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Angular emission patterns of remnant black-holes XIANG LI, Caltech, LING SUN, Australian National University, RICO KA LOK LO, Caltech, ETHAN PAYNE, Australian National University, YANBEI CHEN, Caltech — The final stage of a binary black-hole merger, the ringdown, is described by the Teukolsky Equation, which predicts both the temporal and angular dependencies. Many studies have focused on black-hole spectroscopy, while the angular distribution has not been extensively investigated. In this work, by introducing a novel global fitting procedure over both time and angular dependencies, we further study the spatial distribution of ringdown waveforms. We show that spin-weighted spheroidal harmonics are a better representation of angular emission pattern when compared to spin-weighted spherical ones, and that their differences are distinguishable in numerical relativity waveforms. In the presentation, we will qualitatively draw the relation between the progenitor binary properties and the excitation of quasinormal modes, including higher-order angular modes and overtones. Specifically, we show that the retrograde modes will be excited when the primary black hole's spin in a large mass ratio binary is not aligned with the orbital angular momentum. Our work seeks to inspire a strategy of testing the ringdown angular emission pattern by stacking multiple gravitational-wave events, as a single event cannot be observed from multiple directions to allow for a global fitting.

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