

Electron temperature fluctuation measurements with Correlation Electron Cyclotron Emission in L-mode and I-mode plasmas at ASDEX Upgrade

Wednesday, 22 June 2022 14:50 (20 minutes)

The I-mode confinement regime is a promising operational scenario for future fusion reactors because it features high energy confinement without high particle confinement [1]. The nature of the edge and pedestal turbulence in I-mode plasmas is still under investigation, and open questions exist about the role of the turbulence in determining the transport of I-mode. The edge Weakly Coherent Mode (WCM) appears in the I-mode pedestal and may play a role in transport. In this work we explore electron temperature (T_e) fluctuations in the plasma outer core and pedestal ($\rho_{pol} = 0.85 - 1.0$) using a 24-channel high radial resolution Correlation Electron Cyclotron Emission (CECE) radiometer [2]. CECE measurements provide turbulence information including the T_e fluctuation amplitude, turbulent spectra, and radial localization of turbulent features. With CECE measurements we show that the WCM is localized in the pedestal region in both L-mode and I-mode and is measured in optically thick plasmas with a T_e temperature fluctuation amplitude of 2.3-4.2%. Broad-band drift wave turbulence is measured in the outer core with a T_e fluctuation amplitude of <1%. The quality of the confinement of the discharge phases is found to be independent of the presence of the WCM. The quality of the confinement does correlate with changes in outer core ($\rho_{pol} < 0.95$) T_e fluctuation amplitude. A second CECE system recently installed at AUG allowed for non-standard fluctuation measurements during L-mode and I-mode experiments. The second CECE system was toroidally separated from the primary system, allowing measurements of the long-range toroidal correlation of the WCM indicating its low toroidal mode number. A reflectometer sharing a line of sight with the second CECE system enabled density-temperature cross-phase (α_{nT}) measurements [3]. The WCM α_{nT} changes between L-mode and I-mode -171° to -143° as the T_e gradient steepens.

References

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Session Classification: Diagnostics