Characterization of $T_e$ and $n_e$ Profiles of Discharges Driven Purely by Helicity Injection in the Pegasus Toroidal Experiment$^1$ G.M. BODNER, M.W. BONGARD, R.J. FONCK, M.D. NORNBERG, J.A. REUSCH, N.J. RICHNER, C. RODRIGUEZ SANCHEZ, C.E. SCHAEFER, University of Wisconsin-Madison — Understanding the electron confinement and transport in plasmas driven purely by local helicity injection (LHI) is critical to the demonstration of high-performance discharges. Given the proper operating conditions, purely LHI-driven discharges can feature peaked $T_e$ profiles with $T_{e,0} \sim 150$ eV. Ohmic discharges in PEGASUS at the same field level, $B_T \sim 0.15$ T exhibit similar $T_e$ profiles albeit with higher $n_e$. At lower levels of $B_T$, LHI discharges feature hollow $T_e$ profiles that increase in $<T_e>$ as the effective loop voltage, $V_{LHI}$, is increased. The increase in $<T_e>$ scales with $V_{LHI}$ rather than the injector electrode voltage, $V_{inj}$, contrary to predictions from open field line theory. The hollowing of the $T_e$ profile is hypothesized to be a combination of low $\eta j^2$ heating power due to the hollow current profile and low-Z impurity radiation losses. Approximations of $Z_{eff}$ in LHI discharges from voltage balance assuming purely Spitzer and neoclassical resistivity are $\sim 3$ and $\sim 1$, respectively. Thomson scattering and magnetic probe measurements indicate a pressure-free region between the kinetic and magnetic boundaries, possibly indicative of separate Ohmic and stochastic confinement regions. Overall scaling of $I_p$ with $V_{LHI}$ appears to be consistent with linear Ohmic confinement scaling assuming auxiliary ion and electron heating from magnetic reconnection.

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