Symplectic representation of higher-order guiding-center theory
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— 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]

[1]A. J. Brizard and T. S. Hahm, Rev. Mod. Phys. **79**, 421 (2007).

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