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The validity of the adiabatic approximation for extreme-mass ratio inspirals MARC FAVATA, EANNA FLANAGAN, Cornell University — The inspiral of a compact object into a massive black hole is one of the primary sources of gravitational waves for the planned Laser Interferometer Space Antenna (LISA). The detection of these sources relies on the accurate modeling of the binary dynamics. A precise description of the binary orbit requires an evaluation of the self-force. The adiabatic approximation, which consists of using the time-averaged rates of change of the three conserved quantities for geodesic motion using a prescription derived by Mino, greatly simplifies computation of the orbital evolution. The accuracy of this approximation has been debated in the literature; in particular it has been suggested that the approximation is poor for eccentric orbits. Using post-Newtonian expansions we estimate the error in the waveform's phase for slightly eccentric orbits, generalizing previous estimates for circular orbits. The results indicate that adiabatic waveforms will likely be accurate enough for detection templates. We also show that the approximation becomes poor at low frequencies, in agreement with arguments of Pound, Poisson and Nickel; however those frequencies are outside LISA's waveband.

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