The experimental investigation on the role of E × B flow shear in tilting and breaking of turbulent eddies

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At TEXTOR a Gas-Puff Imaging system (together with the fast reciprocating Langmuir probe system) has been used for the two dimensional monitoring of plasma turbulence. Experiments in ohmic plasmas directly show evidence of the eddy tilting and breaking of turbulent structures in the shear layer. It has been found that the magnitude of the flow shearing rate plays a key role in the eddy breaking and needs to be larger than some lower limit up to which only tilting of eddies is observed. The results confirm the theoretical predictions about the influence of Er × B sheared flows on stretching and breaking turbulence eddies. Moreover, in the recent biasing experiment, with gradual increase of the shear flow (achieved by increasing the electrode biasing voltage) the tilting of turbulent eddies is also enhanced, accompanied by a change in the Reynolds stress around the shear layer. At the same time, the nonlinear coupling of low frequency zonal flows (~ 1 kHz) and ambient turbulence is gradually increased. Above certain flow shear values ($\partial V\theta / \partial r$), the ambient turbulence properties and zonal flows are all significantly modified. The results show direct influence of the poloidal flow shear on tilting/splitting turbulent structures, and consequently, the improvement of confinement.