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Error field penetration and beta limits in two fluid toroidal plasmas[1] D.P. BRENNAN, Princeton University, A.J. COLE, Columbia University, J.M. FINN, Los Alamos National Laboratory — This study addresses error field penetration and beta limits in low flow, low error field, two fluid regimes relevant to ITER experimental scenarios as well as current ITER-like discharges. The focus is on the Hall, Semi-Collisional, Resistive Inertial and Inertial regimes, with equilibrium stability, toroidal rotation and boundary error field otherwise varied within the regimes of the experiments. The penetration thresholds and stability limits in each of these regimes are calculated using asymptotic matching methods for the resistive modes, including toroidal effects in the resonant layers. Accurate toroidal analyses are compared to reduced models for intuitive understanding of the results. The penetrated state has recently been shown at low error field and low viscous torque to lock to a finite frequency state [Finn et al. arXiv:1507.04012]. We present the dependence of this locked state in these two fluid regimes. The dependence of the beta limits, with and without a resistive plasma and a resistive wall, and its impact on error field penetration thresholds, are also examined. The approach to the particular threshold represented in this model reduces penetration thresholds and enhances plasma response.

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Dylan Brennan
Princeton Univ

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