

Variational approach to low-frequency kinetic-MHD in the current-coupling scheme

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Hybrid kinetic-MHD models describe the interaction of an MHD bulk fluid with an ensemble of hot particles, which is described by a kinetic equation. When the Vlasov description is adopted for the energetic particles, different Vlasov-MHD models have been shown to lack an exact energy balance, which was recently recovered by the introduction of non-inertial force terms in the kinetic equation. These force terms arise from fundamental approaches based on Hamiltonian and variational methods. In this work we apply Hamilton's variational principle to formulate new current-coupling kinetic-MHD models in the low-frequency approximation (i.e. large Larmor frequency limit). More particularly, we formulate current-coupling hybrid schemes, in which energetic particle dynamics are expressed in either guiding-center or gyrocenter coordinates.