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As part of the preparation for the second JET DT campaign (DTE2), a series of isotope control experiments in H/D mixtures [1] have shown that NBI fuelling species has only a weak effect on the core isotope composition, which remains determined by the edge H/D ratio and therefore by the injected gas. The analysis of the core particle transport of the ion components revealed a fast isotope mixing ubiquitous in plasmas with dominant ITG turbulence [2-4]. Fast isotope mixing offers an opportunity to significantly boost the fusion power in DTE2 in a variant of a hybrid scenario [5,6] with unbalanced (tritium rich) D/T isotope composition and pure D-NBI heating, as opposed to the symmetric 50/50 D/T mixture and combined D- and T-NBI.

Thermonuclear fusion reactivity (reactions between thermal fuel components) reduces as the plasma composition deviates from the balanced 50/50, although injection of fast deuterium into thermal tritium plasma greatly enhances the beam-target fusion, due to the large cross-section of D_{fast}->T reactions and increased number of the tritium targets. In the parameters space of JET hybrid scenarios that gives a net increase of the total number of fusion reactions, with larger gain at higher tritium concentrations.

Further to the NBI fast-thermal reactions, the low expected D/T ratio ($n_D/n_e \leq 35\%$) enables the usage of deuterium fundamental harmonic ICRH heating scheme which further boosts the fusion power, as, unlike in 2nd harmonic schemes, it avoids accelerating fuel ions to energies well above the peak of the DT cross section (~120keV). The fundamental D minority heating demonstrated the highest Q_{fus}=0.22 in DTE1 (1997) for a 4 second stationary state plasma [7]. In the proposed scenario, part of the ICRH power will also be absorbed by Doppler shifted D-NB ions and the intrinsic Be impurity as the resonant species in a three-ion heating scheme [8]. TOMCAT and TORIC simulations have shown that the fractions of the total ICRH power absorbed by the individual components depend on the exact plasma D/T composition, with more power going to the thermal and fast deuterium in more T-rich plasmas. Therefore, larger D/T imbalance also provides larger boost to the fusion reactivity from the ICRH heating.

Combination of the NBI beam-target reactions with the ICRH effects in the proposed scenario has the potential of boosting the fusion power significantly over an otherwise similar hybrid plasma with n_D=n_T, bringing substantial benefits to the physics goals of DTE2, such as the investigation of alpha particle physics.

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