Abstract Submitted for the DPP20 Meeting of The American Physical Society

Volume-Preserving Integrators for Guiding Center Dynamics¹ ERIC PALMERDUCA, HONG QIN, Princeton Plasma Physics Laboratory, Princeton University — Recently, 6D structure-preserving geometric particle-in-cell (PIC) algorithms for the Vlasov-Maxwell system have been successfully developed and applied. The advantages of structure-preserving geometric PIC algorithms over the conventional PIC algorithms in terms of long-term accuracy and fidelity have been amply demonstrated in recent simulations. A stable variational structure-preserving algorithm for guiding center (GC) dynamics is a much-needed component in the development of structure-preserving geometric PIC algorithms for the gyrokinetic system. However, constructing stable symplectic algorithms for GC dynamics with an arbitrary magnetic field has proved difficult due to the degeneracy of the system's Lagrangian. Here we relax the constraint of symplecticity, and instead search for stable integrators which conserve phase space volume in a gyrokinetic system. Such a volume-preserving algorithm may still globally bound the energy error despite not being symplectic, and thus satisfy the needs of a structure-preserving geometric PIC code.

¹This research was supported by the U.S. Department of Energy (DE-AC02-09CH11466).

Eric Palmerduca Princeton University

Date submitted: 26 Jun 2020 Electronic form version 1.4