Simultaneous visualization of the edge-localized mode in high and low field sides using ECEI

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Edge-localized modes (ELMs) have been visualized for the first time in high field side (HFS) and low field side (LFS) simultaneously using the fundamental ordinary (O1) and the 2nd extraordinary (X2) mode, respectively. The HFS ELM filaments rotate clockwise (or counterclockwise) poloidally, opposite to the counter-clockwise (or clockwise) rotation of the LFS ELM filaments. The discrepancy between LFS and HFS rotations has been interpreted by a strong Pfirsh-Schlüter flow [1] (∼25 km/s), which can generate the poloidal asymmetry of the toroidal flow. The images of HFS ELM filaments have some peculiarities such as: (1) large poloidal spacing compared to the expected ballooning perturbation structure and (2) the apparent location of the filaments often being outside of separatrix. The latter cannot be explained by the usual corrections from finite poloidal field strength, relativistic downshift, Doppler shift and refraction. An easy solution would be the toroidal field correction of ∼2 % to place both side ELM filaments within the separatrix [2]. A paramagnetic toroidal field increase of ∼1 % was indeed seen according to equilibrium reconstruction and an additional paramagnetism may be possible due to force-free Pfirsh-Schlüter current or bootstrap current, which were not taken into account in the equilibrium reconstruction. *This work is supported by NRF Korea under grant no. NRF-2009-0082507 and US DoE under contract no. DE-FG02-99ER54531.

References