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Response of Particle Transport to Neon Injection in JET and FTU

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According to theory, the change of the effective charge in Tokamak plasmas due to low-mid Z impurity doping can drive a turbulent particle pinch velocity resulting in a peaking of the core density profile. This macroscopic effect has been observed in many Tokamaks [1-5].

In this paper we present the analysis of experimental electron density profiles in JET and FTU measured during Neon injection experiments. The analysed JET data are taken from elongated diverted hybrid discharges [6] while those of FTU are circular limiter L-mode plasmas [2]. Both machines have a metallic first wall namely ITER-like Beryllium-Tungsten in JET and all Molybdenum in FTU. The observed electron flux is compared with the outcome of fully predictive transport simulations. In both machines a core density peaking is observed which, in order to be explained, requires the introduction, in code simulations, of a turbulent inward particle pinch proportional to the effective charge and the ion temperature radial gradient. This is in addition to neoclassical and Bohm/gyro-Bohm transport coefficients used for reference in un-seeded discharges. The inward particle flux generated by the Neon doping reduces the overall diffusive/convective flux of both neoclassical and turbulent nature that balances the beam particle source for JET and no core source for FTU. Interestingly, the core density peaking in JET discharges increases with collisionality, which goes in the opposite direction of the well known trend observed in H-mode un-seeded discharges [7]. The presence of heavy impurities coming from the metallic wall in both cases was not enough to justify the observed density peaking.

The stability of micro turbulence at different neon injection level will also be presented to better understand the physics likely to be behind the observed macroscopic effect.

References

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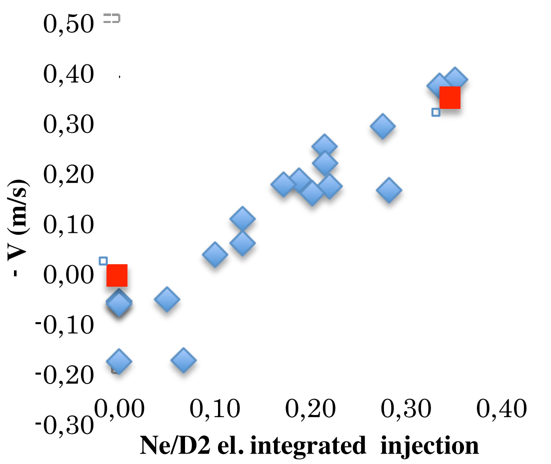

JET: exp. Ne induced particle velocity vs Ne/D_2 total electron injection. JETTO code: red