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Plasma Equilibrium in a Magnetic Field with Stochastic Field-Line Trajectories[1] J.A. KROMMES, A.H. REIMAN, Princeton University — The nature of plasma equilibrium in a magnetic field with stochastic field lines is examined, expanding upon the ideas first described by Reiman et al.[2] The magnetic partial differential equation (PDE) that determines the equilibrium Pfirsch-Schlüter currents is treated as a passive stochastic PDE for $\mu \doteq j_\parallel/B$. Renormalization[3] leads to a stochastic Langevin equation for μ in which the resonances at the rational surfaces are broadened by the stochastic diffusion of the field lines; even weak radial diffusion can significantly affect the equilibrium, which need not be flattened in the stochastic region. Particular attention is paid to satisfying the periodicity constraints in toroidal configurations with sheared magnetic fields. A numerical scheme that couples the renormalized Langevin equation to Ampere's law is described.

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[2]A. Reiman et al, Nucl. Fusion **47**, 572–8 (2007).
[3]J. A. Krommes, Phys. Reports **360**, 1–351.

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