

The self-force method is an approximate approach to solving Einstein's field equations via a perturbation in the mass ratio. It is therefore the leading method in tackling waveforms for Extreme Mass Ratio Inspirals (EMRIs) – a key source for LISA. In calculating the self-force, one finds at zero order, the small black hole follows a test mass's geodesic while at first order it deviates due to interaction with its self-field. This is interpreted as a force, hence the self-force.

A key problem that arises in self-force calculations is the safe removal of the field singularity on the particle, or in the case of EMRI's, the secondary black hole's world line. One must model this singular field and safely remove it without affecting the resulting motion of the system. We use the physically relevant model, the Detweiler-Whiting singular field, where we surpass previous accuracies obtained for generic orbits in Kerr spacetime. This is particularly important in both the mode-sum regularization scheme and the effective source methods, as highly accurate singular fields increase the efficiency of the resulting self-force calculations.

In this talk, I outline the steps required to obtain such a result and illustrate the successful convergence of the resulting self-force calculations in the scalar case.