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Observational Black Hole Spectroscopy (C)

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In the presence of external perturbations, astrophysical black holes (BHs) relax toward a Kerr spacetime, as a consequence of the final state conjecture. During the relaxation process (ringdown), BHs emit a spectrum given by a superposition of damped sinusoids whose parameters are completely determined by the asymptotic BH mass and spin. The ringdown emission is observable in binary black holes (BBH) coalescences by means of the current and upcoming ground-based interferometers network. Employing the known general relativistic predictions for the spectrum (both from linearized theory and complete numerical solutions), it is possible to test for the existence of alternative extreme compact objects, new particles surrounding BHs, hairy BHs or even wormholes. In this talk, we present the first experimental implementation of BH spectroscopy, test for the presence of multiple modes through Bayesian model comparison and infer the transition time between the non-linear and the quasi-stationary regime of the post-merger signal. We further place constraints on the excitation amplitudes of ringdown modes and investigate classical bounds on the information emission rate of BHs. Finally we show the constraints we can currently place on parametric deviations from general relativity predictions for the spectrum and how the increasing sensitivity of the current network of interferometers will allow precision tests of general relativity in the ringdown regime.

Summary

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