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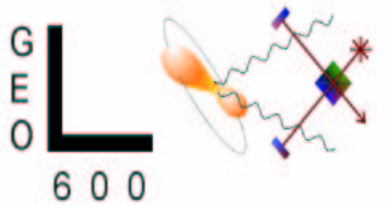

Precessing in−spiral binaries
Computational costs

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Key results in a nutshell

- **The search for precessing binary systems has been considered so far computationally intractable**
- **However, we can use incorrect but qualitatively plausible waveforms − robust fake features − to make initial estimates**
- **We have now good reasons to believe this is actually not true and we can attack the problem**:
  - For nearly equal mass systems we have indications that we have the computational resources to search for precessing binaries.
  - For unequal mass systems (e.g. 1.4 − 10 Msun) the computational problem seems still to be horrendous
  - However, if we are prepared to make choices on the portion of the parameter space we want to probe, we can afford searches

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The mimic template

Assume that the right template family to use is:

$$\tilde{h}(f) = Af^{-7/6} \exp\{i\,[2\pi f t_0 - \phi_0 + \psi(f)]\}$$

where the amplitude is constant and the phase is given by:

$$\psi(f) = \psi_{PN}(f; S = 0) + \xi \cos(\zeta f^{-2/3} + \chi)$$

Usual phase term
for spin−less binaries
2 parameters

5 parameters

Oscillating term
mimicking modulation
3 parameters

The key new ingredient that we introduce here is the oscillatory behavior of the phase induced by precession

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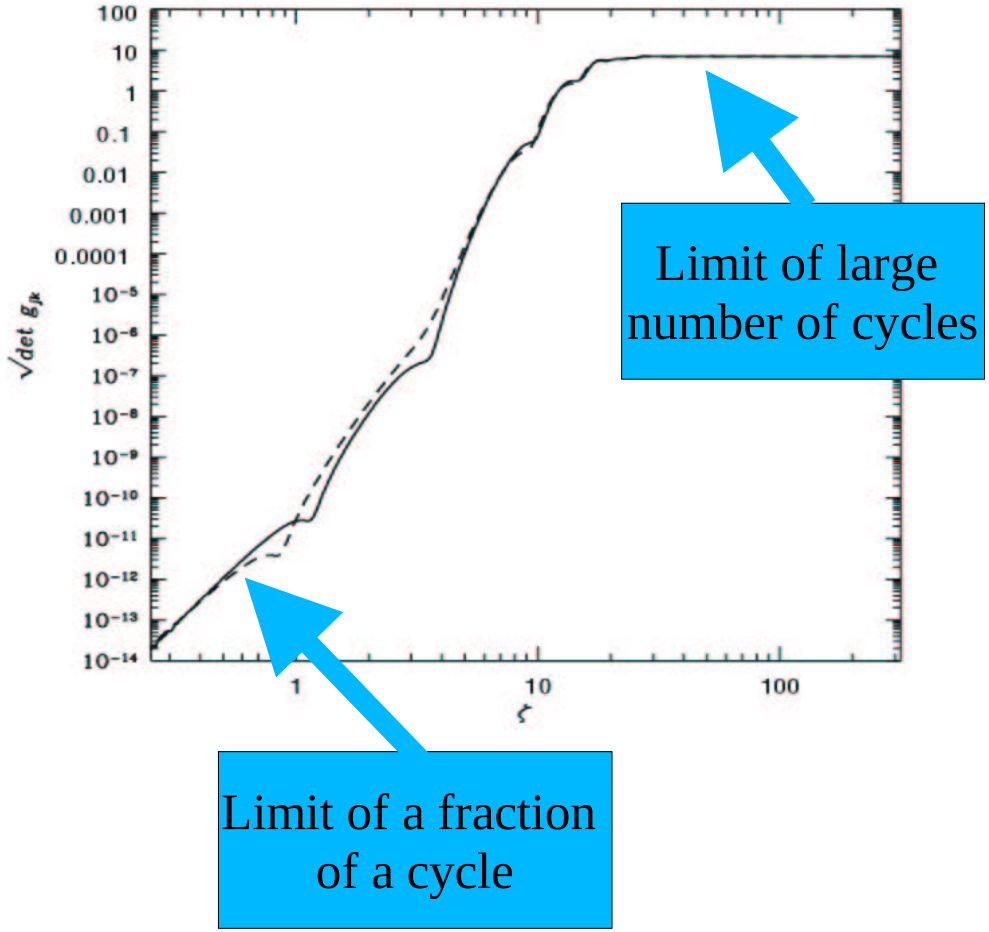
The metric

- The 5−parameter **metric is block diagonal**: the mass parameters are essentially decorrelated from the spin parameters (important practical implications to set up the filter mesh)
- The metric changes dramatically structure at $N_p \sim 1$
- The volume of the parameter space (for the 3 precession parameters) is:

$$\mathcal{V}_p \propto \zeta \chi \xi^3$$



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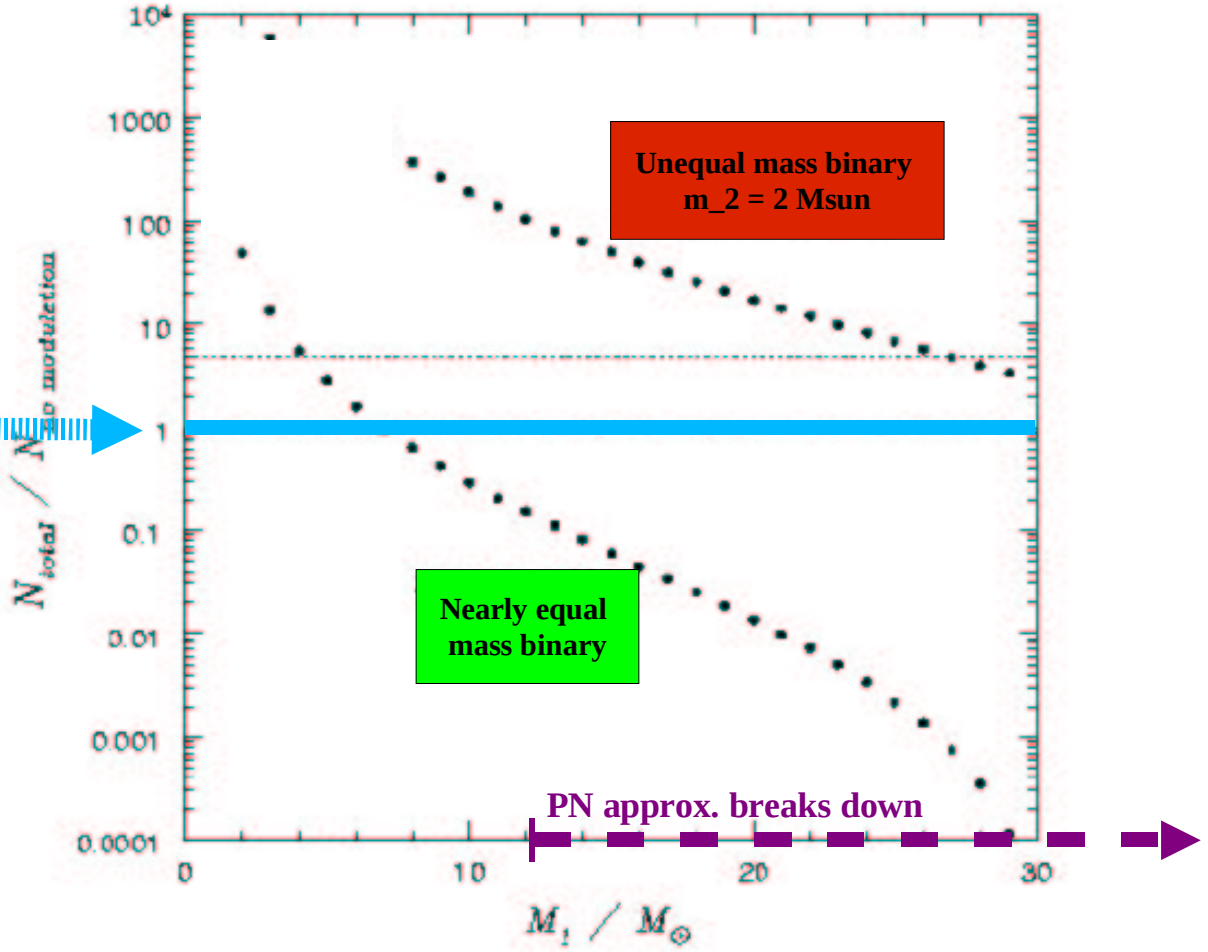
Computational costs
(5 parameters)

Computationally doable for M_min> 1 Msun and no spins (2 par.)



Conclusions

- Despite all the approximations and uncertainties, it is clear that we have indeed a concrete chance of searching for binary systems undergoing precession
- Key open questions:
  - Effective (FF) template family (Grandclement and Kalogera; Buonanno et al.)
  - Efficient (surely hierarchical) search algorithm