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Perturbation theory with black hole quasinormal modes

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The resonant modes of a black hole consist of damped sinusoids, called quasinormal modes. Due to the dissipative nature of the system, the equation governing the modes is non-hermitian. Nevertheless, quasinormal modes have been shown to be orthogonal with respect to a suitable bilinear form defined in Green et al. (2022). More recently, Cannizzaro et al. (2023) showed that this bilinear form is suited to compute the frequency shift of scalar quasi-bound states due to some deformation of the spacetime, at first order in the perturbative parameter.

This work builds on these recent advancements, aiming to develop a perturbative framework analog to perturbation theory in quantum mechanics, suited to investigate spectral shifts and mode corrections to Kerr quasi-normal modes.

Primary author: LESTINGI, Jacopo (The university of nottingham)

Presenter: LESTINGI, Jacopo (The university of nottingham)

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