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Investigation of equilibrium plasma beta limits in 3D magnetic topologies[1] MARK SCHLUTT, C.C. HEGNA, Univ. of Wisconsin, E. HELD, Utah State Univ., S.E. KRUGER, Tech-X Corporation — A fluid model is used to investigate pressure-induced magnetic islands in 3D equilibria. We revisit previous analytic island calculations, allowing for finite parallel heat transport, to find an equation for equilibrium island widths. Finite parallel heat transport can alter the resistive interchange and bootstrap current contributions to magnetic island formation. However, the effect of Pfirsch-Schlüter currents driven by resonant components in $\frac{1}{B^2}$ on magnetic island formation is largely unaffected by transport processes. 3D MHD equilibria are modeled using NIMROD. A vacuum equilibrium helical magnetic field is loaded into the geometry of a straight stellarator. The symmetry of the vacuum field with a dominant magnetic harmonic can be spoiled by adding small magnetic perturbations. These perturbations alter the magnetic spectrum, producing magnetic islands and stochastic regions. Numerical simulations are performed that include a heating source and self-consistent anisotropic transport in different magnetic configurations. The support of pressure gradients in stochastic regions is investigated. The connection between flux surface destruction and the breaching of MHD stability boundaries is also considered.

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