Variational formulation of Hybrid kinetic-MHD models for energetic particles in tokamak plasmas[1] ALAIN BRIZARD, Saint Michaels College — The variational formulation of hybrid kinetic-MHD models for energetic particles (e.g., alpha particles or relativistic runaway electrons) in tokamak plasmas is presented [1]. Models involving either current-coupling or pressure-coupling (e.g., through a CGL-type pressure tensor) between the plasma-bulk MHD behavior and the energetic particle distribution are shown to arise naturally under either particle or drift-kinetic dynamical representations for the energetic-particle dynamics, respectively. The role of the wave-action conservation law, which holds even when the background plasma and energetic-particle distribution are time-dependent, will be discussed.

The inclusion of three-wave resonant interactions within hybrid kinetic-MHD models through a variational principle that is constructed from a Lagrangian density with cubic nonlinear terms will also be discussed.

[1] A.J. Brizard, PoP 1 (1994) 2460.

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