

Symplectic gyrokinetic Vlasov-Maxwell theory

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A new representation of electromagnetic gyrokinetic Vlasov-Maxwell theory is presented in which the gyrocenter symplectic structure contains the electric and magnetic field perturbations needed to yield the standard gyrocenter polarization and magnetization terms appearing in the gyrokinetic Maxwell equations, without the need of deriving the second-order gyrocenter Hamiltonian required for an energy-consistent standard Hamiltonian gyrokinetic Vlasov-Maxwell theory. The self-consistent gyrokinetic Vlasov-Maxwell equations are derived from a variational principle, which also yields exact energy and toroidal momentum conservation laws (through the Noether method) that are verified explicitly.