What's new September-November 2023

Dear readers of the IUPAP Newsletter,

We take the opportunity to inform you about the 32nd IUPAP's General Assembly which took place on October 9th 2023—almost exactly 100 years after the very first IUPAP General Assembly held in Paris. The 32nd GA was a hybrid meeting organized from CERN in Geneva, Switzerland. The assembly brought together prominent physicists from all corners of the globe. We explore in what follows the main outcomes that emerged from this significant gathering.

A tribute to Kennedy Reed

A poignant start to the General Assembly was a ceremony in memory of Kennedy Reed who passed away earlier this year. Reed served IUPAP for a total of 17 years and he was President of the Union from 2017 to 2019. His long standing involvement in improving the participation and recognition of minority groups, particularly women and black physicists, was a focus of his work for IUPAP. To honor Reed's memory, one of the IUPAP medals will now carry his name: "IUPAP Kennedy Reed Medal for Outstanding Contributions to the Enhancement of Physics in Developing Countries".

Administrative updates

Several administrative matters were discussed during the assembly. The former Singapore secretariat has come to a close. The new headquarters are based in Geneva, Switzerland, supported by an administrative secretariat based in Trieste, Italy. The secretariat was commended for its efficient operation.

Honoring early career scientists

Most of the IUPAP commissions award early career scientist prizes in their respective fields of physics. For the first time it was decided to also award an interdisciplinary early career scientist prize. At its first edition, two winners were selected (one for 2022 and one for 2023) who do research that combines the subfields of more than one IUPAP Commission: Evelyn Tang from Rice University and Stefano Martiniani from New York University (see news item below).

Expanding the membership

The General Assembly approved the inclusion of several new Corporate Associate Members, including the organizations Advanced Laser Light Source (ALLS), CERN, Joint Institute for Nuclear Research (JINR), Park Systems, and Synchrotron-Light for Experimental Science and Applications in the Middle East (SESAME). Nepal was also accepted as the first Associate Territorial Member (see news item below), following a Memorandum of Understanding signed between IUPAP and the Nepal Physical Society a few weeks earlier.

Engaging with Africa
A presentation was made on the steps to attract Associate Territorial Members, particularly from Africa, showcasing IUPAP's commitment to fostering international scientific collaboration in the Global South.

A new mechanism for the selection of Commission members
The selection of new Commission members is a very complicated task, with several constraints (gender and territorial balance, diversity of subfields within commissions, the inclusion of people involved in applications of physics, number of units paid by the members, etc) that are very hard to satisfy simultaneously. In order to facilitate the process, it was decided to add an "extra layer" to the sequence of steps requesting an input from current Commission chairs that will subsequently be shared with IUPAP's members. We already started the process and expect to have the preliminary slates ready with sufficient anticipation for ample discussion at the EC&CC meeting and the GA in October 2024.

IUPAP's self-evaluation and future restructuring
The main conclusions of the task force that discussed the rejuvenation of IUPAP were presented as well as the self-evaluation report. Based on these analyses the proposal of having an external evaluation committee was approved. The expectation is that this external evaluation will be ready to be presented at the next (in-person) GA. A resolution was approved to advance in this regard. An internal committee will also be established to investigate possible minor restructurings that could improve the functioning of the Union.

Reports from selected Working Groups
Working Groups 16, Physics and Industry and 18, Ethics, presented reports that were highly appreciated. The creation of Working Group 21, which had been approved by the EC, was approved by the GA with a new name, Physics for Climate Action Change and Sustainability.

Collaborations with other organizations
IUPAP is still acting as the legal entity for the organization of the International Year of Basic Sciences for Sustainable Development. A ceremony will take place at CERN in December 2024 and another meeting will be held in Honduras in March 2024. Although these activities will mark the end of IYBSSD, a new UN approved international endeavor will start: the International Decade of Science for Sustainable Development in which IUPAP will certainly play a key role.

The next General Assembly
The 32nd General Assembly decided that the next gathering will be an in-person event, scheduled to take place in Hainan, China, in October 2024. On the occasion of the 25th anniversary of the creation of Working Group 5 "Women in Physics" a special celebration will be held as well as an inter-commission symposium on "Physics Research for a Sustainable Planet".

Final words
The 32nd IUPAP General Assembly exemplified the spirit of international scientific collaboration and innovation. It reaffirmed IUPAP's commitment to fostering physics, supporting early-career scientists, and addressing critical global challenges, including sustainability and climate action. As physics continues to play an ever more vital role in addressing the world's challenges, the General Assembly provided a platform for physicists to chart a course for a brighter, more sustainable future through science and cooperation.

Michel Spiro, President
Silvina Ponce Dawson, President Designate
Jens Vigen, Secretary-General

Nepal as IUPAP Associate Territorial Member

The signing of a Memorandum of Understanding during the The International Conference on Physics for Sustainable Energy - ICPSE-2023 marked a momentous occasion where the **Nepal Physical Society has become an Associate Territorial Member of IUPAP**. **Nepal is the first such member of IUPAP, and is the pathfinder for this new type of membership.**
The conference was organized by the Nepal Physical Society and IUPAP, and featured an esteemed lineup of speakers, each bringing unique insights and expertise in the field of sustainable energy. The President of IUPAP, Michel Spiro, spoke about science for sustainability, in the context of the International Year of Basic Sciences for Sustainable Development and the coming Decade of Science for Sustainable Development. Recalling the Union's centenary, Secretary-General Jens Vigen spoke about "IUPAP at 100 - reaching out to Nepal", and Igle Gledhill, secretary of IUPAP Working Group 21 on Physics for Climate Change Action and Sustainable Development, gave the vision for the roles that IUPAP can play. The audience enjoyed a talk on the physical science basis of climate change by Carolina Vera, who is just ending her term as Vice-President of work group I of the IPCC, the Intergovernmental Panel on Climate Change. Another WG21 member, Merete Tveten, spoke about preparing for climate change in terms of investment in sustainable energy.

The conference saw the active participation of about a hundred attendees. The engaged audience contributed to the enriching discussions, sparking new ideas and collaborations that will have a lasting impact on the sustainable energy landscape. **The agreement between the Nepal Physical Society and IUPAP opens doors to international collaboration, enabling Nepalese scientists and researchers to leverage global expertise and resources.**

Meet our team

Gabriella Marra

IUPAP Secretariàt

- **Could you please introduce yourself?**

I'm an enthusiast that loves singing, frying and practicing karate, but this has nothing to do with physics, or maybe yes. Physics is everywhere!
Going back in the years, I studied in Rome where I graduated in economics and marketing and did a master's degree in general management. So, I'm not a physicist, but when I took the high school exam, I chose English and Physics as my favourite subjects.
Now I help scientists enhance the world for peace and cooperation, making their life easier taking care of their administrative activities. I love helping people simplifying their life with the things that I know and cooperation and trust in science have always been very important values for me.
That's why I am so happy, and I am grateful for.

- **What is your role within the IUPAP?**

I take care of all administrative matters of IUPAP from the office of F.I.T. (International Foundation Trieste for the Freedom and the Progress of Sciences) Secretariat in Trieste, I work side by side with

the Secretary General that is in Geneve and with anybody needs an administrative support from each of the almost sixty territorial members from all over the world.

- **What did you enjoy most in your collaboration with IUPAP?**

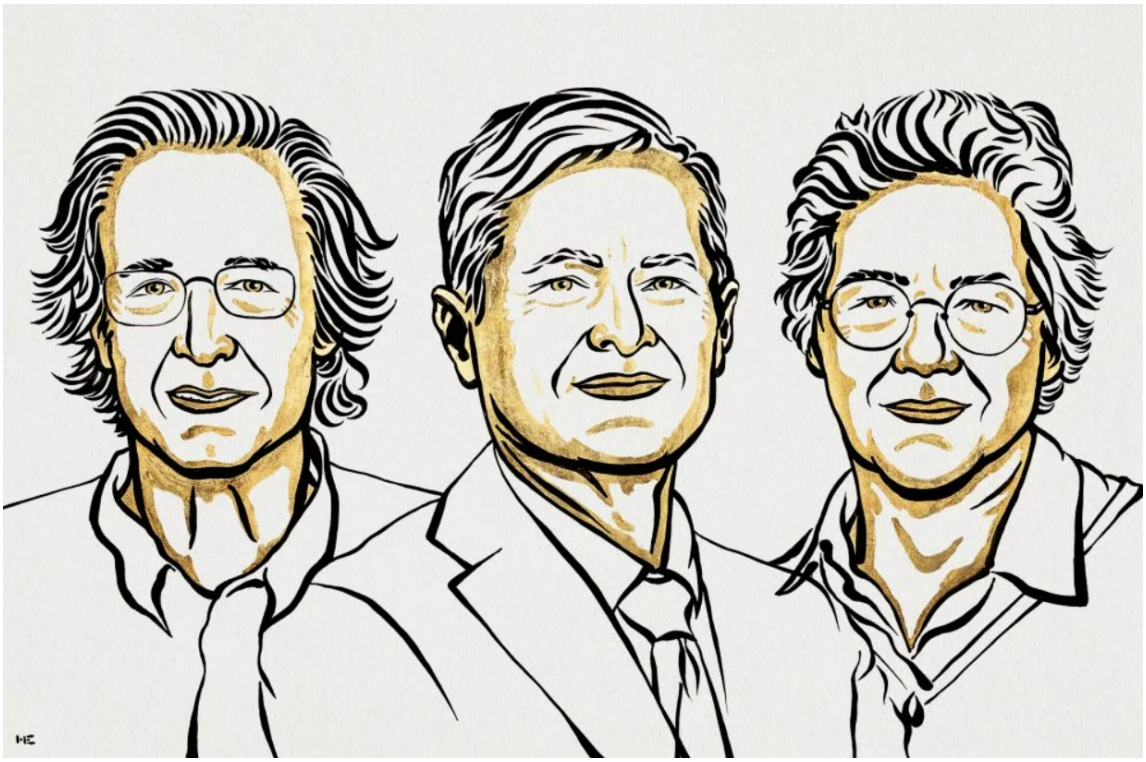
The fact that I work for the cooperation between scientists that come from every part of the world. I think that multiculturalism enriches the progress of the work, but also the human aspect of life. Last but not least, I love thinking that I give my contribution for an organization that exists to solve problems of concern to humanity.

- **What do you think is the greatest potential of IUPAP?**

I believe we can comprehend this by outlining some of the objectives of IUPAP:

- Contribute to the well-being of the planet and humanity by advocating physics as a fundamental instrument for development and sustainability.
- Actively participate in fortifying and enhancing physics education, especially in developing nations.
- Foster diversity and inclusivity in physics, amplifying the involvement and acknowledgment of women and individuals from underrepresented groups.
- Advocate for the unrestricted movement of scientists and the open access to data.

Nobel Prize in Physics



The Nobel prize for Physics 2023 was attributed to Anne L'Huillier (Lund Technical University), Ferenc Krausz (MPQ Garching and LMU Munich) and Pierre Agostini (Ohio State University) ***"for experimental methods that generate attosecond pulses of light for the study of electron dynamics in matter"***. This prestigious award marks the convergence of three distinct research paths, all establishing the experimental foundations of attosecond science.

Pierre Agostini embarked on his journey in the late 1960s. Alongside his fellow researchers at CEA Saclay, he spearheaded the development of innovative electron and ion spectroscopy techniques to unravel the intricacies of atom ionization induced by short-pulse, high-intensity lasers. Their pioneering work unveiled a plethora of remarkable phenomena, including the groundbreaking discovery of Above-Threshold Ionization in 1979.

Also at CEA Saclay, Anne L'Huillier discovered an unexpected phenomenon in 1988 : high-harmonic generation (HHG) from gases, a process in which harmonics of the laser could be coherently generated on-axis, similar to second harmonic generation in conventional nonlinear optics, but with non linearities initially reaching up to 33, then 135 (now exceeding 1000). Through a series of experimental and theoretical studies, she elucidated both the microscopic and macroscopic aspects of this process. This journey was far from straightforward, as the initial enthusiasm of many quickly waned ; one of us remembers vividly how the Letter on the very first high harmonics to extend into the soft X-ray range was initially rejected due to "lack of novelty". Yet L'Huillier doggedly pursued her studies, demonstrating exceptional scientific courage as she perceived the vast scientific potential of her work.

Indeed, drawing an analogy between the spectrum of high harmonics and that of mode-locked laser, in 1992 Anne L'HuIllier and other physicists began to wonder about the possibility to generate attosecond (as) light pulses. Achieving this feat required the spectral phases of the harmonics to exhibit a smooth, ideally linear behavior. Unfortunately, the first numerical simulations displayed erratic phases. It took six years to understand that attosecond pulses should actually exist! The first step saw Schafer and Kulander, then Corkum propose a classical 3-step model of HHG : an electron tunnels through the Coulomb barrier, is accelerated by the laser and possibly undergoes a radiative recombination upon recollision with the parent ion. Subsequently, Lewenstein introduced a quantum model with two separate quantum paths, each with its own smooth phase. Finally a series of studies on propagation and phase-matching by Anne L'Huillier, then at Lund, and few colleagues showed that coherent attosecond pulses should actually be emitted. By 1998 the stage was set for an experimental quest of attosecond pulses.

Based on a theoretical study by Véniard and co-workers, and on their expertise on electron spectroscopies, Müller and Agostini then imagined an experimental technique based on combined photo-ionization with a dressing laser, such that the resulting quantum interferences can be used to characterize a train of attosecond pulses. They promptly tested the idea in collaboration with the LOA laboratory in Palaiseau. In early 2001, Pierre Agostini could demonstrate pulses of 250 as only - a groundbreaking achievement in the realm of optical physics and beyond. However, one challenge remained: how could we ultimately generate a single attosecond pulse and not a train of attosecond bursts?

Over many years, Ferenc Krausz and his coworkers in Vienna and Milan distinguished themselves by developing revolutionary laser methods, eventually allowing one to generate energetic optical pulses close to a single optical cycle. With these, Ferenc Krausz succeeded in 2001, not only to generate isolated attosecond pulses, but to characterize them by time streaking of photo-ionization by a dressing laser. Following this breakthrough, Krausz and coworkers went on with an absolutely outstanding series of scientific premieres in Vienna and Munich on the attodynamics of atomic or solid-state processes.

Thanks to this combination of advanced instrumentation, smart experiments and constant interactions with theory, Anne L'Huillier, Pierre Agostini and Ferenc Krausz, as well as their colleagues made a dream real : being able to capture the internal electron dynamics of atoms, molecules or solids with light pulses shorter than their own timescales.

Attoscience emerged from the realm of highly nonlinear optics, dwelving into an energy and time domain that, just two decades ago, could only be probed through ionization. The intriguing nature of the collected signals, whether in the form of spectra or photoelectrons, could only captivate the experimenter's curiosity, even in the absence of immediate practical applications. It is a physics that skillfully blends quantum and classical mechanics, where phase and coherence aspects take precedence to manipulate electron trajectories within unconventional polarization states. It serves as a pathway, using optical spectra, to glean insights into how quantum effects manifest on a macroscopic scale. Operating on the level of individual electrons, strong field physics generates a XUV pulse that impacts electrons as a collective whole, offering profound insights into the

fundamental essence of matter. This is the captivating tale of an Atomic, Molecular, and Optical (AMO), and laser physics discipline too exquisite to be abandoned during its nascent stages. We extend our heartfelt gratitude to Pierre, Anne, Ferenc, and their collaborators for their unwavering determination in pushing the boundaries of this physics.

Valérie Blanchet, C15 member
Philippe Balcou, C17 member

IUPAP Working Group 21: Physics for Climate Change Action and Sustainable Development

There is very significant evidence that the planet's climate is changing at a rate not observed in the last 10,000 years: the increase in average temperature, the reduction of ice sheets and glaciers, the reduction of the sea ice in the Arctic or a greater frequency of extreme weather events.
These observations, beyond theoretical speculation, have been able to be quantified based on scientific information extracted from natural sources (ice cores, rocks) and modern measurement equipment, and confirm the influence of human activity on climate change.
There is an evident need to make an efficient use of the energy and to seek for renewable and clean energy sources that can replace fossil fuels and to enable a sustainable development of our economy and society.
What can physicists do to engage with this crisis? Many are already deeply involved.
Physicists play a crucial role in understanding complex systems related to global warming and contribute to a better understanding and prediction of our Earth's environment.
The 2021 Nobel Prize in Physics was awarded for groundbreaking contributions to our understanding of complex physical systems related to climate. Syukuro Manabe and Klaus Hasselmann were recognized for their work on the physical modeling of Earth's climate, quantifying variability, and reliably predicting global warming. Giorgio Parisi was acknowledged for discovering the interplay of disorder and fluctuations in physical systems, from atomic to planetary scales.
+The study of new materials is contributing to the development of a new generation of many things, including Perovskites solar cells (light, cheap, and with an efficiency up to 50% higher than current technology), hydrogen storage systems (high capacity, reversible to use for fueling vehicles), and nano active materials for lithium-ion batteries (carbon based to stretch and enhance energy storage systems).
A breakthrough in nuclear fusion has been recently achieved in NIF (National Ignition Facility), releasing more energy than the one used in the ignition process (*).
Such a significant scientific effort requires a multidisciplinary approach in which physicists play a major role in our understanding of the physical world in support of a green economy.
At the 2023 General Assembly, IUPAP formally created IUPAP Working Group 21. WG21 has been tasked to ***identify, promote, engage, and discuss the unique role that physics is and should be playing in this area, and entrench an evidence-based approach to responses to climate change studies and the energy transition process in close collaboration with experts from other disciplines***.
It will establish a strong bridge with the broad international public on these topics. Very importantly, it will suggest and encourage ways of incorporating green economy and sustainability thinking in university curricula and research training. WG21 will organize at least one major conference within the next three years. It fits extremely well with the activities that are expected to take place in

connection with the International Decade of Sciences for Sustainable Development proclaimed by the United Nations General Assembly in August 2023. The Working Group will also liaise with regional and national Physics Societies, and with other Unions.

(*) https://news.mit.edu/2022/perovskites-solar-cells-explained-0715
https://www.energy.gov/eere/fuelcells/hydrogen-storage
https://www.llnl.gov/article/49301/shot-ages-fusion-ignition-breakthrough-hailed-one-most-impressive-scientific-feats-21st
https://www.nature.com/articles/d41586-022-04440-7

Hyunjung Lee, Korea Institute of Fusion Energy, WG21
Tomàs Sintes, University of the Balearic Islands, Palma de Mallorca, WG21
Irvy I(gle) Gledhill, Secretary, WG21

Evelyn Fox Keller Remembered

The recent passing of the American physicist turned social scientist and author, Evelyn Fox Keller, on 22nd September at the age of 87, reminded the authors of a chance meeting with her, which has left a lasting impression.

Keller obtained a first degree in 1957 and PhD in 1963, both in physics. She became interested in biology and took up a faculty position in mathematical biology at Northeastern University. Through her PhD and subsequent years Keller was well aware of the often hostile climate for women scientists and sought to understand her environment, looking at the nature of physics itself through a gender lens. Subsequent to this research, in 1974 she taught her first women's studies course. Keller is often credited with being the first to apply gender studies to science.

In her 1983 book, A feeling for the Organism: the Life and Work of Barbara McClintock, Keller explored the issues of isolation, particularly felt by women scientists, using McClintock, who was awarded the Nobel Prize in Physiology or Medicine in 1983, as a case study. The 1985 book Reflections on Gender and Science further explored further her views on the subject in a series of essays.

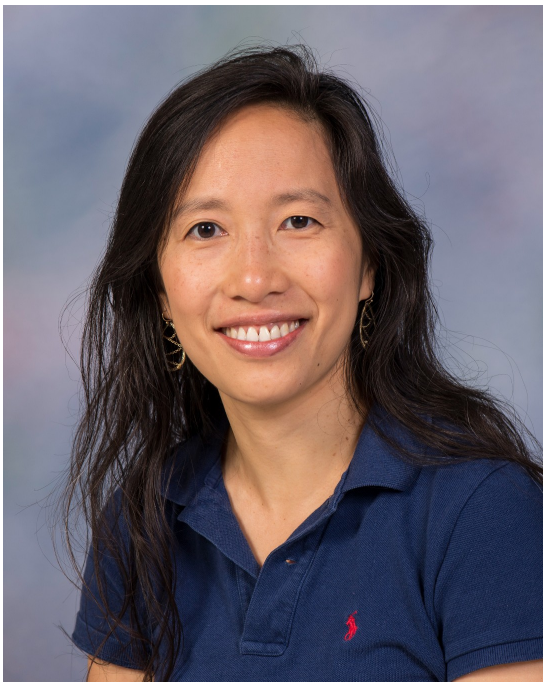
It was at the post-ICWIP2011 meeting of WG5 Women in Physics, at the Stellenbosch Institute for Advanced Studies in South Africa, that the group became aware that Keller was pursuing some research there at that time. During an extended lunchbreak the group got to meet with Keller, who discussed most eloquently the issues facing women in physics.

One of GB's recollections was her response to a question regarding how we, as women in physics, could engage with social scientists to learn from them and improve the situation. Keller was rather pessimistic saying that she didn't see it happening.

Keller's theories of gender and science have their critics but she was a true pioneer, asking questions about the nature of the endeavour of science, arguing that science can never be truly objective, and questioning the role of gender in science. If the field of gender and science has moved on it is because Fox Keller made it a field for discussion.

Gillian Butcher, Igle Gledhill, Silvina Ponce Dawson

IUPAP Interdisciplinary Early Career Scientist Prize 2022-2023



Dr. Evelyn Tang, Rice University, Houston, Texas

For her development of new topological and geometrical analyses that reveal fundamental physics aspects which allow the characterization of robust emergent phenomena in complex systems, from quantum phases of matter to biological systems and the brain.

Dr. Stefano Martiniani, New York University

For groundbreaking contributions to the understanding of the statistical mechanics of active and amorphous systems via the development of uniquely original approaches for quantifying order, entropy and entropy production in systems far from equilibrium, including granular and active matter, neural networks and biological systems.

More

IUPAP Early Career Scientist Prize

C10 - Commission on Structure and Dynamics of Condensed Matter - 2024

Dr. Matteo Mitrano, Harvard University

"For his incisive contributions on to the study and manipulation of dynamical behaviours in quantum materials"

AC4 - Medical Physics - 2023

Dr. Tan Hong Qi, Nanyang Technological University - NTU Singapore

"For his contributions to the fields of clinical radiotherapy dosimetry, quality assurance, modelling and the application of artificial intelligence."

AC4 - Medical Physics - 2022

Dr. Choirul Anam, Universitas Diponegoro

"For his research contribution in medical image processing and dosimetry for diagnostic

AC4 - Medical Physics - 2021

Dr. Chai Hong Yeong, Taylor's University, Malaysia

"For the production and first use of 153SmCl3-ion exchange resin capsule formulation for assessing gastrointestinal motility"

radiology, particularly in computed tomography."

IUPAP Open Calls

- 2024 IUPAP Magnetism Award And Néel Medal
- Early Career Scientist Prize – C9 Magnetism
- Early Career Scientist Prize – C8 Semiconductor Physics

Let me have a look

IUPAP

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Thank you