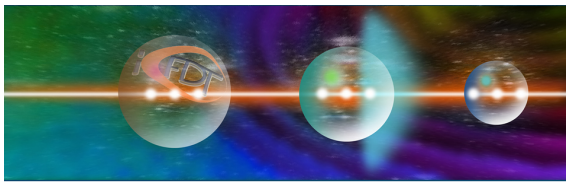

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Measurements of electron temperature in Tokamak Fusion Power Plants

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The measurement of electron temperature (Te) is done in tokamak plasmas mainly by Electron Cyclotron Emission(ECE) and using the Thomson scattered laser radiation(TS).
Recently these measurements were reviewed in the JET (Joint European Torus) DTE2 (second deuterium-tritium campaign) and differences Te_ECE –Te_TS were detected in particular at high electron temperature (Te>6KeV)[1]. Previously these differences were detected in JET, TFTR, FTU tokamaks[2]. The differences can be connected to the physics of ECE and TS and to the intrinsic non-maxwellian nature of the electron velocity distribution function (EVDF) of tokamak plasmas. In practice the strong sensitivity of ECE radiation emission to the deviation from maxwellian of EVDF has been identified as a possible cause of these differences .
The need of measuring the deviation of the EVDF from the maxwellian emerges from a large dataset on various machines . In tokamak fusion reactors ITER, CFETR and DEMO the evaluated bulk plasma electron temperature is higher than 10keV and the EVDF could exhibit a deviation from the maxwellian. The paper presents i) a review on the experimental evidences supporting the physics involved in understanding the differences between the Te_ECE and Te_TS, ii) how such deviations from the maxwellian EVDF can be evaluated and possibly measured in the context of fusion reactors, iii) the minimum set of diagnostics dedicated to the measurement of electron temperature in fusion reactors.

1. F P Orsitto et al , European Plasma Physics Conference 2023 Bordeaux , Mo_MCF P1.019 and EUROfusion report WPJET1-CP(23) 34231
2. M Fontana , F P Orsitto , G Giruzzi et al , Physics of Plasmas 30(2023)122503

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