Modeling of magnetic perturbations and energy confinement in SSPX spheromak

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Abstract

The effects of magnetic field fluctuations on the quality of confinement in SSPX spheromak [1] plasmas are studied by analyzing a perturbed magnetic field. The unperturbed axisymmetric magnetic field is calculated from MHD equilibrium. We explore physically motivated models for non-axisymmetric perturbation such as the external perturbation coil experiment [2] and the central column instability [3]. We calculate the spatial spectrum of the perturbation that determines its effect on the magnetic topology and use numerical line integration to construct Poincare maps. For realistic magnitude of the perturbation the calculations show formation of islands on main resonant surfaces and appearance of stochastic regions in the outer part of the plasma, which is consistent with experimental T_e measurements [4]. The effective heat transport induced by the presence of stochastic magnetic field is calculated by a Monte-Carlo procedure, and the results are compared with the experimental data.

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[2] H. S. McLean et al., Bull. Am. Phys. Soc. **48**, 150 (2003).
[3] D. D. Ryutov et al., Bull. Am. Phys. Soc. **48**, 167 (2003).
[4] S. Woodruff et al., Bull. Am. Phys. Soc. **48**, 150 (2003).

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