Abstract Submitted
for the DPP15 Meeting of
The American Physical Society

A Hamiltonian Five-Field Gyrofluid Model[1] IOANNIS KERAMIDAS CHARIDAKOS, FRANCOIS WAELBROECK, PHILIP MORRISON, University of Texas at Austin, Institute for Fusion Studies — Reduced fluid models constitute versatile tools for the study of multi-scale phenomena. Examples include magnetic islands, edge localized modes, resonant magnetic perturbations, and fishbone and Alfven modes. Gyrofluid models improve over Braginskii-type models by accounting for the nonlocal response due to particle orbits. A desirable property for all models is that they not only have a conserved energy, but also that they be Hamiltonian in the ideal limit. Here, a Lie-Poisson bracket is presented for a five-field gyrofluid model, thereby showing the model to be Hamiltonian. The model includes the effects of magnetic field curvature and describes the evolution of electron and ion densities, the parallel component of ion and electron velocities and ion temperature. Quasineutrality and Ampere's law determine respectively the electrostatic potential and magnetic flux. The Casimir invariants are presented, and shown to be associated to five Lagrangian invariants advected by distinct velocity fields. A linear, local study of the model is conducted both with and without Landau and diamagnetic resonant damping terms. Stability criteria and dispersion relations for the electrostatic and the electromagnetic cases are derived and compared with their analogs for fluid and kinetic models.

[1]This work was funded by U.S. DOE Contract No. DE-FG02-04ER-54742.

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Date submitted: 21 Jul 2015 Electronic form version 1.4