Modeling and Measuring Eccentricity in Binary Black Hole Inspirals

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Due to the emission of gravitational wave (GW) radiation, most compact binaries are expected to circularize before emitting GW in the LIGO frequency band. However, if a binary black hole system resulted from dynamical capture or hierarchal triple interactions close to the end of its life, there is a probability that the system could retain non-negligible eccentricity while in the LIGO band. As such, observing eccentricity from a gravitational wave signal could be a clear signature of dynamical origins. Despite the observational importance of eccentricity, the techniques needed to detect and characterize eccentricity currently remain in their early stages. We seek to model and assess detectability and identifiability of eccentric binary black hole systems, aiming to discover how accurately we can estimate parameters of an eccentric waveform. In particular, we search for degeneracies between eccentricity and other higher order effects, such as spin precession. We employ a variety of data analysis techniques, including calculating overlaps between waveforms, constructing likelihood distributions, and performing Bayesian inference.