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EX/7-2Rb: Turbulent Eddy-mediated Particle, Momentum, and Vorticity Transport in the Edge of HL-2A Tokamak Plasma

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We report the first experimental evidence that turbulent eddies mediate the particle, momentum and vorticity transport at the edge of a tokamak plasma so as to amplify the shear layer at the last closed flux surface (LCFS). We find that turbulent eddies with relative negative vorticity (opposite to B field) and positive azimuthal momentum (electron-diamagnetic drift direction) are drawn from both sides of and move towards the location r-r_LCFS=-1cm ; while eddies with relative positive vorticity (i.e. parallel to the B field) and negative azimuthal momentum (ion-diamagnetic drift direction) propagate away from this location towards to the core and scrape-off layer (SOL) plasma regions. Thus negative vortices act to concentrate positive momentum into the region just inside the LCFS, and plasma in this region acquires a ExB drift in the electron drift direction while plasma deeper within and out in the SOL has an ExB drift in the ion diamagnetic direction. This turbulent eddy-mediated particle, momentum, and polarization charge transport process is shown in figure 1 by the conditionally averaged quantities inferred by using vorticity as the reference. Notice that eddies with positive and negative vorticity are associated with different signs of density fluctuation and transport in different directions inside the LCFS at r-r_LCFS=-2cm and in the SOL at r-r_LCFS=1cm .

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