Optimizing ion heating in D-T plasmas with three-ion ICRF scenarios: insights from JET and strategies for future tokamaks

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Abstract. Achieving fusion-grade ion temperatures ($T_i \approx 15$ keV) is crucial for the performance of future fusion reactors. In this talk, we discuss a new efficient ICRF scenario for enhancing ion heating in D-T plasmas that makes use of selected impurities with $1/3 < (Z/A)_{imp} < 1/2$ (such as ^{7}Li, ^{9}Be, ^{11}B, ^{22}Ne, and Ar), first proposed theoretically [1, 2] and then confirmed during the deuterium-tritium campaign at JET in 2021 [3].

We present a direct comparison of the performance of this novel scenario with H minority ICRF scheme and with an NBI-only heated plasma. Consistent with theoretical predictions, plasmas heated with the H minority scheme exhibited the highest electron temperature, while the highest ion temperature was achieved in the pulse employing the three-ion ICRF scheme with the core resonance of ^{9}Be impurities, see Fig. 1.

This talk also summarizes possible applications of the three-ion T-(IMP)-D ICRF scenarios for future ITER and CFETR operations [4].

[1] Ye.O. Kazakov et al., *Phys. Plasmas* **22**, 082511 (2015)
[2] Ye.O. Kazakov et al., *Nature Physics* **13**, 973 (2017)
[3] Ye.O. Kazakov et al., *AIP Conf. Proc.* **2984**, 020001 (2023)
[4] C. Song et al., *Physica Scripta* **96**, 025603 (2021)