

Abstract Submitted
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Probing beyond-Kerr spacetimes with the inspiral-merger-ringdown consistency tests of gravitational waves¹ ZACK CARSON, KENT YAGI, University of Virginia — The extreme-gravity collisions between black holes allow us to probe the underlying theory of gravity sourcing their interactions in the extreme-gravity regime. For the first time, we apply the theory-agnostic inspiral-merger-ringdown consistency tests to both an example theory beyond general relativity, as well as a generic bumpy-Kerr spacetime metric. With this new prescription, we demonstrate how one can modify the inspiral, the ringdown quasinormal modes, and the remnant black hole properties of the gravitational waveform with relative ease. Here we focus on the string-inspired Einstein-dilaton Gauss-Bonnet theory of gravity, as well as the Johannsen-Psaltis bumpy-Kerr spacetime which can be mapped to several alternative theories of gravity. We then show that future multi-band observations allow us to constrain the example theories stronger than current observations by an order of magnitude using the inspiral-merger-ringdown consistency test. The formalism developed here can easily be applied to other alternative theories of gravity given the necessary ingredients.

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