

Abstract Submitted
for the DPP09 Meeting of
The American Physical Society

Plasma Equilibrium in a Magnetic Field with Stochastic Regions¹

A. REIMAN, J. KROMMES, D. MONTICELLO, M. ZARNSTORFF, Princeton Plasma Physics Laboratory — The nature of plasma equilibrium in a magnetic field with stochastic regions is examined, with particular application to the reconstruction of equilibria for the W7AS stellarator. It is shown that the magnetic differential equation that determines the equilibrium Pfirsch-Schlüter currents can be cast in a form similar to various nonlinear equations for a turbulent plasma, allowing application of the mathematical methods of statistical turbulence theory. An analytically tractable model, previously studied in the context of resonance-broadening theory, is applied with particular attention paid to the periodicity constraints required in toroidal configurations. It is shown that even a very weak radial diffusion of the magnetic field lines can have a significant effect on the equilibrium in the neighborhood of the rational surfaces, strongly modifying the near-resonant Pfirsch-Schlüter currents. Implications for the numerical calculation of 3D equilibria are discussed, with specific application to the calculation of equilibria for the W7AS stellarator.

¹Work supported by DOE contract DE-AC02-09CH11466.

Allan Reiman
Princeton Plasma Physics Laboratory

Date submitted: 15 Jul 2009

Electronic form version 1.4