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Magnetic Activity During LHI Startup and Sustainment[1] N.J. RICHNER, G.M. BODNER, M.W. BONGARD, S.J. DIEM, R.J. FONCK, M.D. NORNBERG, C.E. SCHAEFER, J.D. WEBERSKI, University of Wisconsin-Madison — Local helicity injection (LHI) is a non-solenoidal tokamak startup technique using biased plasma sources for DC helicity injection. This process relies upon magnetic reconnection and relaxation mechanism(s) that convert the helicity from injected current streams into bulk plasma current through helicity-conserving instabilities. To inform this process, high-bandwidth local magnetic measurements have been obtained in a broad survey of LHI operational (I_{inj}, V_{inj}, B_T, injector geometry) and physics regimes (*e.g.* stream-only, actively driven, decaying, etc.). Significant broadband high-frequency activity is present in LHI discharges compared to Ohmic plasmas. $\tilde{B}$ features power-law behavior with spectral indices of $\sim 5/3$ for $f<f_{ci}$ and $\sim 8/3$ for $f>f_{ci}$. Similar signatures are attributed to MHD and KAW/whistler wave turbulence, respectively, in astrophysical contexts, and is predicted to have an inverse cascade of magnetic helicity. Such turbulence has also been observed in reconnection systems. High frequency activity $f>f_{ci}$ is correlated with LHI drive voltage V_{inj} and/or injected beam velocity $v_b \propto V_{inj}^{1/2}$, further suggesting a kinetic role. Activity at $f \sim 2\,\mathrm{MHz}$ (2–4 f_{ci}) is found to scale linearly with applied LHI drive. Its potential role in the current drive process is under investigation.

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