

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 obeys a kinetic equation. Here, we apply Hamilton's variational principle to formulate new current-coupling kinetic-MHD models in the low-frequency approximation [1] (i.e. large Larmor frequency limit). More particularly, we formulate current-coupling schemes, in which energetic particle dynamics are expressed in either guiding center or gyrocenter coordinates. When guiding center theory is used to model the hot particles, we show how energy conservation requires corrections to the standard magnetization term. On the other hand, charge and momentum conservation in gyrokinetic-MHD lead to extra terms in the usual definition of the hot current density as well as modifications to conventional gyrocenter dynamics. All these new features arise naturally from the underlying variational structure of the proposed models.

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- [1] Burby, J.W.; Tronci, C. *Variational approach to low-frequency kinetic-MHD in the current-coupling scheme*. Plasma Phys. Control. Fusion, 59 (2017), no. 4, 045013