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Stability limits in rotation and β with energetic ion, two fluid, and resistive wall effects[1] D.P. BRENNAN, Princeton University, A.J. COLE, Columbia University, J.M. FINN, Tibbar Plasma Technologies, M.R. HALFMOON, University of Tulsa, C. PAZ-SOLDAN, General Atomics — The non-ideal magnetohydrodynamic (MHD) stability of a tokamak configuration that is driven unstable to the $m/n = 2/1$ mode by increasing pressure is studied in a reduced model that includes many of the key physics components driving the instability: two fluid responses in various regimes at the resonant surface, a drift-kinetic slowing down distribution of trapped energetic ions, variations in the magnetic shear, plasma rotation and a resistive wall. The changes in stability are examined as the rotation varies across the Hall, Semi-Collisional and Inertial regimes, and compared with recent experiments on DIII-D for rotational limits. The energetic ion contribution to the perturbed pressure is included in the model, where energetic ions damp and stabilize the mode when orbiting in significant positive shear, and drive the mode unstable in reversed shear regions. The effect of rotation is included in the drift-kinetic ion model, where it modifies this effect. The equilibria are stable for low β and the marginal stability values in β and rotation are computed. The impact of the rotation in both the plasma layer responses, and the energetic ion response, must be taken into account to interpret the experimental results.

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D.P. Brennan
Princeton University

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