

'Black hole ringdown modelling: linking the horizon dynamics to the gravitational wave observations'

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The last phase of a black hole merger is accompanied by a train of damped gravitational radiation known as the ringdown. It can be described linearly at late times, as a sum of discrete modes: the quasi-normal modes (QNMs) of the final Kerr black hole. As a consequence of the black hole no-hair theorem, the QNM frequencies are fully determined by the mass and spin of this black hole. Measures of these frequencies then enable tests of this prediction of GR e.g. by comparison between multiple QNMs. It has been suggested that ringdown signals may be modelled by QNMs already from the merger onwards using a large enough number of modes (overtones), which could remove the need to analyse much quieter late-time signals. I will present and discuss the results of further tests of this claim from numerical relativity results in two regimes: the local dynamics of the final horizon, and the closely related gravitational radiation itself when modelled with many QNM overtones. I will in particular discuss the stability of the recovery of individual QNM tones and the resulting prospects for spectroscopic tests of GR; as well as comparisons to a few phenomenological models beyond the linear QNMs.

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