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Turbulent eddy-mediated transport in the edge of HL-2A tokamak plasma MIN XU, GEORGE TYNAN, PATRICK DIAMOND, U C San Diego, KAIJUN ZHAO, JUN CHENG, JIAQI DONG, Southwestern Institute of Physics, PETER MANZ, NICOLAS FEDORCZAK, SAIKAT THAKUR, JONATHAN YU, U C San Diego, WENYU HONG, LONGWEN YAN, QINGWEI YANG, XIANGMING SONG, YUAN HUANG, LAIZHONG CAI, WULV ZHONG, ZHONGBING SHI, XUANTONG DING, XURU DUAN, YONG LIU, Southwestern Institute of Physics — We report the first experimental evidence that turbulent eddies mediate the heat, 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 region about 1 cm inside separatrix; 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 an ExB drift in the electron drift direction. This physical picture links the macroscopic confinement to the microscopic transport dynamics. Also since the vortcity drive gets stronger as the heating power is increased, it should naturally lead to a very strong shear flow that can suppress the turbulent transport and ultimately can lead to H-mode with sufficient heating.

Min Xu
U C San Diego

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