Preliminary Program

IRAP. Ph. D Erasmus Mundus Workshop

GAMMA-RAY BURSTS, THEIR PROGENITORS AND THE ROLE OF THERMAL EMISSION

Les Houches, October 3-7, 2011

	Monday 3	**Tuesday 4**	**Wednesday 5**	**Thursday 6**
9.00	Chardonnet/Ruffini	Lou	Antonelli	Ryde
9.45	Frontera	Amati	Mazzali	Ryde
10.30	*Coffee Break*			
10.45	Berger	Frontera	Mazzali	Vereshchagin
11.15	Bianco	Boer	Lou	Vereshchagin
11.45	Izzo	Pian	D'Avanzo	Benedetti
12.30	*Lunch Break*			
15.00	Ioka	Pian	Tagliaferri	
15.45	Della Valle	Popov	Ghirlanda	
16.30	*Coffee Break*		*Coffee Break*	
16.45	Amati	Ioka	Covino	
17.30	Penacchioni	Baranov	Izzo/Muccino	
18.15		Moreno Mendez	Longo	
19.00	*Welcome Drink*			
19.30	*Dinner*			
20.30	*Public Lecture* Frontera "Gamma Ray Bursts. 15 Years After Beppo Sax"			

Amati Lorenzo	*GRB experiments: past, present and future* In the first part I will review the basic instrument concepts and performances of those GRB experiments (BATSE, BeppoSAX, HETE-2, Swift, Fermi and more) which, in the last 20 years, provided a substantial contribution to the comprehension of these intriguing and powerful astrophysical phenomena. Then I will focus on GRB experiments presently under study and/or already proposed to national and international space agencies, with particular emphasis on those capable of providing a step forward in the comprehension of the physics of the prompt emission, the study of thermal components, the detection of features from the circum-burst environment, and the testing and use of spectrum-energy correlations. *Gamma-Ray Bursts as cosmological probes* Gamma-Ray Bursts (GRBs) are the brightest sources in the universe, emit mostly in the hard X-ray energy band and have been detected at redshifts up to about 8.1. Thus, they are in principle very powerful probes for cosmology. I shortly review the researches aimed to use GRBs for the measurement of cosmological parameters, which are mainly based on the correlation between spectral peak photon energy and total radiated energy or luminosity. In particular, based on an enriched sample of 110 GRBs, I will provide an update of the analysis by Amati et al. (2008) aimed at extracting information on Omega_M and, to a less extent, on Omega_Lambda, from the Ep,i - Eiso correlation. I also briefly discuss the perspectives of using GRBs as cosmological beacons for high resolution absorption spectroscopy of the IGM (e.g., WHIM), and as tracers of the SFR, up to the "dark ages" (z > 6) of the universe.
Antonelli Angelo	*Very High Energy Emission from GRB: status and perspectives from ground based observations* Gamma-ray bursts are the brightest transient sources in the gamma sky at MeV energies. Physical conditions required to accelerate elementary particles to such high energies are also leading to expect TeV energy gamma ray and neutrino emission from these sources. Recent observations by Fermi satellite have shown GRB emitting up to 33 GeV. Despite the low number of GRBs emitting at GeV, emission at higher energies is still expected. Upcoming ground-based detectors will be able to probe these sources in the GeV-TeV energy range revealing their particle acceleration and emission mechanism(s) as well as constraining their astrophysical model(s). In this talk I will review the status of VHE observations of GRBs as for the present experiments (MAGIC, HESS and VERITAS) and the future perspective offered by the Cherenkov Array Telescopes Project.
Berger Edo	*The afterglows and environments of short GRBs: Implications for the progenitors and for detectability of gravitational waves* I will review the recent advances in our understanding of short GRB properties, ranging from the prompt emission to the host galaxies. I will compare the observations with various theoretical progenitor models and discuss the implications for the detectability of gravitational waves.
Boer Michel	*Panchromatic snapshots of GRBs*

	Rapid observations of GRBs have been made possible thanks to the availability of timely positions from satellites. This provides a means to explore the prompt event, as well as the transition to the afterglow, and the early afterglow at several wavelengths, gamma, X-ray and visible/IR. Soon the radio domain will become accessible and several experiments are detected with neutrino and gravitational wave detectors. I will present a review of the data available, and how it can be interpreted, or not, in the framework of different models.
Covino Stefano	*Polarimetry during the prompt and afterglow phases of GRBs* Linear polarimetry measurements carried out during the prompt emission, the early- and late-afterglow phases, can provide powerful diagnostic tools for the physics and geometry of GRBs. We briefly review the observational results obtained during the years and their meaning within the context of the main interpretative scenarios.
D'Avanzo Paolo	*Constraining the progenitors of long and short GRBs through the study of their environments* I will present an overview of the observational characteristics of long and short GRBs and of their environment. I will discuss how a systematic study of these properties can provide a useful a tool to discriminate among the various progenitor models of these sources.
Della Valle Massimo	*The empirical grounds of the SN-GRB Connection* I'll review the observational status of the supernova/gamma-ray burst connection. Present data suggest that long-duration GRBs form an heterogeneous class of object sometimes associated with bright broad-line Ibc Supernovae and sometimes with faint ones. Occasionally they do not appear associated with SNe. I'll present the new case of association between SN 2010bh and GRB 100316D and discuss the SN/GRB branching ratio.
Frontera Filippo	*Gamma Ray Bursts. 15 Years After Beppo Sax*
Ghirlanda Giancarlo	*Gamma Ray Bursts in the comoving frame: new insights into their physics* I will review the current status of the spectral--energy correlations in GRBs with particular emphasis on the physical properties of GRBs in their comoving frame. These new results offer the a viable interpretation of these correlations and unveil new physical properties of GRBs that need to be explained.
Ioka Kunihito	*Gamma-Ray Burst without Baryonic and Magnetic Load?* Gamma-Ray Bursts (GRBs) are the most luminous objects in the universe. It remains a big challenge to reveal how most of the energy can be converted into gamma-rays with highly nonthermal spectra. We suggest that a confinement of the jet could be a key to this long-standing problem, by showing that, contrary to common belief, internal shocks can arise in an accelerating radiation-dominated jet if it is confined even weakly to a converging opening angle. The radiation-dominated internal shock (RDIS) enable very efficient yet highly nonthermal emission

	by Fermi-like photon acceleration, keeping the electron-positron ($e^{\pm}$) pair photosphere and inertia up to high Lorentz factor >1000. In GRBs, a weak confinement would persist beyond the progenitor star or surrounding matter by the fast cocoon accompanying the breakout jet. The central engine allows less fine-tuned baryon load than previously thought, even pure-leptonic unmagnetized outflows *Population III Gamma-Ray Burst* Gamma-ray bursts (GRBs) are unique probes of the first generation (Pop III) stars. We show that a relativistic gamma-ray burst (GRB) jet can potentially pierce the envelope of a very massive Pop III star even if the Pop III star has a supergiant hydrogen envelope without mass loss, thanks to the long-lived powerful accretion of the envelope itself. While the Pop III GRB is estimated to be energetic (E_{\gamma,iso} ~ 10^{55} erg), the supergiant envelope hides the initial bright phase in the cocoon component, leading to a GRB with a long duration ~1000 (1 + z) s and an ordinary isotropic luminosity ~10^{52} erg s^{-1} (~10^{-9} erg cm^{-2} s^{-1} at redshift z ~ 20), although these quantities are found to be sensitive to the core and envelope mass. We also show that Pop III.2 GRBs (which are primordial but affected by radiation from other stars) occur more than 100 times more frequently than Pop III.1 GRBs, and thus should be suitable targets for future GRB missions.
Longo Francesco	*High Energy Emission from Gamma Ray Bursts* The AGILE satellite observed few Gamma-Ray Bursts at high energy (E >30 MeV). In this presentation I will discuss its results in the context of current observations and theoretical models.
Lou Yuqing	*Quasi-spherical Self-similar HD and MHD Core Collapses and Rebound Shocks* We describe hydrodynamic (HD) and magnetohydrodynamic (MHD) processes for self-similar stellar core collapse, outflows, contractions and rebound shocks in quasi-spherical geometry. Various nonlinear solutions are derived from the pertinent model formulation. In particular, it is possible to construct solutions with central voids. All these provide an important basis for modelling various radiative diagnostics (in frequency bands ranging from radio to gamma rays) during stellar collapses and for benchmarking numerical simulation codes. With these physical scenarios in mind, we elaborate formations of neutron stars, stellar mass black holes, and discuss the plausible origin of intense magnetic fields on compact objects (including magnetars). In addition, we present an approach to construct possible configurations for neutron star magnetospheres. *Stellar Core Collapse Instabilities and Neutron Star Kicks* In reference to stellar oscillations, 3D perturbations during a dynamic stellar core collapse can give rise to acoustic modes (p-modes), internal gravity modes (g-modes), and vortical modes (v-modes), respectively. Unstable modes among such 3D perturbations will grow and lead inevitably to core convections and circulations etc. In particular, the growth of unstable low-order g-modes with harmonic degree l=1 may produce initial kicks for proto neutron star during a dynamic stellar core collapse. For spinning magnetized neutron stars, we also describe MHD tidal waves (i.e. MHD generalizations of Kelvin waves, Rossby waves, Poincare waves -- all coupled with Alfven waves) in a thin dense "plasma ocean" covering compact objects which could provide valuable

	diagnostics ranging from radio to gamma ray emissions on various timescales.
Mazzali Paolo A.	*Supernovae and Gamma-ray Bursts* The properties of the Supernovae discovered in coincidence with long-duration Gamma-ray Bursts will be reviewed, and compared to those of SNe for which GRBs are not observed. The SNe associated with GRBs are of Type Ic, they are brighter than the norm, and show very broad absorption lines in their spectra, indicative of high expansion velocities and hence of large explosion kinetic energies. This points to a massive star origin, and to the birth of a black hole at the time of cor colapse. There is strong evidence for gross asymmetries in the SN ejecta. the observational evidence seems to suggest that GRB/SNe are more massive and energetic than XRF/SNe, and come from more massive stars. While for GRB/SNe the collapsar model is favoured, XRF/SNe may host magnetars.
Pian Elena	*Observations of Supernovae and Gamma-Ray Bursts and their environments* The observed association between long GRBs and supernovae suggests an unavoidable connection with massive stars. However, the mechanism by which the collapse of a massive star leads to a relativistic GRB jet is not clear, and the exact nature of the progenitors is still a matter of speculation. I will review the information that has been obtained so far on the fundamental properties of progenitors from observations of the supernovae themselves and of their environments
Ryde Felix	*Photospheric emission in GRBs and the role of subphotospheric dissipation* I will discuss the physics of relativisitic outflow models in GRBs and pay particular attention to the photosphere. I will review the physical processes that take place close to the photosphere and discuss the the formation of the photon spectrum. Futhermore, I will summaries the observational understanding of the prompt GRB emission and discuss it within the context of the photospheric emission model.
Tagliaferri Gianpiero	*The X-ray and optical light curves of the GRB afterglows* I will review the observational properties of the X-ray and optical light curves of the afterglow. The differences and similarities observed in the early and later phases can give us some clues and the physics involved and on the environment on which the bursts occur.
Vereshchagin Gregory	*Photospheric emission from thermally accelerated relativistic outflows* Relativistic outflows: gradual versus impulsive energy release. Relativistic transformation of the mean free path. Asymptotic solutions for the optical depth and photospheric radius. Line of sight and high latitude emission. Light curves and duration of photospheric emission. Application to GRBs.