

PhenomXHM - a modular, accurate and computationally efficient waveform model including subdominant spherical harmonics and mode mixing effects

We present PhenomXHM, a model for subdominant spherical harmonics of coalescing binary black hole systems, which is calibrated to non-precessing numerical relativity simulations and extreme mass ratio waveforms. The model is based on the new PhenomX model, which is calibrated to the dominant quadrupole mode for non-precessing systems, and supersedes the PhenomD and PhenomP models, which have become standard tools in gravitational wave data analysis. PhenomXHM currently includes four harmonics in addition to the dominant quadrupole mode, mode mixing effects for the $l=3, |m|=2$ spherical harmonic, and accelerated evaluation through a variant of multi-banding. We discuss the accuracy of the model and its impact on parameter estimation for current and some planned gravitational wave detectors.