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On-shell approach to spinning binaries in scalar-tensor theories

Monday, September 22, 2025 10:00 AM (30 minutes)

The detection of gravitational waves has opened a new era in astronomy. At the same time, certain techniques borrowed from quantum field theory have proven very efficient for calculating classical waveforms for gravitational radiation emitted by systems of compact astrophysical objects. In this talk, I will discuss the application of these techniques to scalar-tensor theories of gravity, where long range interactions are mediated by a massless scalar in addition to the graviton. Such theories are of both theoretical and phenomenological interest, with examples including the Einstein-scalar-Gauss-Bonnet and Dynamical Chern-Simons theories. I will explain how to calculate waveforms and power emitted in gravitational and scalar radiation starting from amplitudes describing emission of a graviton or scalar in matter scattering. The required amplitudes can be calculated in a straightforward manner by using the on-shell and spinor-helicity techniques, also when spins of the compact objects are taken into account. At the leading order in spin the emitted power matches earlier results obtained by classical techniques, while spin-dependent corrections can be readily calculated in the on-shell approach. I will also discuss the effective field theory approach to scalar-tensor theories, and possible UV completions.

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