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Magnetic Reconnection and Ion Flows During Point-Source DC Helicity Injection on the Pegasus Toroidal Experiment[1] M.G. BURKE, M.W. BONGARD, R.J. FONCK, D.J. SCHLOSSBERG, G.R. WINZ, University of Wisconsin-Madison — A passive ion temperature polychromator has been deployed on Pegasus to study power balance and non-thermal ion distributions that arise during point source helicity injection. Spectra are recorded from a 1 m F/8.6 Czerny-Turner polychromator whose output is recorded by an intensified high-speed camera. During helicity injection, stochastic magnetic fields keep T_e low and thus low ionization impurities penetrate to the core. Under these conditions, high core ion temperatures are measured ($T_i \approx$ 1.2 keV, $T_e \approx$ 0.1 keV) using spectral lines from CIII, NIII, and BIV. This rapid ion heating is seen to coincide with internal MHD activity. The ion temperature closely follows the injection bias voltage, indicating that power from the guns is strongly coupled to the ions through this MHD activity. Bi-directional toroidal ion flows of ∼60 km/s have been observed on the BIV line during helicity injection when looking near the front of the injectors. The flow is on the order of the Alfvén velocity, as predicted by Sweet-Parker reconnection, and is indicative of magnetic reconnection occurring near the injectors. When looking away from the helicity injectors, the bi-directional flow appears to be replaced by strong toroidal rotation, suggesting that ion acceleration during helicity injection is asymmetric and 3D in nature.

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