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Relativistic effects in the tidal interaction between a white dwarf and a massive black hole in Fermi normal coordinates ROSEANNE M. CHENG, CHARLES R. EVANS, University of North Carolina at Chapel Hill — We present a new numerical code constructed to obtain accurate simulations of encounters between a star and a massive black hole. We assume Newtonian hydrodynamics and self-gravity for the star. The three-dimensional parallel code includes a PPMLR hydrodynamics module to treat the gas dynamics and a Fourier transform-based method to calculate the self-gravity. The formalism for calculating the relativistic tidal interaction in Fermi normal coordinates (FNC) allows the addition of an arbitrary number of terms in the tidal expansion. We present the relevant post-Newtonian terms for this code. Results are given for an $n = 1.5$ polytrope with comparisons between simulations and predictions from the linear theory of tidal encounters. It is shown that the inclusion of the $l = 3$ tidal term will cause the center of mass of the star to deviate from the origin of the FNC. We compare relativistic and Newtonian simulations for three different mass ratios, $\mu \sim 10^{-3}, 10^{-4}, 10^{-5}$. We find that for relativistic encounters, the dimensionless parameter, $T_2(\eta)$, (which characterizes the energy deposited into non-radial oscillations) must not only be a function of the dimensionless disruption parameter, η, but also of a dimensionless relativistic parameter Φ_p.

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