

Probing the Ultralight Boson with the Ringdown Phase of Black Hole Mergers

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Ultralight bosons are an encouraging class of dark matter candidate particles, which may form long-lived bosonic clouds surrounding rotating black holes via superradiance. We compute the shifts in the gravitational quasinormal-mode frequencies of supermassive black holes due to the presence of such a bosonic cloud. We then use the modified ringdown waveform of a supermassive black hole from a surrounding bosonic cloud as a novel probe of the existence of a potential ultralight boson of mass $\in [10^{-16}, 10^{-18}]eV$. Because the ringdown signal of a binary merger is significantly shorter than the inspiral, our ringdown test of the ultralight boson can probe masses on timescales relatively shorter than inspiral-based, stochastic, or population-based search methods.

Reference to paper (DOI or arXiv)

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