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3D Hybrid Simulations of Interactions of High-Velocity Plasmoids with Obstacles Y.A. OMELCHENKO, Trinum Research, Inc., T.E. WEBER, LANL, R.J. SMITH, University of Washington — Interactions of fast plasma streams and objects with magnetic obstacles (dipoles, mirrors, etc) lie at the core of many space and laboratory plasma phenomena ranging from magnetoshells and solar wind interactions with planetary magnetospheres to compact fusion plasmas (spheromaks and FRCs) to astrophysics-in-lab experiments. Properly modeling ion kinetic, finite-Larmor radius and Hall effects is essential for describing large-scale plasma dynamics, turbulence and heating in complex magnetic field geometries. Using an asynchronous parallel hybrid code, HYPERS, we conduct 3D hybrid (particle-in-cell ion, fluid electron) simulations of such interactions under realistic conditions that include magnetic flux coils, ion-ion collisions and the Chodura resistivity. HYPERS does not step simulation variables synchronously in time but instead performs time integration by executing asynchronous discrete events: updates of particles and fields carried out as frequently as dictated by local physical time scales. Simulations are compared with data from the MSX experiment which studies the physics of magnetized collisionless shocks through the acceleration and subsequent stagnation of FRC plasmoids against a strong magnetic mirror and flux-conserving boundary.

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