Short wavelength turbulence generated by shear in the QH-mode edge on DIII–D

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A region of turbulence with large radial wavenumber is found in the high-shear portion of the plasma edge in Quiescent H-mode (QH-mode) on DIII–D using the Phase Contrast Imaging (PCI) diagnostic. At its peak outside the minimum of the E_r well, the turbulence exhibits large amplitude $\tilde{n}/n \sim 40\%$, with large radial wavenumber $|\bar{k}_r/\bar{k}_\theta| \sim 11$ and short radial correlation length $L_r/\rho_i \sim 0.2$. The turbulence inside the E_r well minimum is characterized by the opposite sign in radial wavenumber from that of turbulence outside the minimum, consistent with the expected effects of velocity shear. The PCI diagnostic provides a line-integrated measurement of density fluctuations, so data is taken during a scan of plasma position at constant parameters to allow the PCI to sample a range in k_r/k_θ. Analysis of the Doppler Shift and plasma geometry allows the turbulence to be localized to a narrow region 3 mm inside the last closed flux surface (LCFS), outside the minimum of the E_r well. The turbulence amplitude and radial wavenumber and correlation length are determined by fitting the PCI results with a simple non-isotropic turbulence model with two regions of turbulence. These PCI observations, made in QH-mode, are qualitatively similar to those made in standard ELM-free H-mode and between edge localized modes (ELMs), suggesting a similar role for large k_r turbulence there.

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