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Nonlinear dynamics of compact object mergers beyond General Relativity

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In recent years, gravitational wave observations of compact objects have provided new opportunities to test our understanding of gravity in the strong-field,highly dynamical regime. To perform model-dependent tests of General Relativity with these observations, one needs accurate inspiral-merger-ringdown waveforms in alternative theories of gravity.
In this talk, we consider two generally applicable, but approximate methods for treating modifications to full general relativity that have been used to study binary black hole mergers and other phenomena in this regime, and compare solutions obtained by them to those from solving the full equations of motion. We use shift-symmetric Einstein-scalar-Gauss-Bonnet gravity as a benchmark theory to illustrate the differences between these methods for several spacetimes of physical interest. We will also discuss the nonlinear dynamics of black hole-neutron star binaries which have the potential to place strong constraints on modifications to general relativity that arise at small curvature length scales.

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