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Laboratory Magnetospheric Plasma Studies in LDX and CTX¹

M. MAUEL, M. DAVIS, D. GARNIER, M. ROBERTS, M. WORSTELL, Columbia University, J. KESNER, MIT Plasma Science and Fusion Center — During the past decade, results from the CTX and LDX laboratory dipole plasma experiments have advanced our understanding of magnetized plasma dynamics and shown the influence of magnetic geometry on turbulent transport and high-beta stability. The CTX and LDX devices operate over a wide range of plasma parameters, allow detailed observations spanning global to small spatial scales, and show dynamics relevant to space weather models. Results include slow and fast plasma convection, centrifugal interchange instability and plasma rotation effects, energetic particle and complex wave-particle dynamics, rapid dipolarization in high-beta plasma, intermittent bursty plasma flows, and fascinating plasma turbulence and transport phenomenon. These laboratory magnetosphere experiments confine energetic and relatively collisionless plasma and create unique opportunities for the development and validation of models that help understand turbulent transport in fusion devices and also space weather dynamics. We describe upcoming experiments to investigate (i) turbulence control with electrostatic feedback, (ii) whole-plasma imaging of turbulent dynamics, and (iii) nonlinear gyrokinetic simulations of bounded driven dipole plasma.

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