Poloidal Velocities and Poloidal Velocity Shear as Measured using the Broadband Edge Turbulence in Alcator C-Mod

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The edge and near SOL turbulence in the outboard midplane region and high-shear region near the lower X-point of ohmic L-mode plasmas have been investigated using gas-puff-imaging and probe measurements. Poloidal wavenumber information at the midplane region was obtained by a vertical array of photodiode views (approximately aligned with a flux-surface) with a 1 Mhz sampling rate. At the X-point region it was measured using a fast CCD camera with a 150 kHz sampling rate. The velocity fields of the two regions were characterized by studying the structure of the broadband turbulence over a range of minor radii extending both inside and outside the separatrix for various plasma densities, magnetic configurations (USN, DN, LSN) and toroidal fields with a fixed safety factor. The observed experimental dispersion relations show broadband turbulence with a strong radial variation in the direction of the propagation. The turbulence moves in the ion-diamagnetic direction at and outside the separatrix, and in the electron-diamagnetic direction just inside the separatrix. The dispersions are largely linear with velocities consistent with probe measurements (1.5–2 km/s in the ion, 3–4 km/s in the electron direction), yet seem to be inconsistent with a simple sheared flow model, exhibiting an unusually large velocity gradient. In addition, the poloidal motion of emission structures (blobs) wa followed to further investigate the crossover region between the two observed velocities, where on a ~10 ms time scale features moving in each direction are observed. The trubulence structure also shows an observable variation in and just prior to L-H transition periods, but no significant changes of phase velocities are observed.

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