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Joining black hole imaging and ringdown: A novel view of testing gravity

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In geometric-optics limits, there exists a mapping between black hole images and eikonal black hole quasi-normal 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. The explicit identification of such eikonal correspondence, however, relies a lot on the symmetry of the spacetime under consideration and, therefore, is highly non-trivial. Having in mind that such a correspondence may be violated beyond GR, I will discuss how joining the observations of ringdown and images of black holes could test such correspondence and constrain a class of non-GR theories where the correspondence is broken, opening a novel window of testing gravity.

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