Abstract Submitted
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Unified theory of resistive and inertial ballooning modes in three-dimensional configurations[1] TARIQ RAFIQ, CHRIS C. HEGNA, JAMES D. CALLEN, University of Wisconsin — A linear stability theory of non-ideal MHD ballooning modes is investigated using a two fluid model. Electron inertia, diamagnetic effects, parallel ion dynamics, transverse particle diffusion and perpendicular viscous stress terms are included in calculations for arbitrary three-dimensional electron ion plasmas. Drift RBM eigenvalues and eigenfunctions are calculated for a variety of equilibria including axisymmetric shifted circular geometry and configurations of interest to the Helically Symmetric Stellarator (HSX). For parameters of interest to HSX, characteristic growth rates exceed the electron collision frequency. In this regime, electron inertia effects can dominate plasma resistivity and produce an instability whose growth rate scales with the electron skin depth. Attempts to generalize previous analytic calculations of RBM stability using a two scale analysis on $(s-\alpha)$[1] equilibria to more general 3-D equilibria will be addressed. In this work, a unified theory of RBM and inertial ballooning modes is developed where both the effects of ideal MHD energy and geodesic curvature drives in the non-ideal layer are included in the dispersion relation. [1] R. H Hastie, J.J. Ramos and F. Porcelli *Phys. Plasmas* **10,** 4405 (2003).

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