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Equilibrium and stability in configurations with large flows*

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Plasma flows of significant magnitude seem to be a ubiquitous feature of confined plasmas. The flow by itself, or in combination with the shear in the flow profile, is now recognized to have a stabilizing influence on large scale instabilities such as the resistive wall and internal kink modes in tokamaks, and microturbulence. Long before the beneficial effects of these incidental flows were discovered, flows driven externally as in integral part of a confinement scheme were also examined[1]. Recently some of these ideas have been revived, as in the centrifugal confinement experiment MCT[2] of Maryland and the magneto-Bernoulli experiment of FRC[3]. Both use a mirror field in conjunction with a radial electric field to drive large cross-field flows. Recently we have started to examine these configurations numerically. Our initial goal is to reproduce and extend the shear-flow stabilization of interchange modes seen by the Maryland group[4] and look for self-organized states anticipated for the FRC device[5]. Preliminary results indicate that a radial electric field applied only at the ends, as in the FRC experiment, may not penetrate the plasma to drive a bulk rotation inside, but our numerical experiments are continuing.

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