Abstract Submitted
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Measurement, Modeling and Reconstruction of Parallel Currents in the HSX Stellarator J.C. SCHMITT, HSX Plasma Laboratory, University of Wisconsin - Madison, J.N. TALMADGE, J. LORE — Parallel currents are measured with a set of magnetic diagnostics on the HSX. Measurements show that the Pfirsch-Schlüter current is helical due to the lack of toroidal curvature and is reduced in magnitude compared to an equivalent tokamak because of the high effective transform ($\sim$3) in a quasihelically symmetric stellarator. The bootstrap current density is calculated using the PENTA code,[1] which includes momentum conservation between plasma species. The data shows better agreement with a model that includes momentum conservation. HSX plasmas are heated by a 28 GHz gyrotron which allows the electrons to access the low collisionality regime, while the cold ions are generally in the plateau. In HSX, a 3-D plasma with small symmetry-breaking, the calculations show that for two species in different collisionality regimes, the bootstrap current can be strong function of the radial electric field. In the plasma core, multiple stable electric field solutions to the ambipolarity constraint exist. The large positive electric field, the "electron-root" solution, can result in a reduction and even a reversal of the bootstrap current. The measured fields and fluxes are used in the V3FIT[2] code to reconstruct the current profile. Supported by DOE grant DE-FG02-93ER54222. [1]D.A. Spong, Phys. Plasmas 12 (2005) 056114. [2]J.D. Hanson, et al, Nucl. Fusion 49 (2009) 075031.

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