Time	ID	Plasma Physics *Chair: Stephan Brunner, CRPP-EPFL*
15:15	**481**	**New plasma configurations and heating systems in the TCV tokamak for the European roadmap towards a fusion reactor** *Yves Martin, Centre de Recherches en Physique des Plasmas, EPFL, Station 13, 1015 Lausanne* The TCV tokamak, with its high plasma shaping and heating capabilities is strongly contributing to the EU fusion roadmap. To resolve the issue of heat exhaust, TCV has developed alternative plasma configurations that strongly reduce the heat flow towards the vessel walls, via an increase in the deposition surface areas. A 1 MW neutral beam injector is being installed on TCV to expand its operational domain towards burning plasma regimes, and test exhaust solutions in more reactor relevant regimes. The new system, in particular, will allow the achievement of high temperature plasmas with equal ion and electron temperatures.
15:45	**482**	**Impurity density and momentum transport during the sawtooth cycle** *Claudio Marini, Basil Duval, Lucia Federspiel, Alexander Karpushov, Antoine Merle, Olivier Sauter, EPFL SB CRPP Station 13, 1015 Lausanne* This work is devoted to the experimental determination of Carbon impurity density and toroidal angular momentum evolution across the sawteeth events where the time resolution of the CXRS diagnostic in TCV reached 2 ms, preserving a high spatial resolution. Conditionally resampling measurements were employed and led to the determination of the properties of an averaged (canonical) sawtooth. Data show a fast (<< 2 ms) co-current acceleration at the sawtooth crash in the core region, with a simultaneous counter-current acceleration outside the core. Profiles then slowly (15 ms) relax to the pre-crash values. Carbon density profiles after the crash are hollowed in the core, with relaxation times of 6-7 ms.
16:00	**483**	**SCENIC: a self-consistent tool for the study of ion-cyclotron resonance heating in fusion plasma devices.** *Jonathan Faustin, Wilfred Cooper, Jonathan Graves, David Pfefferlé* *EPFL SB CRPP Station 13, 1015 Lausanne* Radio frequency waves generated by ion cyclotron resonance heating (ICRH) have proven to be an efficient heating source for fusion plasmas.Due to the fast particle population and the Ion-Cyclotron Current Drive (ICCD) the ICRH generates, MHD, such as sawtooth activity can be controlled [1-2]. ICRH is studied using the self-consistent numerical model SCENIC.This model includes fixed boundary 3D geometry with full shaping and anisotropic pressure effects, warm contributions to the dielectric tensor and full orbit effects. It evolves the equilibrium, wave field and hot particle distribution function iteratively until a self-consistent solution is found [3]. SCENIC simulations of JET tokamak plasmas using ICRH for sawtooth control period will be presented. [1] Graves J. P, et al. Control of magnetohydrodynamic stability by phase space engineering of energetic ions in tokamak plasmas. Nat. Commun. 3:624 doi: 10.1038/ncomms1622 (2012). [2] J. P. Graves, et al. Experimental verification of sawtooth control by energetic particles in ion cyclotron resonance heated JET tokamak plasmas. Nucl. Fusion 50 (2010) 052002 [3] M. Jucker, et al. Integrated modeling for ion cyclotron resonant heating in toroidal systems. Comput. Phys. Comm. 182 (2011) 912–925

16:15	**484**	**Gyrokinetic turbulence simulations of plasma shaping and profile resilience effects in the TCV tokamak** *Gabriele Merlo [1], Stephan Brunner [1], Olivier Sauter [1], Laurent Villard [1], Tobias Goerler [2], Daniel Told [2], Frank Jenko [2], Yann Camenen [3], Alessandro Marinoni [4]* *[1] CRPP-EPFL, Station 13, 1015 Lausanne* *[2] Max-Planck-Institut für Plasmaphysik, Boltzmannstr. 2, DE-85748 Garching* *[3] CNRS, Aix Marseille Université, PIIM UMR 7345, FR-13397 Marseille* *[4] Massachusetts Institute of Technology, Plasma Science and Fusion Center, 77 Massachusetts Avenue, 02139 Cambridge, USA* A recent analysis of a large set of TCV discharges pointed out that the electron density and temperature profiles tend to be stiff in the inner core region, while non-stiff in the outer region [1]. The Eulerian gyrokinetic code GENE [2] has been used to investigate stiffness properties of both inner and outer plasma regions with non-linear local simulations. TCV experimental discharges have been considered looking at the effect of plasma shaping. In particular, going from a normal D-shape to an inverted D-shape was experimentally observed to strongly improve energy confinement [3]. This behaviour can be explained by a radial and shape dependent stiffness. First global simulations will be shown as well. [1] O. Sauter, et al., submitted to Physics of Plasmas. [2] F. Jenko, et al., Physics of Plasmas 7, 1904 (2000). T. Görler, et al., J. Comp. Phys. 230, 7053 (2011). [3] Y. Camenen et al., Nuclear Fusion 47, 510 (2007).
16:30		***Coffee Break***
17:00	**485**	**Heat loads in inboard limited plasmas in TCV** *Federico Nespoli, Benoit Labit, Gustavo Canal, Ambrogio Fasoli, Ivo Furno* *EPFL, Centre de Recherches en Physique des Plasmas, 1015 Lausanne* Recent JET measurements [1] in inboard limited plasmas have shown a heat load on the limiter higher than expected from the model used for the current ITER first wall design [2]. In order to improve our understanding, dedicated experiments have been performed in TCV. The heat flux on the limiter is deduced from infrared thermography using the THEODOR code [3]. An array of flush-mounted Langmuir probes provides further measurements for comparison. The main plasma parameters as current, density, and shaping have been varied. The experimental results confirm the presence of an enhanced heat deposition close to the contact point. [1] G. Arnoux, et al., Nucl. Fusion 073016 (2013) 53 [2] R.A. Pitts, et al., J. Nucl. Mater. 957-964 (2011) 415 [3] A. Herrmann, ECA 2109-2112 (2001) 25A
17:15	**486**	**Influence of magnetic field on plasma sputtering of ITER First Mirrors** *Lucas Moser [1], Roland Steiner [1], Marcel Husistein [2], Markus Jenni [2], Boris Stepanov [2], Pierluigi Bruzzone [2], Stefano Alberti [3], Ivo Furno [3], Laurent Marot [1], Ernst Meyer [1]* *[1] University of Basel, Klingelbergstrasse 82, 4056 Basel* *[2] EPFL-CRPP, Fusion Technology, Paul Scherrer Institut, 5232 Villigen* *[3] EPFL-CRPP, Association Euratom-Confédération Suisse, 1015 Lausanne* Due to their proximity with the plasma in the fusion reactor ITER, metallic first mirrors used in optical diagnostic systems will be subject to erosion but mostly to deposition. The most promising insitu technique to remove these deposits is plasma sputtering. This work presents the results of plasma cleaning tests in magnetic field with aluminium deposits on molybdenum mirrors. Using argon 13.56 MHz radio frequency plasma, the removal of a 50 nm film was demonstrated in a 0.35 T magnetic field with various angles between the field lines and the mirrors surface. The cleaning efficiency was evaluated by performing reflectivity measurements, SEM and XPS.

17:30	**487**	**A kinetic neutral atom model for tokamak SOL turbulence** *Christoph Wersal, Paolo Ricci, Federico Halpern, Fabio Riva* *CRPP, EPFL, Station 13, 1015 Lausanne* The first-principle understanding of the processes in the Scrape-Off-Layer (SOL) of a tokamak is crucial for the development of a thermonuclear reactor. Since the plasma temperature in the SOL is rather low, the plasma is typically not fully ionized, and the neutral atoms play an important role in determining the SOL regimes. The description of a simple kinetic model for neutral atoms in the SOL is presented and first results of self-consistent non-linear turbulence simulations with the GBS code [1] are shown. [1] P. Ricci, et al., Plasma Phys. Control. Fusion 54 (2012) 124047
17:45	**488**	**Planar resonant RF network antennas used as inductively coupled plasma source and dedicated for large area processes.** *Rémy Jacquier [1], Philippe Guittienne [2], Alan Howling [1], Ivo Furno [1], Christoph Hollenstein [1]* *[1] CRPP, EPFL, Station 13, 1015 Lausanne* *[2] Helyssen SARL, Route de la Louche, 31, 1092 Belmont* Resonant RF networks are promising devices for many potential fields of use. Particularly, for large area processing, the real impedance at the resonance frequency is a great advantage as it eases the power matching and minimizes the high currents or voltages inherent to up-scaling of conventional capacitively or inductively coupled devices. Beside this point, the plasma discharge produced by RF networks is comparable to conventional ICP devices, with high power transfer efficiencies. We give here an overview of this new source operating principles and a summary of some experimental results.
18:00		***END***

ID	Plasma Physics Poster
491	**Fast ion guiding center orbits in 2D and 3D toroidally rotating tokamak plasmas** *Madhusudan Raghunathan, Jonathan Graves, Wilfred Cooper, David Pfefferlé* *EPFL SB CRPP, Station 13, 1015 Lausanne* Strong toroidal rotation is an important element of plasmas in fusion devices such as spherical tokamaks. We aim to study plasma rotation with a magnetohydrodynamic (MHD) model assuming axisymmetry, and 3D equilibria including the effect of a saturated internal kink mode. For this purpose, we use the VMEC equilibrium solver (adapted for plasma rotation) for generating the equilibrium with free-boundary conditions. Additionally, under rotation, the electric field becomes a significant contributor to the particle orbits. Higher-order electric field corrections, considered in order to satisfy quasi-neutrality, are then applied in the VENUS-LEVIS orbit-following code to establish fast particle behaviour.