Abstract Submitted
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The Physics of Local Helicity Injection Non-Solenoidal Tokamak Startup[1] A.J. REDD, J.L. BARR, M.W. BONGARD, R.J. FONCK, E.T. HINSON, University of Wisconsin-Madison, S. JARDIN, PPPL — Non-solenoidal startup via Local Helicity Injection (LHI) uses compact current injectors to produce toroidal plasma current I_p up to 170 kA in the PEGASUS Toroidal Experiment, driven by 4–8 kA injector current on timescales of 5–20 milliseconds. Increasing the I_p buildup duration enables experimental demonstration of plasma position control on timescales relevant for high-current startup. LHI-driven discharges exhibit bursty MHD activity, apparently line-tied kinking of LHI-driven field lines, with the bursts correlating with rapid equilibrium changes, sharp I_p rises, and sharp drops in the injector impedance. Preliminary NIMROD results suggest that helical LHI-driven current channels remain coherent, with I_p increases due to reconnection between adjacent helical turns forming axisymmetric plasmoids, and corresponding sharp drops in the bias circuit impedance. The DC injector impedance is consistent with a space charge limit at low bias current and a magnetic limit at high bias current. Internal measurements show the current density profile starts strongly hollow and rapidly fills in during I_p buildup. Simulations of LHI discharges using the Tokamak Simulation Code (TSC) will provide insight into the detailed current drive mechanism and guide experiments on PEGASUS and NSTX-U.

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M.W. Bongard
University of Wisconsin-Madison

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