Preliminary Results for Estimation of Neutral Temperature in Aditya-U Tokamak

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In a tokamak, the plasma is confined using strong magnetic fields. Hence, the shapes of the spectral lines emitting from the tokamak plasma are significantly influenced by these confining magnetic fields. The Zeeman splitting of spectral lines in presence of the magnetic fields hinders the proper evaluation of plasma parameters from the line shapes. For example, ion/neutral temperature estimations from the Doppler widths of spectral lines can be erred in presence of Zeeman components. Aditya-U is tokamak having major radius R=0.75 m and minor radius a=0.25 m, TF ranging from 0.75 to 1.5 T. Neutral particle temperature in the edge region of Aditya-U tokamak has been measured by recording the Hydrogen Balmer alpha (H_α - 656.28 nm) emission spectra from different line of sights in both high and low field sides. The spatial profile of H_α emission has been recorded using a 1 m multi-track spectrometer. To estimate the temperature, simulation of spectral line shapes is required in order to account for the Zeeman splitting. The simulated spectra are then fitted to the measured spectra to obtain true values of neutral temperatures. We developed a code for simulating the H_α emission spectra measured from the edge region of tokamak, depending on the strength of magnetic field, 7 Zeeman components are identified in case of normal Zeeman splitting, whereas 48 (18 Π and 30σ) components are identified in case of Paschen-back Zeeman splitting. The developed code generates the synthetic spectra using the magnetic field strength and iterates if for the different temperature of the hydrogen neutrals. This is then fitted with the measured spectra by properly convolving the instrumental width of the measuring system to obtain the true hydrogen neutral temperatures. Initially neutral particle temperature has been estimated during the experiment of hydrogen gas puff. It has been observed that high field side neutral temperature (4 – 5 eV) during plasma flat top is almost twice than low field side neutral temperature (2 eV) suggesting the poloidal asymmetry in neutral temperature.

In this paper, we are presenting the development of code along with preliminary results of estimated neutral temperatures in recent plasma experiments of Aditya-U tokamak.