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Database study of turbulent electron temperature fluctuation measurements at ASDEX Upgrade

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Turbulent transport is generally found to determine energy and particle confinement times in tokamaks. The correlation electron cyclotron emission (CECE) diagnostic installed on the ASDEX Upgrade (AUG) tokamak measures broadband, long-wavelength ($k_\theta \rho_s < 0.3$) electron temperature fluctuations [1], yielding insight into turbulence-driven transport. Analysis of CECE data is well- suited to automation during the steady-state conditions often used for experimental core transport studies. In this work, an automated method for the analysis of CECE data is applied to discharges at AUG. The automated method determines the optimal time windows for CECE analysis during each discharge, evaluates the impact of plasma conditions on measurements, filters the raw data to account for the presence of artifacts stemming from sources including electronics noise, and processes the filtered data into turbulent electron temperature fluctuation amplitudes. For each analysed discharge, the turbulence measurements are paired with dozens of local and global plasma and engineering parameters evaluated during the same time windows and at the same radial locations as the CECE measurements. The resulting experimental turbulence database provides a unique opportunity to search for trends in turbulent electron temperature fluctuation levels over a large range of parameter space and allows for direct comparisons with cutting-edge numerical models of turbulence and transport. In this work, the database is used to study the competing effects of collisionality and gradients on the saturated amplitude of turbulence measured by the CECE diagnostic.

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References

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