

Orbital dynamics from the double copy and effective field theory

Wednesday 11 September 2019 11:30 (25 minutes)

We compute the third-post-Minkowskian conservative Hamiltonian of binary black holes using modern tools from scattering amplitudes and effective field theory. In the limit of large separation, non-spinning black holes have an effective description in terms scalar field particles coupled to gravity. The two-loop integrand is constructed using generalized unitarity and the double copy construction. We perform loop integration by expanding around zero velocity to high orders, using techniques borrowed from NRQCD, before matching the series to known functions. For some diagrams, we also validate the results using the method of differential equations. We comment on spurious collinear singularities that arise from the truncation of the quantum amplitude to the classical limit.

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Session Classification: Wednesday Morning A