P 11: Helmholtz Graduate School II

Zeit: Dienstag 14:00–16:30 Raum: HS 1010

P 11.1 Di 14:00 HS 1010

Kinetic waves in non-Maxwellian plasmas — •Patrick Astfalk[1,2], Seth Dorfman[2], and Frank Jenko[1,2] — [1]Max-Planck-Institut für Plasmaphysik, Boltzmannstrasse 2, 85748 Garching, Germany — [2]Department of Physics and Astronomy, University of California, Los Angeles, CA 90095, USA

Due to low collisionality, particle velocity distributions in space plasmas can develop and maintain nonthermal features. This makes linear wave analysis particularly challenging since it invalidates the use of simple Maxwell-Boltzmann distributions and necessitate the use of sophisticated numerical tools. Nonthermal deviations from an isotropic Maxwell-Boltzmann distribution can, on the other hand, provide a source of free energy and drive a rich variety of velocity space instabilities. We use a recently developed fully kinetic dispersion relation solver which can process arbitrary distributions obtained from spacecraft measurements and simulation data to carry out a realistic investigation of velocity space instabilities in the solar wind and Earth's magnetosphere such as the ion firehose instability and the right-hand resonant ion beam instability. We compare the results to other solvers based on bi-Maxwellian and anisotropic kappa distributions, and we extend the analysis to quasilinear theory to study the instabilities' saturation due to resonant pitch-angle scattering.

P 11.2 Di 14:25 HS 1010

Doppler reflectometry power response regimes: modelling and experiments — •J.R. Pinzon[1,2], T. Happel[1], P. Hennequin[3], E. Blanco[4], T. Estrada[4], U. Stroth[1,2], and The ASDEX Upgrade Team[1] — [1]Max-Planck-Institut für Plasmaphysik, Boltzmannstr. 2, D-85748 Garching — [2]Physik-Department E28, TUM, D-85748 Garching — [3]Laboratoire de Physique des Plasmas, Ecole Polytechnique, France — [4]Laboratorio Nacional de Fusion, CIEMAT, 28040 Madrid, Spain.

The experimental characterization of turbulence in fusion plasmas is relevant for confinement studies and the development of a fusion reactor. Doppler reflectometry (DR) is a microwave diagnostic technique used for the characterization of density turbulence in fusion plasmas. It can provide perpendicular wavenumber($k_\perp$)-spectra of the turbulence, velocity of the plasma and, using two reflectometer channels, the radial correlation length L_r of the turbulence. However it is well known, from theory and simulations, that a non-linear response of the diagnostic is involved, which makes data analysis and interpretation challenging.

The power response in Doppler reflectometry is studied using 2D full wave simulations and the physical optics model. Apart from the already known linear and saturation regimes, a new enhanced non-linear power response is observed. Results from the modelling are compared with experiments from the ASDEX Upgrade Tokamak. The impact of the previous regimes in $k_\perp$-spectra and L_r measurements is studied.

P 11.3 Di 14:50 HS 1010

Radio frequency heating induced edge plasma convection — •Wei Zhang[1,2], Wouter Tierens[1], Diogo Aguiam[3], Vladimir Bobkov[1], David Coster[1], Helmut Fuenfgelder[1], Jonathan Jacquot[1], Jean-Marie Noterdaeme[1], Roman Ochoukov[1], Antonio Silva[3], the ASDEX Upgrade Team[1], and the EUROfusion MST1 Team[1] — [1]Max Planck Institute for Plasma physics, Garching, Germany — [2]University of Ghent, Ghent, Belgium — [3]University of Lisbon, Lisbon, Portugal

Plasma heating with radio waves in the Ion Cyclotron Range of Frequency (ICRF) is one of the standard heating methods in tokamaks. The parallel electric field of the ICRF waves enhances the edge plasma potential nonlinearly through radio frequency sheath rectifications. Subsequently this large inhomogenous potential drives $E \times B$ convection in the plasma edge. In this contribution, the plasma density convection induced by 2-strap and 3-strap antennas with different antenna feeding configurations are investigated in the ASDEX Upgrade tokamak. Experimentally, the $E \times B$ convection is measured with the poloidal distributed reflectometers embedded in the 3-strap antenna. Theoretically, this $E \times B$ convection is simulated by running the EMC3-EIRENE, RAPLICASOL and SSWICH codes in an iterative and self-consistent way. Qualitative agreements are found between the simulations and experiments. It is indicated that the sheath rectifications and density convection induced by 3-strap antennas with optimized feeding configuration are smallest, and those induced by 2-strap antennas are usually largest.

P 11.4 Di 15:15 HS 1010

Characterization of ELM associated phenomena by magnetic pick-up coils on ASDEX Upgrade — •Felician Mink[1,2], Elisabeth Wolfrum[1], Florian M Laggner[1], Ulrich Stroth[1,2], and The ASDEX Upgrade Team[1] — [1]Max-Planck-Institut für Plasmaphysik, Boltzmannstr. 2, 85748 Garching, Germany — [2]Physik Department, E28, TUM, 85748 Garching, Germany

In highly confined tokamak plasmas periodically appearing edge localized modes (ELMs) are accompanied by mode-like magnetohydrodynamic (MHD) activities with defined toroidal mode numbers.

Here magnetic pick-up coil arrays are used to determine poloidal and toroidal mode numbers m and n of these inter-ELM modes and to calculate the variation of their amplitude with the poloidal angle, i.e. the ballooning. The radial position and the rotation velocity of the modes are estimated from m and n values and the measured frequency. Plasma parameters are varied in order to get an insight into the drive of these inter-ELM modes.

Several coexisting branches of modes at slightly different positions in the pedestal region are rotating with the $v_{E\times B}$ dominated plasma velocity. Branches with low toroidal mode numbers, $n = 1 - 5$, appear further outside and stronger ballooned than modes with intermediate ones, $n = 7 - 12$. Mode numbers vary slightly with changing plasma parameters, but the strong ballooning is still only related to the low n modes, which are also conserved during the crash. These mode characteristics are in contradiction with the often mentioned kinetic ballooning modes.

P 11.5 Di 15:40 HS 1010

Plasma turbulence studies in the scrape-off layer — •Alexander Ross, Andreas Stegmeir, David Coster, Karl Lackner, and Sibylle Günter — Max-Planck-Institut für Plasmaphysik (IPP), Boltzmannstraße 2, 85748 Garching bei München

The investigation of plasma edge turbulence is of major importance for future fusion devices. The full-f drift reduced Braginskii model is well suited for the collision dominated SOL, as it does not make any assumptions about the size of the fluctuations. GRILLIX, a plasma turbulence code using the field-line map approach, is being extended by this four-field model, consisting of equations for the density, vorticity, parallel momentum and electron temperature. Statistical diagnostics, e.g. the probabilty distribution function are presented for a slab geometry. The final goal is the investigation of the thermal model in a diverted geometry.

P 11.6 Di 16:05 HS 1010

Theory-based modeling of L-mode plasma intrinsic rotation in ASDEX Upgrade — •Ivan Erofeev, Emiliano Fable, Clemente Angioni, William Hornsby, Rachael McDermott, and the ASDEX Upgrade Team — Max-Planck-Institut für Plasmaphysik, Boltzmannstr. 2, 85748 Garching, Germany

Many tokamak plasmas have been found to develop finite toroidal rotation velocity from rest without external sources of torque, and L-mode plasmas tend to flip the rotation direction in the core twice - from co- to counter-current and back again - as the density grows. This phenomenon is known as intrinsic rotation and is believed to be caused by a component of the stress tensor not related to either viscosity or pinch. This residual stress appears as a consequence of the poloidal symmetry violation.

In this work we investigate the effect of non-zero, poloidally averaged, parallel wavenumbers of plasma microinstabilities like TEM and ITG modes, which arise from finite tilting angles of the turbulent structures. We perform simulations of L-mode plasma experiments in ASDEX Upgrade with the ASTRA code, coupled to the TGLF transport model, and the drift-kinetic solver NEO. We estimate the values of the tilting angles and the average parallel wavenumbers from TGLF linear turbulent spectra, which are necessary to match the experimental toroidal velocity profiles. We then compare the results to global gyrokinetic simulations with the GKW code.