

Abstract Submitted  
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**Common Hamiltonian structure and concomitant topological invariants for extended magnetohydrodynamics models**<sup>1</sup> MANASVI LINGAM, Princeton University, HAMDI M. ABDELHAMID, YOHEI KAWAZURA, University of Tokyo, PHILIP J. MORRISON, UT Austin, ZENSHO YOSHIDA, University of Tokyo, GEORGE MILOSHEVICH, UT Austin, KO TANEHASHI, NORIKI TAKAHASHI, University of Tokyo — Extended magnetohydrodynamics (XMHD) includes 2-fluid effects such as electron inertia and the Hall drift absent in ideal MHD. Hamiltonian structure of the XMHD models (Hall MHD, inertial MHD [3] and full XMHD) is presented [1]. Existence of elegant variable transformations that map every XMHD model to a common noncanonical Poisson bracket is highlighted [2]. The bracket is used to derive the existence of two unique helicities (Casimir invariants) for these models, each of which exhibits close similarities with the magnetic and fluid helicities [1,2] - this is highly significant as the latter are important topological invariants. The Lagrangian origins of the helicities and variable transforms, and avenues for future work are outlined.

[1] H.M. Abdelhamid, Y. Kawazura & Z. Yoshida, *J. Phys. A* **48**, 235502 (2015)

[2] M. Lingam, P.J. Morrison & G. Miloshevich, *Phys. Plasmas* **22**, 072111 (2015)

[3] M. Lingam, P.J. Morrison & E. Tassi, *Phys. Lett. A* **379**, 570 (2015)

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