

Report to IUPAP Council and Commission Chairs Meeting

IUPAP C17: Commission on Laser Physics and Photonics

Vilnius, Lithuania, 1 - 2 November 2018

1. ACTIVITIES SINCE THE LAST C&CC MEETING (MAY 2018)

1.1. Nobel Prize in Physics 2018

The Nobel Prize in Physics was announced on the 1 Oct., awarding three researchers "for groundbreaking inventions in the field of *laser physics*", Prof. Arthur Ashkin "for the optical tweezers and their application to biological systems", and Prof. Gérard Mourou and Prof. Donna Strickland "for their method of generating high-intensity, ultra-short optical pulses". This announcement has thrilled our Commission's community, not just for it recognizing their accomplishments in Laser Physics, but also for the Physics Prize being awarded to a woman since it last went to Maria Goeppert-Mayer in 1963, and only the third winner, with the first awarded to Marie Curie in 1903. Our Commission believes that this is evidence that women remain underrepresented and underrecognized in STEM fields.

1.2. Articles to the IUPAP Newsletter

To promote visibility of young scientists in Laser Physics & Photonics, C17 has asked the winners of the 2017 IUPAP Young Scientist Prizes (YSP) to contribute articles to the IUPAP newsletter. For the June 2018 issue, Dr. Mohsen Rahmani (Australian National University, Canberra, Australia) (Fundamental Aspects), who was awarded C17's YSP 2017 "for his outstanding contributions to light-matter interactions at nanoscale, particularly nonlinear nanophotonics via metallic, dielectric and semiconductor nanostructures and metasurfaces, which have paved the road for extending nonlinear optics to the nanoscale", provided us with a short article on his research (see Appendix B).

For the September 2018 issue, two articles on the International Day of Light (IDL, 16 May) was contributed, by Prof. Parinda Vasa and Prof. Cather Simpson of our commission (see Appendix C). Prof. Vasa described in her article the student photo contest "Light and Life" held at IIT-Bombay, showing beautiful photographs taken by the students. Prof. Simpson gave an overview of the opening activities of IDL in Paris.

1.3. Predatory conferences

In Sep. 2018, our Commission received an application for IUPAP endorsement from a conference to be held in Nov. 2018. After having a look at the conference website and doing some on-line research, it has turned out that this conference is one of the recently frequent predatory ("fake") conferences (see, for example [this article in Physics Today](#)). Naturally, our Commission unanimously did NOT support IUPAP endorsement of this conference. In addition, discussions among our Commission members started, noting that protecting scientists from such predatory conferences and journals is one of the important missions of IUPAP. Ideas about how this could be accomplished was also discussed. Proposals included the IUPAP maintaining a list of conferences and journals that are NOT predatory, or IUPAP having a different category that recognizes a conference as legitimate (without the need for the conference organizers to request endorsement and provide conference reports. However, this may be confused with or perturb applications for IUPAP endorsement). Given the recent increasing number of predatory conferences and journals, our Commission proposes that IUPAP discuss methods to shield physics researchers from such predatory conferences and journals.

1.4. C17 Meeting

On the 9 Oct. 2018, we held a meeting of C17 members to discuss future directions and to exchange ideas. The C17 meeting was held in Vilnius, Lithuania, hosted by one of our members, Prof. Gintaras Valušis of the Center for Physical Sciences and Technology (FTMC), Lithuania, one day before the start of the Conference on Advanced Properties and Processes in Optoelectronic Materials and Systems (APROPOS 16, 10-12 October 2018). We summarize below some outcomes of this C17 Meeting.

1.4.1. IUPAP Conference support

Information was distributed that the deadline for IUPAP support for conferences to be held in 2020 would be the 1 June 2019. Several conferences that we could target for the next deadline were discussed, which included the APROPOS conference and CLEO-Europe (where the award ceremonies for the C17 YSP will be held in 2019). It was agreed that each member will contact organizers of conferences that we see fit for support from IUPAP, to encourage applications.

1.4.2. Articles for Newsletter

Discussions on future contributions to the IUPAP newsletters from C17 were held. The most natural would be on the 2018 Nobel Prize in Physics, and contributions were proposed both from the perspective of the science for which it was awarded, and a reflection upon the fact that this year marks only the third in Physics by a woman. Articles were also proposed for announcements on the plans for IDL 2019, reports on photonic science and industry in specific countries (such as Lithuania), and for obituaries, such as that of Prof. Charles Kao, pioneer of fibre optics in telecommunications.

1.4.3. Associate Members

Associate Members of our Commission have been nominated and voted. For the 2019-2021 period, the next two Associate Members were chosen to be recommended:

- Prof. John Dudley (representing the International Day of Light)
- Prof. John Harvey (representing the International Commission for Optics)

We have also nominated Prof. Nicholas P. Bigelow (representing the Joint Council on Quantum Electronics), and have requested his short CV, but we have not received it to date. As such, his recommendation has been put on hold. We are communicating with OSA to understand the situation. Aside from these three candidates, we also discussed other potential candidates. Given the lack of involvement of researchers from industry to our Commission, it has been proposed that a representative from industry would be appropriate. Several possibilities have been discussed, including a representative from the American Institute for Manufacturing Integrated Photonics (AIM Photonics), an industry driven public-private partnership in photonics in the USA.

1.4.4. Preparations for the C17 Young Scientist Prize (YSP) in 2019

Information on the C17 YSP for 2019 was distributed, including eligibility criteria, and discussions were held on how the applications should be graded.

1.4.5. IDL 2019

Preparations for IDL 2019, and events/activities that C17 could be involved in were discussed. Further follow-up will be performed in collaboration with our Associate Member representing IDL, Prof. J. Dudley.

1.4.6. C17/IUPAP-ICO Collaborations and Workshop 2019

Potential collaborations between our Commission and ICO were discussed, including the C17-ICO Joint Workshop in 2019, proposed to be held in Tunisia.

APPENDICES

Appendix A - Officers and Members of C17 (as of October 2018)

Officers:

Chair: Tsuneyuki Ozaki (2014) (2017)

Email: ozaki@emt.inrs.ca

Vice-Chair: Qihuang Gong (2011) (2014) (2017)

Email: qhgong@pku.edu.cn

Secretary: Roberto Pini (2014) (2017)

Email: roberto.pini@cnr.it

Past Chair: Deborah Kane (2011) (2014)

Email: deb.kane@mq.edu.au

Members:

Kai-Mei Camilla Fu (2017)

Email: kaimeifu@uw.edu

Alexey Kalachev (2017)

Email: a.a.kalachev@mail.ru

Kathy Lüdge (2017)

Email: kathy.luedge@tu-berlin.de

Andre Luiten (2017)

Email: andre.luiten@adelaide.edu.au

Kevin F. MacDonald (2017)

Email: kfm@orc.soton.ac.uk

Ci-Ling Pan (2011) (2017)

Email: clpan@phys.nthu.edu.tw

M. Cather Simpson (2017)

Email: c.simpson@auckland.ac.nz

Yoshiro Takahashi (2017)

Email: yitk@scphys.kyoto-u.ac.jp

Gintaras Valušis (2017)

Email: gintaras.valusis@ftmc.lt

Parinda Vasa (2017)

Email: parinda@iitb.ac.in

Arkadiusz Wójs (2014) (2017)
 Email: arkadiusz.wojs@pwr.edu.pl

Associate Members (mandate until end of 2018):

Nicholas P. Bigelow (representing the Joint Council on Quantum Electronics)

John Harvey (representing the International Commission for Optics)

John Dudley (representing the International Year of Light legacy)

Appendix B - Contribution by Dr. Rahmani (2017 C17 YSP winner) to the IUPAP Newsletter (June 2018)

NONLINEAR OPTICS AT NANOSCALE

Dr. Mohsen Rahmani (2017 C17 YSP winner)

Nonlinear optics describes the behaviour of light in nonlinear media, whereby light is directly controlled by light. It holds a great potential to eliminate the need for electronics altogether. This is the heart of modern photonic functionalities, including diversifying lasers and light, material interactions and more importantly information technology. The non-linear optical response of a material is generally very weak; therefore, non-linear optical interactions in end-user devices are generally based on large anisotropic crystals that gradually accumulate a strong effect.

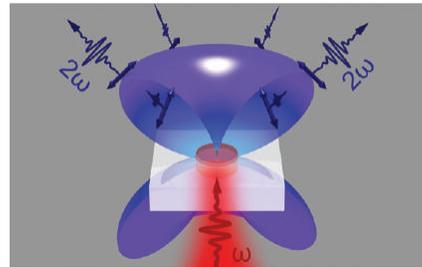


Dr. Mohsen Rahmani

Unfortunately, such crystals are not compatible with the size requirements of cutting-edge miniaturized systems. Together with advancements in nano-technology, the quest to realize nonlinear optics with enhanced optical nonlinear response at nanoscale has become very active in the last decade. My research is focused on developing efficient nonlinear optics from tailored nanostructures, whose thicknesses are typically a few hundred times less than a human hair, including metallic and high-index dielectric, semiconductors and hybrid nanostructures. Metallic (plasmonic) nanostructures are powerful tools due to their capabilities for light localization at the nanoscale. However, low damage threshold and Ohmic losses of metals have guided the attentions to high-index dielectric nanostructures. The negligible resistive losses of dielectric nanoantennas avoid heating problems and allow excitation at much-higher light intensities, which is of

paramount importance for the efficiency. However, most of the dielectrics, e.g. silicon and germanium do not exhibit bulk quadratic optical nonlinearity because of their centro-symmetric crystal structure.

Currently, the group is focused on exploiting materials with non-centro-symmetric crystal structures, such as III-V semiconductors, e.g. GaAs and AlGaAs, with high nonlinear properties. Such nanostructures not only increase the conversion efficiency due to their lower-order nonlinearity, but also provide a unique opportunity to employ and/or control the polarization states of fundamental and/or nonlinear signal. This research opens new avenues for novel nonlinear imaging, bright fluorescent markers for bioimaging, as well as constituent elements for efficient nonlinear holograms.



Forward second harmonic generation by an AlGaAs nanocrystal

Appendix C - Contribution by Prof. Parinda Vasa and Prof. Cather Simpson to the IUPAP Newsletter (September 2018)

LIGHT AND LIFE: A STUDENT PHOTO CONTEST

International Day of Light Celebration at IIT Bombay

Parinda Vasa (C17 Member, Indian Institute Of Technology Bombay, India)



Remya K P (First Prize)



Srinivasulu Grandhi (First Prize)



Shashi Ranjan (Second Prize)



Sujit Udupa (Second Prize)

Starting this year, the International Day of Light (IDL) will be held on May 16th every year, to mark the anniversary of the first successful operation of the laser in 1960 by physicist and engineer, Theodore Maiman. Invention of laser is an ideal example of how light and light related technologies can revolutionize several fields like communications and healthcare and bring benefits to society. Every year, IDL activities will be celebrated worldwide with the help of UNESCO and several other partner institutions and sponsors. This year, over 600 events were held in 87 countries, in which hundreds of thousands of people celebrated the vital role of light and associated technologies in various aspects of life like science, culture, art, and education.

At the Department of Physics, Indian Institute of Technology Bombay, Mumbai, India we organized a student photo contest, "Light and Life" to celebrate IDL. The theme of this contest was the importance of light and light based technologies in life on earth. Along with IDL, we also celebrated Diamond Jubilee of IIT Bombay. This event was also supported by, the International Union of Pure and Applied Physics' (IUPAP) Commission on Laser Physics and Photonics (C17). The contest "Light and Life" was available nationwide to students of all ages and all backgrounds. It promoted equality among different student sectors of society. Students from various departments and institutes enthusiastically participated in the contest. Winning as well as some selected photographs were displayed in Physics Department, and the winners were awarded with book vouchers. Some of the winning photos are shown below. We look forward to celebrate IDL again in coming years.

INTERNATIONAL DAY OF LIGHT, OPENING CEREMONIES IN PARIS

Cather Simpson, Member, Commission on Laser Physics (C17)



The Eiffel Tower lights up the sky. Headquarters Paris Ouverture de la journée mondiale de la Lumière; Copyright: UNESCO/Nora Houguenade



Over 600 people from around the world congregated in Paris to celebrate; Photo Credit: Prof Cather Simpson

On May 16, 1960 Theodore Maiman successfully demonstrated the operation of the ruby laser for the first time. Fifty-eight years later, on May 16, 2018, over 600 artists, scientists, industry leaders, politicians and others gathered at UNESCO Headquarters in Paris, France to celebrate the first International Day of Light. New Zealand played a central role in establishing the International Day of Light in a joint proposal to UNESCO with Ghana, Mexico, and the Russian Federation. I attended as a representative of New Zealand's science community, and it was a brilliant event.

Like the International Year of Light and Light Based Technologies in 2015, the International Day of Light marks and celebrates the importance of light in all facets of our lives today, and inspires us to improve our future through light. It's not just about high-tech

physics – lighting in our houses seems commonplace now, but this seemingly mundane advance transformed our society every bit as much as has the light-driven internet. Access to lighting is changing people's lives for the better today in remote, poor parts of our planet – remedying light poverty is a key initiative of many who celebrate the International Day of Light.

The opening ceremonies featured talks by Nobel Prize winners Claude Cohen-Tannoudji (Physics, 1997) and Kip Thorne (Physics, 2017). A "science show" by a group of young Belgian students entertained us all. New Zealand's Sir Peter Gluckman participated in a panel focused upon how science should inform and influence policy and policy makers. I was fascinated by the international viewpoints – every continent except Antarctica provided some illumination.

It wasn't just science though. Khaled Toukan spoke about SESAME, the Synchrotron-light for Experimental Science and Applications in the Middle East project that he directs. This facility based in al-Balqa Jordan is inspirational and it provides a powerful example of how light can unify across a very troubled region. Other presentations informed us about light and culture and toured us through the universe and our exploration of it. Sometimes the absence of light is every bit as important as its presence.

The cultural events and artistic displays were amazing. A heart-stopping highlight was the soprano soloist, Katerina Mina, whose performances at the beginning and the end immersed and uplifted us. The day ended with a stunning light show by Kari Kola, a video of which can be seen here: <http://karikola.com/productions/international-day-of-light-flagship-event-2018>

Woven through the event were the United Nations Sustainable Development Goals and how light and light-based technologies will help achieve them. The Director-General of UNESCO, Audrey Azoulay, opened the topic with her address at the start



Prof. John Dudley, Chair of the IDL Steering Group. Photo Credit: Prof Cather Simpson

of the ceremony. Professor John Dudley, who led the massively successful 2015 International Year of Light and Chair of the IDL Steering Committee, touched upon them as well.

The International Year of Light saw thousands of events across the globe, run by students and teachers, artists and musicians, politicians and museums, Nobel Prize winners and PhD candidates. The International Day of Light is shaping up to have even more impact. For the first IDL in 2018, over 600 events were run in 87 countries – New Zealand led the way with the first event to mark the day with a light show on the Auckland Harbour Bridge (<https://www.vector.co.nz/about-us/sponsorship/lights/light-events/unesco-international-day-of-light>). The inspirational success of IDL 2018 means we're all looking forward to what we can achieve for IDL in 2019.