Report from the EPS Plasma Physics Division Board, Summer 2025

Board meetings

The Board met in-person twice in 2024, on July 7 in Salamanca (Spain) and on December 3-4 in Padua (Italy).

Operation & Development of the Division

Kristel Crombé (ERM/KMS and Ghent University, Belgium) continues as Chair (2022-2026) of the Division, and Ken McClements (UKAEA, UK) continues as Secretary. The Board members coordinating the 2024 EPS-PPD Prizes were: Alfvén, Andreas Dinklage (Max-Planck-Institut für Plasmaphysik, Greifswald, Germany); Innovation, Eva Kovačević (Orléans University, France); Sylvie Jacquemot Early Career Prize, Mervi Mantsinen (Barcelona Supercomputing Centre, Spain); and the PhD Research Award, Monica Spolaore (CNR, Padua, Italy).

The mandates of 10 Board members will end this summer: David Burgess, Andrea Ciardi, Andreas Dinklage, Basil Duval, Eva Kovačević, Thomas Mussenbrock, Carlos Silva, Jörg Stober, Vladimir Tikhonchuk and Stefan Weber. The division is grateful for their many contributions. An election process was initiated in January 2025 and completed in March. The 6 candidates who received the highest number of votes were elected to the Board, and 2 additional Board members were co-opted. The new members of the Board are as follows: Agata Chomiczewska (Institute of Plasma Physics & Laser Microfusion, Poland), Corinne Champeaux (Université de Limoges, France), Fabrizio Consoli (ENEA, Italy), Andrew Gibson (University of York, UK), Daniela Grasso (Politecnico di Torino, Italy), Costanza Maggi (UKAEA, UK), Daniele Margarone (ELI Beamlines, Czechia) and Emanuele Poli (IPP Garching, Germany). For full details of the new Board, see Board | European Physical Society – Plasma Physics Division.

Salamanca EPS Plasma Physics Conference 2024 (Home - EPS PLASMA 2024)

The 50th annual EPS Plasma Physics Conference took place at the Palacio de Congresos in Salamanca from July 8-12 2024, hosted by the Centro de Láseres Pulsados (CLPU). The Local Organising Committee (LOC) was chaired by Luca Volpe (Universidad Politécnica de Madrid, Spain). The Programme Committee was chaired by John Kirk (Max-Planck-Institut für Kernphysik, Germany) and comprised:

- MCF: S. Ratynskaia (SE – sub-chair), I. Pusztai (SE), J. Harrison (UK), G. Fuchert (DE), M. Chernyshova (PL), P. Lauber (DE), A. Järvinen (FI), J.L. Velasco (ES), E. Solano (ES), M. Tardocchi (IT), R. Dumont (FR)
- BPIF: P. Neumayer (DE – sub-chair), C. Palmer (UK), A. Grassi (FR), D. Doria (RO), F. Consoli (IT), F. Fiuza (PT), J. Honrubia (ES), P. Raczka (PL)
- BSAP: A. Arauda (CZ – sub-chair), S. Servidio (IT), F. Spanier (DE)
- LTDP: A. Granier (FR – sub-chair), W. Thomas (US), F. Greiner (DE), J. Walsh (UK)

Proposals from the plasma research community for invited and plenary speakers were received through an open forum, from the American Physical Society and from the Association of Asia Pacific Physical Societies, which kindly contributed representatives to participate in Programme Committee and EPS-PPD Board meetings in December 2023. There were 599 paying delegates and the financial outturn was positive. The LOC organised the submission of 4-page papers linked to contributed orals and posters. PPD Board Member Basil Duval assisted the LOC in bringing these papers to publication: they are available online at 50th EPS Conference on Plasma Physics - 8 - 12 July 2024 (epfl.ch) and constitute volume 48A of the Europhysics Conference Abstracts series. Many of the plenary and invited talks led to refereed journal articles published in a special issue of *Plasma Physics and Controlled Fusion*, available online at Special Issue Featuring the Invited Talks from the 50th EPS Conference on Plasma Physics, 8-12 July 2024 - IOPscience.

Vilnius EPS Plasma Physics Conference 2025 (Home - 51st EPS Conference on Plasma Physics)

The 51st annual EPS Plasma Physics Conference will take place in Vilnius, Lithuania, from July 7-11 2025, hosted by Vilnius University. The Local Organising Committee is chaired by Jelena Tamulienė (Vilnius University). The programme Committee is chaired by Marija Vranic (PT) and comprises:

- MCF: A. Alonso (ES – sub-chair), M. Bécoulet (FR), A. Köhn-Seemann (DE), Y. Kovtun (UA), E. Militello-Asp (UK), M. Nocente (IT), J. Proll (NL), H. Reimerdes (CH), F. Reimold (DE), P. Schneider (DE), A. Snicker (FI), D. Terranova (IT)
- BPIF: J. Santos (FR – sub-chair), J.A. Perez-Hernandez (ES), M. Cipriani (IT), T. Dornheim (DE), M. Formanek (CZ), E. Hume (UK), M. Lafon (FR), G. Williams (PT)
- BSAP: E. Tubman (US – sub-chair), M. Padovani (IT), I. Mann (NO), Á. Sánchez-Monge (ES), A. Vanthieghem (FR)
- LTDP: J. Walsh (UK – sub-chair), C. Knapek (DE), H. Kondo (JP), F. Krcma (CZ)

Prizes

At the 2025 Annual Conference the EPS Plasma Physics Division will recognise researchers who have achieved outstanding scientific or technological results, reflecting and reinforcing excellence in plasma physics.

The **2025 EPS Hannes Alfvén Prize** for outstanding contributions to plasma physics is awarded to **Michel Koenig** (LULI, France) for outstanding and continuous contributions to the experimental study of laser-plasma interactions applied in the domain of laboratory astrophysics, of high-energy density physics, and of inertial confinement fusion.

Michel Koenig has made remarkable contributions throughout his career in various domains of plasma physics. His work spans atomic physics, planetary science, laboratory astrophysics, and inertial confinement fusion, among other areas. In atomic physics, Koenig has been instrumental in studying quantum effects in dense plasmas generated by high-energy lasers. His pioneering theoretical work was later experimentally verified, providing crucial insights into the behaviour of matter under extreme conditions. In laser-direct drive implosion, Koenig conducted groundbreaking research at the Laboratoire pour l'Utilisation des Lasers Intenses (LULI), where he employed the 4ω LULI laser with a comprehensive set of diagnostics, including neutron bang time, X-ray streak cameras, and alpha-particle imaging. These diagnostics allowed precise measurement of energy efficiency in the implosion process, advancing understanding in laser-driven fusion techniques. Koenig's contributions to equation of state (EOS) measurements and planetary physics have been transformative. His laboratory-based experiments, designed to simulate the interiors of Earth-like planets, especially those involving iron and silicates, are now foundational in planetary science. His work on the melting line of iron under extreme conditions has expanded our understanding of planetary core dynamics and has significant implications for modelling the interiors of terrestrial planets. In laboratory astrophysics, Koenig has significantly advanced our understanding of magnetized plasmas. His contributions include research on radiative shocks, stellar jets, and hydrodynamic instabilities. His recent work on magnetized plasmas and the intricate mechanisms of small-scale turbulence has been highly regarded in the astrophysical community, as it offers new perspectives on phenomena observed in space. Koenig has also made outstanding contributions in inertial confinement fusion (ICF). He has explored alternative fusion ignition schemes, including fast ignition and shock ignition physics, through collaborative efforts with renowned scientists such as Professors Peter Norreys and Dimitri Batani. His experiments with high power lasers, including those conducted on the Laser MegaJoule (LMJ), have provided invaluable insights into the complexities of ignition processes, advancing the field of fusion research.

The **2025 EPS Plasma Physics Innovation Prize** for technological, industrial or societal applications of research in plasma physics is awarded jointly to **Eric Robert** and **Sébastien Dozias** (GREMI, University of Orléans, France) for pioneering work on atmospheric pressure plasma jets and demonstrations of plasma effects on cancer *in vivo*, synergetic effects of plasma treatment and chemotherapy, and plasma oxygenation of tissues, leading to hospital medical applications especially in cancer treatment and wound healing.

Eric Robert and **Sébastien Dozias** are not only pioneers in the development of plasma jets at atmospheric pressure but also in their applications to medicine, cosmetics and well-being. Their major contribution was essential in the understanding and development of long-distance plasma jets and multijets which not only

allowed them to achieve firsts and breakthroughs in the fields mentioned above, but also served as the basis for numerous works carried out by other teams around the world.

Robert and Dozias developed a plasma jet, the Plasma Gun (PG), in 2005-2006. This was patented in 2007 (US 60/999,083). This plasma jet at atmospheric pressure at long distances (a few centimeters to several meters) in several rare gases (He, Ne, Ar) was the basic tool for their first studies of the interactions between plasmas and biological targets. The plasma jet of the PG is produced using high voltage microsecond pulses (1-40 kV) at frequencies ranging from single-shot to several tens of kilohertz. Control and on-demand matching of the high voltage waveforms provided a unique opportunity to achieve major breakthroughs in the physics of the plasma jets. These include the key interactions between plasma jets and various targets, including those relevant for biological/biomedical applications. Robert and Dozias demonstrated the potential provided by the ability of the plasma jet to allow the production of multijets, from a single reactor, making possible the treatment of large surfaces. Their work also led to a better understanding of the processes linked to the production of the main reactive species, RONS, whose role is essential in the effects observed, particularly in plasma medicine, and those linked to plasma/gaseous environment interactions influencing the channelling of the carrier gas that is important for applications.

The use of the PG allowed Robert and Dozias to achieve several firsts in plasma medicine and biology which have led to numerous other breakthroughs achieved by other teams and to hospital applications, particularly in the areas of cancer and chronic wound treatment. With their team, Robert and Dozias carried out the first *in vivo* plasma cancer study and demonstrated the beneficial effect of combined plasma/chemotherapy in the treatment of cancer, since then confirmed by others. Another important first is the demonstration of the induction of a temporary increase in oxygenation and blood flow in the treated tissues. This result, subsequently confirmed by other teams, is extremely important in the treatment of chronic wounds and more generally in all treatments where oxygenation plays a major role, with applications now envisaged in sports medicine. It is also important to note their pioneering work on time-resolved characterization of the intense transient electric field inherent to the plasma jets ignition and propagation and its delivery in interaction with various substrates. This allowed them to highlight the major role played by the plasma-induced electric field, both at the cellular and skin levels, important for applications in cosmetics and dermatology. Recently, they applied a multi-branched PG system to natural and synthetic fibre treatment, leading to a patented process in Europe and the USA.

Beyond applications in medicine, cosmetics, disinfection and material treatment, it is important to note that the work of Robert and Dozias, in collaboration with many other teams around Europe, recently led to a successful application to establish a European Doctoral Network on the use of multijets for the treatment of actinic keratosis. This project will be a unique opportunity to train eight early career researchers to plasma jet technology for innovative approach in cancer therapy, with the main objective of translating this laboratory-inspired research effort to medical institutions.

The **2025 EPS-PPCF Sylvie Jacquemot Early Career Prize** is awarded to **Arno Vanthieghem** (CNRS, France) for major contributions to the plasma physics of extreme astrophysical phenomena through innovative theoretical models and high-performance numerical simulations.

Arno Vanthieghem works at the intersection of theoretical and computational plasma physics, multi-messenger astrophysics, and laboratory astrophysics. He develops first-principles kinetic plasma models of extreme astrophysical phenomena and validates them with high-performance particle-in-cell (PIC) numerical simulations. In a short time span, he has made major contributions to the physics of shock waves in a wide range of conditions and thus advanced significantly our understanding of the plasma processes at work in these extreme sources. In a series of remarkable publications, he has developed a novel and advanced theoretical description of plasma heating and electron-ion energy partition in the transition layer of weakly magnetized collisionless shocks and validated it with PIC simulations. This problem, until now a major theoretical unknown, is of fundamental importance for the interpretation of observed emissions from shock-heated electrons in astrophysical sources, from supernova remnants to relativistic astrophysical jets. Building on these achievements, Vanthieghem has been able to advance the complex kinetic physics of radiation-mediated shock waves, which propagate in dense environments and generate the first radiative signals of explosive astrophysical transients, including gravitational wave events associated with coalescing neutron stars and gamma-ray bursts. In particular, through advanced theoretical and numerical modelling, he has characterized new channels of energy dissipation, opening up exciting possibilities for complementary sources of precursor radiation from these events. Recently, he has carried out the world's first kinetic numerical simulations of relativistic magnetized shock waves forming in the magnetospheres of magnetars and provided a compelling theoretical model of their structure, thereby

opening a new window on the processes thought to be at the origin of the enigmatic "fast radio burst" sources. His research is unique in its skilful combination of theoretical, semi-analytical and numerical methods, and his early achievements have made him a world-renowned expert in the modelling of shock waves and a rising star of extreme plasma astrophysics.

The **2025 EPS Plasma Physics Division PhD Research Awards** were judged by a small external committee of referees who examined the submitted theses in a process co-ordinated by Monica Spolaore representing the EPS-PPD Board. This year's awards go to (in alphabetical order of surname): **Robert Ewart** (University of Oxford, UK) for his thesis "Universal equilibria, phase-space structure of collisionless plasma systems, and turbulence in non-Maxwellian plasmas", nominated by Alex Schekochihin; **Henri Kumpulainen** (Aalto University, Espoo, Finland) for his thesis "Validation of tungsten erosion and transport simulations in tokamaks", nominated by Mathias Groth; **Li Wang** (Ruhr University Bochum, Germany) for her thesis "Process control in low pressure capacitive radio frequency plasmas based on kinetic simulations", nominated by Julian Schulze; and **Benedikt Zimmermann** (Technical University of Munich, Germany) for his thesis "Validation of Momentum Transport Theory in the Core Plasma of the ASDEX Upgrade Tokamak", nominated by Rachael McDermott. For further information on this prize, please see PhD Research Award | European Physical Society – Plasma Physics Division (ciemat.es).

The winner of the **2025 PPCF Outstanding Paper Prize** is "Understanding asymmetries using integrated simulations of capsule implosions in low gas-fill hohlraums at the National Ignition Facility" by José Milovich and co-workers: see Understanding asymmetries using integrated simulations of capsule implosions in low gas-fill hohlraums at the National Ignition Facility - IOPscience.

The winners of the **2025 PPCF/EPS/IUPAP Student Poster Prizes** will be determined during the conference and announced during the closing session.

Future Conferences

A central objective of the EPS-PPD Board is to establish a multi-year pipeline of future venues for our conference. This is essential if we are to continue to host these meetings in appropriate and affordable facilities (primarily located in major population centres), and at the optimum time of year for our community. The challenge of organising the conference requires careful long-term planning by organisations with greater financial resources than those at our disposal. We are therefore extremely grateful to institutions that are able and willing to provide this service. Local organisation for forthcoming EPS plasma physics conferences will be provided in 2025 by C-IN and Vilnius University (Vilnius, Lithuania), in 2026 by the United Kingdom Atomic Energy Authority (Edinburgh, UK), and in 2027 by the École Polytechnique Fédérale de Lausanne (Lausanne, Switzerland). Looking further ahead, the EPS-PPD Board is in discussions with the University of Stuttgart (Stuttgart, Germany) for 2028.

Kristel Crombé, Chair

on behalf of the EPS Plasma Physics Division Board

30th May 2025