

Resonant Currents Near Magnetic Islands in MHD Equilibria: Effects of Pressure Variation Within Flux Surfaces and of Symmetry

Allan Reiman, *Theory Department, Princeton Plasma Physics Laboratory*

Previous analyses have missed the resonant pressure-driven MHD equilibrium current near magnetic islands.

Proper treatment requires inclusion of pressure variation within flux surfaces.

Have obtained analytic expression for pressure-driven MHD equilibrium current:

- logarithmic singularities at X-lines of magnetic islands in non-stellarator-symmetric equilibria.
- Singular components vanish in stellarator-symmetric MHD equilibria. (Tokamaks with balanced double-null divertors are stellarator symmetric, single-null tokamaks are not.)
- To be contrasted with equilibria having $\mathbf{B} \cdot \nabla p = 0$, where singular components of pressure-driven currents vanish regardless of symmetry.
- To be contrasted with 3D MHD equilibrium solutions with simply nested flux surfaces, where pressure-driven current goes like $1/x$ near rational surfaces, where x is distance from rational surface.