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Comparing eccentric waveform models based on post-Newtonian and effective-one-body approaches

In this study, we present a rigorous comparison of two numerical models, CBWaves and SEOBNRE, which are based on the post-Newtonian and effective one-body (EOB) frameworks, respectively, for simulating eccentric binary systems. To ensure a comprehensive evaluation of the differences between these models, we performed an exceptionally large-scale set of 260,000 simulations—comprising 20,000 for non-spinning binaries and 240,000 for spinning configurations—spanning a finely resolved parameter space. This high-resolution grid includes mass ratios, defined as $\nu \equiv m_1/m_2 \in [0.1, 1]$, gravitational masses $m_i \in [10M_\odot, 100M_\odot]$, spin magnitudes $S_i \in [0, 0.6]$, and a fixed initial eccentricity e_0. The computational demands of this extensive simulation campaign were substantial, reflecting the need for high precision in capturing the intricate dynamics of these systems. In my presentation, I will highlight the key findings from this detailed analysis, focusing on the differences in the gravitational waveforms produced by the two models, and their implications for the modeling of eccentric binaries.

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