

Quasinormal Modes Decode Kasner Scaling inside Black Holes

Monday, 9 November 2026 09:00 (30)

Can the geometry hidden behind a black hole's event horizon be reconstructed from its exterior quasinormal-mode spectrum? In this talk, I will explore how high-overtone quasinormal modes encode information about black hole interiors. We show that distinct power-law corrections to the spectrum, obtained through angular-momentum and scalar-mass responses, allow the temporal and angular Kasner exponents to be extracted separately, without imposing the Kasner constraints. Using analytic monodromy methods and numerical calculations, we demonstrate this reconstruction in asymptotically flat black holes. In particular, we establish a four-dimensional Schwarzschild benchmark, where the predicted scaling behavior is confirmed numerically, and show that gravitational perturbations exhibit the same singularity-sensitive asymptotic structure. We further investigate dilatonic black holes, demonstrating that the reconstructed exponents track changes in the interior geometry. Complementary higher-dimensional and asymptotically AdS examples provide additional tests of the underlying mechanism. Our results establish a quantitative connection between exterior quasinormal-mode spectra and black hole interior geometry, opening a theoretical route toward probing otherwise inaccessible regions of spacetime.

Primary author(s) : XIAO, Zi-Qing (ICTP-AP); Prof. NIAN, Jun (ICTP-AP); LI, Li (Institute of Theoretical Physics, Chinese Academy of Sciences)

Presenter(s) : XIAO, Zi-Qing (ICTP-AP)

Session Classification : Parallel-Gravity