

Study of Visible and X-Ray Radiation from a Tokamak Plasma

Abstract

The complete characterisation of a tokamak plasma requires various types of active and passive diagnosing systems. Radiation diagnostics is one of the most promising passive diagnosing systems that are fully capable of providing a number of information about radiating plasma without perturbing it.

The radiation phenomena from a typical tokamak plasma is not uniform throughout the volume. The core of plasma attains the maximum density (n_e), temperature (T_e) etc. and so the dominant radiation from this zone is mainly of Bremsstrahlung type and falls into soft X-ray (SXR) regime. While approaching towards the peripheral zone of the column, SXR emissivity falls and line radiations dominate. Thus, the edge of the plasma column is populated with ultra violet and visible types of emissions. As these radiation phenomena occurs due to several ionic, atomic and molecular interactions, the characterisation of these radiated photons may infer about the insight of the plasma. The present project work is aimed to study the visible and X-ray radiation from a typical tokamak plasma. In the first half, a radial profile of visible radiation from plasma column will be numerically generated by modelling the visible emission pattern from plasma and hence to achieve the most probable profile of visible emission. Finally, a synthetic radiation pattern will be prepared for the entire column for Aditya-U (AU) tokamak. As, the visible emission from the AU tokamak plasma are captured using several diagnostics, these experimentally acquired data would be used for benchmarking the synthetic outcomes. Another type of radiation: Bremsstrahlung is observed in case of most tokamak plasma. The power of radiated SXR is strongly dependent on several plasma parameters, including the effective ion charge (Z_{eff}), n_e , T_e etc. Hence, the radiated SXR carries several information about the basic parameters of radiating source plasma. With the use of AU plasma parameters, the radiated power will be estimated

Academic Project Requirements:

1) Required No. of student(s) for academic project: 1

2) Name of course with branch/discipline: M.Sc. Physics

3) Academic Project duration:

(a) Total academic project duration: 36 Weeks

(b) Student's presence at IPR for academic project work: 3 Full working Days per week

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