2016 ICO in the Optics and Photonics world. Report

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**Message from ICO President**

ICO is a Scientific Associate of ICSU and an affiliated commission of IUPAP, consisting of 53 territorial committee and 7 international member societies. ICO is now in the process of applying to ICSU for becoming an ICSU Union, according to the decision of the 23rd ICO General Assembly held in Saint de Compostela, Sapin in 2014.

Since 1947, ICO has kept a structure similar to that of an ICSU Union. The territorial committees are missioned to represent optics and photonics activity in each geographical territory and to support financial independence of ICO. From the beginning, ICO has been always serving the community of optics and photonics internationally by fostering exchange through scientific events, publications, and topical schools. ICO have been leading activities in the developing world as well as educating young people.

The rich history of ICO and the huge expansion of optics and photonics has enabled ICO to be mature enough to become an ICSU Union. Optics and photonics fall not only within the scope of physics, but also are covered by other disciplines such as mathematics, chemistry, biology, material science, and radio science. ICO hopes expand further its activities as an ICSU Union, especially in regards to new technologies applicable to various fields including biomedical imaging, climate change monitoring, renewable energy, internet of things (IoT), and industrial manufacturing.

We solicit all of you to understand ICO’s activities and support its effort toward becoming an ICSU Union.

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**ICO Territorial Committees as per October 2016**

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**International Societies Members**

- EOS European Optical Society
- OSA 100
- RIAO
- SPIE

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**Yasuhiko Arakawa, ICO President (2014-2017)**
Background. Some History

- In 1946 Prof. Pierre Fleury, then director of the Institut d’Optique in Paris and a French representative to the IUPAP, organized a Reunions d’Opticiens in Paris, 14-19 October, 1946. Scientists from 16 countries participated in this post-war European optics conference.
- In January 1947 the General Assembly of the IUPAP approved the appointment of a Preparatory Committee to consider the formation of an International Commission for Optics.
- The initial objectives of the ICO were the study of optical theory, the theoretical study and construction of optical instruments, and the physiological optics of the eye.
- The first official meeting of the ICO took place in the Netherlands in 1948.

OPTICS & PHOTONICS IN THE WORLD

- Since the discovery of the laser, optical sciences have expanded to incorporate quantum and nonlinear optics, photonics, nano-optics, silicon and semiconductor optical materials science, complex dynamics, quantum computing, etc.,
- All areas having technological applications in communications, health, material processing, and, more recently, in renewable energy generation and energy saving.
- Optical imaging science also plays an important role in monitoring disaster risk in general and ecosystem changes due to global warming.
ICO activities. General Conference & General Assembly

- ICO General Conference and General Assembly takes place every three years.
- The map indicates the countries where this ICO event has taken place, period 1947-2014.

**GEOGRAPHICAL DISTRIBUTION OF ICO GENERAL CONFERENCE AND GENERAL ASSEMBLY EVENTS**

### NORTH-AMERICA
- Cambridge, Mass., ICO-4, 1956
- Santa Monica, CA, ICO-9, 1972
- Québec, Canada, ICO-14, 1987
- San Francisco, CA, ICO-18, 1999
- Puebla (Mexico), ICO-22, 2011

### EUROPE
- Delft (NED), ICO-1, 1948
- London (UK), ICO-2, 1950; Reading, ICO-8, 1969
- Madrid (SPA), ICO-3, 1953; ICO-11, 1978; Santiago de Compostela, ICO-14, 2011
- Stockholm (SWE), ICO-5, 1959
- München (GER), ICO-6, 1962; Garmisch-Partenkirchen, ICO-15, 1990
- Paris (FR), ICO-7, 1966
- Prague (TCH), ICO-10, 1975
- Graz (AUT), ICO-12, 1983
- Budapest (HUN), ICO-16, 1993
- Florence (IT), ICO-19, 2002

### ASIA-PACIFIC
- Sapporo (JPN), ICO-13, 1984
- Taejon (KOR), ICO-17, 1996
- Changchun (CHN), ICO-20, 2005
- Sidney (AUS), ICO-21, 2008

The forthcoming ICO-24 General Congress and General Conference will be held in Tokyo, Japan, July 2017.

*Participants at the ICO-11, Puebla (Mexico), 15-19 August 2011. First ICO General Conference and General Meeting held in a Latin-American country. More than 600 participants from 44 countries located in all continents, including not only the Americas but Europe, Africa, Asia and Australia, presented 594 papers that covered recent advances in a wide variety of topics in optics and photonics.*
ICO recent activities. An overview

ICO is involved in many international activities with conferences, schools and colleges, topical meetings, in addition to the General Congress mentioned in page 3. These activities are held all over the world, and, in particular, including geographical areas needing a support to enhance the current progress in science and technology. The diversity of activities contemplate focus on frontiers in optics and photonics, and interacting with other fields such as biomedicine, energy, climate, telecommunications, cultural heritage, space optics, as examples. The following Table gives a scope of the activities sponsored by ICO in the period 2011-2016.

ICO activities are well defined and organized under international cooperation with its international societies members, EOS, IEEE, African LAM Network, OSA, SPIE, the Ibero-American Network RIAO as well as international institutions. As examples, ICO is having a fruitful collaboration with the Abdus Salam International Center for Theoretical Physics (ICTP) since early 2000. This collaboration includes the Winter College in Optics and recent activities for Schools in Central America and in Mexico for the training of young researchers. There is a special focus in the developing regions of the world.

![Participants at the ICO/ICTP/MCTPCollege in Optics and Energy, held in Chiapas, Mexico in 2012](image)

The Winter College in Optics: “Advances in Nanooptics and Plasmonic”, held in February 2012 at the ICTP, Trieste, Italy, had more than 90 participants, 40 lecturers and seminars delivered by some of the young researchers coming from all over the world, in particular from Africa, Latin America and Asia.
ICO presence in the world of Optics and Photonics. The role of Territorial Committees

ICO structure formed by more than fifty Territorial Committees (TC) all over the world has a great significance for the internationality of optics and photonics in the world of science. As an ICO philosophy, it is enhanced the creation of activities and ideas from our TC. This gives the great value for creating a real world network which, in addition, facilitates a substantial participation of local researchers, professors, teachers, young students, as well as local institutions providing more visibility in the social, political and scientific and education world. There is a variety of activities involving the ICO Travelling Lecture Program, the ICO Topical Meetings, schools, promotion of young researchers through out the ICO Prize in Optics and and the ICO/ICTP Gallieno Denardo Award, specifically addressed to young scientists. We present some examples here in order to recreate the current development of optics and photonics.

Optics and Photonics in Argentina.

Argentina is an ICO member since 1981. Every year the ICO Argentinian Territorial Committee organizes TOPFOT, a Workshop of Optics and Photophysics, which in 2011 was in its 8th year. It was preceded by a meeting of students in Optics and Photophysics (EEOF) organized by the Young Opticians and Photophysicists of Argentina (JODA) and by the SPIE and OSA student chapters of CIoP-University of La Plata, with participation of additional students from the University of Buenos Aires. The activities were attended by 130 participants.

Optics and Photonics in Tunisia

Tunisia is an ICO member since 2006. Among its many activities they organized in December 2014 the Workshop – “Shedding Light On the Contributions of Muslim Scholars to Science and Technology”. More than 35 participants attended the event in Carthage, Tunis.
**Optics and Photonics in Armenia**

Armenia is an ICO member since 2011. They are developing many activities in the region as the International Symposium on Optics and its Applications. The first meeting of the series was held in September 2011 in Yerevan and Ashtarak, where it is located the Institute for Laser Science. The proceedings were published at the Journal of Physics: conferences series with a total of 34 peer reviewed papers in topics such as quantum optics & information, laser spectroscopy, optical properties of nanostructures, photonics and fiber optics and optics of liquid crystals. The symposium was sponsored by ICO along with international professional societies, local Armenian institutions and the ICTP.

**Optics and Photonics in Cuba**

Cuba is an ICO member since 1993. It is quite an active community and involved in many local activities oriented to the training of Cuban young researchers. They also organize international conferences sponsored by ICO. One example is the International Conference on Optics, Photonics & Photoscience. This is a series of conferences held every two, three years in La Havana and under the support of Cuban scientific institutions and academic centers. As additional activities they have settle an exhibition in holography: “Holography in Science, Art and Cultural Heritage” in an open museum to be visited for all public.

**Other ICO activities: The International Year of Light 2015**

The ICO has supported the initiative of an International Year of Light since its inception, and accompanied the application process through the IUPAP and ICSU to UNESCO, and in the last stage, asked its Territorial Committees representatives to look for support from their ambassadors to the United Nations. In April, 2014 ICO invited its Territorial Committees to promote the creation of national committees for the programming of local and regional celebration activities.

*More than half of the ICO Bureau and over 30 other members of the ICO family attended the opening ceremony of the International Year of Light 2015, UNESCO, Paris, January 2015.*
The ICO Awards. The promotion of Optics and Photonics in the international scientific community

The ICO Prizes and Awards are highly prestigious among the international community in Optics and Photonics. They are particularly focused on the recognition of the scientific merits in young researchers having made key contributions at an early stage of his/her professional career. Moreover, ICO has other award addressed to scientists who have made his/her researchers in a developing country.

- **ICO Prize**
  Established in 1982, it is presented annually to a person who has made a noteworthy contribution to Optics before reaching the age of 40. Every year, the ICO Prize Committee issues a call for nominations that is published in the ICO Newsletter.

- **IUPAP Young Scientist Prize in Optics**
  In 2005 IUPAP created the Young Scientist Prizes for its Commissions. The International Commission of Optics (ICO), as an Affiliated Commission of IUPAP, decided in 2008 to adopt the IUPAP Young Scientist Prize in Optics. The prize is awarded annually through ICO to a scientist who has made noteworthy contributions to applied optics and photonics during a maximum of 8 years of research experience after having earned a PhD degree.

- **ICO Galileo Galilei Award**
  Established in 1994, it is presented annually to a person who has made outstanding contributions to the field of Optics in countries where the development of Optical Technology is significantly below average, or where difficult economic or social conditions are encountered, and access to scientific and technical facilities or sources of information is lacking.

- **ICO/ICTP Gallieno Denardo Award**
  ICO and ICTP, the Abdus Salam International Centre for Theoretical Physics, agreed to establish since 2000 this joint prize. In September 2007, ICTP and ICO agreed to rename the Award as ICO/ICTP Gallieno Denardo Award to honor the memory and legacy of the late Prof. Gallieno Denardo, who was in charge of optics activities at the Abdus Salam International Centre for Theoretical Physics (ICTP) for more than twenty years. The award is given to scientists less than 40 years of age, 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.
**ICO publications**

- **International Trends in Optics Triennial**
  Initiated in 1989. The books highlight the advances and focus areas in the field of optics and photonics at the time of their publication.

  Published by SPIE Press

- **ICO Newsletter**: Quarterly

**ICO Triennial Report**

The Triennial Report is distributed to all ICO Territorial Committees prior to the General Assembly

**Proceedings ETOP**

This is an open access publication, edited by SPIE. All ETOP Proceedings.

**ICO e-Publications**

Distributed to all participants at the ICO-22 General Conference, Puebla, Mexico, August 2011.
The future. ICO as an ICSU Union

- After 70 years of ICO activities as an External Commission in IUPAP and as a Scientific Associated in ICSU (since 2005), ICO is a mature organization with important achievements to promote Optics and Photonics in the world.

- The importance of Optics and Photonics, nowadays, is represented with the many institutions, organizations and scientific and technological initiatives, in particular, in highly industrialized regions of the world.

- ICO as a Union can act as a seed to extend the associated technologies in less favored areas.

- To define activities in key fields, already pointed out by ICSU: climate change, solar energy, telecommunications, lighting for all, including rural areas, education and training in optics and photonics, biomedicine and new optical and photonics instrumentation for the well-being.

- Encouraging entrepreneurship and initiatives for local technological companies and local education programs.

- ICO will maintain always its links to the very natural scientific connections with close Unions, and will participate in the activities of related clusters.

Some examples of the key social and global importance of Optics and Photonics

- The International year of Light 2015

  In which ICO has participated since its inception with a great expansion of activities from the Territorial Committees and International Societies.

  - National Academy of Sciences, USA

    Have published various reports with essential information on the current state of optical science and engineering in the United States

  - Photonics21

    The European Technology Platform Photonics21 represents the photonics community of industry and research organizations. Its members develop a common photonics strategy for future research and innovation in Europe.
Let’s open the doors to the future of forthcoming generations

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