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Progress in gravitational self-force theory: recent advances in modelling asymmetric binaries

Monday, 11 September 2023 10:30 (1 hour)

As gravitational-wave detectors become more sensitive to lower frequencies, they will increasingly detect binaries with smaller mass ratios, larger spins, and higher eccentricities. In this talk I describe how gravitational self-force theory, when combined with a method of multiscale expansions, provides an ideal framework for modelling these systems. The framework proceeds from first principles while simultaneously enabling rapid generation of waveforms on a timescale of milliseconds. I discuss the state of the art in this method: non-spinning, quasicircular waveforms at second perturbative order in the mass ratio. I present progress toward extending this second-order model to include spins and to include the final merger and ringdown. I also discuss the domain of validity of these models, focusing on their accuracy for mass ratios in the intermediate regime $\sim 1:10$ to $1:100$.

Presenter: POUND, Adam

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