Abstract Submitted
for the DPP14 Meeting of
The American Physical Society

Derivation of Hamiltonian magnetofluid models with gyroviscous-like contributions using a gyro-map ALEXANDER WURM, Department of Physical and Biological Sciences, Western New England University, Springfield, MA 01119, MANASVI LINGAM, P.J. MORRISON, Institute for Fusion Studies and Department of Physics, University of Texas at Austin, Austin, TX 78712 — Ideal MHD and various reduced magnetofluid models exhibit a noncanonical Hamiltonian structure when expressed in Eulerian variables [1]. Extending the work of Ref.[2], we investigate the possibility of systematically including contributions due to finite ion gyro-radii in three dimensions while preserving a noncanonical Hamiltonian structure. Starting with the Morrison-Greene 3D ideal MHD noncanonical Poisson bracket[1] and a Hamiltonian including gyroviscous terms, we derive equations of motion using a three-dimensional generalization of the gyro-map introduced in Ref.[2]. The origin of the gyro-map is motivated and explained using an action principle formulation as in Ref.[3]. Through a systematic reduction procedure, we also recover the (noncanonical) bracket and the gyroviscous tensor, which are identical to the ones obtained via the Hamiltonian formalism.

[1] P.J. Morrison and J.M. Greene, Phys. Rev. A **45**,790 (1980).
[2] P.J. Morrison, I.L. Caldas, and H. Tasso, Z. Naturforsch. **39a**, 1023 (1984).
[3] P.J. Morrison, M. Lingam, and R. Acevedo, arXiv:1405.2326 (to appear in Phys. Plasmas)

Alexander Wurm
Department of Physical and Biological Sciences,
Western New England University, Springfield, MA 01119

Date submitted: 11 Jul 2014 Electronic form version 1.4