Long waveforms for spinning binaries

The orbital hangup case

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Results from

Achamveedu Gopakumar, MH, Sascha Husa, Bernd Brügmann, arXiv:0712.3737

and

MH, Sascha Husa, Bernd Brügmann, Achamveedu Gopakumar, arXiv:0712.3787

We want to match PN and NR waveforms to produce hybrid waveforms

Equal-mass non-spinning example:

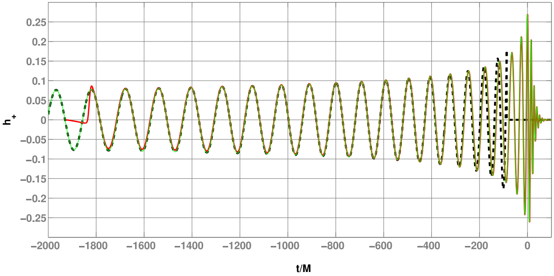


Figure: P. Ajith, *et. al.*, arXiv:0710.2335

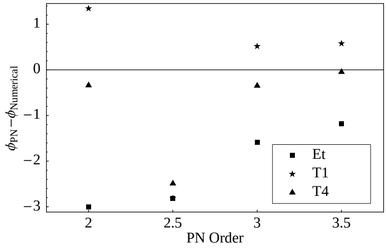
To do this, you want to know in what region PN and NR agree, and by how much

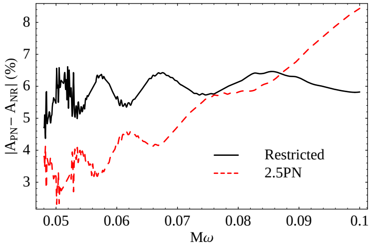
PN-NR comparison: equal-mass nonspinning binaries

Over $\approx$ 14 cylces up to $M\omega = 0.1$, phase agreement is within 1.5 radians.

Amplitude disagreement with restricted PN is about 6%.

With 2.5PN amplitude, the disagreement is about 3% at low frequencies.





See arXiv:0706.1305 (June 2007),
and arXiv:0712.3737 (December 2007, comaprison with TaylorEt approximant).

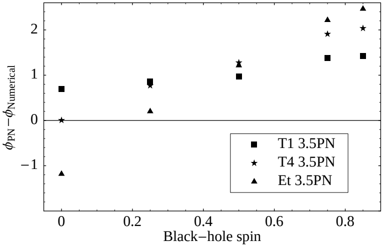
PN-NR comparison: spinning binaries

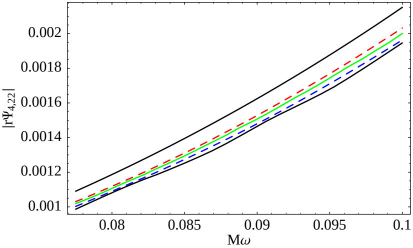
Equal mass, equal spins, parallel to orbital angular momentum.

Consider $S_i/M_i^2 = 0.25, 0.5, 0.75, 0.85$.

Over 10 cycles up to $M\omega = 0.1$, phase disagreement is less than 2.5 radians; roughly constant for T1.

Restricted amplitude disagreement grows to about 12% for $S_i/M_i^2 = 0.85$.



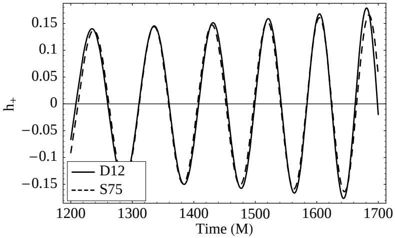


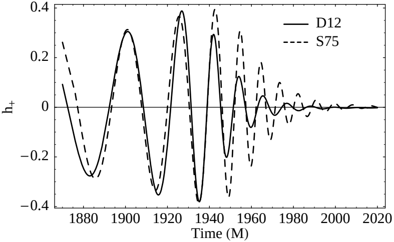
Detection of spinning binaries

During inspiral, it's difficult to distinguish spinning from nonspinning

(Spinning binary = nonspinning binary with a different mass.)

But at the merger, the two are clearly distinct.





See arXiv:0712.3787.