

Not quite a black hole: from quadratic gravity to gravitational wave echoes

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Astrophysical black hole candidates might be horizonless ultracompact objects. Of particular interest is the plausible fundamental connection with quantum gravity. The puzzle is then why we shall expect Planck scale corrections around the horizon of a macroscopic black hole. Taking asymptotically free quadratic gravity as a possible candidate of UV completion of general relativity, I will show how the would-be horizon can be naturally replaced by a tiny interior with high curvature. The new horizonless 2-2-hole as sourced by sufficiently dense matter may then be the nearly black endpoint of gravitational collapse. In the era of gravitational wave astronomy, echoes in the post-merger phase may provide a great opportunity to probe quantum gravity corrections around the horizon. Given the uncertainties associated with the echoes waveform, I will discuss using simple windowing methods to extract a signal from noise, where the time delay between echoes is the primary observable. Applying these methods to the LIGO data, tentative signals for echoes are found for multiple LIGO black hole merger events.

Dr. Ren received Ph.D. degree in physics in 2014 from Tsinghua University. Since then she has been working in University of Toronto in Canada as a postdoctoral fellow. Her research interests lie in the interface between gravity and theoretical particle physics.