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I4.102 Gyrokinetic Comparison of JET-ILW and JET-C Pedestal Transport

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See the full abstract here http://ocs.ciemat.es/EPS2019ABS/pdf/I4.102.pdf

An ITER-like wall (ILW), composed of a tungsten divertor and beryllium chamber, was installed on JET in order to study material erosion and tritium retention in preparation for ITER. The ILW has successfully demonstrated long-term tritium retention but has had an unexpected impact on confinement via its effect on the H-mode pedestal. Since commencement of JET-ILW operation, the JET pedestal is limited to lower pedestal top temperatures than were accessible during earlier JET-carbon (C) operation. This talk focuses on the changes in turbulent transport that arose due to the transition from JET-C to JET-ILW. Understanding these transport dynamics may be key to maximizing confinement in the upcoming JET deuterium-tritium campaign as well as ITER. We will present a comparison of the gyrokinetic instabilities and resulting transport produced in two representative pedestals-one from JET-C and another from recent JET-ILW operation. A comparison of the profiles and heating power reveals a stark qualitative difference between the discharges: JET-ILW requires twice the heating power to sustain roughly half the temperature gradient of JET-C. This points to heat transport as a central component of the dynamics limiting the JETILW pedestal and reinforces the following emerging JET-ILW pedestal transport paradigm, which is the focus of this talk. ILW conditions modify the density pedestal in ways that decrease the pedestal density gradient. This is attributable to some combination of direct metal wall effects and the need for increased fueling to mitigate tungsten contamination. The modification to the density profile increases eta (the ratio of the normalized temperature gradient to that of the density gradient), thereby producing more robust ion temperature gradient (ITG) and electron temperature gradient (ETG) driven instabilities. Collectively, these effects limit the pedestal temperature and demand more heating power to achieve good pedestal performance. Impurity seeding has been observed to mitigate the JET-ILW pedestal limitations. We will present analysis of impurity seeded discharges and discuss mechanisms by which seeding can result in improved pedestal structure.

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