Contribution ID: **235** Type: **Poster**

En Route to High-Performance Discharges: Insights and Guidance from High-Realism Gyrokinetics

Thursday 25 October 2018 14:00 (20 minutes)

Although remarkable progress in ab initio nonlinear gyrokinetic plasma core turbulence studies has been seen in the last decade, some important open issues remain –e.g., in view of high performance discharges where magnetic fluctuations tend to reduce the turbulence levels and where the presence of fast ions may provide further significant stabilization enhancements. This effect was shown to lead to a significant reduction of ion temperature profile stiffness in JET [Citrin, PRL 2013] and was required to explain DIII-D quiescent H-modes [Holland, Nucl. Fusion 2012] as well as non-inductive ASDEX Upgrade (AUG) discharges [Doerk, Nucl. Fusion 2018]. Several questions immediately arise in this context: Are these - mainly local flux-tube simulation based –results modified by nonlocal effects in steep-gradient regimes? Can fast ion populations be used to control turbulent transport in burning plasmas? All of these questions culminate into this one: To which degree is core gyrokinetics able to reproduce observations from present-day experiments and predict future devices? In order to address this crucial task, comprehensive state-of-the-art validation studies with AUG fluctuations measurements will be presented as examples. Furthermore, studies for simplified equilibria [T. Görler, Phys. Plasma 2016] and high-beta AUG discharges will be shown confirming that the level of stabilization and threshold values for transitions between electromagnetic micro-instabilities like ion temperature gradient (ITG) driven and kinetic ballooning modes (KBM), may very well be affected by nonlocal effects. In addition, light will be shed on the improvements that can be expected by considering fast ion effects in electrostatic and electromagnetic simulations. Employing the gyrokinetic code GENE [F. Jenko, Phys. Plasmas 2000], a wave-fast ion resonance mechanism was found to be critical in describing corresponding JET discharges [A. Di Siena, Nucl. Fusion 2018]. While irrelevant to fusion-generated alpha particles which just act as diluting particles, it can be shown that cleverly tailored fast ion temperature (gradient) profiles may still offer pathways towards optimized plasma scenarios with substantial turbulence reduction. The predictions are further improved by studying the impact of more realistic fast ion models than the often employed equivalent Maxwellian backgrounds.

Country or International Organization

Germany

Paper Number

TH/P6-5

Author: Dr GÖRLER, Tobias (DeMPIPGarc)

Co-authors: Dr BAÑÓN NAVARRO, Alejandro (DeMPIPGarc); Mr DI SIENA, Alessandro (DeMPIPGarc); Dr BOCK, Alexander (DeMPIPGarc); Mr CREELY, Alexander (UsMIT); Prof. WHITE, Anne (UsMIT); Dr LECHTE, Carsten (DeIGVP); Prof. POLI, Emanuele (DeMPIPGarc); Prof. SONNENDRUECKER, Eric (DeMPIPGarc); Prof. JENKO, Frank (DeMPIPGarc); Dr CONWAY, Garrard (DeMPIPGarc); Dr DOERK, Hauke (DeMPIPGarc); Mr FARCAS, Ionut-Gabriel (DeTUMue); Dr CITRIN, Jonathan (NlFOM); Dr STOBER, Jörg (DeMPIPGarc); Dr SCHNEIDER, Mireille (ITERFr); Dr HENNEQUIN, Pascale (FrLPP); Dr BILATO, Roberto (DeMPIPGarc); Dr FREETHY, Simon (DeMPIPGarc, UsMIT); Prof. JOHNSON, Thomas (SeKTH); Dr HAPPEL, Tim (DeMPIPGarc); Dr NECKEL, Tobias (DeTUMue)

Presenter: Dr GÖRLER, Tobias (DeMPIPGarc)

Session Classification: P6 Posters