Contribution ID: **3611** Type: **not specified**

P5.1071 Neoclassical simulations of tungsten impurities in JET plasmas using the total-f gyrokinetic code XGCa

Friday, 12 July 2019 14:00 (2 hours)

See full abstract here http://ocs.ciemat.es/EPS2019ABS/pdf/P5.1071.pdf

The neoclassical tungsten impurity transport is studied with the gyrokinetic neoclassical code XGCa [1,2] in whole volume JET plasma, from magnetic axis to scrape-off layer (SOL). Instead of simulating all 74 tungsten charge states, they are bundled and treated as several separate species. It is found, in a model JET plasma, that the general direction of the radial tungsten transport can be partly understood from a single tungsten species study. However, the interaction between different charge states is significant in determining the level of transport, hence a trace impurity approximation or a single tungsten species study may not yield sensible physics results. It is also found that the low-Z tungsten particles can move radially inward from SOL into core region, while the high-Z tungsten particles move inwardly from separatrix to pedestal and outwardly from core to the pedestal top where they accumulate. Poloidally asymmetric tungsten distribution of each bundle is found to be an important factor in understanding their neoclassical transport behavior. A realistic JET-ILW plasma is under investigation and its results will be presented. Optimized plasma and magnetic equilibrium that minimizes the high-Z tungsten in-flux into the core will also be studied. If time permits, preliminary turbulence simulation will be presented. These could help giving insight into the issue of W transport compared to other simulations performed when splitting turbulence (with quasi-linear models) and neoclassical transport, as the ones recently performed by Casson et al. [3].

References
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[3] F. Casson, H. Patten, C. Bourdelle, S. Breton, J. Citrin, F. Koechl, and et al., "Predictive multi-channel flux-driven modelling to optimise icrh tungsten control in jet," 27th IAEA Fusion Energy Conference (FEC 2018).

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Presenter: DOMINSKI, J. (EPS 2019)

Session Classification: Poster P5