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Helicity Injected Torus Program Overview A.J. REDD, T.R. JARBOE, R.Z. ABOULHOSN, C. AKCAY, W.T. HAMP, G. MARKLIN, B.A. NELSON, R.G. O'NEILL, R. RAMAN, P.E. SIECK, R.J. SMITH, G.L. SUTPHIN, J.S. WROBEL, University of Washington, D. MUELLER, L. ROQUEMORE, PPPL — The Helicity Injected Torus with Steady Inductive Helicity Injection (HIT–SI) spheromak experiment [Sieck, Nucl. Fusion v.46, p.254 (2006)] addresses critical issues for spheromaks, including current drive, high-beta operation, confinement quality and efficient steady-state operation. HIT–SI has a "bow-tie" shaped axisymmetric confinement region (major radius R=0.33 m, axial extent of 0.57 m) and two half-torus helicity injectors, one mounted on each end of the flux conserver. HIT–SI has produced spheromaks with up to 30 kA of toroidal current, using less than 4 MW of applied power, demonstrating that Steady Inductive Helicity Injection can generate and sustain discharges with modest power requirements. Fast camera images of HIT–SI discharges indicate a toroidally rotating n=1 structure, driven by the helicity injectors. The direction of the toroidal current is determined by the direction of rotation of the driven n=1. Measured surface and internal magnetic fields in HIT–SI discharges are consistent with that of the true 3D Taylor state, including the injectors. Recent HIT–SI physics studies, diagnostic improvements and machine upgrades will also be summarized.

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