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Reduced order model for binary neutron star waveforms with tidal interactions BENJAMIN LACKEY, Syracuse University, SEBASTIANO BERNUZZI, Parma University, CHAD GALLEY, Caltech University — Observations of inspiralling binary neutron star (BNS) systems with Advanced LIGO can be used to determine the unknown neutron-star equation of state by measuring the phase shift in the gravitational waveform due to tidal interactions. Unfortunately, this requires computationally efficient waveform models for use in parameter estimation codes that typically require 10^6-10^7 sequential waveform evaluations, as well as accurate waveform models with phase errors less than 1 radian over the entire inspiral to avoid systematic errors in the measured tidal deformability. The effective one body waveform model with $\ell = 2$, 3, and 4 tidal multipole moments is currently the most accurate model for BNS systems, but takes several minutes to evaluate. We develop a reduced order model of this waveform by constructing separate orthonormal bases for the amplitude and phase evolution. We find that only 10-20 bases are needed to reconstruct any BNS waveform with a starting frequency of 10 Hz. The coefficients of these bases are found with Chebyshev interpolation over the waveform parameter space. This reduced order model has maximum errors of 0.2 radians, and results in a speedup factor of more than 10^3, allowing parameter estimation codes to run in days to weeks rather than decades.

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