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Pressure Gradient Effects on Alfven Cascade Modes in Tokamaks

G.Y. FU, Princeton Plasma Physics Laboratory, H.L. BERK, Institute for Fusion Studies — Alfven cascade modes are discrete shear Alfven eigenmodes localized at the radius of minimum of safety factor in tokamak plasmas with reserved shear q profiles [1]. The mode frequency is given by $\omega \sim (n - m/q_{min})V_A/R$ over most parameters, and transforms to the geodesic acoustic mode near rational field lines. The mode is seen in experiments, where the mode frequency sweeps up as q drops. Numerical results indicate that the plasma pressure gradient helps establish the mode [2], in contrast to a previous analytic prediction [3] that the pressure gradient term hinders mode establishment. here a modification of the analysis is developed to include a previously neglected interchange term due to the favorable average curvature of a tokamak. This is the key addition that is needed for the pressure gradient to be favorable for the establishment of a cascade mode, and thereby explain the numerical results.

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[2] G. J. Kramer et al., Plasma Phys. Controlled Fusion **46**, L23 (2004).
[3] B. N. Breizman et al., Phys. Plasmas **12**, 112506 (2005).

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