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Seminar

Institute for Plasma Research

- Title :** Study of Compound Sawtooth Oscillations, Observation of EGAM in KSTAR and Development of Probe for the Measurements of Runaway Electrons Inside the Golem Tokamak Plasma Edge
- Speaker:** Dr. Pravesh Dyani
Czech Technical University in Prague
- Date :** 05th March 2021 (Friday)
- Time :** 03:30 PM
- Venue :** Online - Join the talk:
https://meet.ipr.res.in/Dr.PraveshDyani_PDFtalk

Abstract :

In this talk, I will present the main outcomes of my research work at Ulsan National Institute of Science & Technology (UNIST), South Korea, and Czech Technology University (CTU), Czech Republic. In UNIST, the focus of my research was to understand the process of EGAM excitation in KSTAR, and the saturation of electron temperature at the plasma core in the ramp phase of the compound sawtooth oscillation.

(1) Study of Compound Sawtooth Oscillations in KSTAR In neutral beam heated KSTAR plasmas compound sawtooth oscillations are frequently observed. In the ramp phase of a sawtooth oscillation, electron temperature momentarily ceases to increase at the plasma core due to the partial magnetic reconnections which are caused by excitation of $m/n=1/1$ resistive kink mode. The frequency of the $1/1$ resistive kink mode increases with time in the laboratory frame. Simultaneously, a high- temperature annulus is observed away from the axis. Temporal behavior of the resistive kink mode frequency is found to be consistent with the theory given by G. Ara et al., Ann. Phys. 112, 443 (1978). A model will be presented, to explain the electron temperature saturation and heating of the plasma core in presence of the high- temperature annulus.

(2) Observation of EGAM in KSTAR [1] Experimental evidence of EGAM ($n=0$) excitation in KSTAR plasmas will be presented. Analysis suggests that the observed EGAMs oscillations are driven by the energetic electrons generated due to the magnetic reconnections in the precursor phase of a sawtooth oscillation. These toroidally symmetric electromagnetic oscillations appear at the plasma core and their frequency lie in the same range as those of resistive kink mode.

In CTU, my responsibility was to study RE in golem tokamak, where I was developing a probe for the direct measurements of the REs near the golem tokamak plasma edge.

(3) Development of Probe for the Measurements of Runaway Electrons Inside the Golem Tokamak Plasma Edge [2,3] High loop voltage and low-density plasma discharges at the GOLEM tokamak present favorable conditions for the study of the runaway electrons (RE). A probe is being designed and developed for the spectral measurement of the RE energy inside the last closed flux surface of GOLEM tokamak plasma. Design of the probe is based on simulation results of the FLUKA code that estimates the energy absorbed by the scintillating crystals and filters of various densities. In the simulations, graphite, stainless steel and molybdenum were tested to filter the supra-thermal electrons. Since having different light yield, YSO (Y₂ SiO₅:Ce) , NaI(Tl) and plastic (EJ-200) scintillating crystals were chosen for the simulations.

References:

- [1] Results were presented at (i) 3rd UNIST- Kyoto University Workshop on "Physics validation and control of turbulent transport and MHD in fusion plasmas", May 8th - 9th 2017, Kyoto University, Kyoto, Japan, (ii) 1st NFRI International Mini-Workshop on Energetic Particles, November 22th-23th 2016, National Fusion Research Institute, Daejeon, South Korea (iii) 13th International Reflectometry Workshop (IRW 13) May 9th -11th 2017, National Fusion Research Institute, Daejeon, South Korea
- [2] P. Dhyani, et al., Journal of Instrumentation (JINST), 14 C09029 (2019)
- [3] P. Dhyani, et al., Proceedings of 46th European Plasma Physics Conference (EPS 2019), 8–12 July 2019, Milan, Italy
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