Spatial structure and interaction of multiple shear flow populations in tokamak edge turbulence

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The three dimensional spatial structures of multiple shear flow populations were measured using novel combination of Langmiur probe arrays in the edge plasmas of the HL-2A tokamak with Ohmic and electron cyclotron resonant heating. The radial distribution of the low frequency zonal flow (LFZF) and geodesic acoustic mode (GAM) power clearly shows their coexistence in the inner region and transition to GAM domination, moving outwards to the last closed flux surface (LCFS). The Reynolds stress of the ambient turbulence was found to correlate with mean flow, LFZF and GAM well, suggesting that multiple shear flows are driven by nonlinear interaction with turbulence via the stress. The analysis of shear flow-turbulence interaction indicates that the edge turbulence is modulated by the multiple shear flows. In addition, the spatial structures of turbulence envelopes were found similar to those of LFZF and GAM. Some examples of the observation are given in Fig.1.

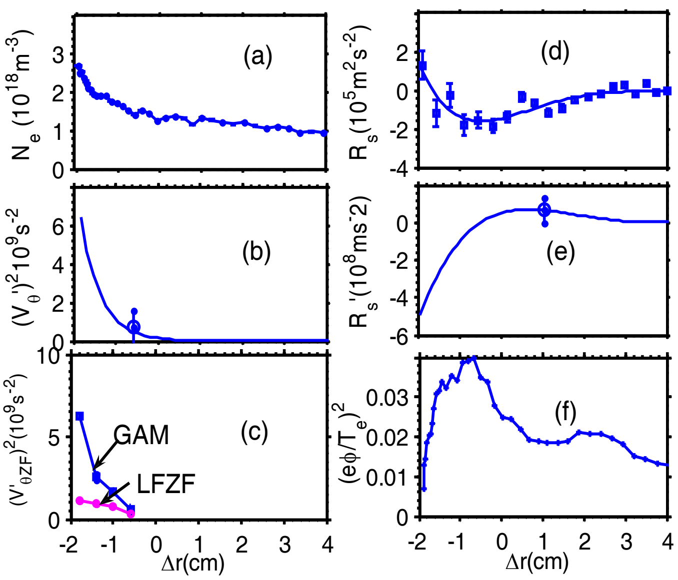

Fig. 1. (a) The profiles of density, （b）square of mean flow shearing rate,（c）squares of LFZF and GAM shearing rate, (d) Reynolds stress,（e）gradient of Reynolds stress,（f）amplitude of the normalized potential fluctuation

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