

## **Report of Affiliated Commission AC.1 for 2014-17**

Affiliated Commission AC.1: The International Commission for Optics (ICO)

### **Introduction**

ICO was founded in 1947 as an international academic organization, and is now composed of 53 territorial committee members and 7 academic society members. Since that time, ICO has been contributing to the international community by promoting research on optics and photonics through scientific events, publications, education, and international conferences, with emphasis on the developing world. ICO is an associate member of the International Council for Science, ICSU, and also as an affiliated member of the International Union for Pure and Applied Physics, IUPAP.

The first General Congress of the ICO, ICO-1, was held in Delft, the Netherlands, in July 1948, the year after the ICO was established, with the aim of providing a forum to discuss progress in optics and photonics. Since then, the ICO Congress has been held every three years, and gained participation from all over the world including developing countries. The ICO General Congress has established itself as one of the most prestigious international conferences in the field of optics and photonics. This year's Congress is the second to be held in Japan, 34 years since ICO13 was held in Sapporo. It is our great honor to host the ICO Congress in Japan again.

Optics and photonics are interdisciplinary academic fields that cover the fundamental physics of light itself, basic technologies such as generation of light, and a wide variety of applications based on optics and photonics. Over the years, the ICO has contributed to society through application of optics and photonics. Evidence of the contribution is obvious from the fact that many Nobel laureates have accomplished their achievements in the field of optics and photonics. In 2014, Professors Akasaki, Amano, and Nakamura were awarded the Nobel Prize in Physics for their invention and fundamental research of the blue LED. Professor Kajita's Nobel Prize in 2015 is awarded for neutrino physics, but the photon detector of course played an important role for his discovery. The Nobel Prize in Chemistry 2014 was awarded jointly to Professors Eric Betzig, Stefan W. Hell, and William E. Moerner for the development of super-resolved fluorescence microscopy. This also indicates that the excellent research in optics has given impacts not only on the field of physics but also that of chemistry and others.

In the period 2014-2017, ICO has supported more than 30 international meetings, including the general congress, topical meetings, regional meetings, schools, traveling lecture programs, and other activities. These include 2016 ICO annual topical meeting jointly with the 117th annual meeting of the Deutsche Gesellschaft für angewandte Optik (DGaO) in Hanover, Germany (17-21 May 2016). Two areas of activity in this period stand out, those associated with the International Year of Light 2015 (IYL2015) and those associated with ICO's move to change its status from that of affiliated member of IUPAP and associate member of ICSU to that of a full ICSU Union. Activities in these latter two areas are elaborated in the following paragraphs.

### **Activities on International Year of Light 2015**

The ICO supported the International Year of Light 2015 (IYL2015) initiative since its inception in 2009 in its capacity as a member of IUPAP and ICSU. The active promotion by ICO for the application of the IYL2015 through IUPAP and ICSU was essential to securing the support of the UNESCO Executive Board for realization of the IYL2015.

More than half of the ICO Bureau and over 30 other members of the ICO family attended the opening ceremony of the IYL2015, which was held in Paris in April 2015. For promoting the IYL2015, the ICO created a new ICO Award for the encouragement of activities in optics and photonics by young people in the ICO Territories. Particular emphasis was given to activities that would be sustainable beyond 2015 and that were replicable in other territories.

The main award of \$5000 USD was awarded to the Spanish Optical Society (SEDOPTICA) for secondary school outreach activities using the European Commission-funded Photonics Explorer kit. The Cuban ICO Territory was awarded a prize for optics and photonics trainees who are potential scientists of the future in Havana. Their initiative taught young people how to operate five telescopes and to learn practical methods of orientation using the most important stars. Another award went to the IIS Cavazzi sez. Liceo Scientifico, Pavullo, a secondary school in Italy. They organized a one-day science fair called Amazing Light that was open to middle and high schools students. The legacy of the IYL2015 by ICO was led to the commencement of the process to create an International Union of Optics and Photonics within ICSU.

In addition to the thousands of activities organized worldwide by ICO Territories during the IYL 2015, the ICO contributed to the realization of the conference Education and Training in Optics and Photonics (ETOP 2015) in Bordeaux, France (29 June - 2 July 2015), where the ICO held its annual Bureau meeting.

### **Actions for becoming an ICSU Union**

Since its establishment in 1947, due to the priority of the optical industry immediately after the Second World War, ICO was primarily aimed at promotion of optical theory, theoretical research, construction of optical instruments, and physiological optics aspects of vision research. As a result of the invention of the laser in 1960, the research scope of Optics and Photonics has expanded greatly, and numerous research results and technological advances have been achieved in fields other than physics. We currently believe that optics and photonics are super-disciplines of science and technology contributing significantly to the development of the world economy. As an example, the U.S. National Science Foundation's Optics and Photonics program includes astronomy, chemistry, material research, mathematical science, physics, biotechnology, environment and transportation systems, electricity, communications, and cyber systems. It also includes departments of biological infrastructure, computers, and network systems. Today, optics and photonics play an important role in improving the well-being of the people of the world. Collaborative efforts with ICSU Unions have already begun and will continue to grow.

As an example, the IYL2015 was initiated with the combined support of ICO, IUPAP, and IUPAC within ICSU. International Member Societies of ICO were sponsors and leaders of the organization of a variety of activities, mostly in the developed world. The ICO itself participated in the preparation and reporting of this event through its Territory Committee Members, who

sought support from their ambassadors of the United Nations and local resources for their own activities.

The 23rd General Assembly held in Santiago de Compostela, Spain in 2014 directed the ICO secretary to initiate the process of application to ICSU to become an ICSU union. Based on the decision, a working group (so called ICO ICSU Committee) consisting of Y. Arakawa (President), D. Moore (Immediate Past President), M. L. Calvo (Second Immediate Past President), A. Guzmán (General Secretary), G. von Bally (Associate Secretary), and J. Harrington (Treasurer) and P. Chavel (Second Past General Secretary) was formed for the action toward becoming an ICSU Union. A draft of the document "ICO Application for the Status of an ICSU Scientific Union" has been prepared by the ICO ICSU Committee members and Prof Pierre Chavel.

In response to the ICO President's request for letters of support for the ICO application, the ICO received supporting letters from six ICSU Union Members (IUMRS, URSI, IUBS, IUPESM, IUPAC, IAU) URSI, IUMRS, IUBS, IUPESM, and IUPAC). In addition, ICO also received endorsement letters from eight ICSU Territorial Members (China (CAST), Germany (DFG), Mexico (AMC), Italy (CNR), Spain (CSIC), New Zealand (RSNC), Japan (SC), and UK (Royal Society)) , and five ICO Territorial Committee Members (SEDO Spanish Optical Society, SFO French Optical Society, SPOF Sociedade Portuguesa, ICO Canadian Territory, DOK German Deutsches Optisches Komitee), and four ICO International Society Members (RIAO, LAM, OWLS, EOS) ). The action of ICO was also supported by a Nobel Prize Laureate, Prof. Stefan W. Hell, via receiving his supporting letter.

Finally, the ICO President sent the document entitled "Application for the status of Union within the International Council for Science (ICSU)" to Professor David Black, Secretary General, International Council for Science on April 5th, 2017.

### **ICO Strategic Planning**

While working on the application of the ICO to the ICSU, a draft of the ICO Strategic Plan 2017 - 2023 was prepared. The purpose of strategic planning is to set overall goals for a business, organization, or institution and to develop a plan to achieve them. It involves asking where the institution is, in what direction it should be headed, and what its priorities should be. The Strategic Plan 2017 - 2023 was attached to the "Application for the status of Union within the International Council for Science (ICSU) as one of Appendixes

The strategic planning is intended to accomplish three important tasks:

1. to clarify the outcomes that an organization wishes to achieve;
2. to select the broad strategies that will enable the organization to achieve those outcomes; and
3. to identify ways to measure progress.

By reflecting the above three tasks, the ICO Strategic Plan 2017-2023, can provide a roadmap for strengthening ICO's international organization competencies in the development and expansion of Optics and Photonics. Authors of this document include the current members of the ICO Executive Committee-Yasuhiko Arakawa, ICO President; Duncan Moore, ICO Past President; Angela M. Guzman, Secretary General; Gert von Bally, Associate Secretary; James H.

Harrington, Treasurer-and, in addition, Maria L. Calvo, former ICO President (term 2008-2011) and Pierre Chavel, former Secretary (1990-2002) are also involved.

The ICO Strategic Plan is a living, evolving document. It is expected that the ICO strategic plan will be reviewed and updated on a regular basis.

### **Awards of ICO**

One of the most important tasks of ICO is to award excellent researchers. During the period of 2014-2017, three awards have been presented that recognize prominent achievements in optics and photonics every year: the ICO Award, the ICO Galileo Galilei Award, and the ICO / ICTP Gallieno Denardo Award. ICO also manages the IUPAP Young Scientist Award in optics and photonics. These awards encourage scientists and engineers, especially young researchers from developed countries, to pursue excellent research.

ICO established in 1982 the ICO Award, to be given each year to an individual who has made a noteworthy contribution to optics, published or submitted for publication before he or she has reached the age of 40. The character of the work of successive Prize recipients should preferably alternate between predominantly experimental or technological and predominantly theoretical. The "noteworthy" contribution in optics is measured chiefly by its impact (past or possibly future) on the field of optics generally, opening a subfield or significantly expanding an established subfield in research or technology. The most recent recipients were Martin Booth (United Kingdom, 2014), Aydogan Ozcan (USA, 2015), and Andrea Ai? (USA, 2016).

The Galileo Galilei Award was established in 1993 and contributes to one of the essential missions of ICO. It is to recognize the promotion of optics in difficult situations. This award recognizes outstanding contributions in the optical field to scientific or technical leadership in basic scientific problems or problems, research or development of optical methods or equipment, or establishment of regional optical centers. A relatively unfavorable situation refers to difficult economic or social conditions, or lack of access to scientific or technical facilities or information sources. The most recent recipients were Chandra Shakher (India, 2014), Aram Papoyan (Armenia, 2015), and Guillermo H. Kaufman (Argentina, 2016).

The ICCP / ICTP Galieno Denardo Award was founded in 2000 with Abdus Salam International Theoretical Physics Center ICTP to certify young researchers in developing countries. Nominations need to be documented in a complete curriculum including a list of publications and selected reprints (3 or fewer), full work experience to promote research activities in developing countries, and explanation of candidate outcomes. The winners are invited to a three-week winter college in optics held annually in Trieste, and they can lead a seminar. Travel expenses, living expenses, cash prizes, diplomas are included. The most recent recipients are Rim Cherif (Tunisia, 2015), Rajan Jha (India, 2015), Jehan Akbar (Pakistan, 2016), Mati Horprathum (Thailand, 2016), and Goutam Kumar Samanta (India, 2017).

ICO cooperates with IUPAP by managing the IUPAP Young Researcher Award (established in 2005). This award is awarded through the ICO annually to scientists who have made remarkable contributions to applied optics and photonics in the research experience of up to eight

years since obtaining the doctor's degree. The most recent recipients were Albert Schliesser (Denmark, 2014), Frank Coppens (Netherlands, 2015), and Roller Na Liu (Germany, 2016).

### **Conclusion**

The period 2014-2017 has been one of the most crucial periods for ICO, particularly because ICO aims at a new status in ICSU as an ICSU union. Although it is not clear whether our proposal will be approved by the ICSU General Assembly, to be held in Taipei, Taiwan in October, 2017, I believe it has been worth discussing future direction of ICO for globally promoting optics and photonics at this stage.