Applied Physics & Plasma Physics; Earth, Atmosphere and Environmental Physics (combined session)

Friday, 30.08.2019, Room G 91

Time	ID	Combined Session *Chair: Laurie Porte, EPFL*
11:15	801	**Simulations of artificial populations with competing skills** *Johannes J. Schneider, Rudolf M. Füchslin* *Institute for Applied Mathematics and Physics, Zurich University of Applied Sciences* We present a model for the spread, transmission, and competition of skills in a population of individuals with finite life span and asexual reproduction. Emphasis is placed on the role of spatial mobility of individuals. In the initialization, individuals may have no skill or either skill A or B. Later on, individuals are born unskilled and may acquire skills by being taught from a skilled individual. Skill A results in a small reproductive advantage but is easy to transmit, whereas skill B is harder to teach but results in a higher benefit. The model exhibits a rich behavior including phase transitions at critical migration rates.
11:30	802	**Non-linear model-based optimization of stationary tokamak plasma profiles using RAPTOR** *Simon Van Mulders, Swiss Plasma Center, EPFL* The coupled dynamics of the radial profiles (magnetic and kinetic) in a tokamak are described by a set of non-linear partial differential equations. RAPTOR is a control-oriented core transport code, solving these equations based on empirical or first-principle-based models for the heat transport. The present work presents the extension of RAPTOR to allow rapid calculation of consistent stationary solutions, either imposing all actuator inputs, or the plasma loop voltage. The fast stationary state solver is embedded in a numerical optimization algorithm, yielding a valuable tool for optimization of the flat-top phase of tokamak discharges. Formulating different parameter optimization problems, this tool can rapidly explore advanced tokamak scenarios, optimizing confinement and external power requirements.
11:45	803	**Fast Electron Studies using the ECE suite of Diagnostics on TCV** *Arsène Stéphane Tema Biwole, Laurie Porte, EPFL, Swiss Plasma Center* Non-thermal electron distributions can be generated by various means in magnetically confined plasmas. On TCV, non-thermal electron populations are routinely generated using electron cyclotron current drive (ECCD), in the presence of magnetohydrodynamic (MHD) instabilities and during disruptions. The kinetic energy of the non-thermal electrons can range from several tens to a few hundred kilo electron volts. Diagnosis of the non-thermal electrons can be partially achieved using electrn cyclotron emission (ECE) radiometers, measuring emission in the frequency range 70 GHz to 140 GHz. On TCV, a suite of ECE radiometers exists and there are several lines of sight available to make measurements. We will describe the available instrumentation, lines of sight, calibration and examine the potential analysis techniques open to us.

12:00	**804**	**Plasma Edge Turbulence Characterization Using Gas Puff Imaging on the TCV Tokamak** *Nicola Offeddu [1], Woonghee Han [2], Christian Theiler [1], Theodore Golfinopoulos [2], Cristian Galperti [1], Basil P. Duval [1]* *[1] EPFL, [2] MIT* Understanding turbulence and anomalous transport in tokamaks remains an important open issue in plasma physics for fusion devices. A prominent feature of turbulence in the edge region of a plasma are coherent filamentary plasma structures that drift across the magnetic field lines at high velocities (~km/s). In 2018, a Gas Puff Imaging (GPI) diagnostic has been commissioned at TCV. Data is acquired with an avalanche photo-diode array at 2 MHz, such that we can resolve structures with the diameter of the order of a cm with velocities of the order of km/s. We will present size and velocity distributions of the filaments, obtained with pattern recognition algorithms, and compare them to previous, more indirect measurements deduced from electrostatic diagnostic probes.
12:15	**805**	**Thermal characteristics of cellulose in relation to forest fire** *Alois Raemy, retired from NRC, CH-1000 Lausanne 26* Cellulose is a carbohydrate present at least in the composition of food, paper, textile and wood. In wood it is the most abundant component. The thermal characteristics of the polysaccharide cellulose in relation to forest fire are mainly: specific heat, exothermic decomposition (pyrolysis) onset temperatures, enthalpy of decomposition (pyrolysis), (self)-ignition temperature, heat of combustion, explosion parameters, flammability. Data of most of these parameters will be indicated and the instruments used for their determinations (high pressure Differential Thermal Analysis (DTA), heat flux calorimetry, Siwek 20 l sphere,…) will be presented briefly [1]. Strategies of intervention against forest fire will also be proposed for discussion. [1] A. Raemy, P. Lambelet and J. Loeliger, Thermochim.Acta, 95 (1985) 441-446.
12:30	**806**	**Kerr lens mode-locked femtosecond thin-disk lasers and their application for broadband THz and intracavity high harmonic generation** *Julian Fischer, Norbert Modsching, Jakub Drs, Francois Labaye, Valentin J. Wittwer, Thomas Südmeyer, Time and Frequency Laboratory, University of Neuchâtel* High-power laser oscillators are a simple, compact and reliable alternative to multi-stage laser amplifier systems. In particular, Kerr lens mode-locked (KLM) thin-disk laser (TDL) oscillators are capable of generating directly sub-100-femtosecond pulse durations at megahertz repetition rates and high average powers. Peak powers at the mega-watt level enable to drive non-linear processes outside as well as inside the laser cavity. We present recent advances in ultrafast KLM TDL oscillators and discuss their application for broadband THz and intracavity high harmonic generation.
12:45	**807**	**Broadband high-power THz generation driven by ultrafast thin-disk laser oscillators** *Jakub Drs, Norbert Modsching, Clément Paradis, Valentin J. Wittwer, Olga Razskazovskaya, Thomas Südmeyer, Time and Frequency Laboratory, University of Neuchâtel* Broadband and high-power THz radiation spanning several THz at mW power levels is so far available using highly complex multistage laser amplifier systems or large-scale facilities. We demonstrate a broadband THz source (spanning nearly 5 THz at 0.3 mW of average power) based on optical rectification in GaP driven directly by an ultrafast high-power thin-disk laser oscillator. The synergy of low-complexity, high average power and a broad spectrum will benefit many spectroscopic and THz imaging applications.

13:00	808	**Laser cooling of C_2^- in a digital RF trap for sympathetic cooling of antiprotons** *Emanuel David Oswald [1,2], Sebastian Gerber [2,3], Alexander Hinterberger [2,3], Christian Zimmer [2,4], Michael Doser [2]* *[1] University of Innsbruck, [2] CERN, [3] Politecnico di Milano, [4] Ruprecht Karls Universität Heidelberg* C_2^- and other anionic molecules produced in an electric discharge in an Even-Lavie valve are accelerated to 1.8 keV in a pulsed electric field; the C_2^- is then mass selected in a Wien filter. Subsequent deceleration in the static electric field of a resistive tube with a potential difference of 1.8 kV reduces the energy of the particles to a trappable range. A digital RF trap on the same 1.8 kV potential stores the C_2^- molecules for subsequent experimentation with cooling lasers. A successful cooling of anionic C_2^- would open up novel experiments based on sympathetic cooling of antiprotons and other anionic systems to sub-Kelvin temperatures.
13:15		***END***

ID	Applied Physics & Earth, Atmosphere and Environmental Physics & Plasma Physics Poster
811	**First results on the effects of toroidal current on 3D equilibria in magnetic fusion devices** *Antoine Baillod, Joaquim Loizu, Jonathan Graves, Wilfred Anthony Cooper ** *École Polytechnique Fédérale de Lausanne, Swiss Plasma Center, * retired* The sensitivity of 3D magnetohydrodynamical equilibria to the toroidal current profile is of paramount importance for stellarator optimization and operation. In fact, magnetic field-line chaos can emerge depending on the plasma pressure and currents, thereby strongly affecting particle confinement. The Stepped-Pressure Equilibrium Code (Hudson et al., Phys. Plasmas, vol 19 (11), 2012) can be used to compute partially reconnected equilibria with coexisting magnetic surfaces, magnetic islands and chaos. The code has been recently extended to allow toroidal current prescription. A study of the toroidal current effect on magnetic topology is presented in a simplified stellarator configuration.
812	**Impact of edge density fluctuations on Electron-Cyclotron beam propagation and absorption in tokamaks** *Jean Cazabonne, EPFL* Electron-Cyclotron waves are an important tool in tokamak devices for core heating, current drive and MHD mode stabilization. Density fluctuations at the edge can cause a broadening of the EC beam before absorption, potentially leading to inaccurate or less efficient power deposition, especially in large tokamak devices. This can be modeled with the quasilinear Fokker-Planck code LUKE, using a dedicated fluctuation module. Experimental constraints are added to the model by measuring Hard X-Ray Bremsstrahlung emission from the plasma using a spectroscopic 4-camera HXR system. Modeling can be augmented using a COMSOL RF solver, coupled with the Global Braginskii Solver that estimates density fluctuations in the Scrape-Off Layer.