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Second-Order Perturbations of Extreme Mass-Ratio Binary Schwarzschild Black Hole Systems JONATHAN THOMPSON, University of Florida — General advancement in perturbation theory usually involves pushing the perturbative analysis to higher orders. When examining the geodesic motion of a point particle in a circular orbit about a Schwarzschild mass, the full spacetime metric may be expanded in powers of the particle's mass, μ. Adhering to the standard formalism for self-force perturbations, one finds that by solving the first-order problem the particle no longer travels along a geodesic of the background metric, but rather a geodesic of the background plus an order $\mathcal{O}(\mu)$ correction to the metric, typically written $g_{\mu\nu} + h^{\mathrm{R}}_{\mu\nu}$. The field $h^{\mathrm{R}}_{\mu\nu}$ is called the regular field. In advancing the perturbation to second-order, one must first calculate the first-order regular field, so as to account for the shift in the particle's worldline. Within this framework, second-order perturbative effects may be attained after solving the Einstein equations for a particle traveling along this regularly perturbed worldline, including as well the non-linear gravitational source terms arisng from the first-order metric perturbation.

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