Contribution ID: **64** Type: **not specified**

# Orthogonality and transitions between black-hole quasibound states

*Friday 7 July 2023 14:20 (20 minutes)*

Linear perturbations around black hole spacetimes can be quasinormal, quasibound or even superradiantly unstable, depending on the fields involved and the system's parameters. Recently, a bilinear form on perturbations of Kerr was proposed, and shown to give rise to an orthogonality relation between quasinormal modes. In this work, we extend the definition of the bilinear form and the orthogonality relation to quasibound and superradiant states of massive scalar fields. As a first application, we evaluate the bilinear form numerically for massive scalar perturbations in Schwarzschild, and confirm numerically the orthogonality between quasibound states of different quantum numbers. We then use the bilinear form to compute the excitation of modes due to a perturbation to the black hole potential, due e.g. to an extreme-mass-ratio companion. We show that the corresponding level mixing between quasibound modes can differ by $\mathcal{O}(10)\%$ compared to the commonly employed non-relativistic (or hydrogenoid) approximation.

**Presenter:** SBERNA, Laura (Max Planck Institute for Gravitational Physics (Albert Einstein Institute), Potsdam)

**Session Classification:** Friday Afternoon