Seminar

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Institute for Plasma Research

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Title: Radiated Power Loss Analysis in ADITYA-U Tokamak Plasma Discharges Using an Infrared Imaging Video Bolometer (IRVB)

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Date: 30th September 2025 (Tuesday)

Time: 10:30 AM

Venue: Seminar Hall, IPR

Abstract

One of the key objectives in present-day fusion research is to protect the plasma-facing components of fusion devices from the damage caused by the energy losses in the plasma. Among these losses, total power radiation loss constitutes a dominant component. Thus, the study of radiation distribution aids in monitoring the plasma performance. In state-of-the-art magnetic fusion devices, the total radiation power losses are measured using diagnostics such as Metal Foil Resistive Bolometers, the Absolute Extreme Ultra-Violet (AXUV) system, and the Infrared Imaging Video Bolometer (IRVB).

In the ADITYA-U tokamak, the measurements of radiation power losses are currently obtained using both AXUV and IRVB systems. The present study focuses on analyzing radiation power loss data for several ADITYA-U plasma discharges using the IRVB diagnostics. The IRVB system is installed on radial port #1 in the ADITYA-U tokamak, and its main components include a 2.5 μm Platinum (Pt) foil that absorbs plasma radiation in a broad spectral band (~4 eV to 8 keV), an IR camera, and a DAQ system. The diagnostic system is configured to provide a tangential view of the plasma volume and delivers spatially and temporally resolved 2D radiation images.

A statistical analysis of several plasma discharges is conducted to examine the correlation between the radiated power and the impurity concentration, temperature, density, and several other plasma parameters. Moreover, the variation of radiated power for Gas Pulse and Micro-particle Pellet Injected plasma discharges has been studied. The analysis indicate that the radiated power is significantly enhanced for pellet injection shots, representing that it is a promising candidate for the successful mitigation of heat load on the first wall during plasma disruption scenarios. The shortcomings of the present IRVB system and the design specifications of the planned upgraded IRVB system, to be installed on ADITYA-U, will also be discussed. The analysis, its interpretation, and the future directions of this study will be presented.
