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The Effect of Sheared Toroidal Flow on an FRC's n=2 Rotational Instability EDWARD RUDEN, Air Force Research Laboratory, Directed Energy Directorate — A Field Reversed Configuration (FRC) gains angular momentum until $\alpha = \Omega_R/\Omega_{Di}$ (rotational frequency over ion diamagnetic drift frequency) reaches a critical value triggering an instability with azimuthal mode number $n = 2$. Questions remain as to whether the observed threshold is explained by a rigid rotor profile. Rotation of the bulk via kinematic viscosity and/or convection can entail significant velocity shear. Rotation results in plasma (centripetal) acceleration supported by an external magnetic field, so the instability may be interpreted as a Rayleigh-Taylor (R-T) mode. The instability is investigated here using an analytic planar R-T model of a Finite Larmour Radius (FLR) plasma with a magnetically transverse sheared flow layer accelerated by the magnetic field. Sheared flow and FLR effects are recognized and synergistic mitigating factors for the R-T instability, but if the sheared layer is too thin to reach the magnetic reversal axis, it is unstable and convection to the magnetic axis can be expected to occur quickly. Once this happens, though, the FRC is stable until the shear factor reaches a high value, at which time the $n = 2$ mode goes unstable. This model provides insight into what may be an important feature of FRC stability, although less simplified calculations are needed. Nonetheless, it can be used tentatively to predict stability characteristics of an FRC during compression by an electromagnetically imploded metal cylinder for Magnetized Target Fusion.

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