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On-shell amplitude approach to spinning binaries in GR and beyond

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The detection of gravitational waves by the LIGO-VIRGO collaboration has marked a transformative era in astronomy, providing groundbreaking insights into the cosmos and creating new pathways for exploration. At the same time, advancements in the classical limit of quantum scattering amplitudes, particularly through the KMOC formalism, have enriched our understanding of compact binary systems.

In this talk, we 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. We will start by providing an overview of how amplitude techniques are used to derive predictions for gravitational waves from binary systems of black holes and neutron stars. We will then proceed to give a purely "on-shell" description of arbitrarily spinning bodies with and without scalar hair, an effect which is often present in these theories and can lead to important modifications in the gravitational wave signal. We will discuss how all the required amplitudes can be calculated in a straightforward manner by using the on-shell and spinor-helicity techniques, which can be in turn used to directly compute waveforms for spinning binary systems.

Secondary track

T01 - Astroparticles, Gravitation and Cosmology

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