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Influence of higher-order waveform multipoles for the detection of eccentric binary black hole mergers[1] ADAM REBEI, Univ of Illinois at Urbana-Champaign, ELIU HUERTA, ROLAND HAAS, DANIEL JOHNSON, NCSA/Univ of Illinois at Urbana-Champaign — Several studies in the literature have quantified the impact of higher-order waveform multipoles for the detection of quasi-circular binary black hole mergers. However, there is no study in the literature that has addressed this important topic in the context of eccentric binary black hole mergers. We shed light on this topic by performing a systematic study of the importance of including higher-order waveform multipoles, in particular the modes $(\ell, m) = (2, 2)$, $(3, 3)$, $(4, 4)$, $(2, 1)$ and $(3, 2)$, for the detection of eccentric binary black hole mergers. We extract these modes from our catalog of eccentric numerical relativity simulations that describe binary black hole mergers with mass-ratios $q < 6$ and eccentricities $e < 0.2$ ten cycles before merger. We explore the configurations in which these modes contribute significantly to the signal-to-noise ratio of astrophysically motivated sources, and find that the inclusion of these modes is not critical for the detection of equal mass binary black hole mergers. However, gravitational wave searches that target asymmetric mass-ratio systems should include them.

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