IUPAP International Union of Pure and Applied Physics

Newsletter

DECEMBER 2019

President: **Michel Spiro** • Editor-in-Chief: **Kok Khoo Phua** • Editors: **Maitri Bobba; Sun Han**

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NEW LEADERSHIP OF IUPAP

On 2 October 2019, the Executive Council of IUPAP received a letter from President Kennedy Reed resigning the presidency because of a family illness. As a result, Michel Spiro, previously the President Designate, is now the President of IUPAP.

Michel was our President Designate from October 2017 to October 2018 and before that, he was the first Chair of our Working Group 10, the Astroparticle Physics International Committee (ApPIC), successfully establishing a very active working group. Presently, he is the Emeritus Research Director at the Commissariat à l'Energie atomique et aux energies alternatives (CEA). He has recently served as the director of Institut National de Physique Nucléaire et de Physique des Particules (IN2P3) in the Centre National de la Recherche Scientifique (CNRS), the President of the CERN Council and as the President of the French Physical Society.

He worked in experimental particle physics at CERN, before moving to astroparticle physics, where he worked on the GALLEX solar neutrino experiment and on microlensing searches for dark matter. He has received a number of prizes recognising his work, most recently the André Lagarrigue Prize of the French Physical Society, and has been appointed a Chevalier de la Légion d'honneur.

These developments mean that we do not have a President Designate, and the Executive Council felt that the Union would not function as well with a depleted Presidential Line. The Council was pleased that Silvina Ponce Dawson, currently our Gender Champion and Vice President at Large, agreed to be nominated by the President to the position of President Designate for the period October 2020 to late 2022, and appointed her as the Acting President Designate until the General Assembly (GA) elects a President Designate in October 2020.

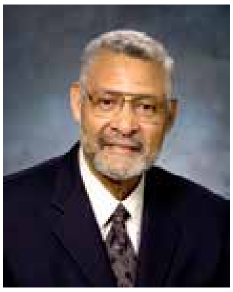
Silvina started her work with IUPAP as a member of the Working Group on Women in Physics (WG5). She was the Chair of WG5 in 2011-2014. At the 2017 GA, she was elected Vice-President at Large with Gender Champion Duties for the period 2017-2020. She is one of the IUPAP representatives on the Executive Committee of the Gender Gap in STEM Project (https://gender-gap-in-science.org/), a project that received one of the three large grants given by the International Science Council (then ICSU) in 2016.

Silvina Ponce Dawson received her PhD from the University of Buenos Aires in 1988 in theoretical plasma physics and is known for her work on statistical, nonlinear and biological physics. She was Director of the Physics Department of the School of Exact and Natural Sciences of the University of Buenos Aires in 2005-2009. She is currently Full Professor at the University of Buenos Aires in Argentina and Principal Researcher of the Argentinian National Research Council, CONICET. She is Senior Associate of the Abdus Salam International Centre for Theoretical Physics (ICTP) in Trieste and Associate Member of the ICTP South American Institute for Fundamental Research (ICTP-SAIFR) in São Paulo, Brazil.

The Executive Council now sees that, with our new President and our Acting President Designate joining me in the Presidential line we have a strong leadership team to continue Kennedy's work in promoting physics, mentoring physicists, and strengthening the ties of the Union with physicists working in industry.

Bruce McKellar, Past President, IUPAP.

Kennedy Reed and IUPAP



Kennedy Reed became the President of our Union at the close of our 2017 General Assembly, with plans to be our President for three years, until the close of our 2020 General Assembly. We are sad that his personal circumstances have forced him to shorten that term, and resign as President on 2 October 2019, depriving us of his expertise and enthusiasm.

He was elected as IUPAP President Designate in 2015 and has been the IUPAP President for the last two years. His work as President was made difficult by his own illness and then the family illness which brought him to the point where he needed to resign. Throughout this period he continued to work as hard as he could for IUPAP. In particular, he devoted much energy to establishing the working group on physics and industry.

His service in the Presidential line was just the final phase of his work for IUPAP. In all, he served IUPAP for 17 years. He started his work with IUPAP as a member of C13 in 2002, and was the Chair of C13 in 2008-2011. He attracted the first ICSU grant which IUPAP received. He was then elected as the IUPAP nominee to the ICSU Executive Board, and in that capacity, served on the ICSU committee for their Regional Office for Africa.

He received his PhD from the University of Nebraska in 1976 in theoretical atomic physics and has made distinguished contributions to our understanding of electron-atom and atom-atom collisions, particularly those relevant to high energy and high density plasmas. He retired two years ago from the Atomic Theory Group at the Lawrence Livermore Lab, where he was working on physics of interest to the laser fusion program.

He has been recognised for his work with and co-founding of the National Physical Science Consortium which provides fellowships for women and minority PhD graduates, particularly through the 2009 Presidential Award for excellence in Science, Physics and Mathematics mentoring. He also received the 2003 John Wheatly award from the American Physical Society for the promotion of physics research education in Africa.

After receiving his resignation, the Executing Council passed this resolution in appreciation of his service

IUPAP receives with regret the resignation of President Kennedy Reed. In accepting this resignation, IUPAP records its appreciation of his 17 fruitful years of service for IUPAP, first in C13, then representing IUPAP in ICSU and culminating in his term as President Designate and President. We wish him well in his future, and will find ways in which IUPAP can be a part of that.

It is a blow to IUPAP that we losing an enthusiastic promoter of physics and mentor of physicists in this way and are grateful for the long and fruitful service he has given to us. We wish him strength in the difficult time ahead. He has made an important difference to our Union. To thank him, we should all work to support and improve IUPAP.

Illuminating Education with the International Day of Light in 2019

Cather Simpson and John Dudley

May 16th, 2019 marked the global celebration of the second International Day of Light. The International Day of Light provides an annual focal point for the continued appreciation of light and the role it plays in science, culture and art, education, and sustainable development. The International Day of Light was proclaimed by UNESCO as a permanent follow-up to the International Year of Light in 2015 which was endorsed by IUPAP and many other scientific unions.

The broad theme of light allows many different sectors of society to participate in science-related activities that raise awareness of the goals of UNESCO. As the Director General of UNESCO, Audrey Azoulay, stated in a special message for 2019: "All its natural benefits and its scientific and technological applications make light an essential part of the daily life of our societies; these benefits and applications make light an important issue for the Sustainable Development Goals of the 2030 Agenda for Sustainable Development." Worldwide in 2019, over 390 events took place in more than 70 countries, reaching an estimated audience of 1.7 million.

A special focus of celebrations was the **Illuminating Education** conference held at the International Centre for Theoretical Physics (ICTP) in Trieste, Italy a physics institute well-known to the IUPAP community promoting physics in developing countries. The conference welcomed 250 participants (with a special emphasis on students) to listen to presentations on topics ranging from leading edge research to discussions of science education, diversity and career advice. Following the warm welcoming addresses of Professor Fernando Quevedo (Director, ICTP) and Professor Roberta Ramponi (President, ICO), Professor John Dudley (Chair, IDL Steering Committee) spoke about the history and the future of the International Day of Light. A plenary lecture from Sir Michael Berry, "Optica Fantastica", took the audience on a winding path through a stunning collection of images reflecting the ordinary and extraordinary behavior of light. Dr. Jess Wade (Imperial College London, UK) and Dr. Rachel Won (International Editor, Nature Photonics) shared insights and advice for those building a career in science. An international slate of speakers addressed "science and development" from a photonics perspective, covering everything from advances in lighting to light and the UN Goals for Sustainable Development. Crowdsourcing quantum physics research was the subject of a lively talk from Dr Federica Beduini (ICFO, Spain) and Professor Cather Simpson (University of Auckland, NZ) explored the many ways in which photonics is transforming the way we grow food for the better. The highlight of the celebration in Trieste was the energetic and creative emerging researcher presentations at the end of the day. An international line-up of talented scientists and speakers discussed their research and their careers with great aplomb.

The International Day of Light provides a unique opportunity for the worldwide physics community to elevate the profile of science among a broad audience, especially for the public. Recent events have clearly shown that the notion of science as a trusted arbiter of truth is under severe threat, and the negative consequences of bad science and the inability to distinguish fact from fiction are becoming evident in all spheres of society. Promoting science and the scientific method via an annual International Day provides us with the chance to do something about this directly. Light is a fantastic theme for outreach. The youngest are attracted to the many visual aspects of colour and shadows, and adults are interested in the underlying science and the many career opportunities for their children. Clear answers to everyday questions about the colour of leaves, the sky, clouds and rainbows never fail to interest people, and they subsequently opened up many interesting avenues to talk about the importance of science to society in general.

Students of IDL 2019

The importance of outreach in communicating the messages of science has motivated plans for the International Day of Light 2020 to focus on an ambitious global awareness campaign, expanded social media efforts, and enhanced promotion of local events. The goal is to see at least 1000 events take place globally, and IUPAP could play a key role through its networks and commissions in stimulating events worldwide through peer-to-peer contacts and volunteers. For more information and updates, please see the website at www.lightday.org

Gender Gap Project – Update

Gillian Butcher, Silvina Ponce Dawson, Igle Gledhill, WG5

It was very appropriate that Trieste, the meeting point of different cultures for centuries, was the venue for the final meeting of the ISC-funded Gender Gap Project, as 100 delegates from 60 countries gathered to discuss the project's findings. The gender gap is typically defined as the gap between women and men in terms of their levels of participation, access to career-advancing opportunities and resources, rights, remuneration or benefits. Two of the project's tasks set out to measure the gender gap, by way of a global survey of scientists and by analysis of publication patterns. It may not come as any surprise that both found the gender gap to be very real.

The global survey assesses scientists' experiences and perceptions and allows interrogation of the responses by discipline, region, by sector and by level of development in the country. Women are more likely to report interruptions in their studies and to report lower pay compared to colleagues with similar qualifications. Across all regions, all levels of development, all disciplines, women were significantly more likely than men to report discrimination based on gender and to say they had personally witnessed sexual harassment. The key findings are essentially identical between the various disciplines. The analysis of publication patterns accesses databases of journals from zbMATH, ADS (Astronomy Database System) and arXiv and Crossref for selected chemistry journals. An analysis tool has been produced which allows users to analyse published papers in these databases by gender over time, by specific journals and to follow similar publication over a period of time. The proportion of women authoring top papers has significantly increased in Astronomy and Astrophysics and Chemistry but has remained static in various maths and theoretical physics journals. More women are to be found in applied and collaborative fields. The third task of the project focussed on what can done to reduce the gender gap, producing a database of existing initiatives around the world, classified by target audience and objectives. A key aspect of the database is to highlight initiatives that have provided evidence of impact. However, it is a cause for concern that only a fraction (10 out of 67) of the initial set of initiatives showed that kind of evidence.

As well as discussing the findings from the tasks, delegates had the opportunity at the conference to try out the tools, offer improvements to the webpages and, for the database of good practice; to input initiatives of which they were aware. The publication pattern tool and database will be available online, in due course, in 2020 as will the final report.

Although this was the final meeting and culmination of the last three years of work, in many ways this is just the beginning, as we try to understand in more detail, what the data is telling us about the gender gap and its nuances, and what we need to tackle in order to reduce it.

Second Regional Conference on Women in Physics, Nepal (RCWIP-2019)

Nilam Shrestha Pradhan and Michael Steinitz (Editor of the Canadian Journal of Physics)

The Second Regional Conference on Women in physics, Nepal (RCWIP-2019) was held on March 27-29, 2019 at Kathmandu University. The central theme of the conference was "Fostering Professional Development and Nurturing Future Women Leaders." The three days of the conference provided the opportunity for women to share their recent achievements and develop and expand networks among female physicists of the region. The Nepalese Society (NSWIP) organised the conference for Women in Physics in association with Tribhuvan University, the Research Centre for Applied Science & Technology, and the Department of Physics, Tri-Chandra Campus. The purpose of the conference was to:

- Help garner interest and encourage young women to participate in and build their careers in the field of Physics
- Provide a platform to access the network of women physicists from all over the world with the purpose of sharing knowledge and fostering research
- Have first-hand opportunities to interact with renowned teachers and researchers in the field of Physics
- Explore strategies to improve data acquisition and analysis

The conference brought together eminent professors from different countries in the region, who spoke on how women can succeed in professional careers in academia or industry. The participants were able to learn and present papers at the conference. Opportunities were provided, for the participants, to present original research. One of the conference's outcomes was to build a nationwide database for women physicists in academia that will enable networking that will foster research collaborations and peer mentoring.

Achievements and outcome

As with most conferences, the primary achievement was the establishment of relationships with peers and with potential mentors. These could lead to scientific collaboration and networks of colleagues which may aid professional advancement. The conference provided a platform for young women physicists to interact with eminent international women physicists and to enable them to increase their self-esteem through seeing others with similar interests and challenges. The conference gathered women physicists at all academic levels in Nepal and neighbouring countries. This gathering would hopefully foster new collaboration and enable networking and peer monitoring. Through comparisons with the results obtained from data

Participants of RCWIP 2019

At 1000 steps peak of Dhulikhel

collected from other countries, we hope to be able to compare the level of retention of women in physics in Nepal to that of other countries. From this analysis, we hope to be able to take the necessary steps to improve female participation in the field of Physics.

Participation and talks

The conference attendees were from seven different countries: Bangladesh, Japan, India, Iran, Nepal, Pakistan, and Canada. They included 15 professors, 14 researchers, 20 full and part-time faculties from universities, and over 80 graduate students, including ten volunteers.

The conference program included nine invited talks, three contributed talks, two guest speaker talks, 12 talks by participants, two webinars, and 12 posters. In total, the 150 participants at the conference presented 40 papers.

Two Skype presentations from Canada included "Mentoring and Promoting Women in Physics" and "Science is empowerment, but empowerment is not science: A critical look at gender and leadership in Physics". At the conclusion of the conference, a Kumari dance was performed, reflecting the cultural heritage of Nepal.

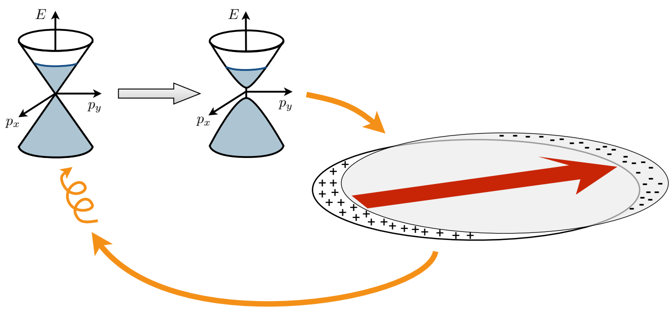
Berryogenesis: spontaneous out-of-equilibrium magnetism

Justin CW Song, Nanyang Technological University Singapore

In recent years, there has been a large effort exploring how oscillating electric fields, e.g. produced by lasers, can be used to dynamically alter the properties of materials for "on demand" behaviour. For example, shining circularly polarized light on graphene can induce an anomalous Hall effect in the absence of an applied magnetic field. For significant changes to a material's bandstructure and its resulting properties, however, large electric field amplitudes are required.

Recently, experiments in nanoscale plasmonic systems, such as in graphene heterostructures, have shown that intense oscillating electric fields can be readily excited. The intense oscillating electric fields originate from the collective plasmonic charge oscillations found in metals. The detailed behavior of plasmons can also depend on the material's bandstructure. For example, in anomalous Hall metals that possess a finite Bloch band Berry flux, plasmons can acquire a chirality. Since the plasmons' behavior depend on the material's properties, we wondered if these intense plasmonic internal fields could induce a feedback enabling the plasmon to take on a "separate life" decoupled from the material's original ground state. Indeed, we found that plasmons can exhibit spontaneous symmetry breaking, yielding magnetism in non-magnetic metallic disks when irradiated by a linearly polarized driving field [1].

To illustrate this, we theoretically analyzed a nanoscale graphene disk under linearly polarized irradiation. When the intensity is low, the plasmons oscillate along the same direction as the light polarization. However, above a critical intensity, we found the plasmons spontaneously choose to rotate, acquiring a handedness that was not originally present in the metallic disk nor the irradiating light: a type of plasmonic magnetism. In fact, the rotation of the plasmons spontaneously breaks the mirror symmetry of the graphene disk under linearly polarized irradiation. We found that this chiral symmetry breaking arises from Berryogenesis: the generation of spontaneous generation of a self-induced Berry flux in the electronic system. In the graphene disks, Berryogenesis supports and is sustained by the chiral circulating plasmonic motion. Interestingly, the incident powers required to achieve Berryogenesis are modest and can be realised in a variety of multiband metals, such as readily available graphene devices. The plasmonic circulation also produces a small (spontaneously generated) magnetic fields [1].



Berryogenesis: Spontaneous generation of Bloch band Berry flux (left) which supports and is self-sustained by a circulating plasmonic motion in a metallic disk (right)

The non-equilibrium spontaneous symmetry breaking is unusual and demonstrates how collective modes can take on a life-of-their-own exhibiting their own phases. Strikingly, the plasmonic magnetism is distinct from conventional ferromagnetism. Ferromagnetism typically arises from spinful exchange physics when the spins in a material spontaneously align with each other. Instead, plasmonic magnetism arises from a bistability induced by the circulating motion of effectively spinless plasmons. Looking forward, the work suggests new prospects for achieving completely new types of non-equilibrium phases by exploiting the dynamical motion of collective modes.

References:
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The interaction of energetic particles and MHD turbulence in astrophysical environments

Siyao Xu (2019 - C4 YSP winner), University of Wisconsin-Madison, USA

Due to the ubiquity of turbulence and magnetic fields in the universe and their interactions with energetic particles, the progress made in understanding magnetohydrodynamic (MHD) turbulence is crucial for studies in astroparticle physics. Dr. Siyao Xu's research on fundamental theories of MHD turbulence and astroparticle physics not only brings new theoretical advancements, but also significantly broadens the scope of their astrophysical applications.

Turbulent reconnection and turbulent dynamo are basic ingredients of the dynamics of MHD turbulence. Energetic particles with the second adiabatic invariant undergo cycles of acceleration and deceleration in turbulent reconnection and dynamo regions, resulting in a globally efficient stochastic acceleration. This adiabatic stochastic acceleration (ASA) leads to a hard electron energy spectrum over a broad energy range irrespective of the shape of injected electron energy distribution (see Figure 1). The ASA is the dominant acceleration mechanism when the non-adiabatic resonant scattering of particles by anisotropic MHD turbulence is inefficient, especially in a strongly magnetized medium. The introduction of the above new acceleration mechanism to the context of gamma-ray bursts (GRBs) explains the characteristic synchrotron spectrum of the prompt emission of GRBs [1,2], which has been a long-standing puzzle in theoretical interpretation of GRB observations. The application of the ASA to the electron acceleration in pulsar wind nebulae also successfully explains

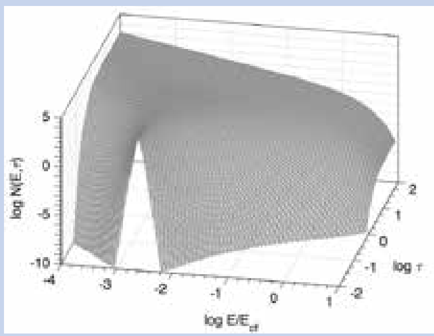


Figure 1. Temporal evolution of electron energy spectrum from an initial delta-function distribution to the hard spectrum under the effect of the ASA [1].

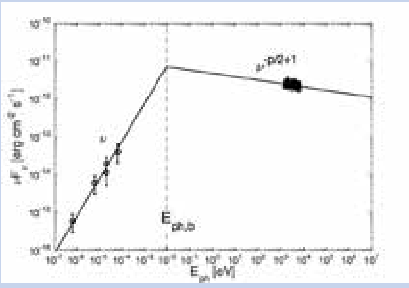


Figure 2. The analytically derived synchrotron spectrum of the Mouse nebula based on the ASA (solid line) compared to the observational data (symbols) [3]

the broadband synchrotron spectra of the radio- and X-ray bright pulsar wind nebulae [3] (see Figure 2). The ASA can be generally applied to diverse high-energy astrophysical systems.

In addition to her work on the ASA, she has also studied the effects of magnetic perturbations and nonlinear decorrelation of turbulent magnetic fields in broadening the transit time damping resonance of both cosmic rays (CRs) and low-energy charge grains [4]. The turbulence-broadened resonance enables the scattering of particles beyond the energy threshold of conventional linear resonance and is important for a realistic estimate of the mean free paths and pitch-angle diffusion coefficients of CRs in the interstellar and intracluster medium. This theory has a general applicability to the scattering of particles by fast and slow modes of MHD turbulence for a wide range of particle energies and in different plasma conditions.

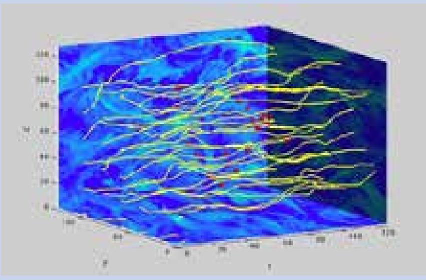


Figure 3. Simulated CR (red dots) propagation in turbulent magnetic fields (yellow lines). From [6].

In partially-ionized interstellar phases, the effect of ion-neutral collisional damping of Alfven slow, and fast modes of MHD turbulence on CR propagation is stressed in detail [5]. Due to severe damping of the fast modes, scattering of CRs by fast modes in partially ionized interstellar phases over a broad range of CR energies is significantly suppressed. Moreover, several new regimes of CR diffusion arising in MHD turbulence, including the perpendicular diffusion and super-diffusion on length scales smaller than the driving scale of turbulence, have been numerically studied by Xu [6] as shown in Figure 3, which radically changes the accepted paradigm of CR propagation.

[1] Xu S. & Zhang B. Adiabatic non-resonant acceleration in magnetic turbulence and hard spectrum of gamma-ray bursts, 2017, ApJL, 846, 28

[2] Xu S., Yang Y. & Zhang B. On the synchrotron spectrum of GRB prompt emission, 2018, ApJ, 853, 43

[3] Xu S., Klingler N., Kargaltsev, O. & Zhang B. On the broad-band synchrotron spectra of pulsar wind nebulae, ApJ, 2019, 872, 10

[4] Xu S. and Lazarian A. Resonance-broadened Transit Time Damping of Particles in MHD Turbulence, 2018, ApJ, 868, 36

[5] Xu S., Yan H. & Lazarian A. Damping of magnetohydrodynamic turbulence in partially ionized plasma: implications for cosmic ray propagation, 2016, ApJ, 826, 166

[6] Xu S. & Yan H. Cosmic-ray parallel and perpendicular transport in turbulent magnetic fields, 2013, ApJ, 779, 140

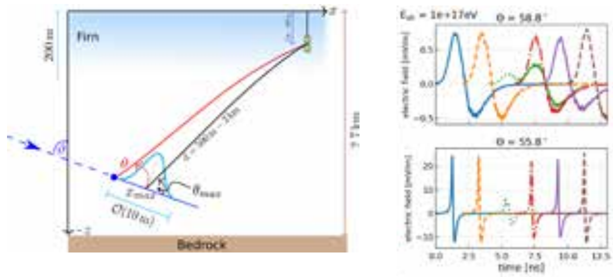
Radio detection of ultra-high energy cosmic rays

Anna Nelles (2019 - C4 YSP winner), DESY Zeuthen and F.A. University Erlangen, Germany

Ultra-high energy cosmic rays have been puzzling the scientific community for a long time. We know that they are accelerated to energies several orders of magnitude higher than what can be achieved on Earth, but it is still unclear where they actually originate. Due to their charge, these particles are deflected in magnetic fields and undergo interactions during their travel from the astronomical sources to Earth, further complicating their study.

It has been argued that neutrinos are linked to the sites of cosmic ray acceleration as the processes accelerating charged nuclei should also produce neutrinos. The IceCube detector has instrumented one cubic-kilometer of ice with optical sensors, which has already given us a glimpse of the astrophysical neutrinos by discovering a handful of them. During the present era of real-time astronomy, where coincidences between particles, gravitational waves and electromagnetic emissions are considered to be a unique tool for the study of Universe, one would like to detect many more neutrinos at higher energies. As the flux of neutrinos falls rapidly with energy, detectors that are much larger than a cubic-kilometer are needed.

This is where radio detection can play an important role. The products of neutrino interactions not only include Cherenkov light in ice, but also radio waves. With an attenuation length of hundreds of meters, radio detectors can be instrumented with sparser spacing than the optical ones, allowing a much larger volume to be covered with the same number of sensors. The radio signal is produced by a coherent effect caused by the charge accumulation in the shower front, leading to a changing and moving dipole that causes radiation measurable in the MHz to GHz regime. Even though Askaryan postulated this effect in



A typical geometry of a neutrino interaction and its radio detection (left). The blue dash line indicates the incoming neutrino.

Typical radio signals from a neutrino shower of 100 PeV (right). The different signals correspond to different viewing angles (top, bottom) and extreme cases of shower-to-shower fluctuations (color). The bottom figure shows the signals very close to the Cherenkov angle. Modified from Glaser, Garcia-Fernandez, Nelles et al. (2019) (https://arxiv.org/abs/1906.01670)
ApJ, 779, 140

the 1960s, the community debated on the usability of this signal. It has a detection threshold above a PeV for cosmic ray showers where it exceeds the background noise the emission could not be studied from neutrinos, yet. That said, we know now that the Askaryan effect of charge accumulation in the shower front is only of secondary importance in air showers. Here, the charge separation in the geomagnetic field is the dominant cause of the emission.

The key to measuring the resulting nanosecond-scale pulses is a fast and broadband receiver that can be run in a radio-quiet environment. Technological developments have reached the necessary sensitivity in the early 2000s, along with the arrival of digital radio telescopes. Since then, many experiments starting with LOPES, CODALEMA as pathfinders moving to AERA at the Pierre Auger Observatory, Tunka-Rex, and LOFAR, have measured the radio emission of air showers and helped us understand its characteristics. Radio detection has proven to be precise in reconstructing energy and particle composition, as well as being robust against external effects, improving on the duty-cycle of optical air shower measurements. Still, using air showers themselves can only reveal their sources to the limit of arrival directions being smeared in magnetic fields; so turning to neutrinos is a complementary approach.

Combining the successes and experiences of air shower detection with pioneering work of pilot-arrays for neutrinos in the polar regions such as RICE, ANITA, ARA, and ARIANNA provides a solid foundation for a large future array for the radio detection of neutrinos. It may measure the continuation of the astrophysical flux to higher energies and target cosmogenic neutrinos that are produced when cosmic rays interact during propagation with CMB or other photon backgrounds. Covering the energy range from at least 10 PeV to 10 EeV, such an array will complement optical methods in their hunt for cosmic neutrinos and open new possibilities for real-time astronomy.

Details of flow–turbulence coupling in magnetic confinement for fusion

Istvan Cziegler (2019 - C16 YSP winner), York Plasma Institute, UK

The most striking develop¬ment in the area of magnetic confinement fusion has been the discovery of regimes of global confinement. Turbulence has long been known to dominate transport (over Coulomb collisions) across the confining magnetic field in toroidal devices. Taken together, these two facts reveal the existence of distinct states of plasma turbulence. Phase transitions between these are inherently interesting for the understanding of turbulence, but also carry a crucial significance for making fusion viable. The most studied of such transitions is the low to high confine¬ment (L-H) transition. High confinement (the "H mode") is characterized by large temperature and density gradients at the plasma surface – termed the "pedestal" – providing increased core pressure and hence fusion power compared to low-confinement scenarios.

Since transitions of this sort represent an instance of highly non-equilibrium thermodynamics, it perhaps comes as no surprise that access to H modes has a thresh¬old amount of external heating power PLH, above which the transition occurs. The parametric dependences of PLH are vital for the design of future plasmas, with several of them still unaccounted for in theory or even the scaling laws that are widely used.

Studying the complex system of fluctuations of plasma density, temperature and electric potential, and of largescale flows was performed to elucidate – on a microphysics scale (the order or particle Larmor radii) – the trigger mechanism of transitions. For this purpose, only "spontaneous", i.e. purely heat-flux driven phase transitions were measured. Two-dimensional, ultra-high speed (2MHz) imaging of the pedestal region of the Alcator C-Mod tokamak at MIT enabled the development of sophisticated analysis methods for turbulence with a fine temporal resolution. Combining the results with measurements of plasma edge density and temperature with timing precision of less than 10μs afforded the first insight into the sequence of events at the transition. Measurements showed that the sequence started by a transient peak in a Reynolds-stress-mediated energy transfer into radially localized, large-scale structures called zonal flows (analogous to their planetary counterpart). The study also included the first quantitative characterization of both the nonlinear zonal flow drive and turbulent kinetic energy, finding that the spectral transfer into zonal flows can indeed be sufficient to account for turbulence suppression. One of the largest effects on the threshold is due to the up-down asymmetry of magnetic configurations with a single null point of the magnetic field in the poloidal direction (short way around the torus). The threshold in a mag¬neto¬hydrodynamic equilibrium in which the ion grad-B drift points toward the poloidal null (the X-point) is approximately half as high as in the opposite case. Since the discovery of the H mode, some inter¬mediate regimes have also been found, especially in recent years. One of the remarkable features in the asymmetry of magnetic geometry is the difference between the intermediate regimes to which each configuration leads, with limit-cycle oscillation typical of H-mode-favouring geometries, and the "I mode" of the opposite. The I mode is an intriguing alternative confinement regime combining high heat confine¬ment with strong mass transport. Beyond being counter intuitive from a thermodynamic standpoint, these characteristics make the regime particularly relevant for operation of fusion reactors. Good heat confinement allows high pressure and thus, high fusion rate in the plasma core, while the rapid mass transport prevents the accumulation of impurities. Building on the results regarding zonal flows, recent studies traced the source of the up-down asym¬metry back to the interactions between turbulence and large-scale flows, showing a significantly higher level of transfer in H-mode favouring geometries and a faster scaling against heat flux. Results from I mode point to a competition between zonal flow branches (of quasi-zero- and finite-frequency) for turbulent energy. Alongside that, these experiments show new evidence that in plasmas where zonal flow phenomena are important, the intermediate-to-suppressed transitions are still dominated by zonal flows. The availability of nonlinear drive for finite frequency modes against net heat flux corresponds very well to empirical scaling laws for accessing the intermediate states. Thus, large-scale flow–turbulence interactions are shown to play a major role in determining the quality of global confinement.

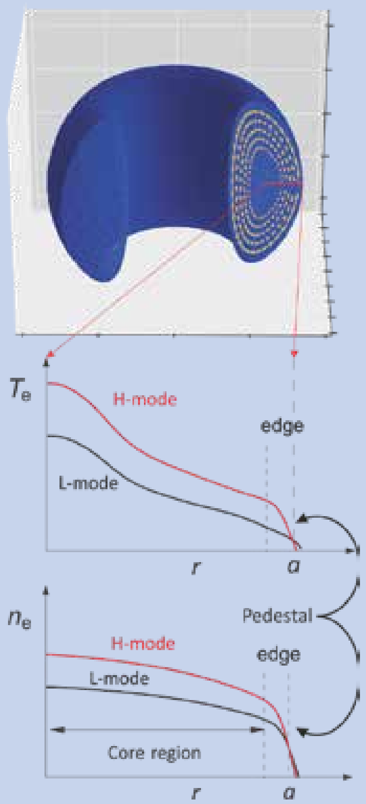


Figure 1. Zonal flows in a toroidal plasma are localized to a small region in minor radius. Below: schematic electron temperature and density profiles in low- and high-confinement plasmas. The I-mode regime operates with H-mode temperature and L-mode density (and impurity) profiles.

Insights into the origins of the hot Neptunes desert

Vincent Bourrier (2019 - C19 YSP winner), University of Geneva

More than 20 years ago, astronomers detected super-Earths orbiting a neutron star, and a Jupiter-mass planet revolving in a few days around a Sun-like star. These first detections of worlds around other stars than the Sun, recently rewarded by a Nobel prize, hinted at the wild diversity that would come to characterize exoplanets. As of October 2019, more than 4000 exoplanets have been found, nearly half of which orbit extremely closely to their star (orbital period < 10 days). These so-called close-in planets range from small rocky objects to gas giants larger than Jupiter, putting in perspective the formation of the Solar system. How do close-in planets form and evolve? What is the composition and structure of their atmosphere? Answering these fundamental questions and addressing the diversity of planetary systems is tied to the study of the most striking feature in the exoplanet population: the lack of Neptune-size planets on very short orbits (e.g. A&A, 461, 1185 (2007); A&A 589, A75 (2016)). This "desert" of hot Neptunes (Fig. 1) is not an observational bias, as close-in planets are the most easily detected (via transit and radial velocimetry).

These planets may have lost their atmosphere via an efficient mechanism called evaporation, but our understanding of atmospheric escape in such high irradiation conditions remained limited by the lack of direct observation. For years, only hot Jupiters were observed losing their atmosphere (e.g. Nat. 422, 143 (2003); A&A 543, 4 (2012)), at tremendous rates of thousands of tons per second that nonetheless do not affect the evolution of these massive planets. It was also proposed that orbital migrating the way by which a planet moves closer to its star after its formation played a role in shaping the desert (e.g. ApJ 820, L8 (2019)). The orbital architecture of an exoplanet (the shape and orientation of its orbit around its star) is used to trace back in time in its orbital history, but most measurements have been obtained for Jupiter-size planets around solar-like stars, limiting our ability to assess the impact of migration on a large variety of systems. Furthermore, the interplay between atmospheric evolution and orbital migration, in particular on billion-year timescales, remains to be fully explored (MNRAS, 479, 5012 (2018)).

The Hubble Space Telescope allowed us to obtain the first detections of atmospheric escape from two Neptune-size exoplanets (Nat., 522, 459 (2015); A&A, 620, A147 (2018)). By monitoring their transits at ultraviolet wavelengths, we measured unprecedented dimmings of half of the stellar light caused by neutral hydrogen escaping from the planetary atmospheres. These dimmings are a hundred times larger than those caused by the planets themselves at visible wavelengths (Fig. 1).

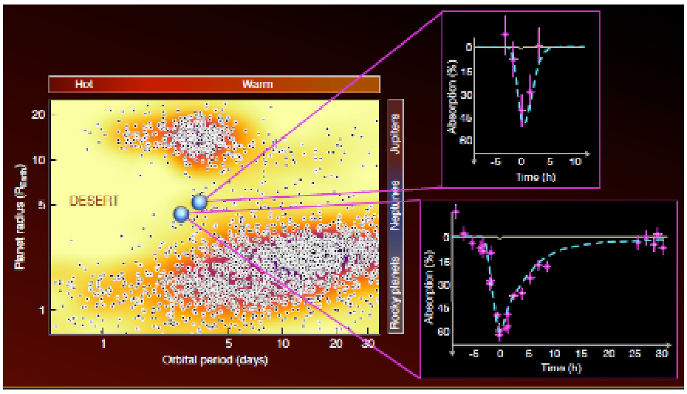


Fig. 1. : Radius and orbital period distribution of known planets (from the exoplanets.eu database and Nasa Exoplanet Archive). Background is colored with planet occurence, from low (yellow) to high (black), highlighting the desert of hot Neptunes. The upper and right colored bars separate close-in planets by their temperature and size ranges. The right plots show the ultraviolet light curves (purple points) of the two warm Neptunes around which we detected giant tails of escaping hydrogen. The blue dash lines correspond to the best-fit model for these tails, obtained with our 3D numerical model of escaping atmosphere. For comparison, the transits of the planets at optical wavelengths, probing their stable lower atmospheric layers, are shown in grey.

Our interpretation of the data with 3D numerical simulations of escaping atmospheres revealed that these warm Neptunes, located at the border of the desert, are surrounded by giant clouds of gas larger than the star and trailing the planets like cometary tails (A&A 591, A121 (2016)). These results revealed that Neptune-size planets, even mildly irradiated by their star, can still evaporate, strengthening the role of atmospheric escape in the formation of the desert. One of the observed planets could already have lost up to half of its mass, and might keep eroding until it turns into a mini-Neptune. The other warm Neptune is much older, and we brought to light a possible interplay between its atmospheric and orbital evolution by measuring its orbital architecture - one of the few such measurements for a Neptune-size planet, and the first in a M dwarf system (Nat., 553, 477 (2018)). This planet is on an eccentric orbit that goes above the poles of its star. This peculiar architecture can naturally be explained if the planet was brought close to its star several billion years after its formation by gravitational interactions with a companion on a wider orbit (Fig. 2). This late migration, resulting in an increased heating of the planetary atmosphere, which could have triggered its evaporation in recent times. Our work opens new perspectives for the coupling between orbital evolution and atmospheric escape, which could reshape the borders of the desert by impacting close-in exoplanets over their entire lifetime, and progressively.

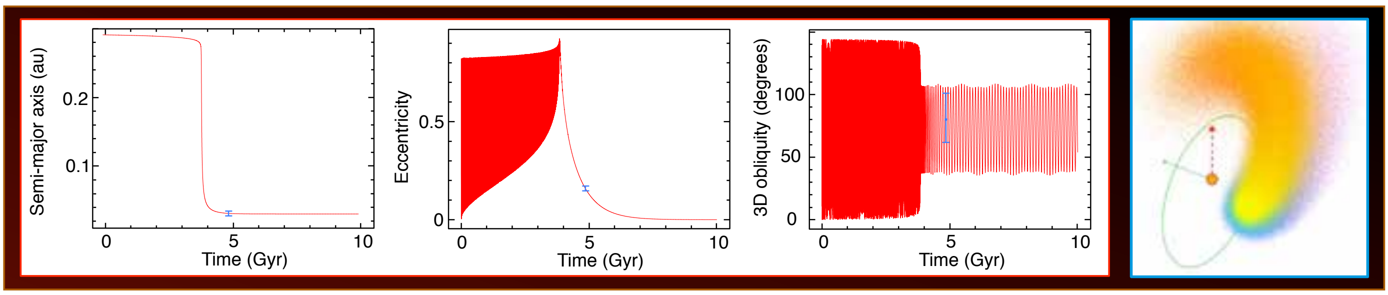


Fig. 2 : Left: Theoretical orbital evolution for the warm Neptune we found on a misaligned orbit around its star (the misalignment is measured via the obliquity, which is the angle between the normal to the orbital plane and the spin of the star). The simulation (red) was constrained by measurements of the present-day orbital properties (blue points). In this scenario, the planet migrated close to its star several billion years after its formation. Right: best-fit model for the giant tail of hydrogen escaping from the planet (colors indicate different gas structures shaped by interactions with the star). The system is to scale, with the planet visible as a black dot along its misaligned eccentric orbit (green curve). The green and red arrows centered on the star indicate the normal to the orbital plane and stellar spin axis, respectively.

Development of a four-dimensional image-guided radiotherapy system: Vero

Mitsuhiro Nakamura (2019 – AC4 YSP Winner), Kyoto University, Kyoto, Japan.

We have developed a four-dimensional (4D) image-guided radiotherapy system in cooperation with Mitsubishi Heavy Industry and the Institute of Biomedical Research and Innovation: the Vero (Mitsubishi Heavy Industries, Ltd., Japan, and BrainLAB, Feldkirchen, Germany) [1]. The Vero has several unique components:

(1) a compact C-band 6-MV x-ray head with a gimbal mechanism, mounted on an O-ring gantry. The gimbaled x-ray head can rotate in both the pan (horizontal to the O-ring) and tilt (vertical to the O-ring) directions;

(2) a gantry-mounted orthogonal kV x-ray imaging subsystem, consisting of two sets of x-ray tubes and flat-panel detectors; and

(3) an extended version of the ExacTRAC system for the real-time tumor-tracking (RTTT) function (BrainLAB) with an infrared (IR) camera mounted on the ceiling of the treatment room.

Two new treatment modalities have been initiated with these unique components; IR marker-based indirect RTTT approach (IR Tracking) and Dynamic WaveArc therapy (DWA). I have played a central role in these medical physics-related developments.

Here, I introduced IR Tracking in some detail.
The Vero is capable of IR Tracking. An advantage of IR Tracking is a substantial reduction in imaging dose, compared with that of x-ray tracking. During beam delivery, the Vero monitors the displacement of the IR markers on the abdominal wall continuously via the IR camera of the ExacTRAC system, and then tracks target motion using a correlation model (4D model) between the target and IR marker motions.

Prior to the clinical application of IR Tracking, we have verified the dosimetric and positional accuracy of IR Tracking and we have confirmed its feasibility in clinical practice. IR Tracking reduced substantially motion-induced marginal blurring in the dose distribution. Additionally, positional tracking errors correlate strongly with 4D-modeling errors, arising from miscorrelations between target and IR marker motions. Thus, the accuracy of the 4D model must be verified before treatment, and margins are required to compensate for 4D-modeling errors [2].

After the above-mentioned commissioning tests, we have applied IR Tracking clinically to lung cancer patients since September 2011. We have analyzed intrafractional tracking accuracy for ten lung cancer patients who underwent IR Tracking in an Institutional Review Board-approved trial [3]. We demonstrated that IR Tracking reduced the impact of respiratory motion substantially.

Figure 1. A photo of when we treated first lung cancer patient with RTTT.

The prediction error is the primary cause of the intrafractional tracking error. Note that the mechanical error is negligible. To compensate for the baseline drift of the positions of the IR markers and the 3D positions of the tumor during a treatment session, we recommend checking the target and IR marker positions constantly and updating the 4D model several times during a treatment session [4]. Figure 1 shows a photo of how we treated first lung cancer patient with RTTT. We have since successfully extended IR Tracking to liver cancer in 2013 [5] and to pancreatic cancer in 2015 [6].

[1] Kamino Y., et al. Development of a four-dimensional image-guided radiotherapy system with a gimbaled x-ray head. Int J Radiat Oncol Biol Phys. 2006;66:271–8.

[2] Mukumoto N., et al. Accuracy verification of infrared marker-based dynamic tumor-tracking irradiation using the gimbaled x-ray head of the Vero4DRT (MHI-TM2000). Med Phys. 2013;40:041706.

[3] Mukumoto N., et al. Intrafractional tracking accuracy in infrared marker-based hybrid dynamic tumour-tracking irradiation with a gimballed linac. Radiother Oncol. 2014;111:301–5.

[4] Akimoto M., et al. Predictive uncertainty in infrared marker-based dynamic tumor tracking with Vero4DRT. Med Phys. 2013;40:091705.

[5] Iizuka Y., et al. Dynamic tumor-tracking radiotherapy with real-time monitoring for liver tumors using a gimbal mounted linac. Radiother Oncol. 2015;117:496–500.

[6] Nakamura A., et al. Evaluation of Dynamic Tumor-tracking Intensity-modulated Radiotherapy for Locally Advanced Pancreatic Cancer. Sci Rep. 2018;8:17096.

XXXIV International Conference on Phenomena in Ionized Gases

Koichi Sasaki, Division of Quantum Science and Engineering, Hokkaido University

The joint conference of the XXXIV International Conference on Phenomena in Ionized Gases (XXXIV ICPIG) and 10th International Conference on Reactive Plasmas (ICRP-10) was held in Sapporo, Japan from 14th to 19th July, 2019. The conference program was comprised of 3 award lectures, 6 invited general lectures, 48 invited topical lectures, 8 invited talks in arranged sessions, 92 contributed oral presentations, and 358 contributed poster presentations. In addition, 42 invited talks were given at five satellite workshops. Of 515 attendees, 54% came from 37 overseas countries. The number of student participants was 165. Since 1953, ICPIG has been a discussion forum for nearly all fields of plasma science. The XXXIV edition of ICPIG was a joint conference with ICRP, organized with the scope covering the fundamentals and applications of reactive plasmas. The scope of the joint conference covered both modelling and experiments, from the fundamentals of plasma elementary processes, basic data and discharge physics, to applications with the plasma processing of surfaces and particles, high pressure and thermal plasma processing, radiation sources, plasma medicine, atmospheric and stellar plasmas, environmental protection and pollution control, plasma aerodynamics, and non-thermal plasmas in fusion devices.

The conference was opened by an exciting talk by Alexander Fridman, the winner of the ICRP Reactive Plasma Award. He summarized the progress of atmospheric-pressure nonthermal reactive plasmas and their applications to gas conversion, medical treatment, and agriculture. The winner of ICPIG von Engel & Franklin Prize was Mark Kushner. He gave an elegant talk on the contribution of plasma modelling and simulation to the progress of microelectronics fabrication technologies. Istvan Cziegler was awarded the 2019 IUPAP Young Scientist Prize in Plasma Physics for his exceptional contribution to flow-turbulence coupling in magnetic confinement for fusion. His award talk was concise and understandable for physicists and chemists in low-temperature reactive plasmas.

The scientific levels of the six invited general lectures were remarkably high. Stefan Matejcik presented electron induced fluorescence technique to study electron excitation and dissociative excitation processes of plasma relevant molecules such as H2, D2, H2O, CH4, and C2H2. Luis Alves reviewed the formulation of global models for plasma simulation, presented several well-known numerical tools available for plasma chemistry, and proposed some topics where the community could concentrate additional efforts. Francoise Massines displayed her experimental work on multi-frequency atmospheric pressure plasmas for surface treatment. The plasma controllability was improved elegantly by the use of dual frequencies for discharges. Jan Benedikt reported sophisticated diagnostics of atmospheric-pressure plasmas using quadrupole mass spectrometry. Richard van de Sanden showed the performance of his microwave plasma for conversion of CO2 into CO and O2. He also mentioned nonequilibrium vibrational kinetics in CO2 in plasmas. Hisataka Hayashi summarized the state-of-the-art plasma dry etching technology in fabrication of NAND flash memories with 3D structures.

In addition to the award lectures and invited general lectures, we found many innovative researches in invited topical lectures, contributed oral presentations, and contributed poster presentations. An example is the new trend of plasma material processing such as plasma-assisted inkjet printing and etching profile optimization using machine leaning. Novel applications such as plasma metamaterials were impressive topics. A recent trend of low-temperature plasma science and technology is atmospheric-pressure plasmas. Numerous studies on precise diagnostics and applications of atmospheric-pressure plasmas were displayed at the conference. Furthermore, we found progress in interaction between atmospheric-pressure plasmas and liquids.

The joint conference of ICPIG and ICRP was supported by IUPAP. The fund from IUPAP allowed the organizers to provide the travel support for student participants and participants from developing countries: this travel support was greatly appreciated by these categories of participants. The successful completion of the conference was primarily due to the continued support of IUPAP.

YOUNG SCIENTIST PRIZES 2018

Commission on Astrophysics (C19)

Elisabeth Krause

"For pioneering contributions to the extraction of cosmological insights from large galaxy surveys, including modeling key observables, covariance matrix estimation, and the development of cosmological analysis tools, which have ushered in a new era of multi-probe cosmology and set a new standard for forthcoming experiments."

Elisabeth Krause is an assistant professor in the department of physics and the department of astronomy at the University of Arizona. She received her Diploma in physics from the University of Bonn in 2007, and her PhD in astrophysics from Caltech in 2012. After postdoc positions at the University of Pennsylvania, Stanford, and JPL/Caltech, she joined the faculty at the University of Arizona in 2018. Dr. Krause's research combines theoretical cosmology and data analysis, with focus on interpreting measurements from large galaxy surveys. She pioneered joint cosmological analysis techniques that combine highly-correlated tracers of the universe's large scale structure and has held several leadership positions in cosmology survey collaborations. She currently co-chairs the science committee of the Dark Energy Survey. Her honors and awards include a Department of Energy Early Career Award in 2019, and the 2020 Maria Goeppert-Mayer Award of the American Physical Society.

YOUNG SCIENTIST PRIZES 2019

Commission on Astrophysics (C19)

Vincent Bourrier

"For his outstanding theoretical and observational work on star-planet interaction and atmospheric escape, which has led to the first live insights into the erosion of atmospheres of low-mass exoplanets, the coupling between the atmospheric and orbital evolution, and innovative techniques to exploit exoplanet observations to bring new insights on stellar physics."

Vincent Bourrier was born in 1987 in Nice, France. His first experience of research was as a graduate assistant in 2009-2010, when he helped design an optical benchtop simulator for the LISA mission (at the Laboratoire AstroParticule et Cosmologie in Paris, France) and performed mesoscale simulations of the Martian atmosphere to prepare the ExoMars landing (at the Laboratoire de Météorologie dynamique in Paris, France, and at the Open University in Milton Keynes, UK). In 2011, he obtained a Masters degree in Astrophysics, Space Sciences & Planetology, and an engineering degree in Space Sciences & Techniques from Paul Sabatier University and the Institut Supérieur de l'Aéronautique et de l'Espace (SUPAERO), France. His doctoral research, carried out at the Institut d'Astrophysique de Paris (CNRS, Paris VI University, France) from 2011-2014, focused on two topical aspects in the exoplanet field. On the one hand, he studied signatures of atmospheric escape in spectroscopic observations obtained with the Hubble Space Telescope, and developed a numerical model of exoplanet upper atmospheres to understand how this process depends on interactions between planets and their host stars. On the other hand, he pushed forward the study of orbital architectures (the shape and orientation of a planet's orbit around its star), as a way to determine how exoplanets can come to orbit extremely close to their star.

Dr. Bourrier is now working as a Research and Teaching Fellow in the Department of Astronomy of the University of Geneva, where he combines his two research interests to understand the interplay between the atmospheric and orbital evolution of exoplanets. He contributed to the detection of gigantic exospheres around Neptunes-size planets close to their star, measuring their erosion rate and demonstrating the central role of atmospheric escape in the demographics of exoplanets. His work pioneered the measurement of orbital architectures around cool stars, revealing that one of these eroding Neptunes orbit over the poles of its M dwarf star. This peculiar architecture suggests that the planet was brought close to its star long after its formation via interactions with an outer companion, the increased stellar irradiation triggering its atmospheric escape. These results open new areas of research to determine the processes that sculpt the population of exoplanets close to their stars.

International Commission on Medical Physics (IOMP) (AC4)

Mitsuhiro Nakamura

"For his outstanding contribution to the performance evaluation of a newly developed three-dimensional model-based global-to-local registration in prostate cancer."

Mitsuhiro Nakamura is an associate professor at Kyoto University, Kyoto, Japan. Dr. Nakamura's early work during the four years of his doctoral course, completed at Kyoto University in 2010, focused on four-dimensional imaging and delivery in radiation therapy for moving tumors. He investigated physical and clinical aspects of four-dimensional computed-tomography. During this work, he developed a visual feedback system, and clinically applied this system to intensity-modulated radiotherapy in combination with breath holding at end-exhalation. This technique was used in a phase I dose-escalation study that showed a significant improvement in the median and 2-year overall survival of patients with locally advanced pancreatic cancer. Thus, this work has made a substantial contribution to improving patient outcomes.

Dr. Nakamura considers that his most meaningful contribution to date has been in the development and clinical application of the Vero system, a radiotherapy unit with an integrated real-time tumor tracking system developed by Mitsubishi Heavy Industries, Ltd., in collaboration with Kyoto University.

Vero is a gimbaled–head radiotherapy device whose unique structure with multi-image-guided radiation therapy functions has initiated two new treatment modalities, such as real-time tumor tracking radiotherapy and Dynamic WaveArc therapy. Dr. Nakamura has played a central role in the medical physics-related development of these advances.
Among other work, Dr. Nakamura is a member of the Japanese Clinical Oncology Group (JCOG) Radiotherapy Committee, a role in which he recently contributed to the development of an on-site dosimetry audit system to support quality assurance in clinical outcomes of JCOG clinical trials.

Internationally, Dr. Nakamura's academic achievements are attested by his participation in the Global Quality Assurance of Radiation Therapy Clinical Trials Harmonisation Group and a number of other international research collaborations, including projects with Prof. Keall et al and Prof. Verellen et al.
To date, Dr. Nakamura has authored 9 book chapters. He has co-authored 101 papers in the peer-reviewed English literature, 15 as first author and 45 as corresponding author.

UPCOMING SUPPORTED CONFERENCES 2020

16 – 21 March 2020 Carthage, Tunisia
Advanced African school & workshop on Multifunctional Ferroic Materials (ASWMFM 2020)

10 – 15 May 2020 Wuhan, China
The International Conference on Precision Physics of Simple Atomic Systems (PSAS2020)

25 – 30 May 2020 Paris, France
Large Hadron Collider Physics Conference (LHCP 2020)

4 – 8 June 2020 Ooty, TN, India
21st International Symposium on Very High Energy Cosmic Ray Interactions (ISVHECRI 2020)

15 – 20 June 2020 Avignon, France
Advances in Radioactive Isotope Science (ARIS 2020)

21 – 27 June 2020 Chicago, IL, USA
XXIX International Conference on Neutrino Physics and Astrophysics (Neutrino 2020)

28 June – 3 July 2020 Gyeongju, Korea
International Congress on Plasma Physics (ICPP 2020)

5 – 25 July 2020 Marrakesh, Morroco
The 6th Biennial African School of Fundamental Physics and Applications (ASP2020)

6 – 17 July 2020 Kigali, Rwanda
6th African School on Electronic Structure Methods and Applications (ASESMA-2020)

23 – 26 July 2020 Kuala Lumpur, Malaysia
18th Asian Oceanian Congress of Radiology 2020 (AOCR 2020)

13 – 17 July 2020 St. Petersburg, Russia
16th International Conference on Integral Methods in Science and Engineering (IMSE 2020)

19 – 24 July 2020 Taipei, Taiwan
15th International Conference on X-ray Microscopy (XRM2020)

19 – 25 July 2020 Toronto, Canada
The 27th International Conference on Atomic Physics (ICAP 2020)

20 – 24 July 2020 Hanoi, Vietnam
3rd World Conference on Physics Education 2020: Innovating physics education: From teacher education to school practices. (WCPE 2020)

30 July – 5 August 2020 Prague, The Czech Republic
International Conference on High Energy Physics (ICHEP 2020)

2 – 6 August 2020 Coventry, UK
XXXII IUPAP Conference on Computational Physics (CCP 2020)

9 – 14 August 2020 Sydney, Australia
International Conference on the Physics of Semiconductors 2020 (ICPS 2020)

15 – 22 August 2020 Hokkaido, Japan
The 29th International Conference on Low Temperature Physics (LT29)

23 – 23 August 2020 Otaru CIty, Japan
International Conference on Ultralow Temperature Physics 2020 (ULT2020)

24 – 25 August 2020 Denver, CO, USA
2020 Conference on Precision Electromagnetic Measurements (CPEM 2020)

6 – 10 September 2020 Fuerth, Germany
11th CIRP Conference on Photonic Technologie (LANE 2020)

7 – 11 September 2020 Matsue, Japan
20th International Conference on the Physics of Highly Charged Ions (ICPHCI 2020)

7 – 11 September 2020 Palermo, Italy
International Conference on Trends in Magnetism (ICTM 2020)

15 – 17 September 2020 Valencia, Spain
9th Very Large Volume neutrino Telescopes (VLVnT 2020)

31 August – 4 September 2020 Dresden, Germany
The 25th Congress of the International Commission for Optics (ICO-25) & the 16th Conference of International Society on Optics Within Life Sciences (OWLS-16)

16 – 20 November 2020 Kigali, Rwanda
The Third African Synchrotron Light Source Conference : Towards a Brighter Future (AfLS3)

UPCOMING ENDORSED CONFERENCES 2020

14 – 19 February 2020 Dubna, Russia
XXV International Baldin Seminar on High Energy Physics Problems (ISHEPP 2020)

22 – 27 March 2020 Sào Paulo, Brazil
XV Hadron Physics 2020 (HADRON)

31 March – 8 April 2020 Cape Town, South Africa
Crystallographic School in South Africa: Data Collection to Structure Refinement and Beyond (CCP4 2020)

24 – 29 May 2020 Whistler BC Canada
International Conference on Technology and Instrumentation in Particle Physics (TIPP 2020)

10 – 15 May 2020 Caen, France
International Particle Accelerator Conference 20 (IPAC 20)

13 – 17 July 2020 Nijmegen, The Netherlands
European Cosmic Ray Symposium (ECRS 2020)

15 – 18 July 2020 Paris, France
Europhysics Sectional Conference on Atomic and Molecular Physics of Ionized Gases (ESCAMPIG 2020)

8 – 13 September 2020 Chengdu, China
16th Nuclei in Cosmos Conference (NIC 2020)

A great step towards the proclamation of an International Year of Basic Sciences for Development in 2022

Michel Spiro, President of IUPAP

To celebrate the centenary of its creation in 2022 and the centenary of its first General Assembly in Paris in 2023, IUPAP plans to organize big events in Geneva and in Paris. These will be a part of the events organized in the framework of a much wider project, that IUPAP is leading: an International Year of Basic Sciences for Development (IYBSD) in 2022/2023.

In January 2017, the idea of an International Year of Basic Sciences for 2022 was submitted on behalf of IUPAP at the IBSP (International Basic Sciences Programme) of UNESCO, scientific enlarged board meeting, which was unanimously recommended in 2018 and confirmed to be held in 2022. In November 2019, a formal recommendation by the General Conference of UNESCO was achieved, followed by a very positive endorsement by the World Science Forum, held in Budapest.

As we head into 2020, we are focussed on enlarging the circle of Unions and to associate the Academies to the project, to finally seek the approval and proclamation by the UN General Assembly in December 2020. After which, in 2021, the detailed preparation of Regional and International events will begin and culminate in the celebration of the 2022-IYBSD!

More information on IYBSD can be found at: http://iupap.org/about-us/international-year-of-basic-sciences-for-development-iybsd-2022/; https://www.iybsd.org/

OPEN FOR NOMINATION

COMMISSION ON PARTICLES AND FIELDS (C11)
YOUNG SCIENTIST PRIZE 2020
OPEN FOR NOMINATIONS - DUE 1ST FEBRUARY 2020

The nominator should collect materials, including reference letters, and upload them using the site: http://indico.cern.ch/e/c11-ysp-2020

Note: Nominations are tied to a unique nominator e-mail in the system.

All material should be submitted before February 1, 2020 at 12:00pm CET.

For information about the prize, please see:
https://iupap.org/commissions/c11-particles-and-fields/c11-news/