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Hydrodynamic mode associated with the pinch flow in RFP simulations GIAN LUCA DELZANNO, LUIS CHACON, JOHN FINN, LANL — We present a systematic study of single helicity (SH) states and quasi-single helicity (QSH) states in RFPs. We begin with cylindrical paramagnetic pinch equilibria with uniform resistivity, characterized by a single dimensionless parameter proportional to the toroidal electric field, or the RFP toroidal current parameter Θ. For sufficiently high Θ, there are several unstable $m = 1$ ideal MHD instabilities, typically one of which is nonresonant, with $1/n$ just above $q(r = 0)$. We evolve these modes nonlinearly to saturation for low Hartmann number H. We show the existence of a new class of unstable modes [1], besides the electromagnetic kink modes typically responsible for the reversal of the axial magnetic field at the edge in RFPs. This new instability is hydrodynamic in nature and is due to the inward equilibrium pinch flow and suitable boundary conditions. In these circumstances, the total angular momentum of the system must grow in response to the flux of particles coming from the boundary. The hydrodynamic mode dominates the nonlinear phase of the velocity field but has little effect on the dynamics of the magnetic field.
[1] G.L. Delzanno, L. Chacón, J.M. Finn, Hydrodynamic mode associated with the pinch flow in Reversed Field Pinch simulations, submitted (2007).

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