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Global and Local Characterization of Turbulent and Chaotic Structures in a Dipole-Confined Plasma[1] B.A. GRIERSON, M.W. WORSTELL, M.E. MAUEL, Columbia University — When the plasma density increases sufficiently, plasma confined by a strong dipole magnetic field exhibit a dramatic transition to a confined state with complex turbulent behaviors. Recent experiments using the Collisionless Terrella Experiment (CTX) used statistical tools and fast imaging to understand this turbulent state. Locally, multi-point and multiple-time correlation and spectral analyses are used to estimate the nonlinear structure coupling of interacting fluctuations. Globally, the whole-plasma dynamics is observed using a unique high-speed imaging diagnostic that views the time-varying spatial structure of the plasma. The bi-orthogonal decomposition is used to decompose the measured plasma dynamics into spatial and temporal mode functions. The dominant spatial modes are found to be long wavelength and radially broad; however, the amplitudes of these modes are chaotic and impulsive. We compare and contrast two competing paradigms of plasma turbulence: (i) One based on measurements from closely spaced probes indicating nonlinear mode-mode coupling and cascading, and (ii) the chaotic evolution of a few dominant, long wavelength modes.

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