

Radial localization of electron temperature edge pedestal and ELM-like events using ECE measurements at Wendelstein 7-X

Tuesday, 21 June 2022 14:00 (2h 30m)

Wendelstein 7-X (W7-X) is a high iota, low shear optimized stellarator concerning magnetic field geometry with a scientific objective to attain 30 min of detached steady-state plasmas. The electron cyclotron emission (ECE) at W7-X is measured by a heterodyne radiometer [1] in the spectral range of the X2 emission from 126 to 162 GHz and by a Martin-Puplett interferometer [2] in the spectral range of 100 to 300 GHz along the same line of sight. The 32 channel radiometer has a temporal resolution of the order of μs which enables the measurement of the rapid fluctuations in the electron temperature, T_e , for example, the rapid crashes like edge localized mode (ELM)s possibly caused by the formation of the T_e edge pedestal. With the high-resolution ECE measurements, it is possible to determine the spatial location of ELMs in the plasma.

A magnetic configuration scan [3] was performed at W7-X by varying the rotational transform to analyze the plasma confinement for magnetic configurations with different edge island sizes and locations. Due to the low shear, the separatrix can be shaped by large islands constituting an island divertor. For a few of the magnetic configurations, it was observed with ECE measurements that an edge pedestal develops at the start of the plasma discharge followed by the ELM-like crashes in T_e . This work aims at investigating the changes in the T_e edge gradients for different magnetic configurations with a focus on the identification of the spatial location of the T_e edge pedestal and the ELM-like events with respect to the radial location of rational islands.

References

- [1] Hirsch, Matthias, et al. EPJ Web of Conferences. Vol. 203. EDP Sciences, 2019.
- [2] Chaudhary, N., et al. Journal of Instrumentation 15.09 (2020): P09024.
- [3] Geiger, J. Proc. 28th IAEA Fusion Energy Conf.(FEC-2020, Virtual Event), 2021.

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