral to observe the Solar Eclipse of May 29, 1919 which, according to Arthur Eddington, gave the first evidence for the observation of the bending of star light by the gravitational field of the sun as predicted by Albert Einstein,
2. the discovery of the Pi meson by Cesare Lattes and Giuseppe Occhialini in Brazil and by Cecil Powell in England heralding the beginning of elementary particle physics, and
3. the work on gravitational collapse by George Gamow and Mario Schoenberg on the URCA process, conceived at the "Cassino da URCA". We will follow the developments arising from these revolutionary discoveries all the way to new space missions from South America, to the Auger experiment in Argentina and to the observations of gamma ray bursts and supernovae from the ESO Very Large Telescope in Chile.

Specialized lectures as well as popular lectures open to the public will take place.

International Organizing Committee

Bergliaffa Perez, Santiago E. UERJ

Braga, Joao INPE

Mosquera Cuesta, Herman CBPF

Novello, Mario CBPF

Ruffini, Remo ICRANet

Santoro, Alberto UERJ

Vieira, F.J. Amaral CBPF

Local Organizing Committee

Almeida, Emerson F. UECE Fortaleza

Christiansen, Hugo UECE Fortaleza

Cunha, Marcony S. UECE Fortaleza

Tahin, Makaruis O. UECE Fortaleza

Vieira, J. Amaral CBPF

Preliminary Program

	Tuesday, 26 May From Sobral to the Solar Mission Chairman: J. Braga	Wesdnesday, 27 May From Lattes to Auger Chairman: A. Santoro	Thursday, 28 May Optical Observatories Chairman: M. Novello
08:30-09:00	**Opening remarks**		
09:00-09:45	**Francis Everitt** Stanford University - USA	**Alberto Santoro** UERJ - Brazil	**Thyrso Villela** AEB
09:45-10:30	**Mac Keiser** Stanford University - USA	**Posters Session**	**Felix Aharonian** HESS
10:30-11:00	**COFFEE BREAK**		
11:00-11:45	**Adriana Silva** U. Mackenzie - Brazil	**Tom Nash** LIGO - USA	**João Braga** INPE - Brazil
11:45-12:30	**R. Ruffini** ICRANet - Italy	**R. Shellard** CBPF - Brazil	**Alberto Rodriguez Ardila** SOAR
12:30-15:00	**LUNCH**		
14:30-15:15	**Pablo Laguna** Georgia Tech - USA	**Felix Mirabel** ESCO - Chile	**Mario Hamuy** University of Chile
15:15-16:00	**Luis F. Urrutia** Unam - Mexico	**Zulema Abraham** IAG-USP - Brazil	**Nelson Pinto Neto** ICRA-Br - Brazil
16:00-16:30	**COFFEE BREAK**		
16:30-17:15	**Luis Herrera** IVIC - Venezuela	**E. Gouveia dal Pino** IAG -USP - Brazil	**Hugo Christiansen** UECE - Brazil
17:15-18:00	**Alonso Sepulveda** University of Antioquia - Colombia	**O. Aguiar** INPE - Brazil	**L. Sodre** IAG - USP - Brazil
20:00-21:00	**Colloquium: R. Ruffini** ICRANet - Italy	**Colloquium: M. Novello** ICRA-Br - Brazil	**Closing** 19.00

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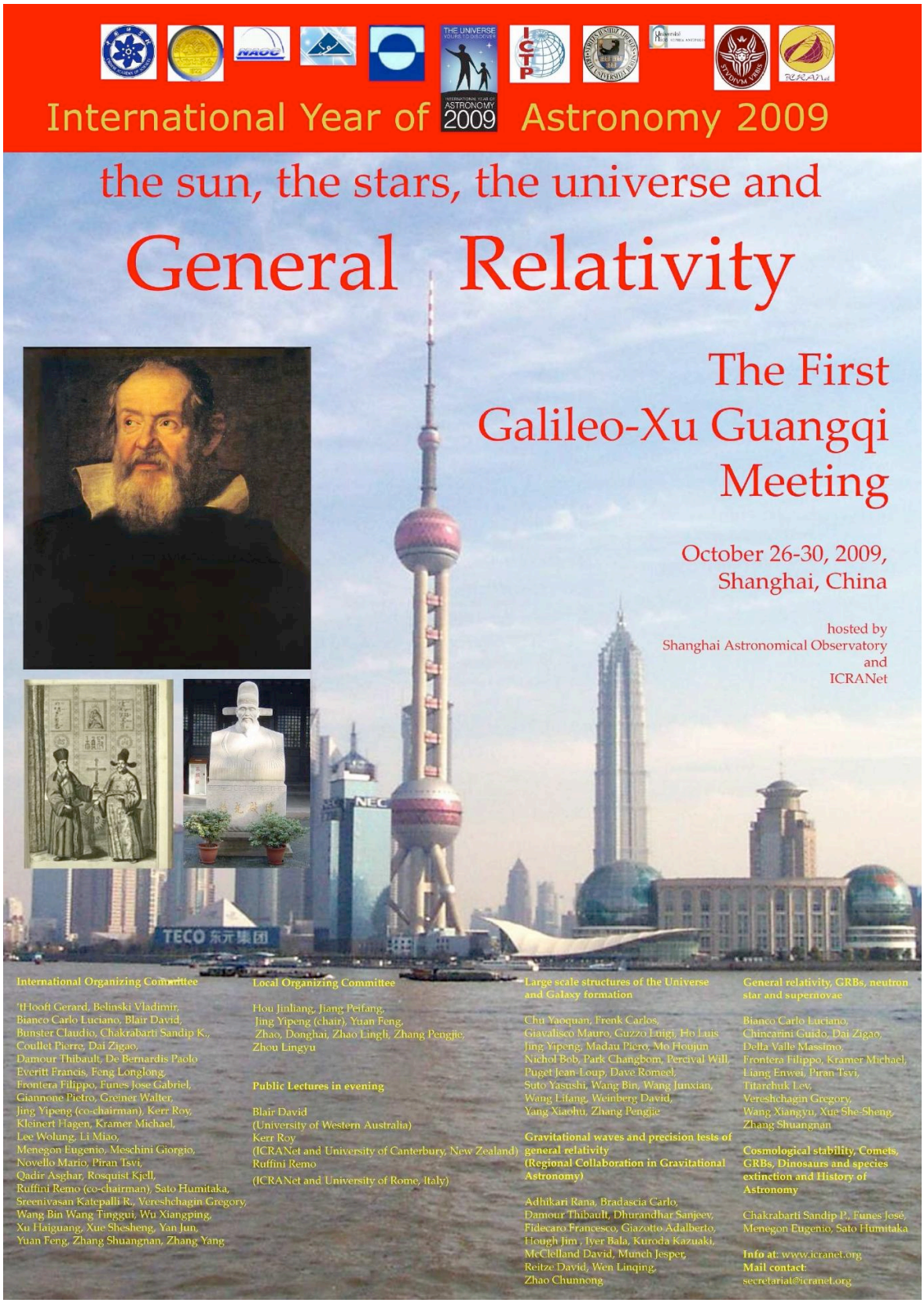
FIRST GALILEO - XU GUANGQI MEETING

THE SUN, THE STARS, THE UNIVERSE AND GENERAL RELATIVITY

October 26-30, 2009 – Shanghai



This first "Galileo – Xu Guanqi meeting" will be held in Shanghai from Oct. 26th to 30th 2009, for celebrating the 400th anniversary of the use by Galileo Galilei of the telescope in order to study the structure of our Universe.

This celebration occurs within the UNITED NATIONS sponsored activities for the 2009 as Year of Astronomy. The meeting is particularly dedicated to recall the roots of the modern scientific research in China and review the recent progress in one of the most advanced fields of scientific research: the one of relativistic astrophysics. We will review current progress in general relativity made possible by astronomical observations of the Sun, of the Stars and of the Universe. These results have been achieved on the ground of the theoires of Albert Einstein and thanks to unprecedented numbers of observational techniques: in X-ray, Gamma-ray, optical wave-lengths from space based observatories, in radio telescopes wavelengths from telescopes on the ground as well as in particle physics from underground observatories.

The name of Xu Guangqi (Xu Guangqi - Wikipedia, the free encyclopedia), the collaborator of Matteo Ricci (Ri Ma Dou) (Matteo Ricci - Wikipedia, the free encyclopedia), celebrates his most extraordinary activities in bringing to China the works of Euclid and Galileo and his strong commitment to the process of modernization and scientific development of China . We are looking for an international meeting of approximate 274 participants, 137 from Asia and 137 from the rest of the Planet. The meeting is organized by an international organizing committee , an international scientific advisory committee and a local organizing committee.

The "Galileo – Xu Guanqi Meetings" will be called in future years in order to foster the scientific cooperation of China and the international scientists in the field of Relativistic Astrophysics.

INTERNATIONAL ORGANIZING COMMITTEE

- 'tHooft Gerard (Nobel Laureate, Institute of Theoretical Physics Universiteit Utrecht, Netherland)
- Belinski Vladimir (ICRANet, Italy)
- Bianco Carlo Luciano (ICRA – ICRANET, Italy)
- Blair David (University of Western Australia, Perth, Australia)
- Bunster Claudio (Director, Center for Scientific Studies, Valdivia, Chile)
- Chakrabarti Sandip K. (Bose Centre and Indian Centre for Space Physics, India)
- Coullet Pierre (Université de Nice - Sophia Antipolis, France)
- Dai Zigao (Nanjing University)
- Damour Thibault (Joseph Louis Lagrange ICRANet Professor, IHES, Bures sur Yvette, France)
- De Bernardis Paolo (University of Rome "La Sapienza", Italy)
- Everitt Francis (William Fairbank-ICRANet Professor, Stanford University, USA)
- Feng Long-Long (Purple Mountain Observatory - Nanjing - Chinese Academy of Sciences)
- Funes Jose Gabriel (Director, Vatican Observatory)
- Giannone Pietro (University of Rome "La Sapienza", Italy)
- Greiner Walter (ICRANet Professor Frankfurt Institute for Advanced Studies, Germany)
- Jing Yi-Peng (Shanghai Observatory – Chinese Academy of Sciences) **co-chairman**
- Kerr Roy (Yevgeny Mikhajlovic Lifshitz-ICRANet Professor, University of Canterbury, New Zealand)
- Kleinert Hagen (Richard Feynmann-ICRANet Professor, Freie Universität Berlin)
- Kramer Michael (Jodrell Bank Centre for Astrophysics, University of Manchester, UK)
- Lee Wo-Lung (National Taiwan Normal University, Taipei)
- Li Miao (Institute of Theoretical Physics- Beijing - Chinese Academy of Sciences)
- Menegon Eugenio (Boston University, USA)
- Meschini Giorgio (Mayor of Macerata, Italy)
- Novello Mario (Cesare Lattes-ICRANet Professor, CBPF, Rio de Janeiro, Brasil)
- Piran Tsvi (Racah Institute of Physics, Hebrew University, Israel)
- Qadir Asghar (Institute of Physics, Pakistan)
- Rosquist Kjell (Karl Gustav Jacobi-ICRANet Professor, Stockholm University, Sweden)
- Ruffini Remo (ICRANet, ICRA and University of Rome "La Sapienza", Italy) **co-chairman**
- Sato Humitaka (Yukawa Foundation, Kyoto University)
- Sreenivasan Katepalli R. (Director ICTP, UNESCO)
- Vereshchagin Gregory (ICRANet, Belarus)
- Wang Bin (Fudan University)
- Wang Tinggui (The University of Science and Technology of China - Chinese Academy of Science)
- Wu Xiang-Ping (Beijing Observatory, Chinese Academy of Sciences)
- Xu Haiguang (Jiaotong University, Shainghai)
- Xue Shesheng (ICRANet – Pescara, Italy)
- Yan Jun (National Astronomical Observatories, Chinese Academy of Sciences)
- Yuan Feng (Shanghai Astronomical Observatory - Chinese Academy of Sciences)

• Zhang Shuang-Nan (Department and Center for Astrophysics, Tsinghua University, China)

INTERNATIONAL SCIENTIFIC ADVISORY COMMITTEE

• Abdildin Abishev Medeu (University of Kazakhstan)
• Amati Lorenzo (INAF – IASF – Bologna, Italy)
• Arnett David (Subramanyan Chandrasektar- ICRANet Professor, University of Arizona, Tucson, USA)
• Bini Donato (CNR and ICRANet, Italy)
• Boccaletti Dino (ICRANet and Università di Roma "Sapienza", Italy)
• Capaccioli Massimo (President, Osservatorio Napoli, Italy)
• Chardonnet Pascal (Université de Savoie – France)
• Chechetkin Valeri (Keldysh Institute for Applied Mathematics, Moscow, Russia)
• Chen Jiansheng (Beijing University)
• Chieffi Alessandro (INAF, Rome, Italy)
• Chincarini Guido (Università di Milano – Bicocca, Italy)
• Della Valle Massimo (INAF-OA, Arcetri, Italy)
• Di Castro Carlo (Università di Roma "Sapienza", Italy)
• Filippi Simonetta (ICRANet and Campus Biomedico, Italy)
• Gurovich Victor (University of Kyrgyzstan)
• Gurzadyan Vahe (ICRANet, University of Yerevan, Armenia)
• Hoang Ngoc Long (Institute of Physics, Hanoi, Vietnam)
• Jantzen Robert (AbrahamTaub-ICRANet Professor, Villanova University, USA)
• Kim Jik Su (Pyongyang Astronomical Observatory, North Korea)
• Kim Sung-Won (Institute of Theoretical Physics for Asia-Pacific, Korea)
• Lee Da-Shin (National Dong Hwa University, Hualien)
• Lee Hyun Kyu (Department of Physics, Hanyang University, Korea)
• Lee Hyung Won (School of Computer Aided Sciences, Inje University, Korea)
• Limongi Marco (INAF, Rome, Italy)
• Lu Tan (Purple Mountain Observatory - Chinese Academy of Sciences)
• Mester John (Stanford University, USA)
• Mignard François (Observatoire de la Côte d'Azur, Nice, France)
• Misner Charles (University of Maryland, USA)
• Montani Giovanni (ENEA and ICRANet, Italy)
• Ng Kin-Wang (Institute of Physics, Academia Sinica)
• Ohanian Hans (University of Vermont, Burlington, USA)
• Pacheco José (Observatoire de la Côte d 'Azur, Nice, France)
• Panagia Nino (Space Telescope Science Institute, USA - INAF-CT, Catania, Italy)
• Perez Bergliaffa Santiago (Univesidade do Estado de Rio de Janeiro, Brasil)

• Popov Vladimir (ITEP, Moscow, Russia)
• Pucacco Giuseppe (Università di Tor Vergata Roma, Italy)
• Punsly Brian (ICRA, Rome, Italy)
• Ruocco Giancarlo (University of Rome “La Sapienza”, Italy)
• Salmonson Jay D. (LLNL – University of California, USA)
• Sato Katsuhiko (University of Tokyo, Japan)
• Thiemann Thomas (Albert Einstein Institute, Berlin)
• Titarchuk Lev (ICRANet Professor, US Naval Laboratory, USA)
• Willingale Richard (Department of Physics and Astronomy, University of Leicester, UK)
• Wiltshire David (Department of Physics and Astronomy, University of Canterbury, Christchurch, New Zealand)
• Wu Yueliang (Institute for Theoretical Physics - Chinese Academy of Sciences)
• Zalaletdinov Roustam (University of Uzbekistan)
• Zhang Jialu (The University of Science and Technology of China - Chinese Academy of Sciences)
• Zhou Youyuan (The University of Science and Technology of China - Chinese Academy of Sciences)
• Zhu Jun (Director of Beijing Planetarium, Beijing - China)

LOCAL ORGANIZING COMMITTEE

• Hou Jinliang (Shanghai Observatory – Chinese Academy of Sciences)
• Jiang, Peifang (Shanghai Observatory – Chinese Academy of Sciences)
• Jing Yipeng (Shanghai Observatory – Chinese Academy of Sciences) **Chairman**
• Yuan Feng (Shanghai Observatory – Chinese Academy of Sciences)
• Zhao, Donghai (Shanghai Observatory – Chinese Academy of Sciences)
• Zhao, Lingli (Shanghai Observatory – Chinese Academy of Sciences)
• Zhang Pengjie (Shanghai Observatory – Chinese Academy of Sciences)
• Zhou, Lingyu (Shanghai Observatory – Chinese Academy of Sciences)

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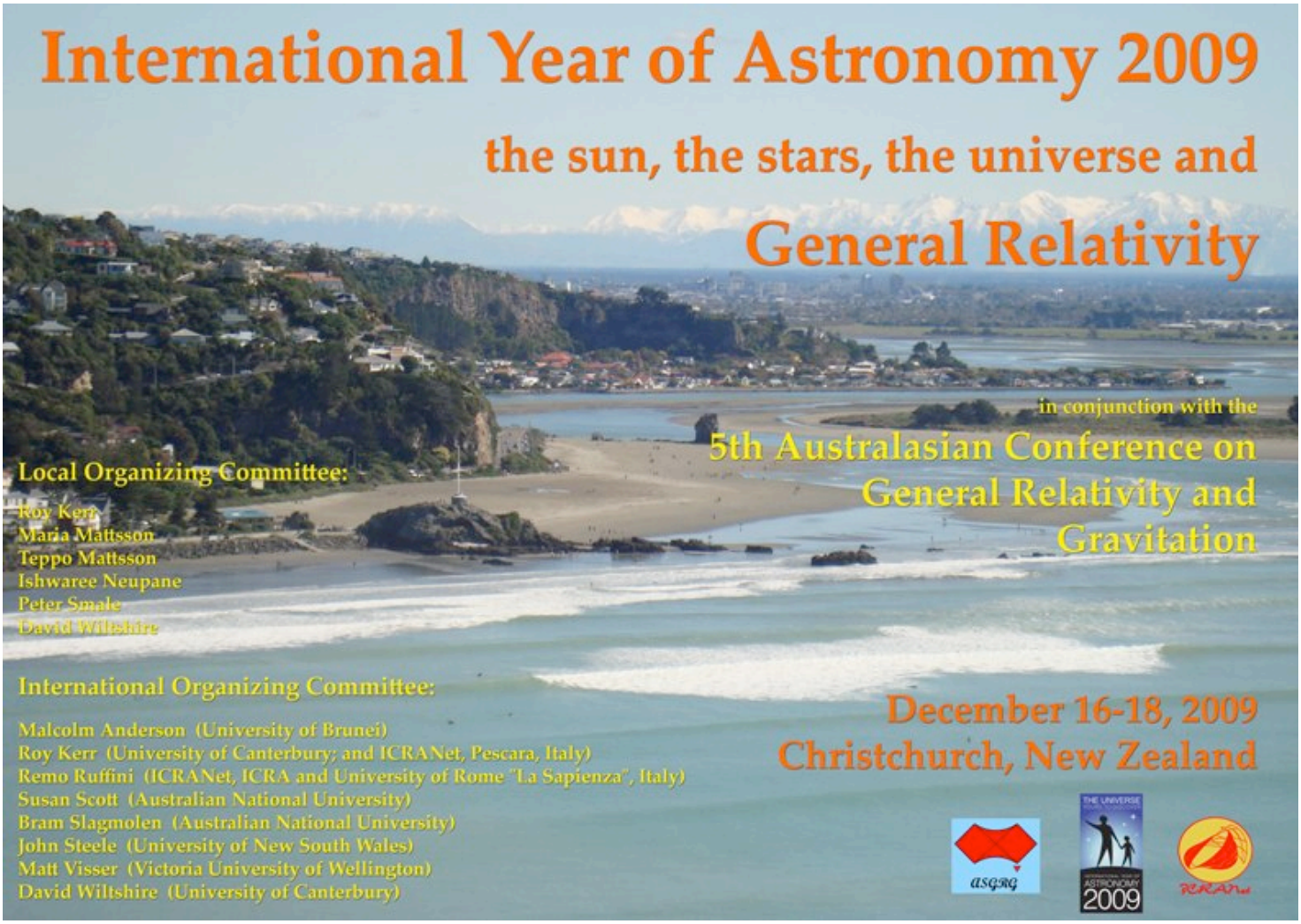
5TH AUSTRALASIAN CONFERENCE - CHRISTCHURCH MEETING

THE SUN, THE STARS, THE UNIVERSE AND GENERAL RELATIVITY

December 16-18, 2009 – Christchurch, New Zealand



The meeting will be held in at the University of Canterbury, Christchurch, New Zealand.

In celebration of the International Year of Astronomy, the conference will be held in conjunction with the Fifth Australasian Conference on General Relativity and Gravitation.

The conference will begin on the evening of Tuesday 15th December, with a reception in the early evening.

INTERNATIONAL ORGANIZING COMMITTEE

Malcolm Anderson (University of Brunei)

Roy Kerr (University of Canterbury; and ICRANet, Pescara, Italy)

Remo Ruffini (ICRANet, ICRA and University of Rome "La Sapienza", Italy)

Susan Scott (Australian National University)

Bram Slagmolen (Australian National University)

John Steele (University of New South Wales)

Matt Visser (Victoria University of Wellington)

David Wiltshire (University of Canterbury)

LOCAL ORGANIZING COMMITTEE

Roy Kerr

Maria Mattsson

Teppo Mattsson

Ishwaree Neupane

Peter Smale

David Wiltshire

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12th Marcel Grossmann Meeting
Paris, 12-18 July 2009

The MG meetings were founded in 1975 by Remo Ruffini and Abdus Salam with the aim of reviewing developments in gravitation and general relativity with major emphasis on mathematical foundations and physical predictions.
The dedication to Marcel Grossmann celebrates the merging of the mathematical ideas of Ricci and Levi Civita with the physics world, made possible by the genius of Albert Einstein.

The scientific objective of these meetings is to bring together scientists from diverse backgrounds in order to deepen our understanding of spacetime structures and review the status of experiments testing Einstein's theory of gravitation. The range of topics is broad: from more abstract classical gravitational theories, quantum gravity, and string theories all the way to relativistic astrophysics and an outlook towards future observational missions.

MG12 is the 12th Marcel Grossmann Meeting on General Relativity and Gravitation, for the first time held in Paris, France, hosted jointly by **UNESCO**, which has offered its headquarters for the plenary sessions and some of the parallel sessions, and by some of the most outstanding **scientific institutions nearby** (by metro) which have witnessed fundamental discoveries in physics and mathematics, including the Ecole Normale Superieure, the Observatoire de Paris, the Collège de France, and the Institut Henry Poincaré, all within walking distance of the Pantheon (home of the original **Foucault pendulum**) in the Latin Quarter.
Paris is a lovely destination city to visit all year round but the timing of the meeting could not be better. The July weather is typically warm and sunny, and the Tuesday of the meeting week is Bastille Day, a day of national celebration that is especially actively celebrated in the nation's capital, which sees Paris turn into a big party town with dancing in the streets, concerts, fireworks, and a frenzy of activities for those lucky enough to be present to enjoy them. Tuesday afternoon will be free of meeting activities so participants can take part in these events.
The conference banquet will be an elegant catered event held at the UNESCO headquarters on Wednesday evening. Additional tickets are available for accompanying persons.
For those who arrive in time, early on-site registration and already registered check-in will take place Sunday afternoon at the UNESCO headquarters, as well as each morning preceding the plenary sessions. The meeting will officially open with the first plenary session Monday morning, followed by five more morning plenary sessions, closing at the end of the Saturday plenary session. Four afternoons of 4 hour parallel sessions will take place Monday, Wednesday, Thursday and Friday.

INTERNATIONAL ORGANIZING COMMITTEE

Blair, David
Choquet Bruhat, Yvonne
Christodoulou, Demetrios
Damour, Thibault
Everitt, C. W. Francis
Fang, Li-Zhi
Giacconi, Riccardo
Haensch, Theodor
Hawking, Stephen
Kerr , Roy
Kleinert, Hagen
Ruffini, Remo
Sato, Humitaka
Sunyaev, Rashid
Weinberg, Steven

LOCAL ORGANIZING COMMITTEE

Boer, Michel
Bourguignon, Jean Pierre
Chardonnet, Pascal
Choquet Bruhat, Yvonne
Chrusciel, Piotr
Coullet, Pierre (Chairman)
Dabholkar, Atish
Damour, Thibault
Esposito-Farese, Gilles
Giraud-Heraud, Yannick
Jantzen, Robert
Kerner, Richard
Ruffini, Remo
Veneziano, Gabriele
Wolf, Peter

Administrative Officer:
Barbaro, Pina

INTERNATIONAL COORDINATING COMMITTEE

• ALBANIA: Hafizi M.
• ARGENTINA: Jakubi A., Mirabel F., Núñez C.
• ARMENIA: Aharonian F.
• AUSTRALIA: Lun A., Manchester D., Scott S., Steel J.D., Veitch P.
• AUSTRIA: Aichelburg P.C., Schindler S.
• BELGIUM: Henneaux M.
• BELARUS: Minkevich A.
• BOLIVIA: Aguirre C.
• BRAZIL: Aguiar O., Novello M.,

Opher R., Perez Bergliaffa S., Villela T.
• CANADA: Cooperstock F., Papini G., Singh D., Smolin Lee
• CHILE: Bunster Weitzman C.
• CHINA (Beijing): Feng L.L., Li M., Wu X.P.,
Yipeng J.
• CHINA (Taipei): Lee D.S., Lee W.L., Ni W.T.
• COLUMBIA: Sepulveda A.
• CROATIA: Milekovic M.
• CUBA: Quiros I.
• CZECH REPUBLIC: Bicak J.
• DENMARK: Novikov I.
• EGYPT: Wanas M.
• ESTONIA: Einasto J.
• FINLAND: Volovik G.
• FRANCE: Brillet A., Chardonnet P., Coullet P., de Freitas
Pacheco J.A., Deruelle N., Iliopoulos J., Mignard F.
• GEORGIA: Lavrelashvili G.
• GERMANY: Biermann P., Fritzsch H., Genzel R.,
Greiner W., Hehl F., Kiefer C., Neugebauer G., Nicolai H.,
Renn J., Ringwald A., Ruediger A., Schutz B.
• GREECE: Batakis N., Cotsakis S., Vagenas E.C.
• HUNGARY: Fodor G.
• ICELAND: Bjornsson G.
• INDIA: Padmanabhan T.
• IRAN: Mansouri R., Sobouti Y.
• IRELAND: O'Murchada N.
• ISRAEL: Bekenstein J., Verbin Y.
• ITALY: Belinski V., Bianchi M., Bianco C.L., Menotti P.,
Stella L., Treves A.
• JAPAN: Fujimoto M., Makino, J., Nakamura T.,
Sasaki M., Sato K.
• KAZAKHSTAN: Abdildin A.M., Mychelkin, E.G.
• KOREA (Pyeongyang): Kim J.S., Kim Y.G.
• KOREA (Seoul): Lee H.K., Kim S.P.
• KYRGYZSTAN: Gurovich V.Ts.
• LIBYA: Gadri M.
• MEXICO: García-Diaz A., Macías Alvarez A., Mielke E.,
Rosenbaum M.
• NETHERLANDS: t' Hooft G.
• NEW ZEALAND: Visser M., Wiltshire D.
• NORWAY: Knutsen H.
• POLAND: Demianski M., Nurowski P., Sokolowski L.
• PORTUGAL: Costa M., Silva L.O., Vargas Moniz P.
• ROMANIA: Visinescu M.
• RUSSIA: Arkhangelskaja I., Bisnovatyi-Kogan G.S., Blinnikov S.,
Chechetkin V.M., Cherepaschuk A.M., Khriplovich I.B.,
Lipunov V.M., Lukash V., Rudenko V.N., Starobinsky A.A.
• SERBIA: Sijacki D.
• SLOVENIA: Cadez A.
• SOUTH AFRICA: Maharaj S.
• SPAIN: Ibanez J., PerezMercader J., Verdaguer E.
• SWEDEN: Abramowicz M., Marklund M., Rosquist K.
• SWITZERLAND: Durrer R., Jetzer P.

• TURKEY: Metin G.
• Ukraine: Zhuk A.
• UK: Cruise A.M., Green M., Kibble T., Maartens R.
• USA: Ashtekar A., Bardeen J., Chen P., Cornish N., Dermer C., DeWitt-Morette C., Drever R., Finkelstein D., Hellings R., Jantzen R.T. (chair), Klauder J., Kolb R., Lousto C., Mashhoon B., Matzner R., Melia F., Nordtvedt K., Parker L., Pullin J., Schwarz J., Shapiro I., Shoemaker D., Smoot G., Thorne K.S., van Nieuwenhuizen P.
• UZBEKISTAN: Zalaletdinov R.M.
• VATICAN CITY: Stoeger W.
• VENEZUELA: Herrera L.
• VIETNAM: Long H.N., van Hieu N.

Preliminary Program of MG12 Plenary Session

12th Marcel Grossmann Meeting ***Paris 12-18 July 2009***						
Preliminary Plenary Program						
	Monday 13	**Tuesday 14**	**Wednesday 15**	**Thursday 16**	**Friday 17**	**Saturday 18**
9:00-9:30	Registration	Juan Maldacena	David Reitze	Peter Michelson	Piero Rosati	Eugene Churazov
5 minutes discussion						
9:35-10:05	Marcel Grossmann Awards	Ashoke Sen	Bernd Bruegmann	Tsvi Piran	Christine Jones	Jean Loup Puget
5 minutes discussion						
10:10-10:30	***Coffee Break***					
10:30-11:00	Alain Connes	Gabriele Veneziano	Thibault Damour	Remo Ruffini	Maxime Markevitch	John Anderson
5 minutes discussion						
11:05-11:35	Demetrios Christoudoulou	Laurent Freidel	Dick Manchester	Felix Aharonian	Alexey Vikhlinin	James Bergquist
5 minutes discussion						
11:40-12:10	Igor Rodnianski	Herbert W. Hamber	Michael Kramer	Andrea Ghez	Yannick Mellier	David Wiltshire
5 minutes discussion						

Preliminary Program of MG12 Parallel Sessions

A. String Theory and Quantum Gravity

SQG1: Strings/Brane Motivated Gravity (Dmitri Galtsov)

SQG2: Loop Quantum Gravity, Quantum Geometry, Spin Foams (Jerzy Lewandowski)

SQG3: AdS/CFT (Anti de Sitter/Conformal Field Theory) (Kostas Skenderis)

SQG4: Perturbative and Non-Perturbative Aspects of String Theory (Pierre Vanhove)

SQG5: Quantum Fields (Vladimir Belinski)

SQG6: Quantum Gravity Phenomenology (Giovanni Camelino-Amelia)

SQG7: Supergravity (Jan-Willem van Holten)

SQG8: Quantum Spacetime in Deformation Quantization and Non-Commutative Geometry (Giuseppe Dito)

B. Black Holes: Theory

BHT1: Strong Fields in Astrophysics (Hagen Kleinert)

BHT2: Black Holes in Higher Dimensions (Black Rings and Black Strings) (Jutta Kunz)

BHT3: Black Holes and Magneto-Hydrodynamics (Gennady Bisnovatyi-Kogan)

BHT4: Black Hole Thermodynamics (Iosif Khriplovich)

BHT5: Black Holes and the Information Puzzle (Gabriele Veneziano, Marika Taylor)

BHT6: Analog Gravity (Ralf Schuetzhold, Clovis Maia)

C. Astrophysics of Neutron Stars and Black Holes

APT1: Observations of Astrophysical Black Holes (Lev Titarchuk)

APT2: Extreme Properties of Neutron Stars: Observations and Theory (Mariano Mendez, Nanda Rea)

APT3: Observations from High Energy Astrophysics Satellites (Elena Pian, Norbert Schulz)

APT4: Astrophysical Black Holes: from Quasars to Nano-Quasars (Sandip Chakrabarti)

APT5: Galactic Gamma-Ray Sources: steady vs. transient sources (Marco Tavani)

D. Theoretical Cosmology

COT1: Topology of the Universe (Marek Demianski)

COT2: Inhomogeneous Cosmologies, Averaging and Back Reaction (Alan Coley, David Wiltshire)

COT3: Nonsingular Cosmology (Mario Novello)

COT4: Quantum Cosmology and Quantum Effects in the Early Universe (Paulo Moniz)

E. Gamma Ray Bursts: Theory and Observation

GRB1: Supernovae and GRBs (Alicia Soderberg)

GRB2: High Energy and GRBs, the Fermi Mission (Peter Michelson, Isabelle Grenier)

GRB3: Observations vs. theory in the Swift era (Filippo Frontera, Sergio Campana)

GRB4: Models for GRBs (Tsvi Piran, Shiho Kobayashi)

GRB5: Multiwavelenghts observations (and theory) of Gamma-Ray Bursts (Michael Boer, Massimo Della Valle)

F. Mathematical and General Theories

MGAT1: Integrability and Solution Generating Methods for Einstein's Field Equations in Four and Higher Dimensions (Georgy Alekseev)

MGAT2: Cosmological Singularities and Asymptotics (Spiros Cotsakis)

MGAT3: Theoretical Issues in GR (Dieter Brill)

MGAT4: Exact Solutions (Physical Aspects) (Susan Scott)

MGAT5: Higher Dimensional Theories (Alan Coley)

MGAT6: Higher Derivative Theories (Salvatore Capozziello)

MGAT7: Gravitational Fields with Sources (Jose Lemos, Vitor Cardoso)

MGAT8: Alternative Theories (Kei-Ichi Maeda)

MGAT9: Self-Gravitating Systems (Pierre-Henri Chavanis)

MGAT10: Chaos in gravitating systems (Thierry Dauxois, Vahe Gurzadyan)

G. Experimental Gravitation

EG1: Tests of Local Lorentz Invariance (Claus Laemmerzahl)

EG2: Variation of Fundamental Constants (Victor Flambaum)

EG3: Space Tests (Serge Reynaud)

EG4: Astrometric Tests (Sergei Klioner, Francois Mignard)

EG5: Short Range Gravity Tests (Joshua Long)

EG6: Compact Binaries and Strong-Field Tests of Gravity (Michael Kramer)

EG7: Equivalence Principle Tests (Pierre Touboul)

H. History of Relativity

HR1: Recent Advances in the History of General Relativity (Jean Eisenstaedt)

I. Analytic and Numerical Methods

ANM1: Post-Newtonian and Analytic Approximations (Luc Blanchet, Gerhard Schaefer)

ANM2: Compact Binary Simulations: Spins and Gravitational Recoil, Comparisons with Post-Newtonian Results (Pablo Laguna)

ANM3: Interfacing analytical and numerical relativity (Alessandra Buonanno)

ANM4: Numerical Methods in General Relativity and Algebraic Computation (Christian Klein)

ANM5: Supernova Explosions and Neutron Star Oscillations (Kostas Kokkotas, Harald Dimmelmeier)

ANM6: Compact Binary Simulations: Miscellaneous (Frans Pretorius)

ANM7: Self Forces, Black Hole Perturbations (Eric Poisson)

ANM8: Collisionless Relativistic Shocks (Mikhail Medvedev)

L. Cosmological Models

COM1: Inflation (Jérôme Martin)

COM2: Dark Energy and Universe Acceleration (Alexei Starobinsky, David Polarski)

COM3: Simulations of the Formation and Evolution of Galaxies and Large Scale Structure: from First Light to the Milky Way and Beyond (Piero Madau)

M. Observational Cosmology

OC1: Primordial Gravitational Waves and the CMB (Leonid Grishchuk)

OC2: CMB Experiments (Silvia Masi)

OC3: The Planck Mission and the CMB (Martin Bucher)

OC4: Observational Gravitational Lensing [Microlensing] (Philippe Jetzer)

OC5: Dark Matter and Large-Scale Structure, Weak Lensing (Yannick Mellier)

N. Astroparticle Physics

AP1: Search for Dark Matter (Gabriel Chardin)

AP2: Neutrino Physics, Astrophysics and Cosmology (Katsushiko Sato)

AP3: Perspectives for Cosmic Rays from Space Missions: PAMELA (Piergiorgio Picozza)

AP4: Active Galactic Nuclei and gamma rays (Felix Aharonian, Helene Sol and Berrie Giebels)

O. Gravitational Waves

GW1: Sources of Gravitational Waves (Andrew Melatos)

GW2: Operating GW Detectors (Adalberto Giazotto, Massimo Bassan)

GW3: Space and Third Generation GW Detectors (Albrecht Ruediger, Sheila Rowan)

GW4: GW Data Analysis (Fulvio Ricci, Valentin Rudenko)

GW5: Advanced GW Detectors (David Blair, Kimio Tsubono)

MG12

MARCEL GROSSMANN AWARDS

PARIS 2009

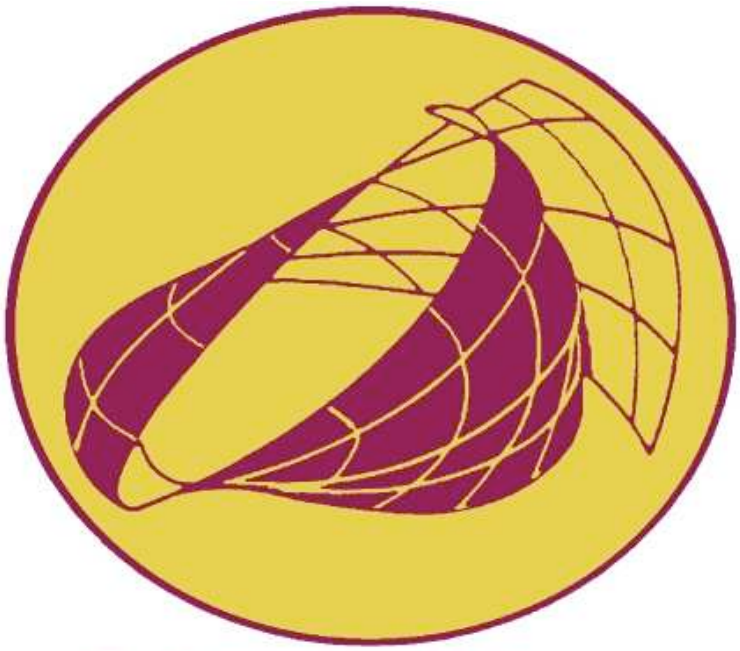
ICRA and ICRANet

MG12 PARIS 2009

MARCEL GROSSMANN AWARDS

and

TEST



ICRANet

The Institut des Hautes Études Scientifiques is a French institute supporting advanced research in mathematics and theoretical physics. It was created in 1958 by Léon Motchane, an industrialist with a passion for mathematics, with the support of Robert Oppenheimer. It has a small number of permanent professors, appointed for life, and invites about 200 visitors a year for varying terms averaging three months. Over the past decade, 2370 scientists from 60 countries have come to carry out their work at IHÉS. Research is not contracted or directed: it is left to each individual researcher to pursue their own goals. Jean-Pierre Bourguignon is the present Director of IHÉS.

12th Marcel Grossmann Meeting

July 2009, Paris

Institutional Award

Institut des Hautes Etudes Scientifique (IHES)
for its outstanding contributions to mathematics and theoretical physics, and notably for having renewed basic geometrical concepts, and having developed new mathematical and physical aspects of spacetime.
- presented to Prof. Jean-Pierre Bourguignon

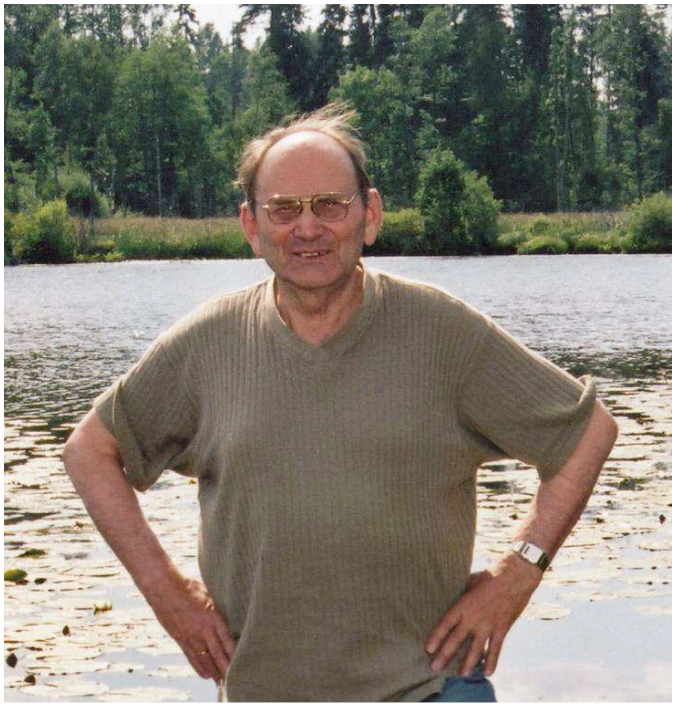
Individual Awards

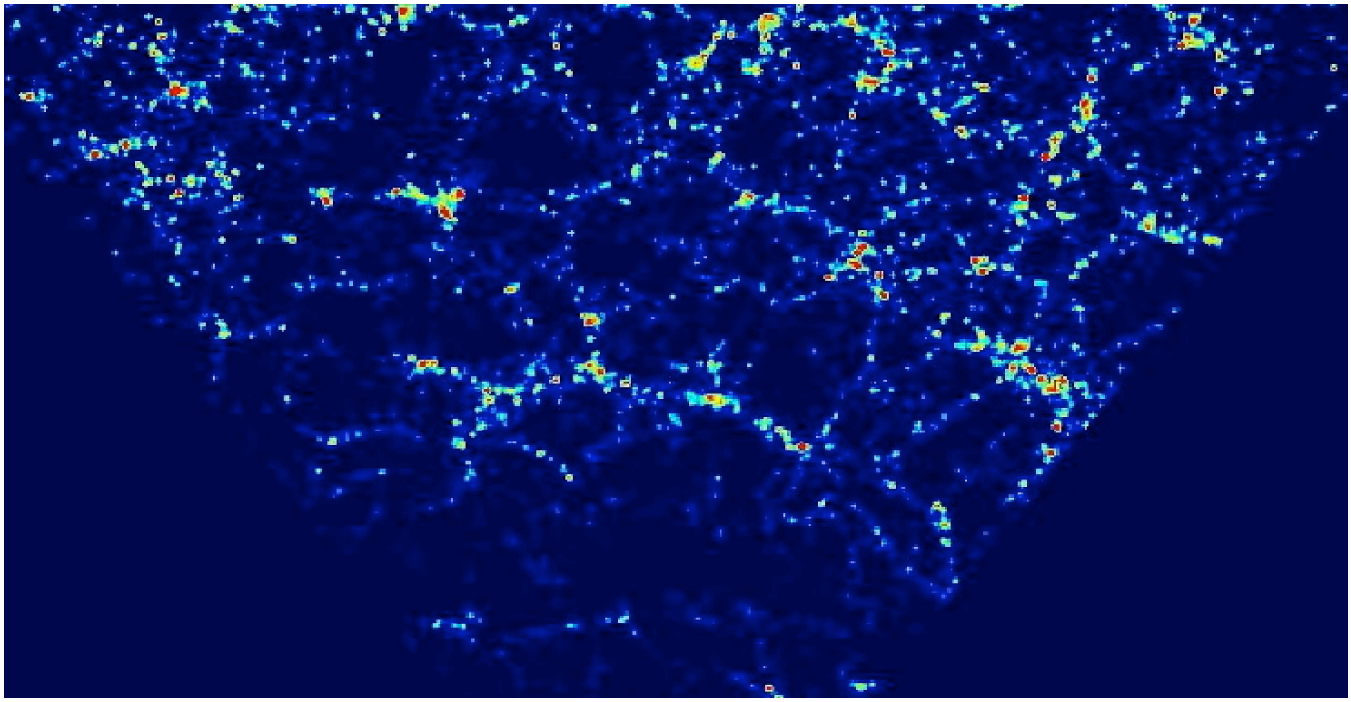
Jaan Einasto
for pioneering contributions in the discovery of dark matter and cosmic web and fostering research in the historical Tartu Observatory.

Christine Jones
for her fundamental contributions to the X-ray studies of galaxies and clusters tracing their formation and evolution and for her role in collaborations using clusters to study dark matter and in analyzing the effects of outbursts from supermassive black holes on the intracluster gas.

Michael Kramer
for his fundamental contributions to pulsar astrophysics, and notably for having first confirmed the existence of spin-orbit precession in binary pulsars.

Each recipient is presented with a silver casting of the TEST sculpture by the artist A. Pierelli. The original casting was presented to His Holiness Pope John Paul II on the first occasion of the Marcel Grossmann Awards.





Picture of Jaan Einasto, Professor at Tartu Observatory. Tartu Observatory is on the UNESCO WHL as the part on Struve Geodetic Arc: a chain of survey triangulation stretching from Hammerfest in Norway to the Black Sea, for over 2,820 km. These are points of a survey, carried out between 1816 and 1855 by Friedrich Georg Wilhelm Struve. A 1000 Megaparsec view of our Universe developed at ICRANet Pescara in May 2009 by Jaan Einasto, illustrating that galaxies must form in filaments (Einasto, Saar, Joeveer 1977, 1980).

11th Marcel Grossmann Meeting
July 2006, Berlin

Institutional Award

FREIE UNIVERSITÄT BERLIN
for the successful endeavour of re-establishing — in the spirit of the Humboldt tradition — freedom of thinking and teaching within a democratic society in a rapidly evolving cosmos —presented to Dr. Dieter Lenzen, President of FUB

Individual Awards

ROY KERR
for his fundamental contribution to Einstein's theory of general relativity: "The gravitational field of a spinning mass as an example of algebraically special metrics."

GEORGE COYNE
for his committed support for the international development of relativistic astrophysics and for his dedication to fostering an enlightened relationship between science and religion.

JOACHIM TRUMPER
for his outstanding scientific contributions to the physics of compact astrophysical objects and for leading the highly successful ROSAT mission which discovered more then 200,000 galactic and extragalactic X-ray sources: a major step in the observational capabilities of X-ray astronomy and in the knowledge of our universe.

10th Marcel Grossmann Meeting
July 2003, Rio di Janiero

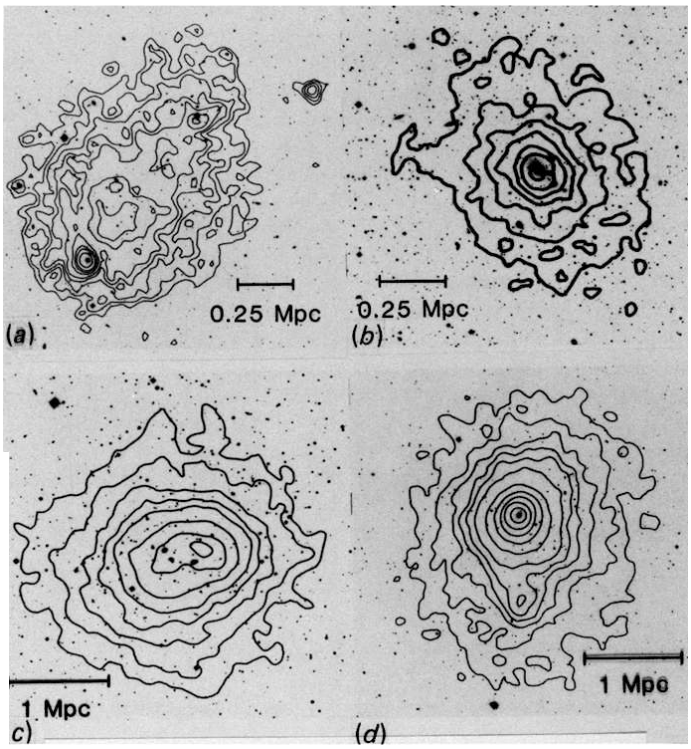
Institutional Award

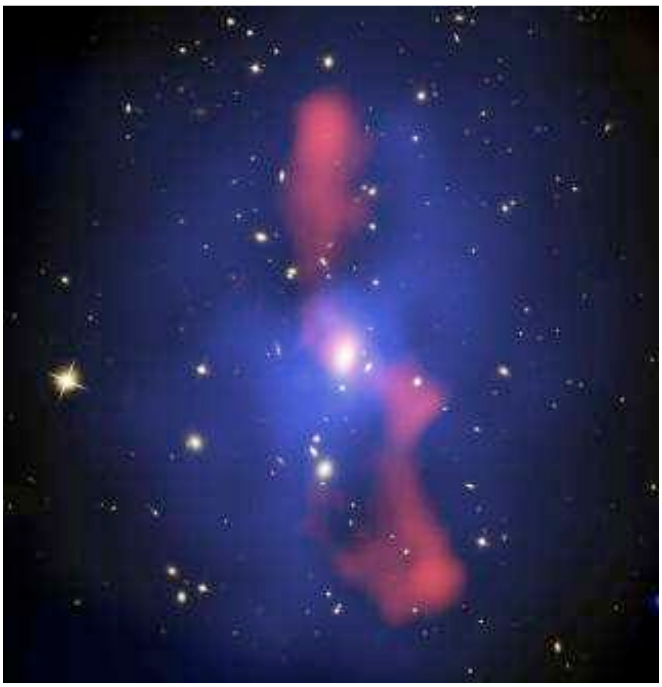
CBPF (Brazilian Center for Research in Physics)
for its role as a teaching and research institution and as a place originating fundamental physics ideas in the exploration of the universe.
—presented to its founders Cesar Lattes, Jos´e Leite Lopez and Jayme Tiomno

Individual Awards

YVONNE CHOQUET-BRUHAT AND JAMES W. YORK, JR.
for separate as well as joint work in establishing the mathematical framework for proving the existence and uniqueness of solutions to Einstein's gravitational field equations.

YUVAL NE'EMAN
for his contributions to science, epistimology, mathematics and physics from subnuclear to space sciences.





A tremendous increase in our understanding of the distribution of the X-ray emitting gas in clusters has come about through imaging of the two-dimensional X-ray surface brightness. The launch of the *Einstein* X-ray observatory satellite made it possible to image X-ray clusters routinely, although a rocket-borne X-ray mirror was used to image the X-ray emission from the Coma, Perseus, and M87/Virgo clusters prior to the launch of *Einstein.* The results of the X-ray imaging observations of clusters were pioneered by Christine Jones and her husband William R. Forman.

9th Marcel Grossmann Meeting
July 2000, Rome

Institutional Award

SOLVAY INSTITUTES
for identifying and recording in discussions by the protagonists the crucial developments of physics and astrophysics in the twentieth century.
—presented to Jacques Solvay

Individual Awards

CECILLE AND BRYCE DEWITT
for promoting General Relativity and Mathematics research and inventing the "summer school" concept.

RICCARDO GIACCONI
for opening, five successive times, new highways for exploring the Universe.

ROGER PENROSE
for extending the mathematical and geometrical foundations of General Relativity.

8th Marcel Grossmann Meeting
June 1997, Jerusalem

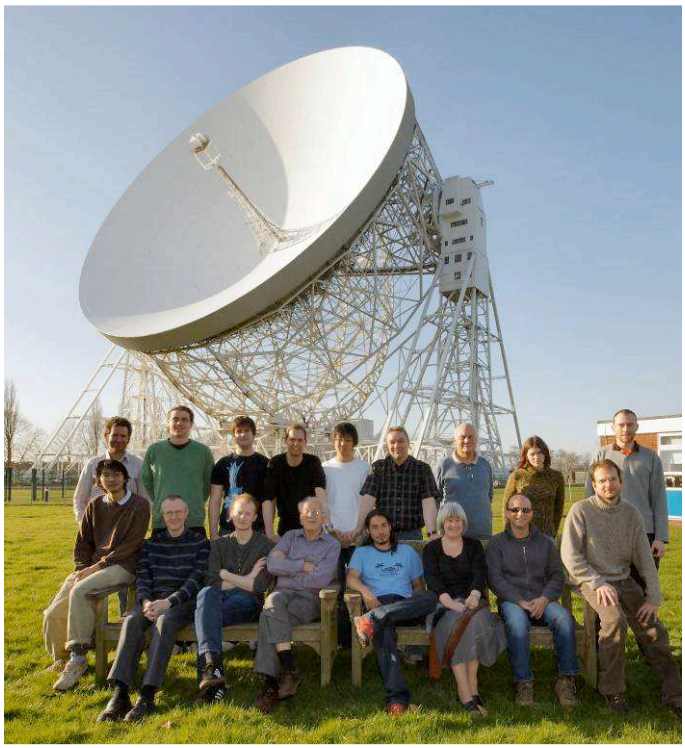
Institutional Award

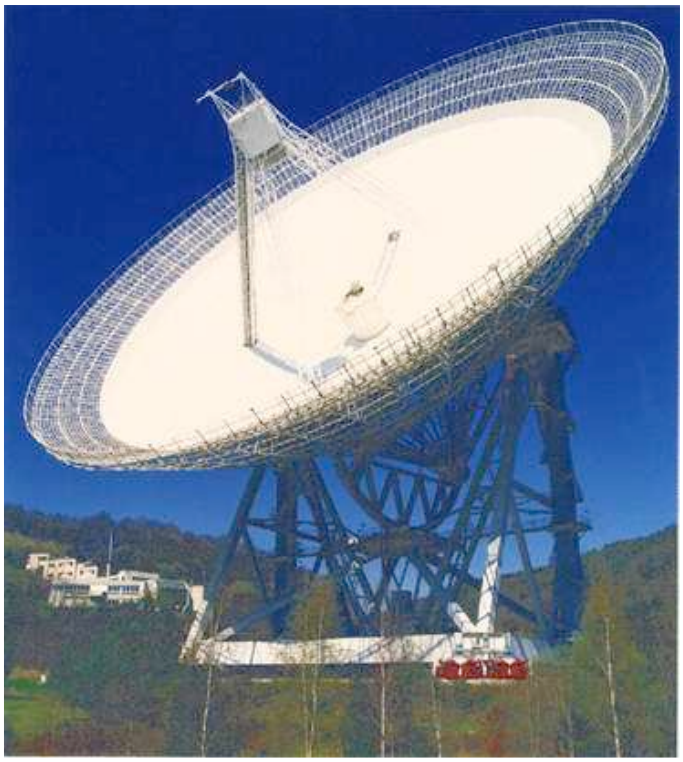
HEBREW UNIVERSITY
for its role as a cradle of Science and Humanities and for hosting the manuscripts of Albert Einstein.
— presented to M. Magidor, President of the Hebrew University of Jerusalem

Individual Awards

TULLIO REGGE
for his contributions to the interface between mathematics and physics leading to new fields of research of paramount importance in relativisic astrophysics and particle physics.

FRANCIS EVERITT
for leading the development of extremely precise space experiments utilizing superconducting technology to test General Relativity and the Equivalence Principle.





The Effelsberg 100-meter Radio Telescope is one of the world's largest fully steerable instruments. This extreme-precision antenna operates up to a wavelength of 3 millimeters. It is used exclusively for research in radio astronomy, both as a stand-alone instrument and regularly for global Very Long Baseline Interferometry (VLBI) experiments. Access to the radio telescope is open to all qualified scientists based on scientific peer review. The telescope is located near Bad Münstereifel-Effelsberg, 40 km southwest of Bonn, Germany.

7th Marcel Grossmann Meeting
June 1994, Stanford, USA

Institutional Award

SPACE TELESCOPE SCIENCE INSTITUTE
for its critical role in the direction and operation of the Hubble Space Telescope, a truly unique international laboratory for the investigation and testing of general relativity in the context of modern astrophysics and cosmology.

— presented to Peter Stockman

Individual Awards

SUBRAHMANYAN CHANDRASEKHAR
for his contributions to the analysis of gravitational phenomena from Newton to Einstein and especially for leading the way to relativistic astrophysics with the concept of critical mass for gravitational collapse.

JIM WILSON
for having built on his experience in nuclear physics, thermonuclear reactions, and extensive numerical simulation to create a new testing ground for the novel concepts of relativistic astrophysics.

6th Marcel Grossmann Meeting
June 1991, Kyoto, Japan

Institutional Award

RITP
for keeping alive first in Hiroshima and them in Kyoto research in relativity, cosmology, and relativistic field theory and the development of a school of international acclaim.

— presented to Professor K. Tomita

Individual Awards

MINORU ODA
for participating in the pioneering work of the early sixties in X-ray astronomy and for his subsequent molding of an agile and diversified Japanese scientific space program investigating the deepest aspects of relativistic astrophysics.

STEPHEN HAWKING
for his contributions to the understanding of spacetime singularities and of the large scale structure of the Universe and of its quantum origins.

5th Marcel Grossmann Meeting
August 1988, Perth, Australia

Institutional Award

THE UNIVERSITY OF WESTERN AUSTRALIA
for its contributions to relativistic astrophysics.
— presented to the Vice Chancellor, Professor Robert Smith

Individual Awards

SATIO HAYAKAWA
for his contributions to research in gamma, X-ray and infrared radiation as well as cosmic rays.

JOHN ARCHIBALD WHEELER
for his contributions to geometrodynamics and Einstein's visions.

4th Marcel Grossmann Meeting
July 1985, Rome, Italy

Institutional Award

THE VATICAN OBSERVATORY
for its contributions to the origin and development of astrophysics.
— presented to His Holiness Pope John Paul II

Individual Awards

WILLIAM FAIRBANK
for his work in gravitation and low temperature physics.

ABDUS SALAM
for his work in unifying fundamental interactions.

TEST: **T**raction of **E**vents in **S**pace-**T**ime

Anna Imponente
National Gallery of Modern Art, Rome

The TEST sculpture provides an innovative example of interaction between science and art, not abstractly interpreted as a result of a subsequent critical analysis but indeed an active and creative collaboration between an astrophysicist and a sculptor.

In order to comprehend the meaning of collaboration between scientists and artists and to retrace its historical origin, we must go back to the Renaissance. There we find the so-called *Weltanschaung* and the idea of unitary art as a continuous and inseparable process of recognition of the structure of reality. This underlies the experience of Leonardo Da Vinci's talent, expressed in his drawings, of not separating scientific enquiry from artistic research.

In the seventeenth century, the "climb to the stars" of the stage machinery in baroque scenography, nourished by imagination, had loosened this link. It had coincided, on the one hand, with experimental Galilean sciences pursuing exact research towards a rational comprehension of the universe, and on the other hand, with the flourishing of the poetics of subjectivity, taste and feeling, the *beaux arts*, and a stratification of painting into specialistic genres.

In the nineteenth century, however, a new reversal of this trend can be observed: the scientific achievements of H.L. Helmholtz in the field of optics and of E. Chevreul in that of chemistry helps *pointillistes* painters in the separation of color. Furthermore, at the beginning of the twentieth century (1907) the Cubist revolution, which changes the concepts of space and time towards a simultaneity of vision, is synchronized with Einstein's theory of special relativity (1905).

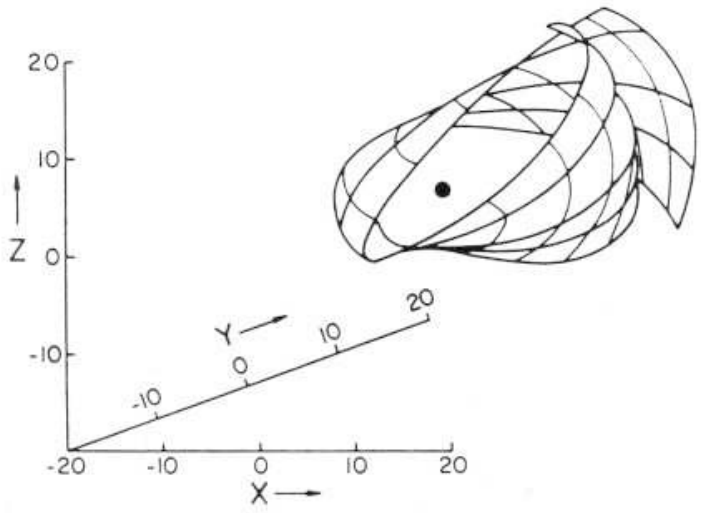
$$\dot{r} = \rho^{-2}\{[E(r^2+a^2) - a\Phi]^2 - \Delta(\mu^2 r^2 + K)\}^{1/2}$$

$$\dot{\theta} = \rho^{-2}\{K - (\Phi - aE)^2 - \cos^2\theta[a^2(\mu^2 - E^2) + \Phi^2 \sin^{-2}\theta]\}^{1/2}$$

$$\dot{t} = -a\rho^{-2}(aE\sin^2\theta - \Phi) + \rho^{-2}(r^2+a^2)\Delta^{-1}P$$

$$\dot{\phi} = -\rho^{-2}(aE - \Phi\sin^{-2}\theta) + a\rho^{-2}\Delta^{-1}P$$

$$E = .968\ ,\ \Phi = 2\ ,\ Q = 10\ ,\ a = e = 1/\sqrt{2}$$



Equations for a family of geodesics in a Kerr black hole and their graphical representation (*M. Johnston and R. Ruffini, 1974*).

The relationship between Remo Ruffini and Attilio Pierelli was not one of director/implementer nor could it exactly be defined as a four-handed performance. It has instead been a line of work suggested to the artist by a graphic design which had already been scientifically tested and computerized by M. Johnston and Ruffini at Princeton University in 1974.

This scientific investigation concerned the calculation of the geometric motion of five particles moving in space-time according to the application of a solution of Einstein's equations; the *in vitro* materialization and the visible replica of the discovery of a phenomenon existing in our own galaxy, namely the *black hole*, consisting of a stellar mass which is sucked into itself by gravitational collapse under the effect of its own self-gravity.

The encounter between Ruffini and Pierelli was not just a coincidence. On the one hand, there is the scientist, who in investigating astrophysical laws has always matched the exactness of results with the acknowledgement of a natural elegance of formulas, approaching an aesthetic outline of the detailed calculations. On the other hand, there is the sculptor, who appeases his eagerness for geometry by the contemplation of intricate reflecting symmetries and by perspective-illusive visions based on proportionate sizes, with the intention of proving the poetry of pure science before it becomes a technological adventure. In the theoretical formulation of his research on space, Pierelli has surveyed the history of mathematical thought and non-Euclidean geometries, deriving his hyperspatial shapes from the investigations of Gerolamo Saccheri, a Jesuit philosopher and mathematician of the seventeenth century.

The intuition of the aesthetic potential of this new form derived from the integration of Einstein's equations and describing the geodesics or trajectories of bodies around a black hole is compared by Ruffini to the "Greeks' discovery of π and the circle, which led to Hellenic architecture and the column" (interview with R. Ruffini by F. Bellonzi, Rome, 1985). Initially in 1981 the structural novelty of this form was understood by the architect Maurizio Sacripanti when he considered it as a space one can enter with one's own body and perceive directly with one's senses (M. Sacripanti in *Catalogo Roma*, Palazzo delle Esposizioni, 1981).

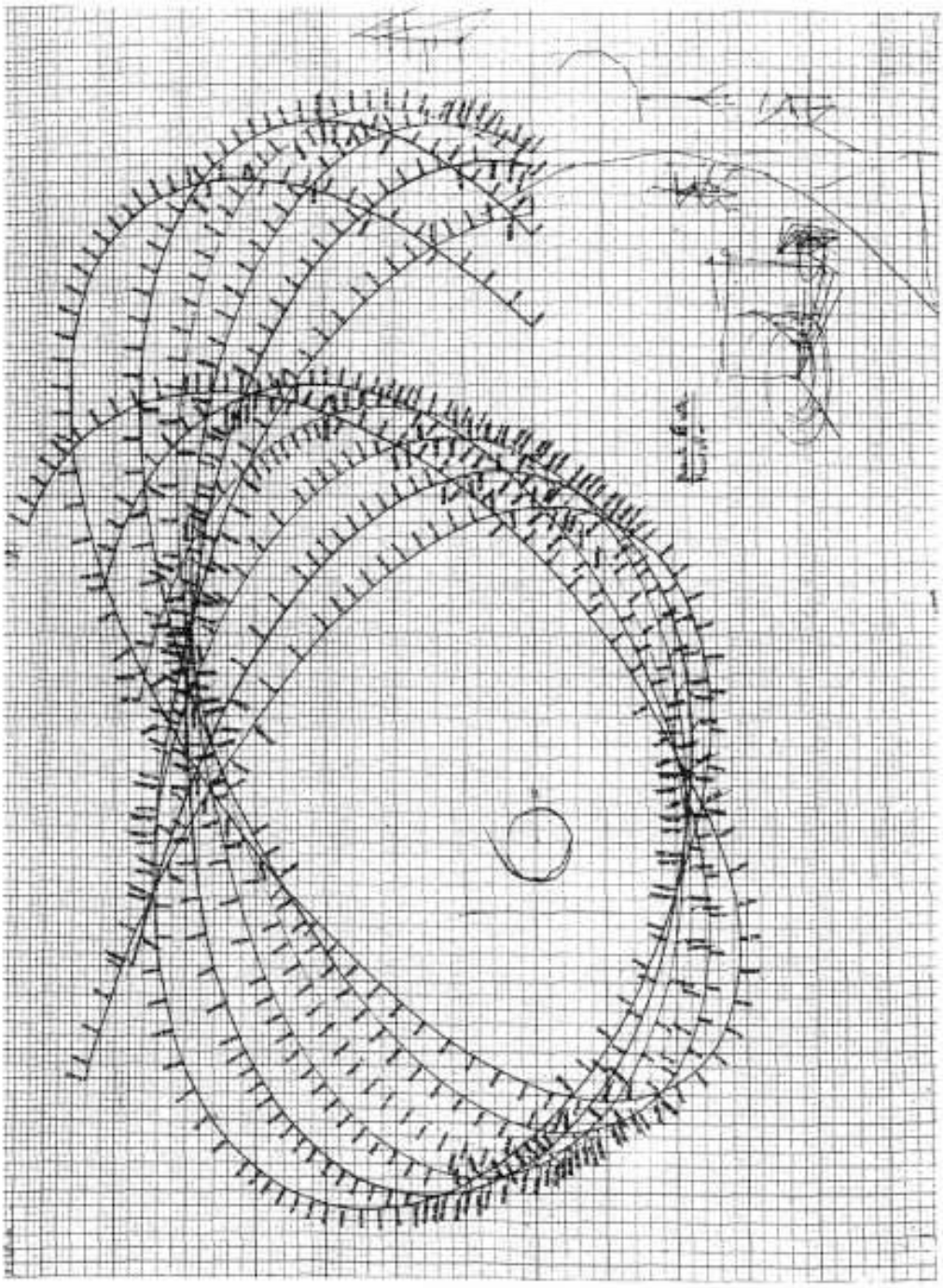
The initiation of this new work has the flavor of a challenge that the sculptor makes to himself, namely to represent the trajectories in a plastic form given their spatial co-ordinates—height, width and length—and to reinterpret them as an aesthetic object, using his own judgement to verify its artistic coherence.

TEST, sculpture by A. Pierelli, photo by S. Takahashi.

The realization of this project seems to be conceptually complex and revolutionary. It is meant to describe a motion, but not a terrestrial one, as the futurists and Boccioni had already done in 1913 with the famous sculpture *Unique forms in space continuity*. Nor should it be the motion of a body set free in the earth's gravitational field, which would fall either vertically or with elliptical or hyperbolic motions. Instead it should resemble a Möbius strip without being so simple, since it would be differentially dragged by the rotational field of the black hole in the geometry of space-time. Hence the acronym TEST which stands for "Traction of Events in Space-Time." Thus the sculpture has no priviledged interpretational directions and no supporting pedestal which might associate it with a central perspective view: no "top" or "bottom," no "right-side" or "left-side." Any orientation gives a complete and faithful realization.

Rather one should imagine it in rotation, with its surface being independent of any relation with the source of natural light ("ambientation" is the fundamental issue of sculpture), ignoring any possible atmospheric effect; in other words, the opposite of a "Mobile" of Calder which awaits a gust of wind to reanimate itself and come alive. Here, the metal light alone outlines and designs the vision of the rotating black hole. The transformation of this sequence of events into a solid form is portrayed by abstracting their properties and reducing everything to a direct perception of its essence, a *Wesenschau*. This representation does not lend itself to psychological or science-fictional interpretation and suggestion; the collective imagination can perceive and attain an emotional projection and exemplification of the universe, of egoism, since it involves a prehensile shape which absorbs and sucks in matter. Moreover, the title TEST, only by pure chance, includes the monogram "ET" which recalls the mythical encounter of a human being with the extraterrestrial of Steven Spielberg's fairy-tale film. There the emblematic image of the finger contact between the two had been borrowed from Michelangelo's *Creation of Man* in the Sistine Chapel while the return to space resembled a mythical ascension on the trail of the Christmas comet.

From a scientific point of view, the clear and lucid form of this sculpture might remind one of the application of mathematical logic to ideographic instantaneity that Giuseppe Peano carried out towards the end of the last century (G.C. Argan, 1985). And from a properly artistic perspective, it can be related to the philosophy of Russian Constructivism around 1920, and to the first clear perception, by Naum Gabo, of the unity of all visible forms and of the existence of aesthetic ones only in accordance with physical and



Three-dimensional trajectories of particles near a Kerr black hole (*Calculations by V. Bellezza and V. Ferrari, drawing by M. Sacripanti*).

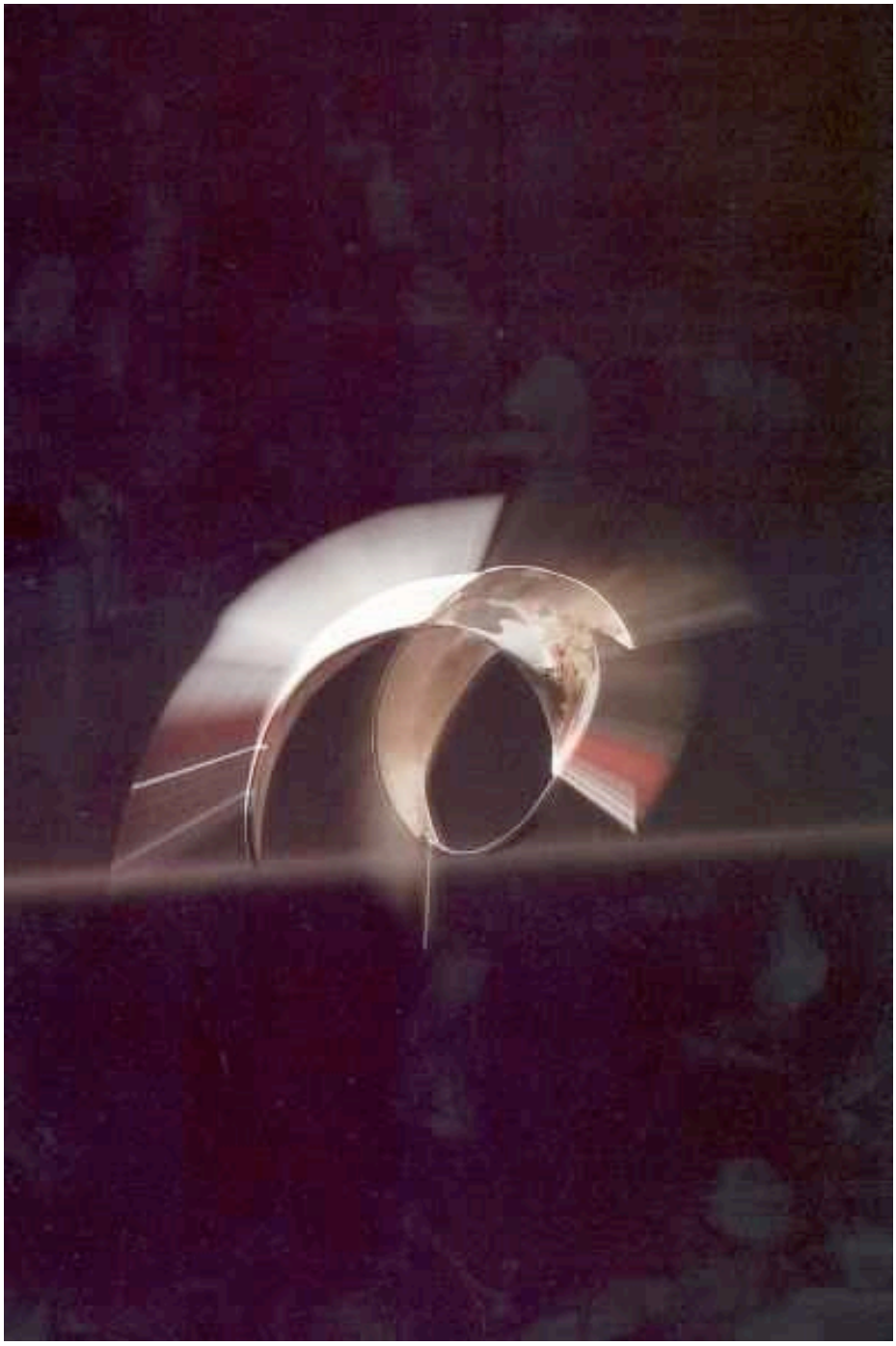
mathematical laws.

In the more recent context, characterized towards the late seventies by strong neo-expressionist and subjectivistic artistic movements, or neo-manner-ist re-evaluation of art from the past, interaction with science has meant above all the adoption and use of advanced technologies, the so-called "computer art." However, the use of media totally different from the traditional ones can change only the visual perception of the image and produce only a technical updating of the communication without necessarily yielding a new artistic message. On the other hand a "snapshot" which is new in concept and ichonography can also be expressed through the use of traditional and experimented techniques. Its very novelty may be expressed through the use of modules of different sizes and composition: namely in the form of a 20cm silver object, as in 1985, or in that of a 50cm bronze one, or in steel tubes, like the $340\times470\times260\text{cm}^3$ structure which was shown at the Venice Biennial Exhibition of 1986.

In the silence of his studio the artist finds his knowing craftsmanship, in making the moulds to be forged into metal and in his attempts to achieve the right shape of the torsions which express the intuition of their artistic value, with the light and opacity of the metal. With his mind, he tries not to betray the accuracy promised to the measurements of the curvatures and strives to make them coincide with his own geometric dream.

The discovery of a form which is not an invention, but bears the simple beauty and the perfection of an archetype existing in nature, leads one to re-experience aesthetically the same emotion that must have been felt by whoever discovered it first.

—English translation by Susanna Hirsch



TEST, sculpture by A. Pierelli, photo by S. Takahashi.

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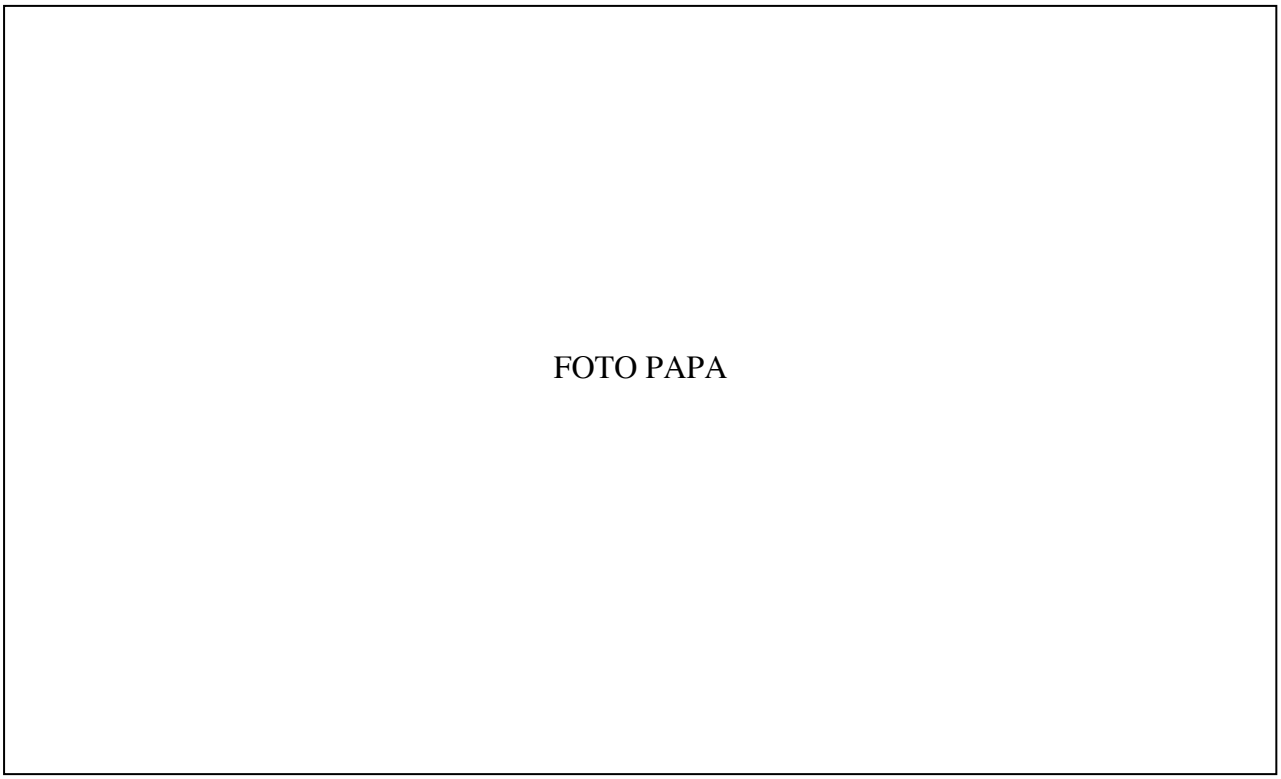

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IRAP PHD

ANNEXES

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