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Exploring the remnant properties of precessing black hole binaries by combining numerical relativity and extreme mass ratio data sets

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For the foreseeable future, numerical relativity waveforms for calibrating waveform models will be sparse in the parameter space of precessing (even more so for generic) black hole binaries, especially at high mass ratios. It is however well known that the extreme mass ratio limit can provide useful information even for the comparable mass ratio regime, and it can be hoped that using such information can reduce the number of numerical relativity waveforms that are needed for calibrating waveform models. In this work, we present two key steps toward this goal: First, we construct a consistent heterogeneous dataset for quasi-circular precessing binaries, which combines numerical relativity waveforms from different codes, numerical solutions of the Teukolsky equation, and information from Kerr geodesics. Second, we discuss models of the remnant properties for single spin precessing binaries, which cover all mass ratios. To accurately understand the region where no NR information is available, we rely on approximations based on Kerr geodesics, which turn out to provide valuable information up to comparable masses.

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