



NEWSLETTER

COMMISSION INTERNATIONALE D'OPTIQUE • INTERNATIONAL COMMISSION FOR OPTICS

Nobel Prize to Attosecond Science

ICO celebrates 2023 Nobel Prize in Physics awarded for experimental methods that generate attosecond pulses



Pierre Agostini (top) Ferenc Krausz (center) and Anne L'Huillier (bottom) recipients one-third each of the Nobel Prize in Physics 2023 "for experimental methods that generate attosecond pulses of light for the study of electron dynamics in matter"

The Nobel Prize in Physics 2023 honors pioneering experimental advancements that have furnished a toolkit for observing and manipulating electrons on their natural time scale. This revolution traces back to the development of intense lasers that changed our understanding of non-linear optics, emphasizing the role of highly non-perturbative interactions.

In an astonishing experiment, **Anne L'Huillier** and co-workers revealed an intriguing new aspect of non-linear photon conversion [1]. Contrary to the intuitive understanding that the efficiency of photon conversion should decrease with the increase in the number of photons involved, the harmonics generated from intense drivers produced a frequency comb.

It is worth to mention that around this period Pierre Agostini demonstrated that electron ionization at elevated intensities could lead to the absorption of photons above the ionization threshold. This was also a surprising outcome, diverging from the existing comprehension of multiphoton ionization. The concept of generating attosecond pulses (10^{-18} s) using high-order harmonic generation had been theorized as early as 1992 by the Hungarian physicists G. Farkas and Cs. Tóth [2]. By the late 90s, while the scientific community was aware of the potential of attosecond pulses, the technology was not mature enough to measure such short events. However, this decade wasn't stagnant; it was a vibrant period of theoretical and experimental growth in the field, from

comprehensive insights to proposals for producing isolated attosecond pulses. Pulse characterization techniques transitioned from mere auto-correlation to the full characterization of the electric field, and supercontinuum generation combined with chirp-compensation edged us closer towards the limit of single cycle laser pulses.

Such exciting advances had a climax in 2001 when two historical milestones propelled attosecond science towards an increasingly mature technology. **Pierre Agostini** and his team introduced a two-color interferometric method, demonstrating the phase-locked nature of the high-order harmonic comb and producing a train of 250-attosecond pulses [4]. Concurrently, **Ferenc Krausz** and his collaborators showcased the production of isolated 650 attosecond pulses, discerned from the photoelectron spectrum emerging from attosecond ionization when an infrared field was present [5]. These milestones undeniably ushered into a novel era of ultrafast optics, pivoting towards the time-sensitive observation and manipulation of electrons in matter. Today, these ultrafast pulses span only a few tens of attoseconds, supporting the fastest technology and measurement methodologies known to science.

[1] J. Phys. B: At. Mol. Opt. Phys. 21 L31 (1988)

[3] Phys. Lett. A 168 447 (1992)

[4] Science 292, 1689 (2001)

[5] Nature 414, 509 (2001)

Prof. Dr. Luis Plaja
Universidad de Salamanca
President, Spanish Optical Society

Optics & Photonics Africa 2023 Meeting

ICO VP Yaseera Ismail chaired the meeting that was celebrated in White River, close to Kruger National Park, one of the most important in South Africa.



Dr. Yaseera Ismail, is with Kwazulu-Natal University. She is ICO Vice-President appointed by OPTICA.

The last **ICO Bureau** meeting has been celebrated during "Optics & Photonics Africa 2023" and has been an excellent opportunity for the planning of future events like the ICO 26th General Meeting scheduled to take place in October 2024.

This event, organized under the auspices of the International Commission for Optics (ICO), has been held in South Africa, close to its emblematic Kruger National Park. It has been co-sponsored by various international societies and institutions: OPTICA, SPIE, RIAO, NITECHS, Kwazulu-Natal University LAM, OWLS, UNITWIN, UNISA, ALC, IFCAE and IUPAP.

Delegates were impressed by the large number of female attendees and boasted that the talks were excellent, with a wide variety of topics that highlighted technological advancements.

The congress offered a diverse range of topics, ranging from Quantum Optics and plenary sessions were given by Andrew Forbes (Tailoring distortion-free light), Alexander Gaeta (Nonlinear

Photonics for All), Michal Lipson (The Revolution of Silicon Photonics), Anna Chiara De Luca (Raman & SERS-based biosensors for biomedical applications), Carlos Hernández-García (Short Wavelength Structured Light for Attosecond Science), Kaoru Minoshima (Versatile control of optical waves with optical frequency combs enables broad applications), Malik Maaza (On the trapping of cold neutrons), Sonja Franke-Arnold (Polarization textures of light-Spin textures of atoms), Zouheir Sekkat (Smart Molecular Machines in Polymers) and Xu Liu (Multi beam parallel laser direct writing and 3D nano-fabrication).

Besides hosting the ICO Bureau meeting and the scientific topics covered the congress provided attendees with a unique opportunity to gather in many social activities and experience the natural wonders of South Africa.

Dr. Yaseera Ismail
ICO VP appointed by OPTICA,
Chair "Optics & Photonics Africa 2023"



Group photo of the attendants to "Optics & Photonics Africa 2023" meeting.

European Optics met in Dijon



Discussions at the panels during EOSAM 2023 in Dijon, France.

EOSAM 2023 was held in the beautiful city of Dijon France, 11-15 September, at the congress center.



The ICO Prize 2021 was delivered at the congress by the ICO Secretary General Humberto Michinel to Prof. Bo Zhen.

The meeting was held in the beautiful city of Dijon France, 11-15 September, at the congress center. It was organized with the French Optical Society (SFO) that is one of the seventeen national optical societies (NOS) of the European Optical Society (EOS). Nine topical optical meetings, four focused sessions (on selected hot topics deemed to be of special interest to conference attendees), EU Project Sessions, Early Stage Researcher Sessions, and sessions on the industrial mastering of optical technologies and systems were scheduled in parallel in large rooms or the big auditorium to fit our over 500 attendees. The exhibition and industrial program fostered relations between science and industry. EOSAM included a high-level program, with six exceptional plenary speakers and two plenary award speakers: Thomas Ebbesen, Ursula Keller, Fabio Sciarrino, Valentina Emiliani, Laura Na Liu, Jean-Pierre Wolf. The exhibition involved 20 companies, exhibiting from Tuesday to Thursday.

The EOS Prize was awarded to the best paper published in the Journal of the European Optical Society, JEOS-RP en-

titled “Optical diagnosis of gastric tissue biopsies with Mueller microscopy and statistical analysis”, authored by Myeongseop Kim, Hee Ryung Lee, Razvigor Ossikovski, Aude Malfait-Jobart, Dominique Lamarque, and Tatiana Novikova. Francesco Baldini, Christophe Moser and Sébastien Tanzilli were upgraded to EOS Fellows. An honorary member title was given to an exceptional service to the community to Hervé C. Lefèvre.

Over 30% of the attendees were students. Master-level students were also given a chance to come and join the tutorials on Monday.

Ten tutorial speakers took the stage before the official opening of the conference on Tuesday: Sébastien Bidault, Julien Charton, Sara Ducci, John M. Dudley, Oliver Föhnle, Philippe Grelu, Sandrine Lévêque-Fort, Rüdiger Paschotta, Roozbeh Shokri, Antoine Dubrouil. Around 90 posters were presented on Wednesday and Thursday, same posters kept on poster boards both days to allow sufficient time for discussions.

Eliina Koistinen
EOS General Director

The ICO Awards 2023 announced

The ICO Bureau announced the ICO Awards for 2023



Prof. Carlos Hernández-García from the University of Salamanca (Spain) has been awarded with the ICO Prize 2023.

Contacts

International Commission for Optics (<http://e-ico.org>).

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Comté, France



The ICO Bureau, during his last meeting in South Africa, has announced the awards of the International Commission for Optics ICO for 2023.

The ICO Prize, to be given each year to an individual who has made a noteworthy contribution to optics, published submitted for publication before the age of 40 has been awarded to Carlos Hernández-García from the University of Salamanca (Spain) due to his seminal contributions in the theory and modeling of laser-driven high harmonic generation and understanding how to manipulate their waveforms to impart orbital and spin photon angular momentum.

This IUPAP Prize for Young Scientist in Optics is awarded to Carlos A. Ríos Ocampo, Assistant Professor at the University of Maryland, USA for pioneering the integration of phase change materials with photonic integrated circuits for a wide range of applications.

The ICO Galileo Galilei Medal recognizes the promotion of Optics under difficult circumstances and has been given to Dr. Rahman Chowdhury Mahdy from North South University, Bashundhara, Bangladesh for "his out-

standing contributions in the areas of optical (main) and quantum mechanical manipulation achieved under comparatively difficult circumstances".

Finally, the ICO and the Abdus Salam International Centre for Theoretical Physics have agreed to establish a joint prize reserved for researchers from developing countries (as defined by the United Nations) less than 40 years old (on 1st December of the year for which the award is given), who are active in research in Optics and have contributed to the promotion of research activities in Optics in their own or another developing country. This year the award was given to Dr Muhammad Qasim Mehmood from ITU Lahore in Pakistan for his remarkable contribution to the field of nanophotonics, in particular plasmonics and metamaterials, and for supervising and inspiring many young researchers in Pakistan". He was invited to receive his award and give a lecture at the ICTP Winter School that took place in Trieste on Feb 14th, 2023.

Prof. Dr. Humberto Michinel
Secretary General of the ICO

Forthcoming events with ICO participation

Below is a list of forthcoming events with ICO participation. For further information, visit their official websites listed below.

16-19 July 2024

International Conference on Applications of Optics and Photonics (AOP)

Aveiro, Portugal

Contact: Marta S. Ferreira

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<https://aop2024.org>

30 September - 4 October 2024

XXVI International Commission for Optics World Congress (ICO-26)

Dakar, Senegal

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<https://ico26.org>

Responsibility for the correctness of the information on this page rests with the International Commission for Optics (ICO); <http://www.e-ico.org/>. **President:** Prof. John C Howell, Hebrew University of Jerusalem, Israel; john.howell@mail.huji.ac.il **Treasurer:** Prof. Joseph Niemela, International Center for Theoretical Physics, Italy; niemela@ictp.it. **Secretary:** Prof. Humberto Michinel, Universidade de Vigo, Spain; secretariat@e-ico.org.