P 19 Magnetischer Einschluß 2

Zeit: Montag 14:45–16:00 Raum: HU 3038

P 19.1 Mo 14:45 HU 3038

Gyrokinetic Tokamak Edge Turbulence — •Bruce Scott — Max-Planck-IPP, Euratom Association, Garching, Germany

The gyrokinetic model for low frequency turbulence in magnetized plasmas, heretofore very successful in the study of tokamak core phenomena, is applied to the tokamak edge. This steep-gradient region is sufficiently nonlinear that the turbulence has its own properties distinct from linear instabilities, which are found by computational diagnosis of the fully developed turbulence. The computational model is a 5-D phase-space grid representation of the gyrokinetic distribution function of each species, with field equations for the electrostatic and magnetic potentials arising from the field Lagrangian. Full energetic self consistency is assured. The transition from the edge region into the core shows clear effect of the changing collisionality and perpendicular/parallel scale length ratios, not least in the distribution of contributions to the turbulent flux in velocity space. The onset of effect due to trapped electrons following the decrease of collisionality is properly captured by the model and leads to a gradual change from fluidlike to a more kinetic "weak turbulence." Energetic pathways from gradient to thermal disturbances to E-cross-B eddies to parallel currents and to dissipation reveal the corresponding change in mode structure and dynamical character. Progress in modelling of experimentally measured tokamak edge phenomena, including the existence of pedestal structures in the temperature and density profiles, will be reported at the conference.

P 19.2 Mo 15:00 HU 3038

Effect of Stochastization on Electromagnetic Fluid Drift Turbulence in Fusion — •D. Reiser[1], B.D. Scott[2], and T. Haberscheidt[1] — [1]Institut für Plasmaphysik, Forschungszentrum Jülich GmbH, EURATOM, Association, Trilateral Euregio Cluster,D-52425 Jülich, Germany — [2]Max-Planck-Institut für Plasmaphysik, EURATOM Association, D-85748 Garching, Germany

Fluid drift turbulence is considered as a major ingredient of the so called anomalous transport in magnetically confined plasmas, causing a deterioration of confinement properties by a strong radial transport. This work gives an introduction into the theory of small scale drift turbulence relevant for the plasma edge of present fusion devices. The technical option to ergodize magnetic fields in fusion relevant tokamak experiments by externally induced magnetic perturbation fields offers the opportunity to influence drift instabilities and therefore the turbulent behaviour of plasmas. Numerical simulations are presented, illustrating the effect of magnetic islands due to single mode perturbation fields and the changes in the turbulent transport for scenarios with multi-mode perturbations (stochastization). These results are compared to experimental results measured at EXTOR-DED. The question of a suppression of ballooning mode dominated turbulence and it's relevance for Edge Localized Modes (ELMs) will be addressed.

P 19.3 Mo 15:15 HU 3038

Electrostatic Drift Turbulence in TEXTOR-DED — •T. Haberscheidt [1], D. Reiser[1], and P. Beyer[2] — [1]Institut für Plasmaphysik, FZ Jülich GmbH, EURATOM Association, Trilateral Euregio Cluster, D-52425 Jülich, Germany — [2]Equipe Dynamique des Systemes Complexes Laboratoire PIIM, CNRS - Universite de Provence, 13397 Marseille cedex 20, France

Small scale fluid drift turbulence in the plasma edge is known to be of importance for the confinement properties of fusion devices due to its impact on the anomalous transport. A nonlinear, electrostatic 2-Field-Model for resistive ballooning modes (RBM) in drift approximation is used for the 3D tokamak configuration of TEXTOR-DED. The RBM3D code has been used in a number of simulations performed for a range of plasma parameters where resistive balloning is expected to dominate the character of turbulence. The switch on of a magnetic field perturbation, which is generated at TEXTOR by external DED coils, introduces a stochastic magnetic field in the plasma. By means of numerical simulations the influence of this perturbation on turbulent transport and experimental observable quantities like e.g. fluctuation levels, poloidal rotation, etc., is studied for different plasma parameter ranges and for computational domains with different radial extension.

P 19.4 Mo 15:30 HU 3038

Impurity up gradient transport in plasma edge turbulence — •Volker Naulin — Optics and Plasma Research, Association EURATOM-Risø National Laboratory, Roskilde, Denmark

Impurities in magnetically confined fusion plasmas poses severe restrictions on the performance of fusion devices. With the source for impurities localized in the plasma boundary region, accumulation and peaking of the impurity density and the related up-gradient transport – or pinching – is important in understanding and controlling impurity behaviour. While neoclassical effects can lead to some pinching of impurities, the rapid inward flow of impurities through the turbulent edge region of fusion devices is poorly understood. We here present an analytical prediction linking impurity pinch with the anomalous turbulent diffusion. Using 3D numerical simulations of electromagnetic drift-Alfven edge turbulence and describing the impurities as passive scalar, we verify the analytical predictions, with numerical values on the pinch velocity close to experiment. The influence of finite mass effects is additionally discussed.

P 19.5 Mo 15:45 HU 3038

Computational Parameter Studies on Ergodic Edge Transport in TEXTOR-DED — •Derek Harting[1], D. Reiter[1] und Y. Feng[2] — [1]Institut für Plasmaphysik, Forschungszentrum Jülich GmbH, EURATOM Association, Trilateral Euregio Cluster, D-52425 Jülich, Germany — [2]Max-Planck-Institut für Plasmaphysik, EURATOM Association, 17491 Greifswald, Germany

Since th 3D edge plasma fluid codepackage EMC3-EIRENE was adapted for the ergodic divertor in the tokamak TEXTOR-DED in 2003, several parameter studies with this codepackage have been carried out. Key findings of these first modeling campaigns are reported here: the recycling neutrals lead to a local flow reversal of the charged plasma particles in front of the divertor surface at leat partially due o overcharging of individual flux bundles by recycling neutrals. The perturbation field, the total recycling flux and the anomalus perpendicular transport parameters for particles, momentum and energy were varied. In this task, the variation of the perturbation field showed, that with increasing perturbation field, the plasma density is decreased over the whole domain. The electron and ion temperature profiles are mainly affected by the perturbation filed in a poloidal modulation, which correlates with the island structure of the Poincaré-Plots. Finaly, a simple effective radial heat transport analysis was carried out, to study the influence of the perturbation field on the radial heat transport. This has shown, as expected, that inside the islands the radial temperature profile is flattened, and on the last 2 cm in front of the divertor surface, the radial heat flux is increased due to the bending of the field lines.