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Toroidal flow & temperature measurements of neutral atoms in edge region of ADITYA-U Tokamak using Zeeman splitting

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Presence of hot neutral atoms and their toroidal flow plays a crucial role in understanding the edge region Physics in a tokamak, as it can affect the plasma rotation by changing the radial electric field in the edge region [1-4]. Measurement of toroidal flow velocity of neutrals (e.g. Hydrogen and Neon atoms) is performed using Doppler shift spectroscopy. 1m long Czerny-Turner configured multi-tract spectrometer (having a dispersion of 0.003nm/pixel), coupled with a fast sCMOS camera (with a time resolution of 20ms) is used to measure the Doppler shifts. Interestingly, due to the presence of high toroidal magnetic field (B_T ~ 1T) in a ADITYA-U tokamak, two Zeeman components (σ^+ and σ^- component) are observed while analysing the emission spectra (from Hydrogen and Neon atoms) coming along the magnetic field B_T. However, when the spectra is taken perpendicular to the magnetic field, all the three Zeeman components (i.e. σ^+, σ^- & π-components) are observed. In order to compare H_α emission, both in presence and absence of toroidal magnetic field in ADITYA-U plasma, the H_α emission is also monitored in the absence of toroidal magnetic field during the dc Glow Discharge Cleaning (GDC) plasma in ADITYA-U tokamak. This study becomes very useful in the precise estimation of temperature of the neutral atoms as well as their flow velocity in the edge region.

References:

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