Comparison of X-Point Neutral Density in L-mode and H-mode Discharges in DIII-D*

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Recently we reported [1] analysis which indicated that charge exchange damping of the poloidal momentum was as large as the neoclassical damping in low density DIII-D L-mode discharges. While those early results relied on data-constrained modeling, corroboration of our conclusions came with measurement [2] of the neutral density and subsequent benchmarking [3] of the 2-D analysis procedure used in ref. [1]. The measurement technique utilizes D_α light from a TV camera viewing the divertor region and electron densities and temperatures from a divertor Thomson scattering diagnostic. The TV camera data are reconstructed onto a poloidal plane and normalized by calibrated D_α monitors. Here we present a comparison of neutral density profiles in L and H-mode discharges.

We analyzed data from a series of discharges with neutral beam heating powers of 0.4, 1.4 and 2.4 MW. The discharge at 0.4 MW remained in L-mode during the X-point height scan, while the other two discharges had an L-H transition. We find that the neutral density in H-mode inside of the separatrix in the X-point region is higher during the H-mode phase. In contrast the X-point electron density stays relatively constant over the power range. The global density rise faster than the beam fueling rate following an H-mode transition suggests that H-mode discharges have a higher core fueling rate than L-mode discharges. Our data are qualitatively consistent with this particle balance requirement. Analysis details and data from a new midplane D_α system will be presented.

[1] B.A. Carreras, et. al., Phys. Plasmas **5**, 2623 (1998).
[2] R. J. Colchin, et. al., Nucl. Fusion **40** (2000) in press
[3] R. Maingi, et. al., "Modeling of 2-D Neutral Density Measurements in DIII-D", EPS 1999.

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