International Union of Pure and Applied Physics

IUPAP Newsletter

SEPTEMBER 2017

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Three years as President of IUPAP

This newsletter will be distributed at the 29th General Assembly of IUPAP, and at the conclusion of that General Assembly, I will complete my almost three years as the President of IUPAP and will pass the Union to Kennedy Reed's leadership. It is therefore appropriate that I take the occasion of my final President's message to reflect on IUPAP as it has changed over the last three years. I will take up three themes: sustainability, visibility and harmony.

Sustainability is one of the themes of the day in the news, and it is of great concern to organisations, including organisations like our Union. A key part of sustainability is to have income sources which one can rely on, and to frame your budget to keep within your income. One of the great achievements of my predecessor as President, Cecilia Jarlskog, was to emphasise that keeping within balanced budgets was vital to the sustainability of the Union. She moved us to a focus on balanced budgets and to achieve that, introduced a severe cut back in our expenditure. Unfortunately, that meant that the amount of money we could spend on assisting the development of physics was severely reduced. She also initiated our move to Singapore. The support of our host, the Nanyang Technological University (NTU) over these last three years has been a major contributor to the brighter future that we now have.

NTU has successfully played host to IUPAP since 2015, and IUPAP has found the support of NTU, and its relocation to Asia to have been valuable for its development. NTU has found that its close connection to IUPAP raises its worldwide profile. We have now concluded an MOU which formally recognises our relationship and guarantees our continuation into the next decade. Since the President of NTU and I (the President of IUPAP) are frequent travellers, we could not arrange to be in Singapore at the same time to have a signing ceremony. We therefore signed and exchanged the executed MOU by mail. We have now finally been able to co-ordinate out schedules to be in Singapore at the same time, and announced and celebrated our continuing relationship at this time. The event took place on the 21st of September 2017.

The key purpose in signing the MOU was to ensure that the current arrangements will continue for at least three more years. Coupling that with more efficient collection of our members dues and the regular increase of the dues in line with global inflation means that we now have a sustainable budget and can spend around 300,000 EUR per year, or about 60% of our income on physicists — such items as conferences, workshops and prizes. Tightening national science budgets worldwide will maintain the pressure on the financial sustainability of IUPAP. We cannot rest on the success of the last three years and must keep working to ensure that IUPAP continues as an organisation well into its second century.

Another aspect of sustainability, related to but different from financial sustainability, is the sustainability of our membership. Countries

From left: Prof Kwek Leong Chuan (Deputy Secretary General, IUPAP), Prof Kennedy Reed (President-Designate, IUPAP), Prof Bruce H McKellar (President, IUPAP), Prof Bertil Andersson (President, NTU), Prof Phua, Kok Khoo (Secretary General, IUPAP), Prof Rudzani Nemutudi (Associate Secretary General) and Prof Phan Anh Tuan (Head, Division of Physics & Applied Physics, SPMS, College of Science, NTU)

which do physics should be members of IUPAP, and IUPAP should have links to physicists in those member countries. But IUPAP also needs the connection with these physicists, because they do most of the work that IUPAP does. I explained in detail in an earlier newsletter how much IUPAP relies on these volunteers to do its work — without them and without the connection to their country which connects them to us, IUPAP would be completely unsustainable.

Visibility of IUPAP among physicists, politicians, funding agencies, universities and research institutions is vital to the future of IUPAP. The traditional means by which IUPAP was visible to the physics community was through the IUPAP supported conferences. Those conferences are still an important means of IUPAP keeping physicists aware of its existence and of what it is doing for them, but that is no longer enough. In 2015, coinciding with our move to Singapore and the appointment of K. K. Phua as Secretary-General, we recommenced the production of IUPAP newsletters. This is the tenth in this series of newsletters, and they are playing a key role in keeping up our visibility. A challenge, in the age of social media, is to establish an IUPAP presence in the social media. Tweeting is not one of my habits, so I have not attempted to gain a Twitter following for IUPAP. That challenge, and the related challenge of establishing a presence on other social media platforms, I pass on to the next leaders. Given the growing importance of China in the world of physics, it would be good if a Weibo presence was created. I suggest that, should IUPAP decide that it needs to develop a social media following, it would need to connect to a different set of volunteers than those it uses at the moment. Do we need to create a new working group to focus on this activity?

Harmony among physicists, and between physicists and other scientists, and between physicists and society is a vital goal for IUPAP. We have begun to make some progress towards harmonious and respectful relationships between the physics community as a whole and its women members. Conferences are now required to have a system in place to ensure harmonious relationships during the conference.

One of the traditional strengths of IUPAP was its role in ensuring that those invited to attend an IUPAP conference are not excluded from that conference because of their nationality. We have recently had to come back to that theme because of the situation in which citizens of some countries were denied entry to the USA, and our recent International Conference on Women in Physics suffered from the denial by the UK of visas for some delegates.

Physics is a very broad discipline, and because of that it has common interests with many other sciences. These common interests lead naturally to co-operation and to competition. In the last three years, partly at the instigation of the International Council of Science (ICSU), we have launched important co-operative activities with many of our fellow Unions. The ICSU project Utilisation of Light Source and Crystallographic Sciences to Facilitate the Enhancement of Knowledge and Improve the Economic and Social Conditions in Targeted Regions of the World, lead by IUPAP and IUCr, and the ICSU project A Global Approach to the Gender Gap in Mathematical and Natural Sciences: How to Measure It, How to Reduce It?, led by the International Mathematical Union and the International Union of Pure and Applied Chemistry, with the strong support and participation of IUPAP have been described in the March Newsletter and will feature in the workshop associated with our General Assembly.

All chemical elements are made in nuclear reactions. Most of the isotopes of those elements around us were made in the early Universe, in stars, in supernovae. We are not yet sure where some were made. But new elements are made in nuclear accelerators, and the science involved in making the recently-named elements 113, 115, 117 and 118 is a co-operation of physicists and chemists, with physicists making the major contribution. The verification of claims for new elements following a procedure set up in the late 1980s and early 1990s by an IUPAC-IUPAP cooperation which was initiated by IUPAP. At that stage the Unions cooperated on the verification, and IUPAC invited those who were identified as the discoverers to propose the names, which they then manipulated to conform to chemical precedents. In time more of the cooperative process was managed by the IUPAC, and my predecessor as President had a difficult time in her negotiations with them. I am pleased to say that we are moving to a truly shared responsibility of the verification process and that a majority of comments on the names of this recent set of elements came from chemists who complained that new elements were not being named after chemists. I look forward to future harmonious relations between these two major Unions.

Looking back over the last three years, I am pleased that I have been able to build on the work of my predecessors and I think I am passing IUPAP on to my successors in a strong position. There will be challenges, but the Union is in a position to overcome them.

35th International Cosmic Ray Conference (ICRC)

The 35th International Cosmic Ray Conference (ICRC) held in Busan (South Korea) from July 12 to 20, 2017 attracted almost 900 participants from 57 countries. It is the main Astroparticle Physics Conference under the auspices of IUPAP and is organized biennially around the world. The scientific topics covered in about 40 plenary and 400 parallel talks and in more than 670 posters included a broad range of areas ranging from new results from solar and heliospheric physics to cosmic rays over its full range of energies, GeV and TeV gamma astronomy, neutrino physics and neutrino astronomy, dark matter, theory related to each these branches of astroparticle physics, as well as review talks from the neighbouring fields of science. The scientific program was complemented by two well-attended public lectures delivered by Nobel laureates Samuel C.C. Ting and Takaaki Kajita.

As part of the opening ceremony, the IUPAP young scientist awards were given to Frank Schröder (KIT, Germany) and Julian Sitarek (U- Łódź, Poland), the Shakti Duggal young scientist award to Abigail Vieregg (KICP, Chicago), the O'Ceallaigh Medal to Christian Spiering (DESY, Germany), the Yodh Prize to Jordan Goodman (U-Maryland, USA), and the Homi Bhabha Medal and Prize to Subir Sarkar (U-Oxford, UK & Niels Bohr Inst., Denmark).

A remarkable number of new space-based instruments for solar heliospheric physics, cosmic ray, and dark matter research have come into operation during the last two years and their preliminary data was reported for the first time. This armada of new instruments include the NUCLEON detector on board of the Russian satellite

From left: Christian Spiering, Julian Sitarek, Abigail Vieregg, Frank Schröder, Jordan Goodman.

RESURS-P N2, designed to measure TeV-energy cosmic ray nuclei from protons to iron nuclei; the Calorimetric Electron Telescope (CALET) operated at the International Space Station; DAMPE (Dark Matter Particle Explorer; the first Chinese astronomical satellite); and the Ultra-high energy cosmic ray detector TUS on board the Lomonosov satellite. More recently, ISS-CREAM was successfully launched using the SpaceX transporter to the ISS (see separate article in this issue), making the ISS, that also hosts the AMS-02 and CALET detectors, an important facility for astroparticle physics.

AMS-02 offers the highest statistics and new data confirm previous PAMELA and AMS results about distinct differences seen in the

electron and positron spectra, now measured beyond 500 GeV. This is considered a clear indication of the different origins of these two species. However, whether this observation requires the existence and contribution of dark matter or could be explained by contributions from nearby pulsars remains a topic of active debate. Interestingly, the H.E.S.S.-Collaboration extended their measurement of the electron spectrum up to about 20 TeV and reported a distinct break in the spectrum around 1 TeV, providing constraints to contributions from local sources. Anti-protons, measured by AMS, show the same rigidity dependence as the protons, which is unexpected if anti-protons were mostly secondaries produced by protons interacting with the interstellar medium. Thus, pushing the understanding of galactic cosmic ray propagation to a much greater level of detail is a prerequisite to fully benefit from the high quality of data and before firm statements about dark matter contributions could be made.

Direct and indirect searches for dark matter have been reported from a number of experiments. While IceCube reported the best spin-dependent WIMP limits, XENON1T provides the presently best spin-independent limits. If the pace in pushing down the limits continues as it did in the past, the neutrino floor may be reached in only a decade from now such that either an important discovery will be made or we will have learned about what dark matter is not.

Much progress has also been reported at the highest cosmic ray energies. A joint inter-collaborative working group by the Pierre Auger and Telescope Array collaborations reported agreement between their measurements of the mass composition, i.e. the TA data is compatible both with a proton dominated composition as well as with the increasingly heavy composition reported by Auger. The flux suppression observed at the highest energies may thus be caused by the limiting energy of the sources, rather than by the GZK-effect. This conclusion is also supported by the latest constraints of EeV neutrino and photon fluxes, as well as by the low levels of anisotropies. As a first observation of large-scale anisotropies, Auger reported a >5 sigma dipole-like anisotropy above 8 EeV.

The measurements of the spectrum and properties of the cosmic neutrino flux have made a large step forward, as well. Data from IceCube range out now to 5 PeV with a spectral index of $\gamma \approx 2.2\text{-}2.5$ while the neutrino sky remains highly isotropic with no significant correlation to the galactic plane and no indications of point sources, yet. Interesting data at lower energies were also reported by SuperK, which becomes the background limited in searches for the neutrino background by the diffuse flux from supernova neutrinos.

TeV γ-astronomy by H.E.S.S., Magic, Veritas, and HAWC has evolved to a well-established branch of astronomy studying different galactic and extragalactic source classes in multi-wavelength observations together with Fermi-LAT, optical, and radio observations.
Besides digging deeper with each of these instruments individually, multi-messenger observations between photons, neutrinos, cosmic rays, and now also gravitational waves, have demonstrated their power already in a variety of cases and will do so even more in the near future when the presently operated observatories will be complemented by more sensitive instruments. Theoretical models, reported in a number of presentations, provide the benchmarks to which the manifold data is compared. Clearly, the field is witnessing the dawn of a new era in astronomy and astrophysics with keys in hand for a much better understanding of our universe.

Cosmic Ray Energetics And Mass – CREAM Launch to the International Space Station

Eun-Suk Seo (University of Maryland, seo@umd.edu)

A high energy cosmic ray experiment, Cosmic Ray Energetics And Mass (CREAM), was launched to the International Space Station (ISS) on August 14, 2017. The CREAM payload in the unpressurized trunk of the Dragon spacecraft was launched aboard a SpaceX Falcon 9 rocket from pad 39A at NASA's Kennedy Space Center in Cape Canaveral, Florida. This SpaceX's 12th Commercial Resupply Service (CRS-12) mission, aka SpX-12, carried almost 6,000 pounds of scientific research, crew supplies and hardware to the International Space Station in support of the Expedition 52 and 53 crew members including the 1.4 ton CREAM payload.

ISS-CREAM project logo.

Left, the SpaceX-12 launch; top right, the ISS-CREAM payload in the Dragon spacecraft trunk when the spacecraft separated from the upper stage of the Falcon rocket; bottom right, the ISS-CREAM payload on the ISS JEM-EF.

The CREAM instrument was initially developed to measure cosmic ray elemental spectra using a series of ultra-long-duration balloon (ULDB) flights. The balloon-borne CREAM experiment was flown seven times (12/15/04 - 12/28/16) over Antarctica accumulating ~191 days of flight time, the longest known exposure for a single balloon project. Building on the success of the balloon flights, the payload was transformed for accommodation on the ISS. This version of CREAM is called ISS-CREAM (pronounced "ice-cream"). Two days after launch, the Dragon spacecraft with CREAM arrived at the ISS. The CREAM payload was extracted from the trunk by the Space Station Remote Manipulator System (SSRMS) on August 21 and transferred to the Japanese Experiment Module Remote Manipulator System (JEMRMS). Following the installation of CREAM on the Japanese Experiment Module - Exposed Facility (JEM-EF), CREAM was activated successfully on August 22. The housekeeping data show nominal condition of the instrument, which is currently being tuned.

The goal of CREAM is to extend direct measurements of cosmic-ray composition to energies capable of generating gigantic air showers, which have mainly been observed from the ground, thereby providing calibration for indirect measurements. The instrument has redundant and complementary particle detectors capable of precise measurements of elemental spectra for Z = 1 - 26 nuclei over the energy range ~10^{12} to >10^{15} eV. Precise measurements of the energy dependence of elemental spectra at the highest of these energies, where the rigidity-dependent supernova acceleration limit could be reflected in a composition change, provide a key to understanding cosmic ray acceleration and propagation.

The CREAM investigation is conducted by an international collaboration (http://cosmicray.umd.edu/iss-cream/) of researchers from UMD, NASA GSFC, PSU, and NKU in the US, SKKU and KNU in South Korea, LPSC in France, and UNAM in Mexico.

IUPAP YOUNG SCIENTIST PRIZES 2017

Commission on Astroparticle Physics (C4)

Frank Schroder

"For his outstanding contributions to cosmic ray physics in general and to the development of radio detection of extensive air showers in particular"

Dr. Frank Schröder received the IUPAP Young Scientist Prize in Astroparticle Physics 2017 for his outstanding contributions to cosmic ray physics in general and to the development of radio observations of extensive air showers in particular. After finishing his undergraduate studies of physics with a Diploma from Technische Hochschule Darmstadt (Germany) in July 2007 in detector development for Axion searches, Frank started his PhD in Physics at KIT to study in detail the radio detection technique of high energy cosmic rays at the air shower experiments LOPES in Karlsruhe and the Pierre Auger Observatory in Argentina. After completing three years of PhD study in February 2011 with best marks, he initialised and started his first solo project at the Tunka facility in Siberia, where he optimised the radio detection technique. The project was driven by the idea to answer experimentally the question about the sensitivity of the radio signal to the primary mass of the cosmic rays. The success of Tunka-Rex lies in the first experimental correlation of longitudinal shower observations of the radio and Cherenkov light components of extensive air showers. Moreover, he could prove that radio observations allow the reconstruction of the shower maximum and the energy of extensive air showers with a quality similar to those of conventional detection techniques. As visiting scientist at the Universidad Nacional de San Martin, Buenos Aires, Argentina in 2013 and at his renewed postdoc position at KIT, he further improved his impressive publication record in high-ranking Journals and wrote a comprehensive review article on the radio detection technique.

Julian Sitarek

"For his distinguished contributions to high energy astrophysics in general and to TeV gamma-Astronomy in particular"

Dr. hab. Julian Sitarek received the IUPAP Young Scientist Prize in Astroparticle Physics 2017 for his distinguished contributions to high energy astrophysics in general and to TeV gamma-astronomy in particular. He has graduated in Physics at the University of Lodz at the age of 23 and continued for on to a PhD project at the University of Lodz (Poland) and Max Planck Institut für Physik in Munich (Germany). He received his PhD in Astrophysics at the age of 26 based on his contribution to the analysis of data from the MAGIC telescopes and for the development of models for gamma-ray production in cascade processes in active galaxies. Next, he moved for a 3 year postdoc position to the Instituto de Fisica d'Altes Energies (IFAE, Barcelona, Spain) and returned to University of Lodz in 2014 to take a permanent position at the Department of Astrophysics. He continued his very active contribution to the MAGIC Collaboration serving as the coordinator of the software group and one of the coordinators of the AGN group and also continued his interest in theoretical investigation of models for the high energy processes in galactic and extragalactic sources. At the age of 32, he completed a habilitation based on his contribution to the development of the analysis techniques and performance of the MAGIC stereo system and the discovery of gamma-ray emission from a few extragalactic sources, becoming one of the youngest researchers with the degree of habilitation in Poland. Recently, he obtained a prestigious 3-year fellowship for young researchers from the Polish Ministry of Science and Higher Education and became a principal investigator of the grant from the National Research Centre.

Commission on Low Temperature Physics (C5)

Hicks Clifford

"For his pioneering development of low temperature measurement techniques, notably concerning the application of uniaxial stress, and his experiments on unconventional superconductivity".

Clifford Hicks received his Ph.D. from Stanford University in 2009, investigating unconventional superconductors. The work involved using a scanning SQUID magnetometer to search for chiral edge states in Sr2RuO4, and the development of a new method, based on local measurements using a scanning SQUID susceptometer, for measuring the penetration depth of superconductors. For his postdoctoral work at the University of St Andrews, with Professor Andrew Mackenzie, he focused in part on transport and cantilever torque magnetometry on delafossite oxide metals. He also developed a piezoelectric-based uniaxial pressure cell, and applied it to study the superconductor Sr2RuO4. In 2014, Clifford joined the Max Planck Institute for Chemical Physics of Solids, Dresden, to lead a new research group, focusing on the effects of uniaxial pressure on unconventional superconductors and magnets, and further development of the technique. Remarkably, it was shown that strain can double Tc of the unconventional superconductor Sr2RuO4. With two former students from St Andrews, he has also co-founded a company that has successfully commercialized piezoelectric-based pressure cells.

Vlad Pribiag

"For his important contributions to two main areas of low temperature and nanoscale physics: superconductivity in the edge modes of two-dimensional topological insulators; spin-dependent quantum transport in one-dimensional semiconductors with strong spin-orbit coupling".

His results have elucidated key aspects of the electronic properties of these novel materials, which are candidates for quantum and classical information processing.
Vlad Pribiag received his Ph.D. in 2010 from Cornell University, investigating the magnetization dynamics magnetic vortices driven by spin-transfer torques. For his postdoctoral work at the Kavli Institute of Nanoscience Delft, he focused on quantum transport in low-dimensional materials with strong spin-orbit coupling, including single-spin dynamics in quantum dots and superconducting transport in 2D topological insulator devices. During this time, he was the recipient of a VENI award from the Netherlands Organisation for Scientific Research. Dr. Pribiag then joined the School of Physics and Astronomy at the University of Minnesota in Fall 2014. His current work focuses on the physics of nanoscale devices based on novel low-dimensional materials, such as 2D topological insulators, complex oxide interfaces, and semiconductor nanowires. He has recently been awarded a Sloan Fellowship (2017) and an NSF CAREER Award (2016).

Commission on Atomic, Molecular and Optical Physics (C15)

Johannes Feist

"For his outstanding contributions in cavity-induced modifications of molecular structure under strong light-matter coupling"

Johannes Feist received his Ph.D. from Vienna University of Technology in 2009 and was later awarded the ITAMP postdoctoral fellowship at the Institute for Theoretical Atomic, Molecular and Optical Physics (ITAMP) at the Harvard-Smithsonian Center for Astrophysics and Harvard University. In 2012, Johannes joined to the group of F. J. García Vidal as a senior postdoc at the Department of Theoretical Condensed Matter Physics at the Universidad Autónoma de Madrid, and in 2017, he started a tenure-track position as an IFIMAC Young Researcher at the Condensed Matter Physics Center (IFIMAC) in the same university.
His current research focuses on the influence of strong light-matter coupling on the properties of organic materials. In this regime, the interaction between transitions in emitters and confined light modes becomes strong enough that the elemental excitations of the system become hybridized light-matter states, so-called polaritons. This can lead to changes in material properties and even significantly modify chemical reactions. Johannes has made a number of significant contributions to this rapidly growing field, in particular, he developed a theory combining molecular physics with cavity QED that can treat polaritonic chemistry by extending the concept of molecular potential energy surfaces to the strong-coupling regime. Based on this work, he has been able to show that nuclear motion in separate molecules could become correlated through their common interaction to a single light mode, as well as that photochemical reactions can be significantly suppressed or novel reaction channels opened under strong light-matter coupling with organic molecules.

Commission on Astrophysics (C19)

Pratika Dayal

"For his important contributions to two main areas of low temperature and nanoscale physics: superconductivity in the edge modes of two-dimensional topological insulators; spin-dependent quantum transport in one-dimensional semiconductors with strong spin-orbit coupling".

"For her work as a theorist, combining analytic theory, numerical simulations and data interpretation, which has significantly contributed to building tantalising bridges between fields as diverse as astrophysics, particle cosmology and astrobiology.

Pratika Dayal was born in 1984 in Chandigarh, India. She received a Master's degree in Astronomy from the University of Sussex in 2006, where she studied the triaxiality of elliptical galaxies. Her doctoral research, carried out at the International School for Advanced Studies (SISSA, Trieste) from 2006-2010, focused on modelling galaxies in the first billion years to put robust constraints on the end stages of reionization and unveiling their physical properties. She then held postdoctoral fellowships at the Leibniz Institute for Astrophysics (Potsdam, Germany) and the Institute for Astronomy (Edinburgh, UK) where she combined the latest datasets and theoretical models to show that the earliest galaxies observed by the Hubble Space Telescope could be the smallest progenitors of galaxies like our own Milky Way. She then moved to the Institute of Computational Cosmology (Durham, UK), to take up an Addison Wheeler fellowship, where she opened up new lines of astrobiological research, ranging from modelling the habitability of the Milky Way to that of the entire Universe over 13 billion years.

Since 2016, Pratika Dayal has held an assistant professorship and the Rosalind Franklin Fellowship at the Kapteyn Astronomical Institute at the University of Groningen where she is leading calculations for the forthcoming era of 21cm cosmology with the Square Kilometre Array. Since 2017, her group has been supported by the European Research Council's starting grant, in addition to the support from the University of Groningen.

Commission on Computational Physics (C20)

Glen Evenbly

"For conceptual advances, development, refinement and application of tensor network renormalization for the efficient simulation of quantum many-body systems"

Glen Evenbly was awarded the IUPAP Young Scientist Prize in Computational Physics 2017 for his exceptional work in the development of simulation algorithms for quantum many-body systems using the tensor network formalism. After studying physics in Auckland (New Zealand), Glen finished his PhD in 2010 in Brisbane (Australia). Afterwards, he was awarded the Sherman-Fairchild Prize Postdoctoral Scholarship in Theoretical Physics at California Institute of Technology working as a postdoc in Professor John Preskill's group, before joining the group led by Professor Steven White at the University of California Irvine as an assistant project scientist. Glen then joined the faculty at the University of Sherbrooke, Canada, in 2016 as an assistant professor.

His research activities focus on the development of tensor network methods, in particular, he has made significant contributions to the multi-scale entanglement renormalization ansatz (MERA) and its application to the study of many-body systems at criticality, as well as in the proposal of new tensor network algorithms for the coarse-graining of partition functions and Euclidean path integrals.

IUPAP YOUNG SCIENTIST PRIZES 2016

Commission on Astrophysics (C19)

Nikku Madhusudhan

"For his pioneering and outstanding contributions to the characterization of exoplanetary atmospheres which have led to the first insights into various physical processes and chemical compositions of exoplanetary atmospheres, and have laid the foundations for understanding planetary formation and migration based on exoplanetary atmospheric compositions."

Dr. Nikku Madhusudhan was born in 1980 in India and pursued his undergraduate studies at the Indian Institute of Technology, Banaras Hindu University, in Varanasi, India. He then went to the Massachusetts Institute of Technology (MIT) in Cambridge, Massachusetts, USA, where he obtained a Master's degree in engineering in

2004 and a PhD in Physics (astrophysics division) in 2009. After his PhD, he held postdoctoral positions at MIT (2009-2010), Princeton University (2010-2011), and Yale University (2012-2013) where he was the YCAA Prize Postdoctoral Fellow. In 2013, he joined the faculty of the Institute of Astronomy at the University of Cambridge, UK, as a university lecturer in astrophysics. In 2017, he was promoted to a tenured Readership (equivalent of an associate professorship) in astrophysics and exoplanetary science at Cambridge.

Dr. Madhusudhan has made several seminal contributions to the study of exoplanetary atmospheres over the past decade. His PhD work gave birth to exoplanetary "atmospheric retrieval", which allows statistical estimation of atmospheric properties of exoplanets from their observed spectra. This work and its variants have made possible detailed measurements of atmospheric chemical abundances and temperature profiles of various exoplanets and sub-stellar objects ever since. His work led to the first statistical constraints on atmospheric chemical abundances, temperature profiles, non-equilibrium chemical processes, etc, in numerous objects. In another major development, in a series of papers in 2011-2012, he demonstrated the feasibility of measuring carbon-to-oxygen (C/O) ratios in hot giant exoplanets and demonstrated the critical implications of C/O ratios for various atmospheric and interior properties of exoplanets. These works have galvanized intense activity both in theoretical and observational studies to investigate C/O ratios in exoplanets and sub-stellar objects, and the C/O ratio has emerged to be the most desirable observable in exoplanetary atmospheres with upcoming large facilities such as the JWST. Among other results, his work also suggested unexpectedly low H2O abundances in several hot Jupiters. Such chemical measurements have motivated new interdisciplinary efforts for connecting exoplanetary atmospheric compositions to their formation processes, a frontier area where Dr. Madhusudhan has also played a pioneering role in recent years.

Dr. Madhusudhan's scientific contributions and leadership role have been widely recognized in exoplanetary science and astrophysics. His work has been recognized with the Yale YCAA prize fellowship in 2011 and the 2014 Vainu Bappu Gold Medal in astrophysics, was awarded in 2016, followed by the present 2016 IUPAP Medal in astrophysics, besides numerous invitations to seminars/colloquia/conferences, review talks/papers, and large projects.

International Commission on Optics (ICO) – AC1

Laura Na Liu

"For outstanding contributions to nano-optics, nanophotonics, nanoplasmonics, and metamaterials."

Laura Na Liu is Professor at the Kirchhoff Institute of Physics, University of Heidelberg, and Group Leader at the Max-Planck Institute for Intelligent Systems, Germany. She graduated with a BS in physics from Jilin University, China, and a MS in physics from the Hong Kong University of Science and Technology. She obtained her PhD in physics with "summa cum laude" from the University of Stuttgart, Germany, in 2009. In 2010, she was post-doc at the Lawrence Berkeley Lab, University of California, Berkeley, USA. In 2011–2012, she was Texas Instruments Visiting Professor at the Electrical Engineering Department of Rice University, Houston, TX, USA. Since 2012, she is the leader of the Smart Nanoplasmonics group at the Max Planck Institute for Intelligent Systems, Stuttgart, Germany, and in 2015, she became Full Professor at the Kirchhoff Institute of Physics of the University of Heidelberg. Her research group focuses on developing sophisticated and smart plasmonic nanostructures for gaining precise insight into cell biology and catalytic chemistry.

She has received multiple awards: among them a Chinese Government Award for outstanding students abroad in 2008. In 2012, she was awarded the Sofja Kovalevskaja Award of the Alexander von Humboldt Foundation, which provides young researchers with up to €1.5 million as risk capital for innovative projects at an early stage of their careers. Na Liu proposed to use nanoplasmonics to observe biological and chemical processes at the level of individual particles, by combining gold nanoparticles with DNA and observing the dynamics of chemical reactions with high-resolution microscopes. She was awarded the Elisabeth Schiemann-Kolleg Fellowship of the Max Planck Society and the Heinz Maier-Leibnitz Prize of the Deutsche Forschungsgemeinschaft (DFG) in 2013. In 2014, her project "dynamic nanoplasmonics" was awarded a Starting Grant (€1.5 million) of the European Research Council (ERC). During the International Year of Light, the European Optical Society (EOS), awarded her with the Light 2015 Young Woman in Photonics Award.

ADDITIONAL CONFERENCE REPORTS 2016

Sixth International Conference on Nanostructures (ICNS6), held in Kish Island, Iran from 07/03/2016 - 10/03/2016, was graced by distinguished world-renowned scientists who held different scientific sessions and workshops. Two important workshops were held besides the conference, entitled "How to prepare papers for publication in high impact Journals" and "Commercialization in Nanoscience" which were greatly welcomed by the participants and conference organisers who hoped that this could be the beginning of a path for more practical conferences.

International Conference on Applied Optics and Photonics 2016, held at Herrenhausen Castle, Hannover, Germany from 17/05/2016 - 21/05/2016 had special Sessions on Women in Optics by Elisabeth Rogan (CEO Optical Society OSA, Washington), Dr. Merve Wollweber (University Hannover) and Dr. Doris Böbel (Automotive Lighting, Reutlingen, Germany). It also had the session on Optics in Developing Countries by Dr. Yanne Chembo (Paris,France und Yaounde, Cameroun) and Prof. Mourad Zghal (Tunis, Tunesia) and the session on Topics in optics and photonics at the forefront of research and development which covered: Fringe projection technology, Quantum dot laser, Planar integrated polymer sensor foil, Optical length metrology, Microresonator applications, Solutions to unmet medical needs, Optical System Design, Ultra-broadband optical parametric oscilators, Superresolution micrsocopy.

18th International Congress on Plasma Physics (ICPP-2016), held at Kaohsiung Exhibition Centre, Kaohsiung City, Taiwan from 27/06/2016 - 01/07/2016, consisted of one keynote lecture, 8 plenary talks, 164 invited talks, 65 oral talks, and 115 poster papers. In the plenary and invited talks the most up-to-date development of plasma science and technology were presented. The ceremony for the IUPAP young scientist prize in plasma physics was held on June 29, 2016 at the ICPP-2016 conference banquet.

The 24th International Conference on Supersymmetry and Unification of Fundamental Interactions (SUSY 2016), held at The University of Melbourne, Melbourne, Australia from 03/07/2016 - 08/07/2016, discussed summaries from ATLAS and CMS on their searches for supersymmetric particles which confirmed no excesses in data recorded by the LHC at 13TeV during 2015. These results have enabled the experiments to eclipse previous limits on supersymmetric particles set by data recorded at 8TeV. SUSY 2016 saw a diverse range of talks representing many sectors of the vibrant theory community. The properties of the Higgs boson continue to be a strong motivational force, leading to new results in precision Higgs mass calculations in a variety of models and studies of the alignment limit. The absence of any signal from the LHC has also led to much work on “non-minimal” SUSY, which goes beyond the minimal supersymmetric Standard Model.

21st International Conference on General Relativity and Gravitation (GR21), held at Columbia University, New York, NY, USA, from 10/07/2016 - 15/07/2016, was the first very large international meeting that brought together scientists from GR and from the GW experimental and theory fields to discuss the highlights of the recent discovery of GWs and the implications.

International workshop on jamming and granular matter, held at Queen Mary University of London from 13/07/2016 - 15/07/2016, presented new results on: jamming transition; isostaticity and structural properties; effect of friction; jamming in systems of non-spherical particles; granular flow and rheology; statistical mechanics and mean-field theories; functional jammed materials. This was a satellite meeting held in conjunction with Statphys26.

Statphys26, held in Lyon (France) from 18/07/2016 - 22/07/2016 played host to the presentation of "The Boltzmann Medal for 2016", awarded during the Boltzmann Ceremony to Daan Frenkel and Yves Pomeau for their seminal contributions to Statistical Physics during their fabulous careers. Similarly, the "Young Scientist Award for 2016" was awarded to Lisa Manning and Martin Lenz, recognizing their outstanding achievements as scientists at an early stage of their careers in the field of Statistical Physics. The level of plenary talks and different contributions was outstanding.

XXVII International Conference on Neutrino Physics and Astrophysics (ICNPA), held in London, UK from 04/07/2016 - 09/07/2016. New results were presented from all the world's major neutrino experiments. T2K showed new data on the long-baseline oscillation of muon anti-neutrinos. Together with new data from NOvA and reactor experiments a "preference" for the violation of the matter-antimatter symmetry was reported. Observations of extra-galactic neutrinos (ICECUBE) were presented. Together with the ground breaking evidence for gravitational waves, reviewed at the meeting, these measurements pave the way for progress in multi-messenger astronomy. Clear evidence for an additional contribution to the neutrino spectrum at ~5 MeV was reported by all reactor neutrino experiments. Major new initiatives, DUNE and SBN in the US and Hyper-K results, were reported.

The 25th International Conference on Atomic Physics, held in Seoul, South Korea from 24/07/2016 - 29/07/2016. The highlight of this meeting was the ICAP Summer School and Workshop which were organized in series, both of which discussed the new and exciting findings in the field.

Conference on Long-Range-Interacting Many Body Systems: from Atomic to Astrophysical Scales, held in Trieste, Italy from 25/07/2016 - 29/07/2016. The talks, on recent experimental results for ion traps described by long-range effective Hamiltonians with tuneable range of the interactions, for Rydberg molecules and on collective effects in light scattering, in particular, were much appreciated by the audience.

International Conference on High Energy Physics (ICHEP), held in Chicago from 03/08/2016 - 10/08/2016, had two new parallel sessions (Diversity and Inclusion, and Technology Applications and Industrial Opportunities) with a video session with students from Africa. The lunchtime sessions aimed at increasing ICHEP participants' skills in outreach and communication through news and social media. The Physics slam (the public event), was very successful, where five scientists competed to earn audience applause through presentations of their research. The outreach programme included events at 30 public libraries in Chicago with 65 conveners from all continents (33 females and 32 males).

European Cosmic Ray Symposium (ECRS), held in Torino (Italy) from 04/09/2016 - 09/09/2016. At the conference many results from the experiments studying cosmic radiation were presented. The highlight among all those presented were the AMS-02.

International Nuclear Physics Conference 2016 (INPC 2016), held in Adelaide Australia from 11/09/2016 - 16/09/2016 presented the discovery of element 113 at RIKEN. There was also a public lecture by Dr. Cynthia Keppel on Hadron Beam Therapy.

13th International Conference on Mathematical Results in Quantum Theory (QMATH), held in Atlanta, USA from 08/10/2016 - 11/10/2016, had presentations by Alessandro Giuliani (describing perturbation theory for many-body fermion systems applied to the Haldane-Hubbard model of graphene), Yoshiko Ogata (presenting an outline of her recent proof of the completeness of the classification of gapped ground state phases in the case of models with matrix product ground states), Nicholas Read (presenting a topological criterion using K-theory for the existence of compactly supported Wannier functions for periodic lattice fermion systems), Subir Sachdev (discussing his model with Ye and Kitaev in the area of quantum gravity) and Fernando Brandao (discussing locality properties of the entanglement spectrum of quantum lattice systems).

International Conference on Medical Physics (ICMP), held at the Shangri La Hotel Bangkok, Thailand from 09/12/2016 - 12/12/2016 had a variety of new and important topics of lectures, such as: Medical physics aspect of proton therapy, Development and future of e Learning in medical physics, Advances in Image Guided Radiation Therapy, MDCT physics, dosimetry and radiation protection, The new era of medical physics in Asia, Computed Aided diagnosis and radiation therapy, Comprehensive audit in radiotherapy, diagnostic and interventional radiology and nuclear medicine, Radiation protection in dental radiology, Eye lens dosimetry and radiation cataract in interventional cardiologists, Dosimetry of small static photon fields: challenges and solutions, Recent development in dosimetry, treatment planning, QA for IMPT.

CONFERENCE REPORTS 2017

International Particle Accelerator Conference 2017 (IPAC'17), held in Copenhagen, Denmark from 14/05/2017 - 19/05/2017 discussed the Europ. XFEL, which was commissioned & achieved first lasing just before the conference. The new SwissFEL demonstrated first lasing, too. Other new concepts for synchrotron light sources gaining significant brilliance were discussed, e.g. the Hybrid Multi Bend Achromat concept in the ESRF upgrade, were also discussed. LHC exceeded the design performance, while the SuperKEKB at KEK in Japan has been successfully commissioned. Important technology advancements include a higher quality factor of superconducting cavities achieved at Fermilab, amorphous Carbon coating of beam chambers against electron cloud and a new scheme to produce very low emittance muon beams using a positron beam interacting with a thin target directly inserted in the ring chamber (INFN Frasc.).

8th International Conference on the Physics of Dusty Plasmas, held in Prague, Czech Republic from 20/05/2017 - 25/05/2017 discussed several topics. Most importantly, among the topics discussed were: Unconventional observations of dust in space – impact detection by satellite antennas or plasma detectors – that are supported by laboratory simulations in dust accelerator facility. A full understanding of the ongoing processes would significantly enhance the amount of experimental data on space dust; A new microgravity experiment for the International Space Station that is based on a successful series of PK experiments; Novel approaches to description of turbulence and turbulent flows in complex plasmas including microgravity conditions; and Interaction of dust with a hot plasma and strong magnetic field and also its importance to fusion reactors.

3rd International Conference on Advances in Radioactive Isotope Science (ARIS 2017), held in Keystone, Colorado, USA from 28/05/2017 - 02/06/2017 discussed the novel test to probe QED with nuclear physics techniques, new approach to constrain rp process reaction rates, novel concept: Transfer reactions with isomeric beams, first spectroscopy of 40Mg and progress on constraining the 'nuclear clock transit'.

Crossroads in Complex Systems, held at the Campus Universitat Illes Balears, Mallorca, Spain from 05/06/2017 - 08/06/2017 was held on the occasion of the 10th anniversary of IFISC (Institute for Cross-Disciplinary Physics and Complex Systems, UIB-CSIC). The conference represented a broad spectrum of topics on Complex Systems as wide, at least, as the IFISC range of research lines.

2017 International Cosmic Ray Conference (ICRC 2017), held in Busan, South Korea from 12/07/2017 - 20/07/2017, had 2 public lectures by, Takaaki Kajita(University of Tokyo) and Samuel C. C. Ting(MIT). 2,200 participants took part in the lectures. Special talks by Barry Barish on Gravitational Waves, Albert de Roeck on Particle and Astroparticle Physics at LHC and Myeong-Gu Park on Accretion onto Black Holes, were also presented.

Mesoscopic Transport and Quantum Coherence 2017 (QTC 2017), held in Espoo, Finland from 05/08/2017 - 08/08/2017, presented the latest research, ongoing development efforts and applications related to quantum effects in electron transport, superconducting qubits and hybrid circuits, quantum thermodynamics, circuit QED, cavity optomechanics, topological and 2D materials.

Workshop - IUPAP

(International Union for Pure and Applied Physics)

New Challenges in Pure and Applied Physics

10-13 October 2017- University of São Paulo, São Paulo - Brazil

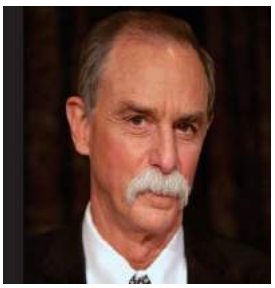
The General Assembly of the International Union of Pure and Applied Physics (IUPAP) will be held for the first time in her history in Latin America. In conjunction with this event, a special workshop will be organized to discuss the new challenges in many areas of Physics. World leaders in physics and leaders of IUPAP commissions will provide overall perspective in their respective fields and areas. Some of the special guests are: W. Phillips (Nobel Prize 1997), D. Wineland (Nobel Prize 2012); Robin Kaiser (France), Mark Raizen (USA). The workshop is an excellent opportunity to follow the progress in major fields of physics. This event is therefore highly recommended for all students and researchers in Physics.

General Topics and Speakers

Astrophysics	Grazina Tautvaisiene (Lithuania)
Astroparticle physics	Sunil Gupta (India)
Atomic, Molecular & Optical Physics	Toshiyuki Azuma (Japan)
Biological Physics	Aihua Xie (USA)
Computational Physics	HaiQing Lin (China-Beijing)
Gender in Physics	Igle Gledhill (South Africa)
Fundamental Constants and Units	Peter J. Mohr (USA)
Laser Physics & Photonics	Deborah Kane (Australia)
Low Temperature Physics	John Saunders (England)
Magnetism	Xiao-Feng Jin (China-Beijing)
Mathematical Physics	Manfred Salmhofer (Germany)
Nuclear Physics	Robert Tribble (USA)
Particle & Fields	Juan Fuster (Spain)
Physics Education	Hideo Nitta (Japan)
Physics for Development	Sandro Scandolo (Italy)
Plasma Physics	Minh Quang Tran (Switzerland)
Semiconductors	Belita Koiller (Brazil)
Statistical Physics	Itamar Procaccia (Israel)
Structure & Dynamics	J. Raynien Kwo (China-Taipei)

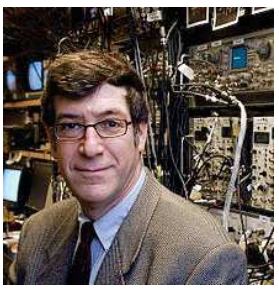
Special Guests

W. Phillips



D. Wineland

R. Kaiser



M. Raizen

USP

Organizers

Vanderlei Bagnato
Alinka Lépine-Szily

Do not miss this opportunity to discuss new challenges in many areas of Physics.
Venue: University of São Paulo - SP - Brazil (Biblioteca Brasiliana).
Free attendance (registration is required)

Registration and Information: http://www.ifsc.usp.br/iupap2017/
or eventosoptica@ifsc.usp.br

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