Seminar

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Institute for Plasma Research

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Title: Zeeman Spectroscopy in ADITYA-U Tokamak

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Date: 12th August 2024 (Monday)

Time: 12.00 PM

Venue: Committee Room 4, IPR

Abstract

The magnetic field can influence the atomic and molecular spectral line profiles, a phenomenon known as the Zeeman Effect. This effect is an inherent consequence when a magnetic field is present, as observed in magnetic confinement devices such as tokamaks. This presentation will provide an overview of the progress on the development of a Zeeman polarization spectroscopy diagnostics for the Aditya-U tokamak, as well as an experimental investigation into the correlation between Zeeman-broadened neutral and ion temperatures within the Aditya- U tokamak. The safety factor of tokamak plasma can be obtained by estimating angle between magnetic field direction and viewing direction of the radiation. When plasma is viewed tangentially and magnetic field line in an angle, the intensities differences between two σ components of the circularly polarized light Zeeman splitting Hα emission at 656.28 nm by using a Zeeman polarization diagnostic. The details design scheme of the Zeeman polarization spectroscopy system for Aditya U will be presented.

As the analysis of Zeeman splitting spectral lines require the detailed modelling of spectral line shape by considering all the Zeeman lines and their thermal broadening, a generalized Python code has been developed to model the experimentally observed spectral lines. This code can compute all the Zeeman level, select all the allowed transition and calculate the relative intensities for a given transition based on the types of Zeeman Effect happening in the tokamak magnetic field environment. Using this code, neutral hydrogen and oxygen ion temperature has been estimated from Doppler broadened spectral lines from those for investigating the poloidal asymmetries in neutral temperature in the ADITYA-U tokamak. Experiment has been carried out using an 1-meter multi-track spectrometer equipped with an 1800 grooves/mm grating and as CMOS detector [2], This presentation also includes the analysis of the neutral and ion temperature