Report from the EPS Plasma Physics Division Board, Summer 2017

Board meetings

The Board met twice in 2016, on 3rd July in Leuven (Belgium) and on 16th December at Culham (UK).

Development of the Division

Richard Dendy (Culham Centre for Fusion Energy and Warwick University, UK) succeeded Sylvie Jacquemot (Ecole Polytechnique, France) as elected Chair of the Division on completion of her successful four-year term on 8th July 2016. Kristel Crombé (ERM/KMS, Belgium) succeeded Emilia Solana (CIEMAT, Spain) as Secretary. The Board members leading the arrangements for the competitions for the 2017 EPS-PPD Prizes were: Alfvén, John Kirk (Max Planck Institute for Nuclear Physics, Germany); Innovation, Holger Kersten (Kiel University, Germany) with Eva Kovačević (Orléans University, France); PhD Research Award, Elisabeth Wolfrum (Max Planck Institute for Plasma Physics, Germany). Further information is available at http://plasma.ciemat.es/eps/board/.

Leuven EPS Plasma Physics Conference 2016 (https://kuleuvencongres.be/eps2016/)

The 43rd EPS Conference on Plasma Physics was hosted by the Katholieke Universiteit Leuven (Belgium) from 4th to 8th July 2016, in the university's buildings in historic central Leuven. The Local Organising Committee was chaired by Stefaan Poedts, assisted by Tom Van Doorsselaere (scientific secretary) and Nele Vennekens (conference and events office). They ensured a smoothly run conference which attracted 635 registered participants, of whom 193 were students. The Programme Committee, ably chaired by Paola Mantica with the help of Gerardo Giruzzi (Magnetic Confinement Fusion: MCF), Elena Amato (Basic, Space & Astrophysical Plasmas: BSAP), Marta Fajardo (Beam Plasma & Inertial Fusion: BPIF) and Timo Gans (Low Temperature & Dusty Plasmas: LTDP), met for the second time in March 2016 in Leuven. Its detailed composition is given on the conference website at https://kuleuvencongres.be/eps2016/committees. A total of 289 suggestions for invited and plenary contributions were received from individual scientists and from institutions through the EPS-PPD Open Forum, and from the American Physical Society and the Association of Asia Pacific Physical Societies; these partner organisations also kindly supplied participants to Programme Committee and Board meetings during 2016. The scientific programme included joint activities with other EPS Divisions: Solar Physics, and Quantum Electronics and Optics. The conference benefited from highly effective work by Boudewijn van Milligen in support of the online system, including the publication of the 4-page papers associated with contributed orals and posters which are available online at http://ocs.ciemat.es/EPS2016PAP/html/ and constitute volume 40A of the Europhysics Conference Abstracts series. A very high proportion of the invited talks, totalling 52, led to refereed journal articles published in the January 2017 issue of *Plasma Physics and Controlled Fusion*, available online at http://iopscience.iop.org/issue/0741-3335/59/1

Belfast EPS Plasma Physics Conference 2017 (https://www.qub.ac.uk/sites/eps2017/)

The 44th EPS Plasma Physics Conference takes place in Belfast (UK) from 26th to 30th June 2017, hosted by Queen's University Belfast. The Local Organising Committee is chaired by Brendan Dromey. The Programme Committee is chaired by Marta Fajardo (PT) and comprises:

- MCF: E. Westerhof (NL – sub-chair), C. Challis (UK), A. Hakola (FI), P. Hennequin (FR), M. Hirsch (DE), R. Lorenzini (IT), M.-L. Mayoral (UK), B. van Milligen (SP), T. Puetterich (DE) and V. Pustovitov (RU)
- BPIF: C. Riconda (FR – sub-chair), A. Marocchino (IT), F. Negoita (RO), J. Nedjl (CZ), G. Sarri (UK), U. Schramm (DE), P. Velarde (SP) and J. Vieira (PT),
- BSAP: A. Bret (SP – sub-chair), J. Büchner (DE), R. Keppens (BE), J. Petri (FR), A. Robinson (UK) and N Vlahakis (GR)
- LTDP: A. Melzer (DE – sub-chair), N. Bordel (SP), W. Miloch (NO), I. Pilch (SE) and S. Starikovskaya (FR).

Suggestions from the plasma research community for invited and plenary speakers were welcomed through the Open Forum, and from the American Physical Society and the Association of Asia Pacific Physical Societies.

Prague EPS Plasma Physics Conference 2018 (https://www.eli-beams.eu/en/media/events/eps-conference-plasma-physics-2018/)

The 45th EPS Plasma Physics Conference will take place at the Žofín Palace in Prague (CZ) from 2nd to 6th July 2018, hosted by a consortium of Czech plasma research organisations. The Local Organising Committee is chaired by Stefan Weber (ELI-Beamlines), who is also an EPS-PPD Board member. The Programme Committee is chaired by Stefano Coda (CH) and comprises:

•MCF: M. Mantsinen (FI – sub-chair), T. Eich (DE), G. Ericsson (SE), L. Frassinetti (SE), G. Huijsmans (ITER), R. König (DE), J. Mailloux (UK), P. Piovesan (IT), R. Zagorski (PL)

•BPIF: C. Michaut (FR – sub-chair), O. Klimo (CZ), M. Nakatsutsumi (XFEL), A. Ravasio (FR), S. Kar (UK), R. Scott (UK)

•BSAP: G. Lapenta (BE – sub-chair), M.E. Dieckmann (SE), E. Falize (FR), T. Grismayer (PT), G. Rodriguez-Prieto (SP), M. Romè (IT)

•LTDP: J. Berndt (FR – sub-chair), U. Cvelbar (SI), V. Guerra (PT), O. Petrov (RU)

In addition to the annual Divisional conference, the EPS-PPD supports a new biennial conference: the **2nd European Conference on Plasma Diagnostics** was held in Bordeaux (France) from 18th to 21st April 2017, see https://ecpd2017.sciencesconf.org/

Prizes

On the occasion of this Annual Conference, the EPS Plasma Physics Division recognises researchers who have achieved outstanding scientific or technological results, reflecting and reinforcing excellence in plasma physics.

The **2017 Hannes Alfvén Prize** is awarded to **Ksenia Aleksandrovna Razumova** of the Kurchatov Institute, Russia, for obtaining, for the first time, a macroscopically stable plasma column in a tokamak configuration; this led to the world-wide programme of experimental exploration and development of the tokamak concept for magnetic confinement fusion.

Professor Razumova started her experimental investigations of magnetically confined plasmas on the very first tokamak in 1955. At that time, magnetohydrodynamic (MHD) events were preventing the formation of macroscopically stable plasma columns in tokamaks, and so Professor Razumova focused her activity on MHD stability and validation of the Shafranov-Kruskal criterion. In carrying out this validation, Professor Razumova approached, step-by-step, the parameter space in which stable tokamak plasmas could be obtained. This project culminated in 1962 when, for the first time ever, Professor Razumova obtained a macroscopically stable hot plasma column in a tokamak. It was this successful experiment that led to the worldwide programme of exploration and development of the tokamak concept for magnetic confinement fusion. The enormous extent and scale of the contemporary international research programme in tokamak plasma physics reflects the centrality of Professor Razumova's first successful experiment, which was a defining milestone in the field of magnetic confinement fusion.

The results of the key experiment were presented in 1963, where it was shown that tokamak plasma stability was limited by strong MHD events, which Professor Razumova termed "disruptions". Since then, disruptions have become one of the most important aspects of tokamak plasma physics, and their importance increases as larger devices and higher currents are employed in the path towards fusion power.

Professor Razumova was actively involved in several other pioneering research achievements. In 1965, she found MHD modes with higher mode numbers, and demonstrated fine MHD structure of macroscopically stable plasmas. In 1966, she was first to develop the measurement of plasma energy by means of the diamagnetic effect, which is now used on all tokamaks. In 1972, working with V. Alikaev, Professor Razumova obtained, on the TM-3 tokamak, the first demonstration of plasma heating using the electron cyclotron resonance. In 1975, they reported detailed investigations of tokamak plasmas in which a significant part of the current is carried by runaway electrons, with a specific kinetic instability of the runaway beam which was then called the "fan instability". In 1985, working with Yu. V. Esiptchuk, Professor Razumova found that the normalized plasma pressure profile remains the same in all plasma scenarios except those with internal transport barriers. Since then, Professor Razumova's research interests have focused on the self-organisation of tokamak plasmas.

During her scientific career, Professor Razumova became an exceptionally influential and charismatic leader, whose advice is widely sought across plasma physics and magnetic fusion science. Many scientists, who had the privilege to collaborate with Professor Razumova, have warm memories of her enormous experience, her complete dedication to the field, her truly scientific approach, her always open and critical mind, and her unassuming and friendly personality.

The **2017 EPS Plasma Physics Innovation Prize** is awarded to **Michel Moisan** of the Université de Montréal, Canada, for pioneering contributions to the development and understanding of microwave plasma sources and their applications to materials processing, healthcare and environmental protection.

Professor Moisan has made numerous profound contributions to plasma physics, and especially to a variety of commercial and industrial applications. He was the lead inventor appearing on the 1974 patent application disclosing the "surfatron" and "surfaguide" electromagnetic field applicators. These devices have been truly enabling for many plasma applications. They are widely used throughout the world for sustaining stable and reproducible plasma columns under a large range of operating conditions. The plasma discharge using these devices is conveniently achieved in dielectric tubing, allowing flowing gases to be utilized. The applied frequency ranges from 150 kHz to 40 GHz, with discharge tube diameters from 1 mm to 300 mm. Plasma can be sustained with gas pressure as low as 1 mTorr, with electron cyclotron resonance operation, up to at least ten times atmospheric pressure. It should be stressed that establishing and maintaining stable plasma under such a wide range of conditions is not possible with any other existing plasma sources.

These devices have enabled fundamental studies into the structure and dynamics of RF and microwave plasmas, to a degree hitherto unattained. An especially powerful property is that the EM-field configuration remains the same from 150 kHz to a few GHz, enabling specialized plasma studies of the effects of frequency on plasma parameters.

The value of these devices is even more impressive for industrial applications and in many other practical contexts. Hundreds of surfatrons have been utilized worldwide in industrial and research laboratories; indeed this design is now so widely accepted and integrated into the plasma community that publications no longer refer to its inventors. Among many others that could be cited, the following abbreviated list identifies some examples of practical and novel use: (1) robust, reliable secondary-ion mass spectroscopy in a French-Soviet spacecraft around Phobos, a Mars satellite; (2) efficient, powerful, low damage, room temperature surface sterilization; (3) efficient abatement of effluent of difficult-to-treat global warming gases, such as perfluorocarbons and hydrocarbons, in chemical plants and semiconductor fabrication facilities; and (4) highly efficient and powerful purification of Krypton and Xenon gases obtained from cryogenic distillation in industrial chemical plants. Many different types of surface-wave launchers, together with a great variety of applications, were developed over the years by the team of Professor Moisan, as well as by many other teams throughout the world. The gas abatement applications were patented, under Professor Moisan's name, by the French company Air Liquide.

The **2017 EPS Plasma Physics Division PhD Research Awards** were judged by an external committee, comprising Tim Hender, Tito Mendonça and Klaus-Dieter Weltmann, who examined all the submitted theses in a process co-ordinated by Elisabeth Wolfrum representing the EPS Plasma Physics Division. This year's awards go to: **Justin Ball** (Oxford University, UK) for his study of the effect of plasma boundary shape on driving intrinsic rotation in the tokamak, and more generally on the confinement properties; **Luca Fedeli** (Pisa University, Italy) for his study of surface plasmons, which are excited by intense laser pulses at a vacuum-plasma interface; and **Toon Weyens** (Universidad Carlos III de Madrid, Spain, and Eindhoven University of Technology, Netherlands) for his study of a key aspect of toroidal plasma stability, the effects of non-axisymmetric fields on peeling-ballooning stability.

The winners of the **2017 EPS/PPCF/IUPAP Poster Prizes** and the **2017 Kyushu University Itoh Project Prize**, sponsored by Kyushu University (Japan) and supported by IOP Publishing, will be determined during the conference, and will be announced during the closing session.

Richard Dendy
on behalf of the EPS Plasma Physics Division Board
June 2017