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Analysis of extreme mass ratio inspirals in Kerr: Transition from inspiral to plunge TANJA HINDERER, Caltech — The gravitational radiation reaction driven inspiral of a compact object into a much more massive Kerr black hole proceeds through three different regimes: (i) An adiabatic inspiral, where the inspiral time scale is much larger than the orbital period and which can be modeled theoretically using two-timescale expansions, (ii) a transition regime near the separatrix where the orbit becomes unstable, and (iii) the infall which can be approximated as a geodesic plunge. A systematic local analysis of the orbital dynamics near the separatrix together with matched asymptotic expansions shows that the effect of passing through the transition regime amounts to small shifts in the constants of motion, whose magnitudes can be computed, together with a time adjustment. These results give insight into how the information about the initial conditions from the beginning of the inspiral is passed through the separatrix to give the initial conditions for the plunge. Since the timescale for the plunge is much shorter than the radiation reaction timescale, the plunging orbit will closely track the corresponding unperturbed separatrix trajectory. A detailed theoretical model of the near-separatrix dynamics for generic orbits is important for understanding features such as zoom-whirl behavior.

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