



Optical Society of India's

NEWS LETTER

Vol. 2 No.2, January-June, 2016

Greetings !

The special issue of OSI's News Letter on 2015 the Year of Light, edited by Dr. Nithyanandan, Research Associate, Pondicherry University, Pondicherry came out extremely well covering almost all events. He could get inputs from all allied societies of optics like Photonics Society, Luminescence Society, Laser Society etc and cover meetings and seminars as far as from North East to South and East to West corners of India. We sincerely thank and congratulate Dr. Nithyanandan for this excellent and flawless editing of Special Issue of OSI News Letter celebrating International Year of Light. The Department of Physics of Central University of Tezpur with the guidance of Professor R S Sirohi organized a well received DST-SERB School on Metrology during June 1 to 21, 2016. I hope research students and young faculty who had attended the SERB School might have benefitted immensely from the lectures. The Department of Physics, of Tezpur University will also be organizing OSI's annual symposium during 26-28 November 2016. The first six months in 2016 after the eventful year of light 2015 also has witnessed several new emerging technologies in the field of optics. One such emerging technology is LED (Light Emitting Diode) which will be the light source of the world and it will be illuminating the world. One of the foremost societies which, actually is the mother for all optical societies in the world is Optical Society of America (OSA), and it will be celebrating 100 year of its existence this year. As most of us are publishing in OSA journals, we join in congratulating OSA for maintaining standards in their journals and for completing 100 wonderful years. There will be an article about OSA's 100 years in this issue.

We are not receiving any inputs from OSI members or readers for strengthening this News Letter. I request all the OSI members to share their experiences in organizing any optics related meetings or news about latest developments in the field of optics. We are planning to start reports on latest developments in researches related to optics and the readers who can write such reports are encouraged to write and also about their respective department's contribution to the development of optics related researches in India.

C S Narayanamurthy (naamu.s@gmail.com)

(Editor, OSI's News Letter)

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1. Optical Society of America Scores 100 !

This year 2016 marks the 100th anniversary of the Optical Society of America which since its founding in 1916. The Optical Society of America or OSA has actually united a global community of scientists, Engineers, business leaders, and students, for transforming the world through their works in optics and photonics. Last century, actually expanded the light based applied technology to a great extent and for that OSA played a crucial role through its publications like *Jl. Optical Society of America (JOSA)* and *Applied Optics*. Some of the important developments over these 100 years related to optics are the laser, Light Emitting Diodes's, holography, Optoelectronics Devices like Charge Coupled Device (CCD), CMOS for imaging from space to biology, revolution in communication technology using optical fibers, atomic clock etc. The list of light based technologies is endless and it is growing exponentially.

It all started 50 years before the birth of Optical Society of America i.e in 1860's when, *James Clark Maxwell* established that light is an electromagnetic wave and in 1905 *Albert Einstein's* description of photoelectric effect suggested that light is made up of discrete packets of energy known as photons. Thus, the dual nature of light as wave and particle led to number of engineering and technological innovations. The necessity of a full-fledged society for optics came due to the break of the first, World War in Europe which demanded more technological innovations and in this background, *Mr. Perley Nutting* who was with Eastman Kodak in Rochester along with some of local luminaries formed the Rochester Association for the Advancement of Applied Optics. This association within a year became Optical Society of America (OSA) in 1916 with main focus on applied optics. The first OSA meeting was held at Columbia University on 28th December 2016 which actually kick started a new era in the science of light.

i) Optics for seeing universe

One of the astronomers *George Ellery Hale* served as OSA's first Vice President who also honored with prestigious OSA's honorary membership in the year 1916. He was chiefly responsible for the development of making 40 inches refracting telescope at Yerkes Observatory, 60-inch Hale and 100-inch Hooker reflecting telescopes at Mount Wilson Observatory. In fact his last project was the 200-inch Hale reflecting telescope at Palomar Observatory which was completed 10 years after his death in 1938. One can clearly see the OSA's contribution in developing these telescopes through *George Hale*.

ii) Photography

In 1928, for honoring photographic technology, the Optical Society of America (OSA) established the prestigious *Frederic Ives* award. *Frederic Ives* was the inventor and pioneer of modern photoengraving, color photography, 3-D stereoscopic photography etc. Also, another award in name of *C E Kenneth Mees* was instituted by OSA in 1961 (After *Kenneth Mees* death) for bringing numerous advances in scientific photography for capturing faint astronomical images. In 1947 OSA meeting *Edwin Land* demonstrated first instant camera and demonstrate its ability to produce instant images.

iii) Laser Era

After *Albert Einstein's* discovery of possible stimulated emission of radiation in atomic system in 1917, it was realized only in 1953 when *Charles Townes, James Gordon* and *Herbert Zeiger* at Columbia University built first maser (microwave amplification by stimulated emission). Also, along with them, *Aleksandr Prokhorov* and *Nicolay Basov* from former Soviet Union's, Lebedev Physical Institute independently developed ammonia maser at the same time. Later they shared Nobel Prize in 1964. Then *Theodore Maiman* at Hughes Research Laboratory developed first laser (Ruby Laser) in 1960 using the theoretical work developed by Townes and Arthur Schawlow. Fellow of OSA, *Donald Herriot* and later President of OSA with his group at Bell Laboratories invented first continuously operating infrared Helium-Neon laser. Since then till now, the laser technology has revolutionized all fields from Astronomy to Biomedical imaging and in fact laser played central role in numerous scientific, technological, medical, industrial and military applications.

iv) Fiber Optics Communication

The other important development during OSA's 100 years is the communication through light. The optical waveguides (Fiber optics) played major role in bringing distant countries in the globe closer even via under water. This was possible because a laser beam propagating through optical fiber can encode information for more than half a million telephone conversations/thousands of TV channels. OSA's member *Charles Kao* and *George Hockham* of United Kingdom's Standard Telecommunication Laboratories in 1956, by increasing purity of glass fibers demonstrated that light can transmit signals up to 100 KM. For that *Kao* shared Nobel Prize for physics in 2009 and he was also known as father of fiber optics. Later, during 1980's, Fellow of Optical Society of America, *David Payne* of University of Southampton, U.K developed the erbium doped fiber amplifiers which can boost optical signals to travel much longer distances with negligible losses.

v) Spectroscopy and Non-linear Optics

C V Raman, who was Optical Society of America's honorary member, in 1928 showed that when a light is scattered by a transparent substance, a shift in scattered light's frequency occurs due to the characteristics of the scattering substance and it is known as Raman effect in

spectroscopy. This effect became very powerful tool in analyzing the chemical makeup/biological samples to probe matter and today, Laser Raman Spectroscopy is standard tool for material scientists for probing the matter. C V Raman was awarded Nobel Prize for this discovery in 1930. Another important discovery in spectroscopy using laser was, precise measuring of spectral lines of hydrogen by *Schawlow* who later became President of Optical Society of America and also shared half of Nobel Prize in 1981 with *Nicolaas Bloembergen* of Harvard University. It may be noted here that *Bloembergen* (Honorary OSA member in 1984) was the first one to propose the concept of Non-Linear optics using intense laser beam especially four wave mixing and other non-linear phenomena for extending the scope of spectroscopic studies.

vi) Holography and CCD technology

Dennis Gabor in 1947, invented that addition of reference wave to object wave can help in reconstructing depth information of an object. This concept of recording is known as holography and it could be realized only after the invention of lasers in 1962 when, *Emmet Leith and Juris Upatnieks* of University of Michigan and *Yuri Denisuk* of Soviet Union independently demonstrated holographic recording technique. *Gabor* was awarded Nobel Prize for this discovery in 1971 and he was OSA's honorary member and *Emmet Leith* became fellow of OSA. The discovery of holography actually revolutionized the imaging technology and now it is widely used for security, advertisements and many more scientific applications.

Another important development in imaging technology is the invention of electronic light sensor in 1969 known as CCD(Charge-Coupled Device) which was the beginning of digital era in photographic imaging. Two OSA members namely, *Willard Boyle* and *George E Smith* at Bell Laboratories developed the core concepts and were awarded Nobel Prize in physics(2009). It is no surprise that CCD/CMOS really changed the perspective of imaging to new heights and still dominating the imaging technology. One of the spectacular applications is the use of 54 CCDs to use it for surveying the sky which is known as SLOGAN DIGITAL SKY SURVEY.

v) Laser cooling and Bose-Einstein condensation

The lasers were used to cool atoms to micro/nano-kelvin level by *Steven Chu* from Bell Laboratories, *Claude Cohen Tannouji* of Ecole Normale Supérieure and *William Phillips* of NIST which actually opened the door to new experiments in quantum physics and it helped researchers to observe atoms at absolute zero temperature. All of them are honorary members of OSA and they received Physics Nobel prize in 1997 for this discovery. The laser cooling discovery paved way for our own *Satyendra Bose* and *Albert Einstein's* 1920 prediction about creating new state of matter called as Bose-Einstein condensate. The new state of matter *Bose – Einstein* condensate is created by two OSA members *Eric Cornell, Wieman* at JILA and *Wolfgang Ketterle* at MIT in 1995 and they were awarded Nobel Prize in 2001. The BE-condensation exhibit macroscopic quantum phenomena and pave way for new experimental approaches.

vi) Quantum Optics and Frequency Combs

The Fellow of OSA, *Roy Glauber* of Harvard University formulated quantum theory for optical coherence which actually laid the foundation for quantum optics and for that he was awarded half of Nobel Prize in 2005 and the other half prize was shared by two OSA fellows namely *Theodor Hansch* of Max Planck Institut Fur Quantum Optics and *John Hall* at JILA for creating ultra-precise optical frequency combs. This invention has applications in GPS, atomic clocks and high precision spectroscopy.

vii) Microscopy

In 1930's, OSA honorary member *Frits Zernike* at Groningen University developed phase-contrast microscope in which the scattered light from transparent specimen and un-scattered light from the background. This technique made possible to image biological cell structures which are earlier used to be killed and stained for imaging. After, the Second World War many phase contrast microscopes were manufactured and in 1953 *Frits Zernike* was awarded Nobel Prize in physics. Recently in 2014, OSA fellow *W E Moerner* and two OSA members *Stefan Hell* and *Eric Betzig* were awarded Nobel Prize in chemistry for building super resolution microscopy which uses laser excited fluorescence to overcome diffraction induced resolution limitation. This technique can image single molecule.

viii) Light Emitting Diodes

Another important and energy efficient light technology belongs to Light Emitting Diode's. They are long-lasting and provide light for scientific equipments, consumer electronics and many more technologies. Though due to advancements in semi-conductor materials in 70's made possible colored LED's, blue LED which is key to produce white light was missing. But, OSA member *Hiroshi Amano*, *Isamu Akasaki* and *Shuji Nakamura* developed first practical blue LED's and they were awarded physics Nobel Prize in 2014. Thus this discovery changed the lighting technology in today's world in a big way.

ix) Conclusion

The Optical Society of America(OSA), has played significant part of last 100 year's crucial technological developments starting from biomedical applications to astronomical imaging. The recent, observations of gravitational waves is one big example of optical research and light based technology. *We hope coming 100 years will make OSA much more crucial for development of mankind in a peaceful manner.* OSI wishes OSA many more 100 years of service to optics community.

2. Conferences/Symposia

i) **SPIE Optics + Photonics 2017**, the meeting where the latest research in optical engineering and applications, nanotechnology, sustainable energy, organic photonics, and astronomical instrumentation is presented. Four conferences and multiple application areas in one event. See Conferences for Call information. Late Abstracts considered.

Further information in SPIE(USA) website

ii) **INTOPMAA-17, *International Topical Meeting on Applied and Adaptive Optics*** will be held at IIST, Trivandrum, India from 11th August 2017 to 13th August 2017.

Contact Person : *Rakesh Kumar Singh, Conference Co-Chair, IIST*

E-mail : krakeshsingh@iist.ac.in

iii) **Frontiers in Optics**

Frontiers in Optics, the OSA Annual Meeting, encompasses the breadth of optical science and engineering and provides an atmosphere that fosters the exchange of information between those working on fundamental research and those looking for solutions to engineering problems. American Physical Society's (APS) [Division of Laser Science \(DLS\)](#) provides an important forum for presenting the latest work on laser applications and development, spanning a broad range of topics in physics, biology and chemistry. In collaboration with colleagues at OSA, DLS provides thorough coverage of mutually interesting topics in a number of joint sessions. Session schedules are coordinated to encourage attendees with their intellectual wanderings among DLS, OSA and joint sessions. The meeting will be held at *Washington Hilton, Washington, District of Columbia, United States during September 17 to 21, 2017*

Further Information : OSA Website

Edited by : C S Narayanamurthy, E-mail : naamu.s@gmail.com

Acknowledgements

I thank, Kallol Bhattacharya and Dr. P T Ajith Kumar 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 to next issue of News Letter to naamu.s@gmail.com