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Motion of a hyperelastic sphere in Schwarzschild spacetime NISHITA JADOO, J. DAVID BROWN, North Carolina State University — We simulate the motion of a 10 cm hyperelastic sphere in Schwarzschild spacetime. We use a finite element discretization of the sphere and a Lagrangian formulation of the equations of motion to evolve each node. After obtaining the worldline of each node, we choose a fiducial node and set up a Fermi normal frame (FNF) at that node. Since the size of the sphere is small compared to the curvature of spacetime, we approximate the metric in the FNF as nearly flat. We look at both a close encounter orbit as well as a radial plunge. We plot the spatial coordinates of the nodes in the FNF and observe the sphere as it deforms, oscillates and rotates. The observed oscillation frequency in the FNF agree with the lowest-frequency ellipsoidal mode for small oscillations of a free solid elastic sphere. We integrate the stress-energy-momentum tensor to obtain the spin, internal energy and center of mass in the FNF. We observe the changes in spin and internal energy as the sphere interacts with the black hole.

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