



Optical Society of India

NEWS LETTER

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Greetings !

*Several advancements in the field of optics are taking place in this International Year of Light and many institutions all over the world and in India are organizing symposia and schools related to Optics. Unfortunately the International Year of Light saw the demise of one of the greatest luminaries of optics, Professor Charles Hard Townes, the inventor of the ultimate light source, the laser, on 28th July 2015. A detailed obituary is included in this Newsletter. The XXXIX Symposium of the Optical society of India, **ICOP 2015**, was held at Department of Applied Optics and Photonics, University of Calcutta from February 20th to 22nd, 2015. ICOP 2015 was also the Golden Jubilee concluding conference of the Optical Society of India. A detailed report on ICOP-2015 is included in this News Letter. Dr. Naveen Nishal, IIT Patna will be organizing DST (Department of Science and Technology), Govt. Of India funded SERC school on **Modern Optics and Applications** from 30.11.2015 to 18.12.2015 for Research Scholars and Young faculties working in Optics. Normally SERC schools provide necessary interactions and inputs from resource persons drawn from various academic institutes who carry out frontier researches in optics. Attending such schools will definitely provide solid foundations for young researchers and faculties in most areas of optics. The XXXX OSI symposium is scheduled to be held at Tezpur University, Assam, during 26-28 November, 2016. (refer to conference website at <http://www.tezu.ernet.in/dphy/icl2t/>).*

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(Editor, OSI's News Letter)

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Embracing the International Year of Light and Light-based Technologies

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Since 1959, the United Nations has been observing international years under its auspices. For instance, the World Refugee Year (1959), the International Health and Medical Research Year (1960), the International Year of Physics (2005), the International Year of Astronomy (2009), the International Year of Chemistry (2011), the International Year of Sustainable Energy for All (2012). Year 2014 was the International Year of Crystallography [1-2]. 2015 has been proclaimed as the *International Year of Light and Light-based Technologies (IYL 2015)*.



**INTERNATIONAL
YEAR OF LIGHT
2015**

Like many other international endeavours — such as CERN: the European Organization for Nuclear Research [3]; ICTP: the Abdus Salam International Centre for Theoretical Physics [4]; and ESA: the European Space Agency [5]) — the *International Year of Light* had its genesis in Italy! The IYL Project was officially launched during a workshop, *Passion for Light*, held on 16 September 2011 in Varenna, Lake Como, Italy [6-7]. This historic workshop was jointly sponsored by the European Physical Society and the Società Italiana di Fisica (SIF, the Italian Physical Society). It is to be noted that this historic meeting provided the *Prospectus for the International Year of Light* and the

accompanying press releases in English and Italian. Luisa Cifarelli of the University of Bologna and the National Institute of Nuclear Physics served as the Chair of the Steering Committee. She was then the president of both EPS and SIF. EPS led a delegation to the International Union of Pure and Applied Physics (IUPAP) during its General Assembly in London in November 2011. The endorsement from IUPAP paved the way for the organizers to prepare a formal request to the UN through UNESCO [7]. Thereafter, the IYL was on track.

A resolution welcoming and endorsing an International Year of Light in 2015 was adopted by the UNESCO Executive Board at its 190th session, which took place at the UNESCO Headquarters in Paris from the 3rd-18th October, 2012. UNESCO formally submitted the resolution to the UN on 6 November 2013. On Friday the 20th of December, during the 71st Plenary Meeting of the UN General Assembly 68th Session, 2015 was proclaimed as the *International Year of Light and Light-based Technologies*. The move has been lauded by a number of scientific societies and institutes. The IYL-2015 partnership is a cross-disciplinary educational and outreach project with more than 100 partners from more than 85 countries, accompanied by the UNESCO *International Basic Sciences Program*. It is an effort of several years and the persuasion of the numerous optics-related organizations, which eventually lead to the proclamation. The text of the resolution, which was adopted as a part of a more general agenda item on science and technology for development, stated:

'Applications of light science and technology are vital for existing and future advances in medicine, energy, information and communications, fiber-optics, astronomy, architecture, archaeology, entertainment and culture' [8-11]. The IYL-2015 has created a forum for scientists and engineers and all others inspired by light, to interact both with each other and with the public so as to learn more about the nature of light and its many applications. IYL-2015 is a tremendous opportunity to ensure that policymakers are made aware of the problem-solving potential of light technology. As light becomes the key cross-cutting discipline of science and engineering in the 21st century, it is essential that the brightest young minds continue to be attracted into careers in this field. The Opening Ceremony of the International Year of Light and Light-based Technologies 2015 was held on 19-20 January 2015 at UNESCO HQ in Paris, France. The two-day event gathered over a thousand participants comprising international diplomats and decision-makers, Nobel laureates and science and industry leaders from across the globe.

The central role of light needs no elaboration. On the very basic level it provides us vision. On the most fundamental level through photosynthesis (mostly in the green leaves of the plants), light is necessary to the existence of life itself. In human skins, the sunlight induces the synthesis of the essential vitamin-D. The science of light is applied in the technological field known as *photonics*, and this theme addresses the important ways that photonic devices impact on areas such as medicine, communications and energy. When harnessed, the light-based technologies can promote sustainable development and provide solutions to global challenges in energy, education, agriculture, health and well-being. Light is more than just science and technology. Light matters to all of us. The IYL-2015 has created a forum for scientists and

engineers and all others inspired by light to interact both with each other and with the public so as to learn more about the nature of light and its many applications. IYL-2015 is a tremendous opportunity to ensure that policymakers are made aware of the problem-solving potential of light technology. As light becomes the key cross-cutting discipline of science and engineering in the 21st century, it is essential that the brightest young minds continue to be attracted into careers in this field.

The interdisciplinary fields of radiation sciences and light sciences are intimately interlinked through the common thread of the electromagnetism. The mechanisms of detection and handling of course differ when one is using visible sources, lasers, X-Rays or synchrotron radiation. The underlying mechanisms of production of the aforementioned sources of radiation differ dramatically. Different source serve different purposes. X-Rays are one of the most widely used tools to understand the structure of matter. Many path breaking discoveries in physics, chemistry and medicine have been made using X-Rays. Particle accelerators provide us a family of sources including synchrotrons, Free Electron Lasers (FELs) among others. The accelerator-based sources have very specialized properties (higher intensity, coherence, etc) and a very wide range (in principle) covering the complete electromagnetic spectrum. These special features come with a tag! They are costly and require a technological expertise to build. There are about seventy-five synchrotron radiation sources in various stages of operation, construction or planning in twenty-six countries. There are more than 20,000 synchrotron users per year and a strong growth is predicted. India has the expertise and the experience of indigenously building two synchrotrons, both at the Raja Ramanna Centre of Advanced Technology (RRCAT) in Indore. Indus-I, the first synchrotron

source in India was commissioned in July 1999 and is in regular operation. It is a 450MeV storage ring with a 20MV microtron as its injector. The beam energy of this synchrotron can be increased up to 700MeV. The second synchrotron is the Indus-II is a 2.5GeV storage ring sufficient to produce very powerful X-rays. Indus-II has provision for 22 beam lines [12].

The year 2015 commemorates a remarkable series of important milestones in the history of optics. A number of major scientific anniversaries will be celebrated in 2015, starting with the early work on optics by the Islamic scholar Ibn al-Haytham in 1015 [13]. The French engineer Salomon de Caux invented a prototype solar-driven engine using lenses and reflectors in 1615. The notion of light as a wave was proposed by Fresnel in 1815; the electromagnetic theory of light propagation proposed by Maxwell in 1865; Einstein's theory of the photoelectric effect in 1905; Einstein's embedding of light in cosmology through general relativity in 1915; the discovery of the cosmic microwave background by Penzias and Wilson in 1965; and Charles Kao's achievements in 1965 concerning the transmission of light in fibers for optical communication. Electron spinor optics was initiated by Jagannathan, Mukunda, Simon and Sudarshan in 1989/1990 (Electron optics or charged-particle beam optics has a very close analogy with light optics) giving birth to the quantum theory of charged-particle beam optics. This work has extended the Hamilton's optical-mechanical analogy into the wavelength-dependent regime [14-19].

Light science is one of the most accessible themes to promote cross-disciplinary education. IYL 2015 is endorsed by the International Council of Science and a number of other international scientific unions. IYL 2015 is being administered by an

International Steering Committee convened by John M. Dudley, in collaboration with the UNESCO International Basic Sciences Program at UNESCO headquarters in Paris and a Global Secretariat at ICTP: the Abdus Salam International Centre for Theoretical Physics in Trieste, Italy, which is a UNESCO Category 1 Institute. The international committee is running a number of cornerstone projects while encouraging national committees to inspire celebrations at a more local level [11]. The first postage stamp on the International Year of Light was issued by Liechtenstein on 25 March 2014 (Fig 1).



Fig. 1 The first postage on the International Year of Light, issued by Liechtenstein on 25 March 2014.

Here, it is interesting to note that the 2014 Nobel Prizes for both physics and chemistry are optics-related. Two Nobel prizes in optical sciences was a fitting kickoff to the International Year of Light. The Physics prize citation honours Isamu Akasaki, Hiroshi Amano and Shuji Nakamura for '*the invention of efficient blue light-emitting diodes which has enabled bright and energy-saving white light sources*' [20]. The Chemistry prize to Eric Betzig, Stefan W. Hell and William E. Moerner is

‘for the development of super-resolved fluorescence microscopy’ [21]. The last time light sources and imaging captured two Nobel Prizes in the same year was 1964. That year the Physics prize was awarded to Charles Hard Townes, Nicolay Gennadiyevich Basov and Aleksandr Mikhailovich Prokhorov for masers and lasers; and the Chemistry prize was awarded to Dorothy Crowfoot Hodgkin for biochemical studies using X-ray crystallography. The International Year of Light has received an additional boost with the Grätzel Solar Cells being recognized by the 2015 King Faisal International Prize [22].

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The historic event – IYL 2015 – is aimed at stimulating worldwide interest, especially among young people in light and related sciences & technologies. It will highlight to the citizens of the world the importance of light and optical technologies in their lives, for their futures, and for the development of society. A variety of events and activities are being organized throughout 2015 world-wide. It is an excellent opportunity to recognize and present the numerous and path-breaking Indian contributions to the science of light nationally and internationally.

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ICOP-2015 Volunteers with some participants

Report on XXXIX Annual Conference of the Optical Society of India

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The interdisciplinary nature of modern day optics necessitates productive cross-interaction between its diverse branches and sub-branches and awareness of the trends and projections of this fascinating field. ICOP 2015, the XXXIX Annual Conference of the OSI, attempted to bring together experts, professionals and students working in diverse fields of Optics and Photonics. It is largely with this objective that 'International Conference, on Optics and Photonics' (ICOP), had been organized during February 20-22, 2015 by the Department of Applied Optics and Photonics, University of Calcutta. ICOP 2015 was also the Golden Jubilee concluding conference of the Optical Society of India. Over 286 research papers including 35 invited papers authored by scientists, technologists and research workers were presented in the Conference. The areas covered were Optical Imaging, Optical System Design, Optical Metrology, Optical Data Storage & Display Devices, Diffractive Optics, Optical Interferometry, Holography & Laser Speckles, Laser Systems and

Applications, Guided Wave, Nonlinear & Quantum Optics, Photonic Components & Devices, Optical Networks and Components, Fiber Optic Sensors and Instrumentation, Bi-photonics and Medical Imaging, Silicon Photonics, Nano-Photonics & Plasmonics, Optical Techniques for Materials Characterization, and Astronomical Optics. About 100 presentations selected from the Conference have been published in SPIE Proceedings, Vol. 9654,. The Conference was cosponsored by DST, DRDO, SPIE, OSA, and endorsed by ICO and AOS.

A Technical exhibition with participation from ATOS, Taylor Hobson, Mahr Metrology Pvt.Ltd, Ametek and other companies was also organized.

A pre-conference workshop coordinated by Dr.Rajib Chakraborty (Calcutta Univ.) and Dr. B.K.Das (IITM) on Silicon Photonics was held on Feb.19, 2015 and was addressed by Prof.P.K.Basu (Calcutta Univ.), Prof.Jorg Schulze (Univ.of Stuttgart, Germany), Shayan Mookherjee (Univ.of California) and the Coordinators of the Workshop.



LECTURE SESSIONS AT ICOP-2015



Cultural Programme at ICOP-2015



Prof. B P Pal Receiving SPIE Fellowship
From SPIE President *Prof. Toyohiko Yatagai*

Congratulations Professor Bishnu P Pal

Optical Society of India congratulates Prof. Bishnu P Pal for being selected as SPIE Fellow this year for his outstanding contributions to Optics and Optics community Professor Pal spent almost 4 decades at IIT Delhi at various capacities and had contributed not only academically but also for promotion of optics in India. Prof. Pal is conspicuous by his presence and illuminating lectures in optics meets in India and abroad. He held very important positions

in Optical Society of America, SPIE and had served as President of OSI from 2012 to 2015 during which period he had been instrumental in furthering the cause of the Society and increasing its visibility manifold. It is really befitting for Professor Pal, to receive SPIE fellowship from Professor Toyahiko Yatagai, SPIE President and that too in the Year of Light and during Golden Jubilee Conference of OSI at University of Calcutta.



Charles Hard Townes

(28.07.1915 to 27.01.2015)

Charles Hard Townes : Mourning the man who amplified million times the field of optics by inventing LASER

The international year of light lost one of its illustrious sons who made this year of light a reality by inventing the ultimate light LASER as *Charles Hard Townes* was known for his work on the theory and application of the MASER (Microwave Amplification of Stimulated Emission of Radiation). Charles Townes got the fundamental patent, and other work in quantum electronics connected with both maser and laser devices and in 1964 he shared the Nobel Prize for Physics with *Nikolay Basov* and *Alexander Prokhorov* of USSR.

Townes was born in Greenville, South Carolina, to *Mr. Ellen Sumter Townes* and

Mrs. Henry Keith Townes , an attorney. After graduating from Furman University, *Townes* completed work for the Master of Arts degree in Physics at Duke University in 1936. He received a Ph.D. degree in 1939 from graduate school at the California Institute of Technology. *Charles Townes* then worked on radar bombing systems at Bell Labs during world-war II. Later, *Townes* was appointed Professor in 1950 at Columbia University where, he served as Executive Director of the Columbia Radiation Laboratory from 1950 to 1952 and was also Chairman of the Physics Department from 1952 to 1955. When *Charles Townes* mooted idea of laser by stimulated emission of radiation, established

theoretical physicists like *Niels Bohr* and *John von Neumann* doubted whether it was possible to create such a thing and in fact, Nobel laureates *Isidor Isaac Rabi* and *Polykarp Kusch* who at that time received the budget for their research from the same source as Townes and with just three months before the first successful experiment, tried to stop him carrying out his famous MASER experiment at Columbia University. Finally, in 1953, *Townes*, along with his colleagues *James P. Gordon*, and *H. J. Zeiger* built the first ammonia maser at Columbia University. They used stimulated emission in a stream of energized ammonia molecules to produce amplification of microwaves at a frequency of about 24.0 GhZ. For this discovery of the maser, *Townes* along with *Nikolay Basov* and *Alexander Prokhorov* received the 1964 Nobel Prize in Physics. Apart from this, Townes also pioneered the use of masers and lasers in astronomy. He was part of a team that first discovered complex molecules in space, and determined the mass of the super-massive black hole at the centre of the Milky Way galaxy.

Professor *Charles Townes* from 1959 to 1961, served as Vice President and Director of Research of the Institute for Defense Analyses in Washington, D.C., which was a nonprofit organization which advised the U.S. government and was operated by eleven universities. Before moving as

Professor of Physics at the University of California at Berkeley in 1967, he served as both Provost and Professor of Physics at the Massachusetts Institute of Technology during 1961 to 1967. *Charles Townes* remained for almost 50 years and his status was as professor emeritus by the time of his death in January 2015. Townes was chairman of the NASA Science Advisory Committee for the Apollo lunar landing program for a period of 4 years from 1966 to 1970. *Townes* also served as a *Karl Schwarzschild* Lecturer in Germany and the *Birla* Lecturer and *Schroedinger* Lecturer in India in recent years. For us as Indians we were fortunate to have him in that position.

Townes married *Frances H. Brown* in 1941 and lived in Berkeley, California and they had four daughters. Charles Townes died in Oakland, California on January 27, 2015 thus ending one of the greatest and most important experimental physicists of last century at the age of 99. The invention of laser has paved way for almost dozen Nobel prizes (still counting) in physics and chemistry since its invention including Non-linear optics, holography, medical imaging, Fiber Optics to name a few. According to *Professor Reinhard Genzel*, at Berkeley, *Townes* strength was his curiosity and his unshakable optimism, based on his deep Christian spirituality.

Though Professor Townes died in the year of light for which he is one of chief reasons to celebrate, we as practical users of laser beam salute this great man who invented a source which changed not only life styles of human being but also saved many lives and eyes of our people.

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Acknowledgements

I thank Professor Hazra and Dr. K Bhattacharya for their inputs in making this News Letter.

Request to OSI members and any one related to Optics

I request all optics researchers from India and abroad to send relevant materials for the next issue of News Letter to the Editor at naamu.s@gmail.com