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Universal Nature of Black Hole Ringdown: Overtone Excitation and Graybody Factors

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A gravitational wave from a binary black hole merger is an important probe to test gravity. Especially, the observation of ringdown may allow us to perform a robust test of gravity as it is a superposition of excited quasi-normal (QN) modes of a Kerr black hole. The excitation factor is an important quantity that quantifies the excitability of QN modes and is independent of the initial data of black hole mergers.

In this talk, I will show which QN modes can be important (i.e., have higher excitation factors) and will discuss how we can determine the start time of ringdown to maximally enhance the detectability of the QN modes.

Also, I will introduce my recent conjecture on the modeling of ringdown waveform: the thermal ringdown model in which the ringdown spectrum of a small mass ratio merger involving a massive and rapidly spinning black hole can be modeled by the graybody factor of the black hole, which is similar to the thermal Fermi-Dirac distribution.

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