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Progress towards multiscale EMRI approximation: zones and scales

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We present an update to the multiscale analytic approximation method for computing EMRI dynamics. The multiscale method takes advantage of the separation of the radiation-reaction timescale to the orbital timescale. By appropriately accounting for the slow evolution of the system, we suggest a framework for computing the waveform with only $\mathcal{O}(\epsilon)$ phase error. This framework will also be useful for computing quantities relevant for comparisons to Post-Newtonian or Numerical Relativity computations to second order in the mass ratio. Full second-order solution requires the introduction of ‘puncture’ regions near the horizon, near the small companion, and far from the binary, which are related to the interaction with the inspiral via a matched asymptotic expansion. We propose a geometric optics approximation for the region far from the inspiral.

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