

Black hole spectroscopy: GR and beyond

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According to the no-hair theorem, quasi-normal mode frequencies and damping times are exclusively determined by a black hole's mass and spin. Black hole spectroscopy has shifted from theoretical conjecture to an empirical method for testing these assumptions using current LIGO-Virgo-Kagra observations. We employ a time-domain analysis in an agnostic framework to identify multiple ringdown modes, and verify their agreement with Kerr solution predictions. Analyzing a “controlled” dataset of GW150914-like signals, we investigate deviations from General Relativity using Bayesian model comparison. We explore various scenarios, including how waveform systematics and data quality issues might lead to biased results or false claims of GR violation, and analyse beyond-GR signals, focusing on Kerr-Newman simulations as the most well-posed cases beyond GR.

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