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Inspirals of point particles into black holes via two-timescale TANJA HINDERER, EANNA FLANAGAN, Cornell University — The inspiral of stellar mass compact objects into massive black holes are an important source for future gravitational wave detectors such as LISA and Advanced LIGO. Detection of these sources and extracting information from the signal relies on accurate theoretical models of the binary dynamics. We analyze this problem using a two-timescale expansion, which provides a rigorous derivation of the prescription for computing the leading order waveform. As shown by Mino, this leading order waveform, which we call the adiabatic waveform, requires only the radiative self force. The two-timescale method also lays the foundations for calculating the post-adiabatic corrections needed for measurement templates. We show that the leading order post-adiabatic corrections (terms in the phase that scale as the square root of the mass ratio) are due to transient resonances that occur during an inspiral when the ratio of the radial and azimuthal frequencies is a low order rational number. This effect is not seen in post-Newtonian expansions. At the next, subleading order (order unity terms in the phase), there are phase corrections due to the conservative and dissipative pieces of the first order self force, and the dissipative piece of the second order self force. The resonant phase shifts depend on the subleading order terms. Therefore, going beyond the adiabatic approximation would require computation of the dissipative piece of the second order self force.

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