Symplectic representation of higher-order guiding-center theory

ALAIN BRIZARD, Department of Physics, Saint Michael’s College, Colchester, VT 05439, USA, NATALIA TRONKO, Centre for Fusion Space and Astrophysics, University of Warwick, UK — Two representations of guiding-center theory are possible depending on whether the guiding-center Poisson bracket (i.e., the symplectic structure) or the Hamiltonian contains higher-order corrections due to the nonuniformity of the magnetic field. By combining the guiding-center parallel hierarchy with the symplectic representation, the guiding-center equations of motion are derived with second-order corrections included in the symplectic structure without the need of carrying out the guiding-center transformation to second order. Guiding-center polarization and magnetization are thus shown to arise naturally from higher-order guiding-center theory within the context of a two-step derivation of nonlinear gyrokinetic theory.¹