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Effect of impurity seeding on Edge toroidal Rotation in Aditya-U tokamak

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Intrinsic toroidal rotation velocity (V_ϕ) has been measured from the Doppler shift of C^{5+} carbon spectral lines (at 529.05 nm) in the edge region of the ADITYA-U tokamak without any auxiliary torque input in an ohmically heated pure hydrogen (H_2) plasma as well as in H_2 plasmas seeded with medium-Z (neon and argon) impurities . The toroidal rotation in the edge region is observed to reverse its direction from the counter-current to the co-current direction with an increase in plasma current beyond I_p ~ 145–150 kA. Furthermore, a systematic decrease in the co-current V_ϕ has been observed with the edge density, which tends to decrease to almost zero velocity with an increase in the edge density [1]. The injection of medium-Z (neon and argon) impurities is observed to influence the edge toroidal rotation significantly. In low I_p discharges, argon injection leads to a reversal of edge intrinsic rotation from the counter-current to the co-current direction. In high I_p discharges, both neon and argon seeding enhance the co-current rotation by about ~5–10 km s−1, at a constant I_p compared to pure H_2 discharges. Simultaneous measurements of the edge radial electric field, E_r, shows that the $E_r \times B_\theta$ flow seems to be driving the edge toroidal rotation in ADITYA-U. With impurity injection, the E_r also gets modified, leading to an observed increase in the edge toroidal rotation [1].

References:

[1]. Ankit Kumar, *et al* 2024 *Nucl. Fusion* 64 086019