11th European Fusion Theory Conference, 26-28 September 2005, Aix-en-Provence

Tritium transport in Improved H-mode JET plasmas

I.Voitsekhovitch[1], K.-D. Zastrow[1], X. Garbet[2], D. C. McDonald[1],
G. V. Pereverzev[3], P. R. Thomas[2], and JET EFDA contributors

[1]*EURATOM/UKAEA Fusion Association, Culham Science Centre, Abingdon, OXON, OX14 3DB, UK*
[2]*Association EURATOM/CEA Cadarache, F-13108, St Paul lez Durance, France*
[3]*Max-Planck-Institut für Plasmaphysik, Boltzmannstr. 2, Garching, Germany*

Tritium transport in improved H-mode JET plasmas such as hybrid scenarios (HS) and the hot ion (HI) H-mode is analysed and compared to ordinary H-mode plasmas, performed in the same density range $(2.5 - 4.5)\times10^{19}$ m^{-3}. The good confinement in these plasmas is achieved due to pre-forming the safety factor profile q with subsequent operation with a flat q, in a broad core region, during the main heating phase. The discharges selected for analysis include the tritium either as a trace (H-mode and HS [1]) or as a full species with varying concentration (10 to 90%) (hot ion mode [2]).

The transport modelling of these discharges is done by using the ASTRA, UTC and TRANSP codes. The simple stability estimation with the MMM/ASTRA model shows that the ITG mode is the dominant core instability in all these discharges. The maximum ITG growth rate is nearly the same in stationary H-mode plasmas, HS and at the beginning of the HI H-mode while it reduces as the performance of HI H-mode improves. The modelling of tritium evolution with the theory-based and semi-empirical models is supplemented by modelling the evolution of thermal energy and the main deuterium species. The objective of this analysis is to compare (i) the transport of tritium as a main plasma species and as a tracer [3]; (ii) the energy and particle transport with the prediction of electrostatic MMM and GLF23 models in ordinary and improved H-mode plasmas and (iii) the transport mechanisms (electrostatic vs. electromagnetic) of energy and particles.

The results of this study are of interest for the estimation of H-mode ITER performance where the treatment of tritium transport is important.

This work was partly funded by EURATOM and the UK Engineering and Physical Sciences Research Council.

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