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O5.102 Modelling of three-ion ICRF schemes with PION

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Ion Cyclotron Resonance Frequency (ICRF) heating is one of the auxiliary heating methods which will be used in ITER. A detailed assessment of ICRF schemes available in the non-active phase of ITER operation was recently carried out [1]. As a result, the ICRF scenarios considered for ITER also include the so-called three-ion ICRF heating schemes in addition to standard minority and majority ion heating. They provide new ways to couple ICRF waves in the core plasma for efficient heating and fast ion studies. Such scenarios have been a focus of intensive research from the theoretical, numerical and experimental point of view [2], and they are also planned for the future JET D-T (DTE2) campaign. In the present work, we analyse discharges carried out with three-ion ICRF schemes on JET and ASDEX Upgrade tokamaks using the ICRF modelling code PION [3]. PION computes the ICRF power absorption and the distribution functions of the resonant ions in a self-consistent way. It also includes a simplified model for taking finite-orbit-width effects of the resonant ions into account. Prior to this work, PION has been extensively compared against experimental data for a large variety of minority and majority ion heating schemes on JET, AUG, DIII-D and Tore Supra. We show that despite its relatively simple models, PION reproduces the main features observed in the experiments using three-ion ICRF schemes on JET and AUG. They include strong ion cyclotron damping by the third ion species despite their very low concentration, strong ICRF acceleration of resonant ions, and the dependence of the resonant ion distribution function on experimental parameters. This increases our confidence in using PION for modelling the performance of three-ion ICRF schemes in JET DTE2 and ITER [4].

References
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