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Geometry and dynamics of a tidally deformed black hole ERIC POISSON, University of Guelph — The metric of a nonrotating black hole deformed by a tidal interaction is calculated and expressed as an expansion in the strength of the tidal coupling. The expansion parameter is the inverse length scale $\mathcal{R}^{-1}$, where $\mathcal{R}$ is the radius of curvature of the external spacetime in which the black hole moves. The expansion begins at order $\mathcal{R}^{-2}$, and it is carried out through order $\mathcal{R}^{-4}$. The metric is parameterized by a number of tidal multipole moments, which specify the black hole's tidal environment. The tidal moments are freely-specifiable functions of time that are related to the Weyl tensor of the external spacetime. The metric is presented in a light-cone coordinate system that possesses a clear geometrical meaning. At the order of accuracy maintained in this work, the horizon is a stationary null hypersurface foliated by apparent horizons; it is an isolated horizon in the sense of Ashtekar and Krishnan. As an application of our results we examine the induced geometry and dynamics of the horizon, and calculate the rate at which the black-hole surface area increases as a result of the tidal interaction.

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