COMPARISON OF L-MODE REGIMES WITH ENHANCED CONFINEMENT BY IMPURITY SEEDING IN JET AND DIII-D*

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Neon seeding has been used in the JET and DIII-D tokamaks to increase confinement in L-mode up to $H_{97Y} = 1.1$. In JET, the addition of the impurity produces a dramatic increase in the ion temperature, nearly doubling in the core, and causes an increase of the neutron rate by about 10%, even though $\langle Z_{eff} \rangle$ from visible Bremsstrahlung measurements is substantially higher. Similar behavior has been observed in DIII-D where the higher energy confinement and reduced ion transport have been correlated with a reduction in low wavenumber density fluctuations measured by beam emission spectroscopy (BES) and far infra-red (FIR) scattering. Gyro-kinetic analysis has shown that low k turbulence, predominantly due to ion temperature gradient (ITG) modes, was stabilized by an increase in the E×B shearing rate with impurity injection. Although fluctuation data are not available in JET, similar analysis of neon seeded JET discharges predicts a reduction in low k ITG turbulence although the effect of E×B shear stabilization does not extend across the entire profile. Higher growth rates at higher k due to trapped electron (TE) modes are also calculated over the outer part of the JET profile, a feature not observed in DIII-D.

Gyro-kinetic and transport analysis of JET and DIII-D neon seeded L-mode discharges will be compared to reference discharges. In order to further elucidate the physical mechanisms responsible for reduced transport and improved confinement which accompany impurity injection we will also compare similarities and differences in JET, DIII-D, and TEXTOR. The operational conditions under which L-mode discharges with enhanced confinement have been obtained will be discussed, including the reduction of MHD and methods of maintaining L-mode at relatively high heating powers.

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