Abstract Submitted
for the DPP11 Meeting of
The American Physical Society

Nonlinearly unstable interchange modes in transverse magnetic field JUPITER BAGAIPO, P.N. GUZDAR, A.B. HASSAM, University of Maryland — The nonlinear stability of the ideal MHD interchange mode immersed in a constant transverse magnetic field near marginal conditions is studied. We used reduced equations for a strong axial field to show a way to calculate an analytic solution for the nonlinear behaviour as a function of the deviation from marginality. The result could find application in assessing the B-field tolerances in stellarator coil design. A perturbation analysis in the smallness parameter, $|b_2/B_c|^{1/2}$, is carried out, where B_c is the critical transverse magnetic field for the zero-frequency ideal mode, and b_2 is the deviation from B_c. The lowest order expansion yields an eigenvalue equation for the magnitude of the critical field required for marginality, B_c. The calculation is carried out to third order, including nonlinear terms, where a time-evolution equation for the amplitude is found. In the short wavelength limit we find that the system is nonlinearly unstable for large enough perturbations even if $b_2/B_c > 0$ (linearly stable) and the amplitude will grow without saturation. This result is similar to those of Cowley and Artun (Physics Reports 1997) for the marginally stable line-tied g-mode. We found the normalized amplitude for the instability to scale as $|b_2/B_c|^{1/2}$. Nonlinear numerical simulations of this system in dissipative MHD have verified the result in our calculations. Work supported by the USDOE.

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Date submitted: 13 Jul 2011

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