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Supersonic drift-tearing magnetic islands in tokamak plasmas[1]

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— A two-fluid theory of long wavelength, supersonic, drift-tearing magnetic islands in low collisionality, low-β plasmas possessing relatively weak magnetic shear is developed. The model assume s both slab geometry and cold ions, and neglects electron temperature and equilibrium current gradient effects. The problem is solved in two asymptotically matched regions. The "inner region" contains the island. However, the island emits electrostatic drift-acoustic waves which propagate into the surrounding "outer region", where they are absorbed by the plasma. Since the waves carry momentum, the inner region exerts a net force on the outer region, and *vice versa*, giving rise to strong velocity shear in the region immediately surrounding the island. Isolated supersonic islands propagate with a velocity which lies between those of the unperturbed local ion and electron fluids, but is much closer to the latter. The ion polarization current is *stabilizing*, and *increases* with increasing is land width. Finally, the supersonic branch of isolated island solutions *ceases to exist* above a certain critical island width. Supersonic islands whose widths exceed the critical width are hypothesized to bifurcate to the so-called "subsonic" solution branch.

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