Abstract Submitted
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A Geometric Particle-in-Cell Method for Magnetized and Polarized Media[1] WILLIAM BARHAM, PHILIP MORRISON, University of Texas at Austin, ERIC SONNENDRUECKER, Technical University of Munich — The Maxwell-Vlasov equations were shown to possess a noncanonical Hamiltonian structure in [1]. The Poisson bracket of this Hamiltonian theory demonstrates that the Maxwell-Vlasov equations possess a geometric structure. Of particular interest are the conserved quantities known as Casimir invariants. The geometric electromagnetic particle-in-cell (GEMPIC) computational framework exposited in [2] provides a means of discretizing the Maxwell-Vlasov equations in a manner that replicates in finite dimensions the Poisson manifold structure of the continuous model. A method of lifting the characteristics of a particle model to a kinetic model in a gauge invariant manner was given in [3]. Moreover, it was shown that many kinetic models of interest, such as drift kinetic models or gyrokinetic models, yield Maxwell's equations in a polarized and magnetized medium with these fields related to the electric and magnetic fields self-consistently through an energy functional. This work incorporates such models into the GEMPIC framework.

[1] P. J. Morrison. Phys. Lett. **80A**, 383 1980.
[2] M. Kraus, K. Kormann, P.J. Morrison, and Eric Sonnendrucker. J. Plasma Phys. **83**, 905830401 (2017).
[3] P. J. Morrison. Phys. Plasmas, **20**, 012104 (2013).

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