Contribution ID: **30** Type: **poster**

An improved analytical representation of the postmerger and ringdown

Wednesday, 20 February 2019 18:00 (1 minute)

The postmerger-ringdown waveform of coalescing, non-precessing, spinning binary black holes in the \texttt{TEOBresumS} model is given by a closed form, analytic, time-domain family of template waveforms, informed by a large set of Numerical Relativity waveforms from different codes such as the BAM code, the SpEC code and state-of-the-art test-particle waveforms. The NR waveforms cover the parameter space from the equal mass case till the test-particle limit. This includes 5 waveforms generated by the BAM code with mass ratio $m_1/m_2 = 18$ and with the heavier BH spinning with spins up to ± 0.8. The peak is fitted with an error of at most 2% in both amplitude and frequency. The phase (amplitude) is fitted with an accuracy of at least $0.1 rad$ (10%) over the first 10-15M after the peak, with the exception of 3 outliers.

Stand alone the model can be used for several studies independently as well. The postmerger and ringdown of very heavy black hole binary systems, such as GW170729, will still be in the observable band of 2nd generation gravitational wave detectors such as advanced LIGO and advanced Virgo. Analyzing the signals directly in the time-domain, using the analytical postmerger-ringdown waveform model, gives a fully independent measurement of source parameters. Further, it was demonstrated in arXiv:1811.08744 that fits of key waveform characteristics, such as peak amplitude and frequency, could be used for consistency tests of general relativity in the strong-field regime.

After a pedagogical introduction to the analytic setup I will discuss the set of Numerical Relativity waveforms used to inform the model and highlight several technical details of the fitting procedure. I will discuss the fitting of the peak structures for the complex multipolar waveforms. I will conclude by showing results of the application of the model to the analysis of real gravitational wave data.

Summary

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Session Classification: Poster session

Track Classification: Gravitational Waves