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Two Fluid Steady States in Magnetically Confined Plasmas[1] L.E. SUGIYAMA, MIT, H.R. STRAUSS, NYU, W. PARK, PPPL, G.Y. FU, PPPL — Two-fluid plasma models, which allow the electron and ion fluids to move independently, have been shown to have important consequences for magnetically confined plasma behavior and steady states compared to MHD, particularly when axisymmetry is broken. Two-fluid steady states can be described in terms of the canonical momenta and generalized vorticities of the two species (eg [1]). Analytical solutions typically oversimplify and do not describe the conditions of actual plasmas nor their nonlinear numerical simulations. The radial electric field, required to balance the two flows, depends on the full velocities and therefore on the complete dissipation picture, necessarily present numerically. The plasma edge region, which supplies boundary conditions for the global solution, is almost always strongly idealized, while actual plasmas may have large localized flows and radial electric fields as well as pressure gradients, as in H-mode, perhaps due to non-fluid effects. These questions are investigated, in part with the help of the M3D initial value code, that can also study non-axisymmetric configurations.
[1] L.C. Steinhauer, *Phys. Plasmas* **6** 2734 (1999).

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