P 17: Poster Session - Helmholtz Graduate School for Plasma Physics

Time: Wednesday 16:30–18:30 Location: SPA Foyer

P 17.1 Wed 16:30 SPA Foyer

Acceleration of test particles in imbalanced magnetohydrodynamic turbulence — •Martin S. Weidl[1,2], Bogdan Teaca[2,3,4], and Frank Jenko[1,2] — [1]Max-Planck-Institut für Plasmaphysik, EURATOM-Assoziation, Boltzmannstraße 2, 85748 Garching, Germany — [2]Max-Planck/Princeton Center for Plasma Physics — [3]Applied Mathematics Research Centre, Coventry University, Coventry CV1 5FB, United Kingdom — [4]Max-Planck-Institut für Sonnensystemforschung, Max-Planck-Straße 2, 37191 Katlenburg-Lindau, Germany

The spatial structure and the strength of the turbulent electric field in a plasma are strongly affected by cross-helicity, a quantity which measures the level of alignment of the velocity and the magnetic field. Although often neglected in numerical magnetohydrodynamic (MHD) simulations, cross-helicity can reach significant values in many astrophysical plasmas, such as the solar wind.

We study the transport and acceleration properties of charged particles in plasmas with non-zero cross-helicity, or imbalanced turbulence, by performing test particle simulations in parallel with three-dimensional MHD simulations. The cross-helicity level of the MHD steady-state is controlled by using a correlated forcing scheme for velocity and magnetic fields. We discuss the decrease of the turbulent heating rate in systems with non-zero cross-helicity and compare its scaling with theoretical predictions. Our results are expected to be relevant for any plasma in which turbulent heating is important, for example the heating of dust particles in the interstellar medium.

P 17.2 Wed 16:30 SPA Foyer

The role of collisions in 2D gyrokinetic turbulence: the freely decaying electrostatic case — •Silvio Sergio Cerri, Alejandro Banon Navarro, Hauke Doerk, Daniel Told, and Frank Jenko — Max-Planck-Institut für Plasmaphysik, EURATOM-Assoziation, Boltzmannstraße 2, D-85748 Garching.

Turbulence in weakly collisional magnetized plasmas is one of the most fascinating and challenging topics, both for astrophysical and laboratory plasmas. In this context, collisional gyrokinetic theory plays an important role.

We present a study of freely-decaying 2D electrostatic turbulence on the sub-ion Larmor scale by means of numerical simulations with the gyrokinetic code GENE [1]. The effect of the collisionality regime on the turbulent spectra is here systematically investigated. In the low collisionality regime, we show an excellent agreement with the existing analytical theory [2,3] and previous numerical investigations [4–6]. However, we find deviations from the theory for increasing collision frequency. In this intermediate collisionality regime, non-universal power laws due to multiscale dissipation arise.

[1] GENE webpage: `http://www.ipp.mpg.de/~fsj/gene/`
[2] Schekochihin et al., *Plasma Phys. Control. Fusion* **50**, 124024 (2008)
[3] Plunk et al., *J. Fluid Mech.* **664**, 407 (2010)
[4] Tatsuno et al., *Phys. Rev. Lett.* **103**, 015003 (2009)
[5] Tatsuno et al., *J. Plasma Fusion Res.* **9**, 509 (2010)
[6] Tatsuno et al., *Phys. Plasmas* **19**, 122305 (2012)

P 17.3 Wed 16:30 SPA Foyer

Exploration of radiation cooling for startup plasmas at Wendelstein 7-X with EMC3-EIRENE simulations — •Florian Effenberg[1], Yühe Feng[2], Sergey Bozhenkov[2], Heinke Frerichs[1], Hauke Hölbe[2], Detlev Reiter[1], Oliver Schmitz[1], and Thomas Sunn Pedersen[2] — [1]Institute of Energy and Climate Research - Plasma Physics, Forschungszentrum Jülich GmbH, Association EURATOM-FZJ, Partner in the Trilateral Euregio Cluster, 52425 Jülich, Germany — [2]Max-Planck Institute for Plasma Physics, Association EURATOM-IPP, 17491 Greifswald, Germany

The stellarator Wendelstein 7-X will use a limiter configuration in the first plasma operation phase. In this field configuration the edge does not include magnetic islands and the scrape-off layer is defined by five poloidal graphite limiters at the toroidal symmetry planes. Exploring options to reduce the heat flux to these components is important for optimization of the performance and duration of these first plasmas.

The 3D plasma transport Monte-Carlo code EMC3-EIRENE is based on a fluid model for electrons and ions, on a kinetic model for neutral particles, and a simplified fluid approach for impurity ions. For startup plasmas with heating power up to 5 MW, plasma transport simulations are performed taking impurities due to carbon sputtering from the limiters into account. The reduction of heat load to plasma facing components by radiative cooling is investigated with respect to intrinsic carbon and active injected nitrogen.

P 17.4 Wed 16:30 SPA Foyer

Reconstruction of q-profiles using Monte-Carlo-technique — •Alexander Bock[1], Jörg Stober[1], Rainer Fischer[1], Patrick Mc Carthy[2], Matthias Reich[1], and ASDEX Upgrade Team[1] — [1]Max-Planck-Institut für Plasmaphysik, Boltzmannstr. 2, 85748 Garching, Deutschland — [2]Department of Physics, University College Cork, Cork, Ireland

The helicity of magnetic field lines is an important property of equilibrium states of magnetically confined plasmas. It can be expressed through so-called q-profiles and has decisive influence not only on transport of heat and particles in the plasma, but also on its stability.

Typically magnetic equilibria are being calculated through iterative techniques where the solutions of the Grad-Shafranov-equation are being varied until the result is in sufficient agreement with the experimentally measured quantities. Aside from physical data, other less physical aspects like the choice of basis functions play a role which can make these techniques biased. Sampling possible equilibria using Monte-Carlo-simulations can yield more unbiased results.

This poster gives and overview over the basics of equilibrium reconstruction, describes a new reconstruction technique for q-profiles/equilibria based in Monte-Carlo-simulations and compares it with previous results.

P 17.5 Wed 16:30 SPA Foyer

Preconditioning for Eigenvalue Computations in Gene — •Juergen Braeckle and Thomas Huckle — TU Muenchen, Fakultaet fuer Informatik, Boltzmannstraße 3, D-85748 Garching

In the Plasma Turbulence Code Gene, turbulences are examined by finding the rightmost eigenvalues of the linear gyrokinetic operator. Finding these inner eigenvalues with the Jacobi- Davidson method requires an iterated solving of shifted linear systems $(I - uu^*)(A - \lambda_k I)(I - uu^*)x_k = b_k$ (restriced to the subspace orthogonal to u) with a non-hermitian matrix A given as an implicit operator and changing eigenvalue approximations λ_k of A. With λ_k being a good approximation of an eigenvalue, $(A - \lambda_k I)$ gets almost singular, and therefore this system has to be modified with a preconditioner $(I - uu^*)M(I - uu^*)$. Besides a good preconditioning quality ($M \approx (A - \lambda_k I)^{-1}$), we are interested in high scalability, a preconditioner applicable on implicit systems and with cheap updating capabilities for a sequence of different shifted matrices. With respect to these properties, we try to solve this problem using the SPAI method and polynomial preconditioners.

P 17.6 Wed 16:30 SPA Foyer

Upgrade of the Edge Charge Exchange System at the ASDEX Upgrade tokamak — •Marco Cavedon, Thomas Puetterich, Eleonora Viezzer, and ASDEX Upgrade Team — Max-Planck-Institut für Plasmaphysik, EURATOM-Assoziation, Boltzmannstraße 2, D-85748 Garching

The edge charge exchange recombination spectroscopy (CXRS) system at ASDEX Upgrade has been upgraded. Time and spatial resolution have been increased in order to study fast phenomenas. First measurements of ion temperature, rotational velocity and impurity density with the new system are presented.

Three new optical heads have been installed looking toroidally at the plasma edge increasing the total line of sights (LOSs) from 8 to 33. Moreover, the existing poloidal head has been refurbished with 22 LOSs instead of 8. The radial coverage is 5 times wider than the pedestal region while the radial resolution is below one fourth of it. The upgrade of both systems allows detailed profiles to be measured at each timepoint and therefore to study fast transient events.

A new lens-based Czerny-Turner like spectrometer ($f = 2.8$) has been designed. Making use of an interference filter, it is now possible to arrange more spectra in a limited area of the CCD camera chip. This allows to run up to 9 channels at 25 μs (= 40 kHz) exposure time (standard resolution: 2.3 ms). However, the actual time resolution is limited by the signal intesity. External impurity seeding is planned to be used in order to reach the best compromise between signal to noise ratio and measurements speed.

P 17.7 Wed 16:30 SPA Foyer

Towards non-linear simulations of full ELM crashes in ASDEX Upgrade — •Alexander Lessig, Matthias Hoelzl, Karl Lackner, and Sibylle Guenter — Max-Planck-Institut für Plasmaphysik, EURATOM Association, Boltzmannstrasse 2, 85748 Garching, Germany

Edge localized modes (ELMs) of large size are a severe concern for the operation of ITER due to the large transient heat loads on divertor targets and wall structures. Using the non-linear MHD code JOREK, we have performed first simulations of full ELM crashes in ASDEX Upgrade, taking into account a large number of toroidal Fourier harmonics. The evolution of the toroidal Fourier spectrum and the drop of pedestal gradients are studied. In particular, we confirm a previously introduced quadratic mode coupling model for the early non-linear evolution of the mode structure and present first results concerning the evolution in the fully non-linear phase.

Eventually, we aim to identify different ELM types in our simulations as observed in experiments and to compare the results to experimental observations, e.g., regarding the pedestal evolution and the heat deposition patterns. Work is ongoing to increase poloidal resolution and include diamagnetic stabilization of high mode numbers.

P 17.8 Wed 16:30 SPA Foyer

Numerical Methods for 3D Tokamak Simulations using a Flux-Surface indeoendent Grid — •Andreas Stegmeir — Max-Planck-Institut für Plasmaphysik, EURATOM-Assoziation, Boltzmannstraße 2, 85748 Garching, Germany

A numerical approach for 3D Tokamak simulations using a flux surface independent grid is presented. The grid consists of few poloidal planes with a Cartesian Isotropic grid within each poloidal plane. Perpendicular operators can be discretised within a poloidal plane using standard second order finite difference methods. The discretisation of parallel operators is achieved with a field line following map and an interpolation. The application of the support operator method to the parallel diffusion operator conserves the self-adjointness of the operator on the discrete level and keeps the numerical decay rate at a low level. The developed numerical methods can be applied to geometries where an X-point is present.

P 17.9 Wed 16:30 SPA Foyer

First Turbulence Measuremenents using Poloidal Correlation Reflectometry at AUG — •Dmitrii Prisiazhniuk[1], Andreas Kramer-Flecken[2], Garrard Conway[1], and Ulrich Stroth[1] — [1]Max-Planck-Institut für Plasmaphysik, Boltzmannstraße 2, 85748 Garching, Germany — [2]Institut für Energieforschung - Plasmaphysik, Forschungszentrum Jülich, Association EURATOM-FZJ, 52425 Jülich, Germany

The new poloidal correlation reflectometer (PCR) system (previously used on TEXTOR) has been installed on AUG. The system consist of two Ka-band and one U-band reflectometer. The waveguides connecting the reflectometers with the antennas array are allow the operation of reflectometers in O-mode and X-mode polarization. The transmitting antenna is surrounded by 4 receiving antennas all having square geometry to allow poloidal and toroidal correlation measurements. With the 2^{nd} Ka-band reflectometer the investigation of radial correlation is possible.

The main parameters measured by the system are perpendicular rotation velocity and inclination of turbulence eddies relative to the toroidal direction. Furthermore turbulence properties such as poloidal correlation length, radial correlation length and turbulence decorrelation time can be accessed. These are important quantities for plasma edge studies and are currently not available at AUG. First measurements from the commissioning phase will be presented at this conference.

P 17.10 Wed 16:30 SPA Foyer

Poloidal asymmetries of heavy impurities in the ASDEX Upgrade plasma — •Tomas Odstrcil[1], Thomas Puetterich[1], Anja Gude[1], Ralph Dux[1], Didier Mazon[2], and ASDEX Upgrade Team[1] — [1]Max-Planck-Institut für Plasmaphysik, Boltzmannstraße 2, 85748 Garching, Germany — [2]CEA, IRFM F-13108 Saint Paullez-Durance, France

For heavy and highly charged impurities multiple mechanisms exist that produce non-constant impurities densities on the flux surfaces. As for neoclassical and turbulent transport models such an asymmetrie is highly importance an effort is launched to experimentally characterize the asymmetries comparing them with theoretical expectations.

In the ASDEX Upgrade tokamak (AUG) is routinely observed increase of outboard tungsten density in fast rotating plasma. This asymmetry is caused by the centrifugal force pushing tungsten ions outward due to its high mass. Furthermore, the high charge makes heavy impurities sensitive to poloidal variations of the plasma potential. The variation can be generated by magnetic trapped ions heated by RF heating. In such a case, the presence of an inboard asymmetry or at least the absence of an outboard asymmetry due to the centrifugal force can be observed. Finally, ion-impurity friction enhanced by the large charge of the impurity ions may cause a relatively weak up-down asymmetry of the impurity density.

The aim of this poster is to show first evidence of these asymmetries in the AUG plasmas, the description of the used methodology, and to compare with theoretical models based on the parallel force balance.

P 17.11 Wed 16:30 SPA Foyer

Experimental study of the radial structure of turbulence with a ultra-fast sweeping reflectometer in ASDEX Upgrade — •Anna Medvedeva[1,2,3,4], Christine Bottereau[3], Frederic Clairet[3], Garrard Conway[1], Stephane Heuraux[2], Diego Molina[3], and Ulrich Stroth[1,4] — [1]Max-Planck-Institut für Plasmaphysik, Boltzmannstraße 2, D-85748 Garching — [2]Commissariat a l'energie atomique et aux energies alternatives, 13108 Saint Paul Lez Durance — [3]Universite de Lorraine, 34 cours Leopold, 54000 Nancy — [4]Technische Universitat Munchen, James-Franck-Straße1, D-85748 Garching

Confinement of fusion plasmas is restricted by anomalous transport where micro-turbulence is suspected to play a major role. Experimental documentation of this turbulence, its dependence on the plasma temperature, density, current will provide insights in the nature of this turbulence and the driving parameters. In this work advantage is taken of the ultra-fast sweep capabilities of the V & W band (50-110 GHz) reflectometers, developed by CEA, to record fast plasma turbulent events on ASDEX Upgrade. The X-mode polarization will provide a rather large radial access to the plasma from the very edge to, under certain conditions, the center. The scope of the work is to exploit the specific strengths of the diagnostic in order to study the radial spectra of fluctuations, radial turbulence spreading and the fast dynamic profile evolution after confinement transitions or changes in the discharge control parameters. First experimental data obtained during the ASDEX Upgrade campaign 2014 will be presented.

P 17.12 Wed 16:30 SPA Foyer

Negative ion formation in Ion-Molecule collisions — •Angelin Ebanezar John and Rainer Hippler — Institut für Physik, Ernst-Moritz-Arndt-Universität Greifswald, 17489 Greifswald

Positively charged H^+, H_2^+, He^+, and Ar^+ ions, with impact energies of 50 – 350 keV, were employed to bombard O_2 and SF_6 molecules. The collision cross sections of positive and negative ionic fragments were determined and their dependence on impact energy will be presented. Besides positively charged ion fragments, negatively charged secondary ions are an important contibution for various applications especially in atmospheric chemistry and plasma physics.

One of the exciting observation is superoxide anion O_2^- belong to the reactive oxygen species(ROS). We propose formation of superoxide anion to proceed via a charge-transfer reaction with the positively charged incident ion,

$X^+ + O_2 \longrightarrow X^{2+} + O_2^-$

where an electron transferred to the oxygen molecule originates from the incident ion, ($X=H_2^+$or He^+ or Ar^+) having atleast one electron for the reaction. Measured cross sections for O_2^- formation are about 2 orders of magnitude smaller compared to O_2^+ formation, which is attributed to the larger energy transfer required.

P 17.13 Wed 16:30 SPA Foyer

Electromagnetic simulations of tokamaks and stellarators — •Michael Cole and Alexey Mishchenko — Max-Planck-Institut für Plasmaphysik, EURATOM-Assoziation, Wendelsteinstraße 1, 17491 Greifswald, Germany

A practical fusion reactor will require a plasma β of around 5%. In this range Alfvénic effects become important. Since a practical reactor will also produce energetic alpha particles, the interaction between Alfvénic instabilities and fast ions is of particular interest. We have developed a fluid electron, kinetic ion hybrid model that can be used to study this problem. Compared to fully gyrokinetic electromagnetic codes, hybrid codes offer faster running times and greater flexibility, at the cost of reduced completeness.

The model has been successfully verified against the worldwide ITPA Toroidal Alfvén Eigenmode (TAE) benchmark, and the ideal MHD code CKA for the internal kink mode in a tokamak. Use of the model can now be turned toward cases of practical relevance. Current work focuses on simulating fishbones in a tokamak geometry, which may be of relevance to ITER, and producing the first non-perturbative self-consistent simulations of TAE in a stellarator, which may be of relevance both to Wendelstein 7-X and any future stellarator reactor. Preliminary results of these studies will be presented.

P 17.14 Wed 16:30 SPA Foyer

Numerical studies for the nuclear fusion reactor Wendelstein 7-X — •Hauke Hölbe — Max-Planck-Institut für Plasmaphysik, EURATOM-Assoziation, Wendelsteinstraße 1, D-17491 Greifswald

The nuclear fusion experiment Wendelstein 7-X is currently under construction in Greifswald, Germany. After completion in 2014, the experiment will be the largest and most advanced stellarator ever built. The cryostat hosting the superconducting coils and the vacuum vessel has a diameter of 16 meters and a height of 5 meters, and the magnetic field will be 2.5 T on axis.

Wendelstein 7-X is designed to prove simultaneous high density, high temperature, steady-state plasma operation. The first plasma is planned for 2015. After first tests the plasma pulse time will be gradually increased up to 30 minutes from 2019 on.

The core plasma temperature in this device will be over 100 million degree. Therefore, contact with the plasma facing components must be done carefully. One challenge in this connection is that the plasma shape will change during operation due to internal plasma currents generated by the plasma itself. Using state-of-the-art codes, we are investigating and developing operational scenarios for the first, relatively short plasma pulses, that allow us to address important issues for the later steady-state operation.

P 17.15 Wed 16:30 SPA Foyer

Experimental investigations on the dust density distribution inspatially extended dust clouds — •Carsten Killer, Michael Himpel, and André Melzer — Institut für Physik, Ernst-Moritz-Arndt-Universität Greifswald, 17489 Greifswald

Large dust clouds confined in the discharge volume of low temperature rf plasmas often feature interesting phenomena such as a central void and the propagation of self-excited dust density waves. Most experimental diagnostics in the field of dusty plasmas focus either on 2-dimensional slices of the dust system (using laser sheets) or on small 3-dimensional observation volumes. Due to the limitations of these methods it is therefore difficult to measure global properties of the dust cloud.

In this contribution, a novel approach towards the reconstruction of the dust density distribution is presented. A two-dimensional projection of the dust cloud can be obtained by measuring the light extinction of a homogenously illuminated cloud, effectively observing the dust clouds shadow. Assuming cylindrical symmetry, the radial dust density profile can be derived via Abel inversion. This method is especially suited to investigate the three-dimensional character of the void and dust density waves. It is furthermore possible to compare the radial dust density distribution to the plasma glow structure, which can also be reconstructed by Abel inversion. Hence, the influence of the dust presence and dust dynamics on the plasma glow can be investigated.

P 17.16 Wed 16:30 SPA Foyer

Selective fluid mode excitation in finite 3D Yukawa-balls — •Matthias Mulsow, André Schella, and André Melzer — Institut für Physik, Ernst-Moritz-Arndt-Universität Greifswald, Felix-Hausdorff-Straße. 6, D-17487 Greifswald

In low-temperature plasmas micrometer-sized particles are able to form highly ordered structures. Using a harmonic three-dimensional trapping potential strongly coupled finite systems can be created, the Yukawa-balls. An established model to describe the dynamic properties of these finite crystal-like structures are normal modes. Here the possible oscillations of all individual particles are composed to describe the collective motion.

In opposite to this, Kählert and Bonitz recently proposed [1,2] to consider the cluster as a uniform cold fluid droplet, neglecting the movement of single particles. The collective motions are then interpreted as superpositions of orthonormal fluid modes.

In our experiments, we utilize a special cuvette with conducting corners to manipulate the cluster using electrical fields in a uniform way that copes perfectly with the fluid mode approach. Thus, on the one hand theoretical predictions concerning mode resonance can be tested while on the other hands new scenarios to manipulate three dimensional Yukawa-balls can be developed in order to gain new insights on their dynamic properties.

[1] H. Kählert and M. Bonitz, Phys. Rev. E 82, 036407 (2010)
[2] H. Kählert and M. Bonitz, Phys. Rev. E 83, 056401 (2011)

P 17.17 Wed 16:30 SPA Foyer

Possibility of a Kondo resonance at the wall recombination of positive ions — •Mathias Pamperin, Franz Xaver Bronold, and Holger Fehske — Institut für Physik, Universität Greifswald, 17489 Greifswald, Germany

Wall recombination of positively charged ions is one of the main surface-based loss processes for positive ions in a low-temperature gas discharge. Together with volume-based charge production and destruction processes it controls the overall charge balance of the discharge. Depending on the electronic structure of the ion and the wall an ion may recombine either via Auger neutralization or via resonant charge transfer. Both processes are of fundamental interest. The time-dependent ion-surface system represents a quantum-impurity system supporting–under appropriate conditions–a Kondo resonance which is one of the paradigms in the physics of highly correlated electrons and should also affect the wall recombination. Indeed He and Yarmoff [1] interpreted the anomalous temperature dependence of the neutralization of Sr^+ ions at a Au surface in terms of a Kondo resonance. To support this claim we calculated within an Anderson-Newns model the temperature dependence of this particular atom-surface collision using quantum-kinetic equations and a pseudo-particle representation for the electronic configurations of the ion. We found that a Kondo resonance indeed shows up and affects the neutralization rate. To gain further insight we also studied the neutralization of Mg^+ or Ga^+ ions at a Au surface where the Kondo effect is not expected.

[1] X. He and J. A. Yarmoff, Phys. Rev. Lett. **105**, 176806 (2010).

P 17.18 Wed 16:30 SPA Foyer

Time-resolved measurements of cluster mass distribution in a pulsed gas aggregation system — •Steffen Drache, Florian Berg, Vitezslav Straňák, Marina Ganeva, Harm Wulff, and Rainer Hippler — Institut für Physik, Ernst-Moritz-Arndt Universität, Felix-Hausdorff-Straße 6, D-17487 Greifswald

Owing to their large surface to volume ratio, nano-size particles (clusters) exhibit unique physical and chemical properties. These particles of a few nm size can find application in, e.g. micro electronics, chemical catalysts, or quantum dots. In our experiment Cu cluster particles were synthezised in a gas aggregation nanocluster source. In contrast to the conventional constant gas flow the buffer gas was delivered in pulses. The aim was to alter the clusters mass distribution by means of a time dependent pressure in the aggregation region. For time-resolved analysis a labview-controlled quadrupole mass filter (QMF) was installed and the pressure in the cluster source was also monitored. As a first result, cluster current and mass quickly respond to pressure changes. Since the QMF mass range is limited, deposited clusters were also examined by atomic force microscopy (AFM). Results show a broadened mass distribution compared to the unpulsed experiment. Finally, clusters were co-deposited during reactive Ti magnetron sputtering in an Ar/O_2 atmosphere to study nanoparticles embedded in a TiO_2 matrix. GIXD and XPS reveal that clusters become x-ray amorphous and oxidized in the confining TiO_2 matrix.

P 17.19 Wed 16:30 SPA Foyer

Stellarator-specific developments for the systems code PROCESS — •F. Warmer[1], P. Knight[2], C.D. Beidler[1], A. Dinklage[1], Y. Feng[1], J. Geiger[1], F. Schauer[1], Y. Turkin[1], D. Ward[2], R. Wolf[1], and P. Xanthopoulos[1] — [1]Max-Planck-Institut für Plasmaphysik, Wendelsteinstraße 1, D-17491 Greifswald, Germany — [2]Culham Centre for Fusion Energy, Abingdon, Oxfordshire, OX14 3DB, United Kingdom

The code package PROCESS is a tool widely used for Tokamak systems studies. In this study, however, the application of PROCESS to Stellarators is addressed. In order to incorporate a Stellarator module in the systems code PROCESS, Stellarator-specific models are considered which reflect the differences due to the confinement concept. These include: a geometry model based on Fourier coefficients which can represent the complex 3-D plasma shape, a divertor model which assumes diffusive cross-field transport and high radiation at the X-point, a coil model which is a scaling based on the Helias 5-B design and a transport model which employs a confinement time scaling derived from empirical scalings and by sophisticated 1-D neoclassical and anomalous calculations. This approach is investigated to ultimately allow one to facilitate a direct comparison between Tokamak and Stellarator power plant designs.

P 17.20 Wed 16:30 SPA Foyer

Einfluss von Alfvén Eigenmoden und Ionenzyklotronheizung auf die schnelle Ionen-Verteilung im Tokamak ASDEX Upgrade — •Markus Weiland, Benedikt Geiger, Roberto Bilato, Philip Schneider, Giovanni Tardini, Philipp Lauber, François Ryter, Mirjam Schneller und ASDEX Upgrade Team — Max-Planck-Institut für Plasmaphysik, Garching

Schnelle, supra-thermische Ionen werden im Tokamak ASDEX Upgrade durch Neutralteilcheninjektion und Ionenzyklotronheizung (ICRF) erzeugt und werden für Plasmaheizung und Stromtrieb benötigt. Eine Möglichkeit, sie zu untersuchen, ist die spektroskopische Beobachtung von Linienstrahlung (Fast-ion D-alpha, kurz: FIDA), die durch Ladungsaustausch entsteht. Die schnellen Ionen können hier durch ihre starke Dopplerverschiebung von den thermischen Teilchen unterschieden werden, und so deren radiales Dichteprofil gemessen werden.

Durch die Analyse des gesamten Dopplerspektrums können Informationen über Bereiche der 2D-Geschwindigkeitsverteilung $f(v_\parallel, v_\perp)$ gewonnen werden. Die Beobachtung aus verschiedenen Blickrichtungen erlaubt dann eine tomografische Entfaltung von $f(v_\parallel, v_\perp)$. Dazu wurde die FIDA Diagnostik an ASDEX Upgrade von zwei auf fünf Blickrichtungen ausgebaut, sowie zur simultanen Beobachtung des rot- und blauverschobenen Teils des Dopplerspektrums erweitert. Diese neu entwickelten Diagnostikverfahren erlauben die Beobachtung von Veränderungen im Geschwindigkeitsraum, die von Alfvén Eigenmoden ausgelöst werden. Ferner wird die weitere Beschleunigung von schnellen Ionen durch ICRF-Absorption der zweiten Harmonischen untersucht.

P 17.21 Wed 16:30 SPA Foyer

Investigation of mass selected poly-anionic clusters by laser excitation and photoelectron spectroscopy — •Madlen Müller[1], Gerrit Marx[1], Patrice Oelssner[2], Josef Tiggesbäumker[2], Robert Wolf[3], Karl-Heinz Meiwes-Broer[2], and Lutz Schweikhard[1] — [1]Ernst-Moritz-Arndt-Universität, Greifswald, Germany — [2]Universität Rostock, Germany — [3]Max-Planck-Institut für Kernphysik, Heidelberg, Germany

The physics of atomic clusters is an important field of research because it bridges the domains of atomic and solid state physics. Photo-interaction experiments provide insights into the electronic structure of atomic clusters. We plan to perform photoelectron-spectroscopy experiments on poly-anionic metal clusters as model systems for electron-correlation phenomena. A magnetic-bottle time-of-flight electron spectrometer will be used to determine their electron affinity and electronic structure. In addition, the Coulomb barriers of these multiply charged cluster anions will be probed by varying the wavelength of the photo-detachment laser. The selection of the clusters of interest (with respect to element, size and charge state) will be realized by the use of a Paul trap. Moreover, higher charge-state clusters will be realized by sequential electron attachment in the trap. We present test measurements on fullerene mono- and di-anions with ultraviolet nanosecond laser pulses. In the future, measurements will be extended to poly-anionic metal clusters. The project is part of the Collaborative Research Center (SFB) 652.

P 17.22 Wed 16:30 SPA Foyer

Modelling the effect of resonant magnetic perturbations in ASDEX Upgrade with the extented MHD code XTOR-2F — •Johannes Griesshammer — Max Planck Institut für Plasmaphysik Boltzmannstraße 2, 85748 Garching bei München

Resonant magnetic perturbations (RMPs) are used in medium sized tokamaks like ASDEX Upgrade or DIII-D for the mitigation of edge localized modes (ELMs), which allows reduction of the maximum head load power on the divertor plates. The poloidal mode number spectrum of the applied RMPs is wide and penetration into the plasma of the RMP at resonant magnetic surfaces is complex due to non-ideal MHD plasma dynamics and geometry. The fully toroidal extented MHD code XTOR-2F is used to study RMP penetration, the effect of RMPs on confinement deteriorating tearing modes (TMs) and plasma rotation. Apart from RMP amplitude and mode spectrum also the influence of different plasma equilibria and plasma fluid models are (to be) studied.