

Frequency-domain approach to self-force in hyperbolic scattering

Tuesday 4 July 2023 11:00 (20 minutes)

Calculations of the scatter angle in hyperbolic black hole encounters have been of recent cross-disciplinary interest, driven by its potential to advance post-Minkowskian theory and the effective-one-body model of binary dynamics. In this talk I will present our frequency-domain method for calculating the self-force acting on a scalar charge on a fixed scattering geodesic in Schwarzschild spacetime. Existing frequency-domain methods, which are tailored for bound orbits, are inadequate here for several reasons. One must account for the continuous spectrum in the scattering problem, deal with slowly-convergent radial integrals that are hard to evaluate numerically, and confront the inapplicability of the standard EHS method, which only works for compactly supported sources. I will describe solutions to each of these issues in turn, and then present a full numerical implementation, in which we calculate the self-force correction to the scatter angle due to scalar-field back-reaction. Validation is achieved using regularization tests, as well as comparisons with the existing time-domain code. Finally I will discuss the merits and remaining limitations of our method, and outline directions for future work.

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