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High Precision Kerr Black Hole Scattering

Tuesday 11 November 2025 12:10 (30 minutes)

Scattering amplitudes have emerged as a powerful tool for predicting physical observables in two-body gravitational interactions. In this talk, I will present state-of-the-art results for the scattering of a spinning and non-spinning black hole, modelled as point particles in fixed-spin representations. A key complication in this approach is the mixing of classical and quantum contributions, introduced by the finite-spin description. We resolve this ambiguity using the recently developed spin interpolation method, which cleanly isolates the classical information. With this advance, we obtain the first computation of the classical two-loop scattering amplitude including terms up to quartic order in spin. From this amplitude we derive the radial action, enabling the extraction of observables such as the linear and angular impulses. Remarkably, the resulting amplitude reveals a novel spin-shift symmetry in the probe limit: it remains invariant under a shift of the black hole spin by the momentum transfer in the scattering process.

Presenter: AKPINAR, Dogan

Session Classification: Scattering Amplitudes in Gravity