Isotope identity experiments in JET-ILW: L-mode regime

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NBI-heated L-mode plasmas have been obtained in JET with the Be/W ITER-like wall (JET-ILW) in H and D, with matched profiles of the dimensionless plasma parameters, ρ^*, ν^*, β and q in the plasma core confinement region. The achieved isotope identity [1], [2] indicates that the confinement scale invariance principle [3] is satisfied in the confinement region of these plasmas, where the dominant instabilities are found to be Ion Temperature Gradient (ITG) modes. The dimensionless thermal energy confinement time, $\Omega_i \tau_{E,th}$, and the scaled core plasma heat diffusivity $A\chi_{eff}/B_T$, are matched in H and D, yielding $\Omega_i \tau_{E,th} \sim A^{0.05}$. The lack of isotope mass dependence of the dimensionless L-mode thermal energy confinement time in JET-ILW is not inconsistent with the weak, positive ion mass dependence $\tau_{E,th} \sim A^{0.15\pm0.02}$ obtained in dimensional L-mode NBI power scans at constant density in H and D [4]. Predictive modelling with JETTO-TGLF of the H and D identity pair is in very good agreement with experiment for both isotopes: the stiff core heat transport, typical of JET-ILW NBI heated L-modes, overcomes the gyro-Bohm scaling of gradient-driven TGLF, explaining the lack of isotope mass dependence in the core confinement region. The effect of *ExB* shearing on the predicted heat and particle transport channels is negligible for these low beta and low momentum input plasmas.

References:

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