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Perturbations of Schwarzschild black holes in the Lorenz gauge: Formulation and numerical implementation[1] CARLOS LOUSTO, The University of Texas at Brownsville, LEOR BARACK, University of Southampton, England — We reformulate the theory of Schwarzschild black hole perturbations in terms of the metric perturbation in the Lorenz gauge. In this formulation, each tensor-harmonic mode of the perturbation is constructed algebraically from 10 scalar functions, satisfying a set of 10 wavelike equations, which are decoupled at their principal parts. We solve these equations using numerical evolution in the time domain, for the case of a pointlike test particle set in a circular geodesic orbit around the black hole. Our code uses characteristic coordinates, and incorporates a constraint damping scheme. The axially-symmetric, odd-parity modes of the perturbation are obtained analytically. The approach developed here is especially advantageous in applications requiring knowledge of the local metric perturbation near a point particle; in particular, it offers a useful framework for calculations of the gravitational self force.

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