



Contribution ID: 572

Type: Poster

## Multi-species ITG-TEM driven turbulent transport of D-T ions and He-ash in ITER burning plasmas

*Tuesday, 18 October 2016 14:00 (4h 45m)*

Burning plasmas are composed of multiple ion species such as fuel isotopes(D and T) and He-ash produced by the fusion reaction, and more complex turbulent transport processes are expected in comparison to the single-ion plasmas. Since simultaneous measurements of the kinetic profiles for all species are limited even in experiments, systematic studies on the particle and heat transport by the first-principle-based gyrokinetic simulations are indispensable for the prediction of the confinement performance and the optimization of the impurity exhausts and D/T fueling. In this study, the ion-temperature-gradient and trapped-electron-mode (ITG-TEM) driven turbulent transport in realistic ITER plasmas is investigated by means of the multi-species electromagnetic gyrokinetic Vlasov simulation GKV[Watanabe et al., NF2016] with D, T, He, and real-mass kinetic electrons including their inter-species collisions[Nakata et al., CPC2015, Nanami et al., PFR2015], where a good prediction capability has been confirmed against the actual JT-60U tokamak experiment[Nakata et al., IAEA-FEC2014]. The GKV simulations reveal different saturation levels and spatial structures of the turbulent fluctuations in D-T ions and He-ash. For the first time, gyrokinetic-simulation-based quantitative evaluation of a steady burning condition[Reiter et al., NF1990] with He-ash exhaust and fuel inward-pinch is realized by extensive nonlinear scans. Furthermore, the strong impacts of D-T fuel ratio and He-ash accumulations on turbulent energy and particle fluxes are clarified. New findings in this study, which are crucial for the burning plasma performance, are (i)imbalanced D-T turbulent particle transport strongly influenced by He-ash accumulations, and (ii)identification of the steady burning profile regimes with He-ash exhaust and D-T fuel inward-pinch associated with the off-diagonal transport.

### Paper Number

TH/P2-2

### Country or International Organization

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**Session Classification:** Poster 2

**Track Classification:** THC - Magnetic Confinement Theory and Modelling: Confinement