

Abstract Submitted
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Derivation of the Hall and Extended Magnetohydrodynamics

Brackets ERIC D'AVIGNON, University of Texas at Austin, MANASVI LINGAM, Princeton University, PHILIP MORRISON, University of Texas at Austin — There are several plasma models intermediate in complexity between ideal magnetohydrodynamics (MHD) and two-fluid theory, with Hall and Extended MHD being two important examples. In this research we investigate several aspects of these theories, with the ultimate goal of deriving the noncanonical Poisson brackets used in their Hamiltonian formulations. We present fully Lagrangian actions for each, as opposed to the fully Eulerian, or mixed Eulerian-Lagrangian, actions that have appeared previously. As an important step in this process we exhibit each theory's two advected fluxes (in analogy to ideal MHD's advected magnetic flux), discovering also that with the correct choice of gauge they have corresponding Lie-dragged potentials resembling the electromagnetic vector potential, and associated conserved helicities. Finally, using the Euler-Lagrange map, we show how to derive the noncanonical Eulerian brackets from canonical Lagrangian ones.

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