

## Comparison of various methods to extract ringdown frequency from gravitational wave data

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The ringdown part of gravitational waves in the final stage of merger of compact objects tells us the nature of strong gravity which can be used for testing the theories of gravity. The ringdown waveform, however, fades out in a very short time with a few cycles, and hence it is challenging for gravitational wave data analysis to extract the ringdown frequency and its damping time scale. We here propose to build up a suite of mock data of gravitational waves to compare the performance of various approaches developed to detect quasi-normal modes from a black hole. In this paper we present our initial results of comparisons of the following five methods; (1) plain matched filtering with ringdown part (MF-R) method, (2) matched filtering with both merger and ringdown parts (MF-MR) method, (3) Hilbert-Huang transformation (HHT) method, (4) autoregressive modeling (AR) method, and (5) neural network (NN) method. After comparing their performance, we discuss our future projects.

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