P 18: HEPP VII

Time: Thursday 15:45–17:00 Location: CHE/0091

P 18.1 Thu 15:45 CHE/0091

Electron kinetics in a high-Z plasmoid — •Alistair M. Arnold[1], Pavel Aleynikov[1], and Boris N. Breizman[2] — [1]Max-Planck-Institut für Plasmaphysik, Greifswald, Deutschland — [2]Institute for Fusion Studies, University of Texas at Austin, Austin, TX, USA

The problem of the electron dynamics on a closed magnetic field line passing through a high-Z plasmoid is considered. The electron kinetic equation is integrated over bounce motion and pitch-angle, reducing the independent variables to a single adiabatic invariant plus time. Integration of the full Landau self-collision operator is carried out exactly, resulting in a nonlinear integro-differential operator in the new invariant. Conservation laws and the H theorem of the integrated self-collision operator are proven. Numerical solutions of the integrated kinetic equation are obtained with a self-consistent quasineutral electric potential, given the initial condition of a cold plasmoid immersed in a hot ambient plasma. The fact that cold electrons are deeply trapped in a potential with a parabolic peak leads to exactly 3/4 the usual rate of collisional heating by the ambient plasma, independent of any other parameters.

P 18.2 Thu 16:10 CHE/0091

Grad-Zhdanov multi-ion collisional closure for fluid edge codes — •Sergei Makarov and David Coster — Max-Planck-Institut für Plasmaphysik, D-85748 Garching, Germany

Moments of the distribution function form an infinite sequence of fluid equations. For the specific cases, this system can be cut to the finite amount of equations. For doing this we use, so called closure. In collisonal plasmas, which can be observed in the Edge and Scrape-off layer (SOL) in fusion magnetic devices, a collisional closure can be applied. When the impurity mass is significantly larger than the mass of the main ions the multispecies extension of the single ion Braginskii approach can be applied. However, for ions with close masses the Grad-Zhdanov 21N-moment method should be used for the transport coefficients estimation. It is necessary, for example, when He plasmas or D-T plasmas are considered. This approach takes into account masses of ions for kinetic coefficients calculation. It is the major improvement in comparison to the previous approach applied for the SOLPS-ITER code. Only hydrogen isotope plasma with heavy impurities could be treated by SOLPS-ITER versions prior to 3.0.8. This approach is implemented into the SOLPS-ITER code for multiple ion parallel transport description in collisional plasmas. The particular approach is discussed in. The complete multi-ion generalization of the SOLPS-ITER code has been preformed without explicit separation between main and impurity species. The new code is tested for the He and D-T mixtures. The new effects coming from the improved multi-ion treatment are analyzed.

P 18.3 Thu 16:35 CHE/0091

AI based Larde Eddy Simulations for Turbulence in Fusion Reactors — •Robin Greif[1], Frank Jenko[1], and Nils Thuerey[2] — [1]Max-Planck Institute for Plasma Physics, Garching bei München, Germany — [2]TUM Department of Mathematics, Garching bei München, Germany

In this talk, we demonstrate the effectiveness of using hybrid AI and numerical methods to produce practically endlessly stable turbulence simulations conserving physical, spectral, and statistical properties. Specifically, we look at the two-fluid Hasegawa-Wakatani model discretized in two spatial dimensions used for simulating drift wave turbulence in fusion reactors. The presented hybrid AI predictor-corrector model in the large eddy domain allows for reducing complexity by three orders of magnitude with negligible losses.