Abstract Submitted
for the DPP05 Meeting of
The American Physical Society

Reduced, FLR, 2-fluid equations in 3-dimensional paraxial geometry.[1] J.J. RAMOS[2], A. ISHIZAWA, NIFS, Toki, Japan. — A reduced, finite-Larmor-radius, two-fluid system for plasmas in a strong but weakly varying magnetic field is derived by means of asymptotic expansions of the fluid moment equations in two basic small parameters. The first one is the ratio between the ion gyroradius and the characteristic length scales perpendicular to the magnetic field. The second one is a measure of the magnetic field inhomogeneity, assumed to be comparable to the ratio between characteristic perpendicular and parallel length scales, and to the plasma beta. The relevant time scales exclude the fast magnetosonic waves while including the Alfven, sound and drift waves, and the flow velocities are ordered formally as comparable to the ion thermal speed. By keeping only linear terms in these two small parameters, a consistent fluid closure is achieved. This result is consistent with but more general that Newcomb's paraxial closure theorem derived within the framework of collisionless kinetic theory. Our system provides an extenstension of Hazeltine et al.'s four-field model. It includes diamagnetic effects, temperature gradients, pressure anisotropy, parallel flows, and Hall physics in the generalized Ohm's law. Electron inertia is retained only in the parallel component of Ohm's law, in order to make the model applicable to collisionless reconnection problems.

[1]Work suppported by the U.S.-Japan JIFT and the U.S. DOE
[2]Permanent address: PSFC, MIT

J.J. Ramos
PSFC, MIT

Date submitted: 21 Jul 2005 Electronic form version 1.4