Matched filtering properties of all-sky searches for continuous gravitational waves

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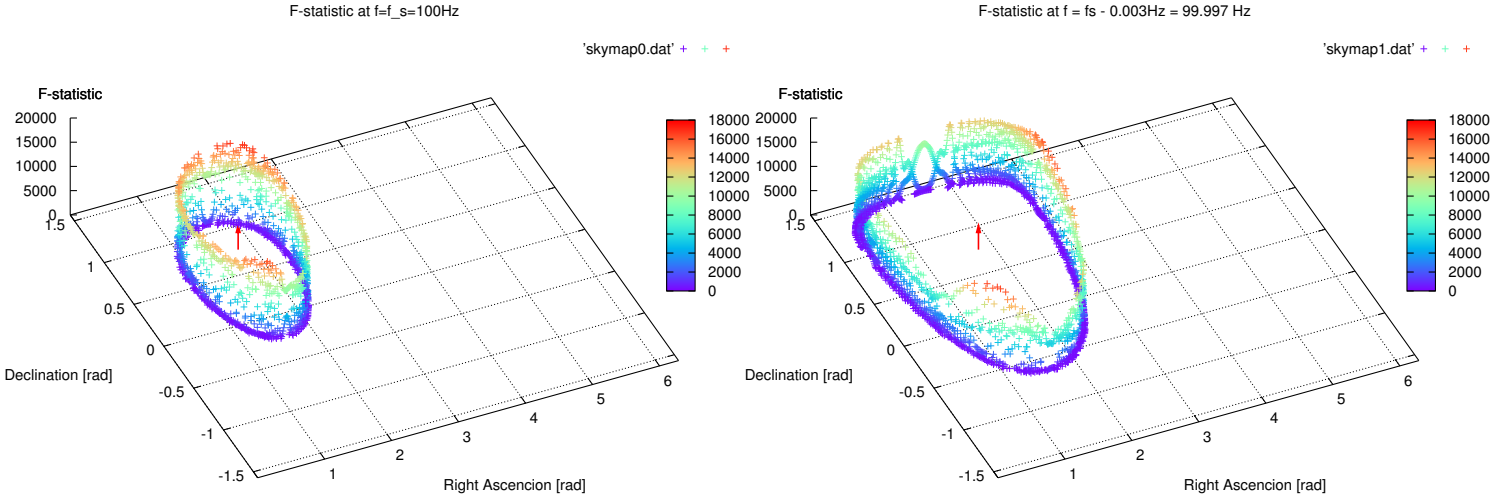
Software-injected signal at $f_s = 100$ Hz, $\dot{f}_s = 0, \{\alpha_s,\ \delta_s\} = \{2.0,\ 1.0\}$

10-hour F-statistic all-sky search at $f = f_s$ and at $f = f_s - 0.003$ Hz:



(only showing $F > 0.01\ F_{\max}$)

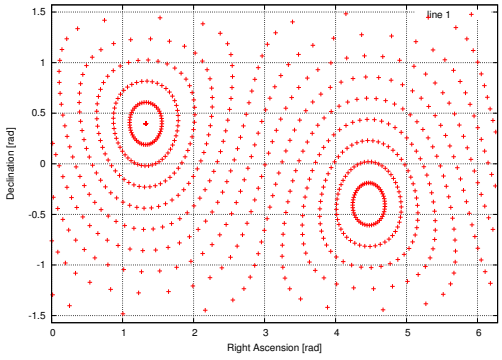
☞ Can we find an (approximate) analytic expression to describe the structure of the matched-filtering "maxima" in the $3+s$-dimensional parameter-space $\{\alpha,\ \delta,\ f,\ f^{(k)}\}$? (assuming $T_{\rm obs} \ll 1$ year)?

Preliminary answer 1: neglecting Earth's spin

"Circle equation":

$$f\left(1 + \vec{V}_o \cdot \vec{n}/c\right) = f_s\left(1 + \vec{V}_o \cdot \vec{n}_s/c\right) = \text{const.}$$

☞ V_o is a suitably "avereraged" orbital velocity over the observational period.



Preliminary answer 2: including Earth's spin to first order