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Variational Algorithms for Drift and Collisional Guiding Center Dynamics[1] C. LELAND ELLISON, Princeton Plasma Physics Laboratory, JOHN M. FINN, Los Alamos National Laboratory, HONG QIN, WILLIAM M. TANG, Princeton Plasma Physics Laboratory — The simulation of guiding center test particle dynamics in the upcoming generation of magnetic confinement devices requires novel numerical methods to obtain the necessary long-term numerical fidelity. Geometric algorithms, which retain conserved quantities in the numerical time advances, are well-known to exhibit excellent long simulation time behavior. Due to the non-canonical Hamiltonian structure of the guiding center equations of motion, it is only recently that geometric algorithms have been developed for guiding center dynamics. This poster will discuss and compare several families of variational algorithms for application to 3-D guiding center test particle studies, while benchmarking the methods against standard Runge-Kutta techniques. Time-to-solution improvements using GPGPU hardware will be presented. Additionally, collisional dynamics will be incorporated into the structure-preserving guiding center algorithms for the first time. Non-Hamiltonian effects, such as polarization drag and simplified stochastic operators, can be incorporated using a Lagrange-d'Alembert variational principle. The long-time behavior of variational algorithms which include dissipative dynamics will be compared against standard techniques.

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