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Turbulence Structures and Velocities in the Edge of Alcator C-Mod[1]

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The work to be presented describes the velocity fields and scale structure of the turbulent edge regions in Alcator C-Mod plasmas. Strong turbulence phenomena are routinely observed in the plasma edge and Scrape-Off-Layer regardless of the quality of global confinement. These turbulence layers have been characterized using Gas-Puff-Imaging measurements. Observations of short ($\sim$ 10 μs) timescale features and variations of the velocity fields will be presented for plasmas with a range of n_e, I_p, in both L and H-mode regimes. Radial profiles of poloidal propagation velocities have been constructed using direct Fourier methods. The observed experimental dispersion relations show a clear radial structure with turbulence propagating in the ion-diamagnetic direction ($1.5 - 2$ km/s) around and outside the separatrix, and moving in the electron-diamagnetic direction ($3.5 - 4$ km/s) around and inside the separatrix. In the crossover region around the separatrix two counter-propagating velocities are registered as long as the observation duration is $\gtrsim$ 1 ms. However for observation durations ($\sim 100\mu$s) coinciding with the characteristic time for the ejection of coherent features (blobs), rapid changes in the propagation direction are revealed, while the speed of propagation in the two regions remains largely invariant. Data obtained from both classical and spatio-temporal wavelet analysis on the statistical behavior of the propagation velocities and spectral characteristics will also be presented. These results suggest a view of the plasma edge qualitatively different from the one previously considered. Possible interpretations and implications will be discussed in relation to the formation of blobs and the structure of the high-shear region.

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