

Phenomenology: Testing black hole eikonal correspondence

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Adopting geometric-optics approximations in black hole spacetimes enables the construction of a mapping between black hole images and eikonal black hole quasinormal modes (QNMs). More explicitly, the real part and imaginary part of the QNM frequencies correspond to the ring size and the detailed ring structure of the image, respectively. This correspondence may be violated when going beyond general relativity. In this talk, I'll discuss the possibility of testing this mapping using real black hole observations. We propose a novel method to test the eikonal correspondence via the comparison of two sets of observables from a nonrotating black hole, one extracted from QNM spectra and the other from the lensed photon rings on the image plane. In particular, I'll demonstrate that the photon ring observables robustly capture the information of the black hole spacetime itself regardless of the surrounding emission models. Therefore, the proposed test of eikonal correspondence can be validated in quite broad scenarios.

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