3rd Asia-Pacific Conference on Plasma Physics, 4-8,11.2019, Hefei, China

Effect of Electrode Biasing Generated Radial Electric Field on Edge Electrostatic Fluctuations and Runaway Electrons in ADITYA-U Tokamak

Tanmay Macwan[1, 2], Harshita Raj[1, 2], J. Ghosh[1, 2], R. L Tanna[1], Rohit Kumar[1], Suman Aich[1], Jayesh Rawal[1], K. A. Jadeja[1], K. M. Patel[1] and ADITYA-U Team

[1] Institute for Plasma Research, [2] Homi Bhabha National Institute

e-mail: tanmay.macwan@ipr.res.in

The effect of the radial electric field in the improvement of plasma confinement is widely studied for tokamak plasma. The mechanism for improved confinement is believed to be the formation of a transport barrier due to a radial electric field generated $E \times B$ shear. The improved confinement mode was obtained in CCT tokamak during the edge biasing experiments [1]. Such experiments were later conducted in various tokamaks [2-5]. Recently, the edge biasing experiments were conducted for real-time disruption mitigation in ADITYA tokamak [6].

Electrode biasing experiment is conducted in ADITYA-U tokamak (R = 0.75 *m, a* = 0.25 *m*) in limiter configuration. The electrode is inserted up to 2.5 *cm* inside the last closed flux surface (LCFS). To measure the electrostatic fluctuation in the tokamak edge, radial array of Langmuir probes (Rake Langmuir Probe) are inserted inside the LCFS to measure the localized floating potential and density fluctuations. Three such arrays provide the poloidal and toroidal variations in measurements. The measurement of hard X-rays emission is done using a lead shielded NaI (Tl) scintillator which detects the radiation mainly coming out of the limiter. The results show a definite decrease in the edge electrostatic fluctuations at the onset of electrode biasing. There is a corresponding change in the hard X-ray emission, the details of which are presented in the paper.

References:

1. R. J. Taylor *et al.*, "H-mode behavior induced by cross-field currents in a tokamak," *Phys. Rev. Lett.*, vol. 63, no. 21, p. 2365, Nov. 1989.
2. W. Zhang *et al.*, "Improved confinement and edge plasma fluctuations in the STOR-M tokamak," *Phys. Fluids B Plasma Phys.*, vol. 4, no. 10, pp. 3277–3284, Oct. 1992.
3. L. G. Askinazi, V. E. Golant, S. V. Lebedev, V. A. Rozhanskij, and M. Tendler, "Radial current in a tokamak caused by a biased electrode," *Nucl. Fusion*, vol. 32, no. 2, p. 271, 1992.
4. E. Y. Wang *et al.*, "Biased H mode experiments in Phaedrus-T," *Nucl. Fusion*, vol. 35, no. 4, p. 467, 1995
5. S. Jachmich, G. V. Oost, R. R. Weynants, and J. A. Boedo, "Experimental investigations on the role of flow shear in improved confinement," *Plasma Phys. Control. Fusion*, vol. 40, pp. 1105–1113, Jun. 1998.
6. P. Dhyani *et al.*, "A novel approach for mitigating disruptions using biased electrode in Aditya tokamak," *Nucl. Fusion*, vol. 54, no. 8, p. 083023, Aug. 2014.