Seminar

Institute for Plasma Research

Title: Development of integrated Spectral database for ITER X-ray Crystal Survey (XRCS) Spectrometer

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Date: 23rd January 2026 (Friday)

Time: 11:00 AM

Venue: Seminar Hall, IPR

Abstract

The XRCS-survey spectrometer for ITER surveys ITER plasma emissions in X-ray wavelength region to detect the plasma impurities, and quantify the impurity content. The XRCS survey spectrometer is a broad band spectrometer, designed to monitor all the important impurity emissions falling in the energy range of 0.5 keV to 13 keV. An accurate wavelength and intensity calibration are essential for the measurements done by XRCS-survey spectrometer to ensure accurate identification of impurities and estimation of impurities concentration. In order to monitor the impurity spectral lines and assess their content in the ITER plasma detailed analyses supported by comprehensive spectral modeling across various ITER operational setups are needed. Plasma emission modelling has already been carried out for several key impurities (like, Tungsten) in earlier reported works [1]. Further studies have been conducted using experimentally measured spectral lines from different databases like, NIST-ASD [2], NORAD, etc. to improve the diagnostic reliability.

In the present work we report the computational study to generate a spectral database using Cowan's atomic code [3], a well-established tool for calculating energy levels, transition rates, and spectra of complex atoms/ions. The Cowan computed spectral database developed considering different sources (NIST/Tokamaks/other codes) focuses on key intrinsic and extrinsic impurities ions from low to high Z impurity ions, such as; B, O, Ne, Ar, Fe, Cu, Xe, & W which are relevant to ITER XRCS Survey spectrometer. The obtained results highlight prominent transitions (during ITER operation) suitable for the XRCS survey diagnostics for impurity monitoring, impurity influx, and concentration.

Keywords: XRCS-survey spectrometer, Plasma emissions, Cowan Code, Spectral database.

References

[1] Beiersdorfer P, Clementson J and Safronova UI, ***Atoms***, 3, 260-272. *(2015).*
[2] Kramida A, Ralchenko Yu, Reader J, NIST ASD Team. ***NIST Atomic Spectra Database***; version 5.8, Gaithersburg, MD, USA: National Institute of Standards and Technology. *(2020).*
[3] Cowan RD. The theory of atomic structure and spectra, Berkeley, CA, USA: ***University of California Press***. *(1981).*