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Evolution of the Carter constant for inspirals into a black hole: effects of the quadrupole and quadratic in spin 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. The detection of these sources relies on the accurate modeling of the binary dynamics. Crude approximate waveforms can be computed using post-Newtonian methods. We analyze the effect of gravitational radiation reaction on generic orbits around a body with an axisymmetric mass quadrupole moment Q to linear order in Q, to the leading post-Newtonian order, and to linear order in the mass ratio. This system admits three constants of the motion in absence of radiation reaction: energy, angular momentum along the symmetry axis, and a third constant analogous to the Carter constant. We compute instantaneous and time-averaged rates of change of the three constants. For a Kerr black hole, the quadrupole is related to the spin parameter $a = S/M^2$ by $Q = -a^2M^3$. Our results, when combined with an interaction quadratic in the spin (the backscattering of the radiation off the piece of spacetime curvature due to the black hole's spin), gives the next to leading order evolution of the Carter constant, the leading order term being linear in the spin was previously computed by Ryan.

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