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Measurement & Modeling of Equilibrium Currents in HSX J.C. SCHMITT, J.N. TALMADGE, J. LORE, HSX Plasma Laboratory, University of Wisconsin-Madison, S. KNOWLTON, Auburn University — The Pfirsch-Schlüter (PS) and bootstrap currents in the quasihelically symmetric stellarator HSX are unlike those of traditional stellarators and tokamaks. The lack of toroidal curvature in HSX results in a helical PS current that rotates with toroidal angle. The bootstrap current is opposite in direction to that in a tokamak and reduces the rotational transform, but increases the effective transform. Both currents are reduced in magnitude by a factor of n-mι ($\sim$3 in HSX) compared to an equivalent tokamak. The bootstrap current induces a toroidal current that decays resistively, resulting in a current profile and rotational transform that varies during the plasma discharge. The decay rate scales with $\sim 1/\mathrm{Z}_{eff}$. Two Rogowski coils measure the net toroidal current. The B_θ and B_r due to plasma currents are measured with an array of magnetic pickup coils. VMEC and BOOTSJ provide a self-consistent estimate of the plasma currents, a model of the resistive decay of the toroidal current is shown, and V3FIT[1] calculates the expected magnetic signals due to these currents throughout the shot. Direct comparisons of V3FIT with diagnostic data confirm the helical nature of the PS current and the evolving toroidal current. [1] Hirshman, S. P., Lazarus, E. A., Hanson, J. D., Knowlton, S. F., & Lao, L. L. *Phys Plasmas,* **11**, 595 (2004). Supported by DOE grant number DE-FG02-93ER54222.

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