Influence of SOL plasmas on LHCD Performance on Alcator C-Mod

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Experimental and modeling results from Alcator C-Mod show that details of the scrape off layer (SOL) can significantly impact the effectiveness of lower hybrid current drive (LHCD) actuators. C-Mod experiments show a significant reduction of LHCD efficiency when cold, dense conditions are maintained in the divertor and SOL regions ($n_e > 10^{20}$ m^{-3}, $T_e < 20$ eV) in combination with weak single-pass absorption of LH waves in the core plasma. The need of maintaining such conditions was discovered making "density limit" more restrictive in diverted configuration [G.M. Wallace, et al, Nucl. Fusion **51** 083032 (2011)]. This work was followed by power flux measurements looking at the edge plasma, which shows a prompt response to LH power modulation, ruling out absorption of the LH waves in the confined plasma. Furthermore, the toroidally symmetric nature of the edge response indicates that the LH wave absorption is distributed around the torus outside the LCFS due to ray stochasticity in the multi-pass regime [I.C. Faust, et al. Submitted to Phys. of Plasmas (2016)]. A ray tracing/Fokker-Planck model including a realistic 2-point SOL model [S. Shiraiwa, et al, AIP Conference Proceedings, 1689, 030016 (2015)] indicates that collisional absorption in such a cold dense region could explain the lack of LHCD at high density. C-Mod experiment also suggests that recovering high current drive efficiency at densities in excess of 10^{20} m^{-3} would be possible when SOL plasma profiles are optimized and/or core single pass absorption is improved [S. Shirawia, Nuclear Fusion **53**, 113028]. The technique could be applied on EAST experiment, since LHCD on EAST is in the same multi-pass absorption regime. In a reactor, LHCD is envisioned to have high single pass absorption. It is important to separate the effect of weak single pass power absorption from the observed reduction of LHCD efficiency, when extrapolating present experiments to a reactor. This motivated the recent experiment of LH launched wave spectra measurement on C-Mod, using high frequency RF probe arrays [AIP Conf. Proc. **1689**, 080005 (2015)] The detail of this recent experiment will be presented.

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