



Optical Society of India's

NEWS LETTER

Vol. 1 No1, July – December 2014

Greetings !

Optical Society of India will be regularly churning out *NEWS LETTER* (twice in a year) from this edition onwards. We are sorry for this delay due to un-avoidable reasons. Every news letter will consist of editorial, special section on latest topic on optical research, calendar for forthcoming optical conferences, meetings etc. I thank OSI to put faith in me for editing this *NEWS LETTER* especially *Professor Bishnu Pal* and I hope I will try to make it readable and very useful for young optical scientists. It is great beginning as this year's Physics and Chemistry Nobel Prizes go to Optics related fields(details are in this letter) and that too just before the year of light. This also makes our first issue proud as our first edition of *NEWS LETTER* carries this news about Nobel Prizes related to Optics. Similarly, ICO(International Commission of Optics) selected *Professor Martin Booth* of University of Oxford and *Professor Chandra Shacker* of IIT Delhi for prestigious ICO Prize and Galileo Galilei award respectively. The OSI's News Letter congratulates Professors *Martin Booth* and *Chandra Shacker* for their achievements. It may be noted here that Professor *Stefan Hell*, this year's one of Chemistry Nobel Laureates was also awarded ICO prize for his invention on super resolution imaging in ICO's 2002 meeting held at Florence, Italy, in which I had the opportunity to listen to him. On other side, optics community lost *Professor Adolf Lohmann* and we have written a tribute to him and his loss is irreplaceable. I welcome from all optics researchers from India and abroad, articles related to new inventions in optics related areas and more importantly suggestions to improve OSI's NEWS LETTER.

Wishing you all very happiest and productive year of light 2015 !

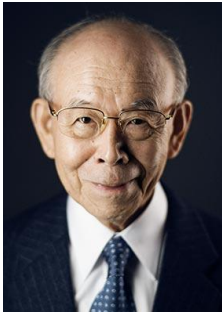
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(Editor, OSI's News Letter)

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1. Nobel Prizes 2014 related to field of Optics (Physics and Chemistry)



Isamu Akasa



Hiroshi Amano



Shuji Nakamura

Prize motivation: "for the invention of efficient blue light-emitting diodes which has enabled bright and energy-saving white light sources" **Field:** Semiconductor /Optical Technology

The physics Nobel Prize 2014 was awarded to three persons namely *Professor Isamu Akasaki* (Born 30 January 1929, Chiran, Japan, Meijo University, Nagoya, Japan, Nagoya University, Nagoya, Japan), *Professor Hiroshi Amano* (Born: 11 September 1960, Hamamatsu, Japan, Nagoya University, Nagoya, Japan) and to *Professor Shuji Nakamura* (Born: 22 May 1954, Ikata, Japan University of California, Santa Barbara, CA, USA).



Eric Betzig



Stefan W. Hell



William E. Moerner

Prize for the “development of super-resolved fluorescence microscopy”

The Chemistry Nobel Prize 2014 was awarded to three persons namely Professor *Eric Betzig* (Born : 3 January 1960, Ann Arbor, MI, US Janelia Research Campus, Howard Hughes Medical Institute, Ashburn, VA, USA), *Professor Stefan Hell* (Born : 23 December 1962, Arad,

Romania, Max Planck Institute for Biophysical Chemistry, Göttingen, Germany, German Cancer Research Center, Heidelberg, Germany and to **Professor William E Moerner** (Born : 24 June 1953, Pleasanton, CA, US Stanford University, Stanford, CA, USA) for developing super resolution fluorescence microscopy.

1.1 Why For Blue LED's ? (Physics Nobel Prize, 2014)

Light-emitting diodes (LEDs) are narrow-band light sources and are made using semiconductor components, with wavelengths ranging from the infrared to the ultraviolet. LEDs were first studied and developed during the 1950s and 1960s in several laboratories and they emit light at different wavelengths, from the infrared to the green except blue light which was a difficult task. The development of blue LED took three more decades to achieve as it required the growth of high-quality crystals as well as the ability to control p-doping of semiconductors with high band-gap, which was only achieved using gallium-nitride (GaN) and that too towards the end of 1980s. The development of efficient blue LEDs required the production of GaN-based alloys with different compositions and their integration into multilayer structures such as hetero-junctions and quantum wells with high precision. Also, the invention of efficient blue LEDs led to white light sources for illumination. Whenever a phosphor material is excited with a blue LED, light is emitted in the green and red spectral ranges, which, combined with the blue light, will appear as white. Alternatively, multiple LEDs of complementary colours (red, green and blue) can also be used together and these two technologies are now widely used in today's high-efficiency white electroluminescent light sources. These light sources, with very long lifetimes, have now replaced many incandescent and fluorescent lamps for general lighting purposes. As lighting for our mankind is essential and it represents 20-30% of our electrical energy consumption, and blue LED based new white light sources require ten times less energy than ordinary light bulbs, the invention of blue LEDs leads to significant energy savings, and is great benefit to mankind and that is the reason behind this year's Nobel Prize in Physics.

1.2 Discovery of super-resolved fluorescence microscopy (Chemistry Nobel Prize)

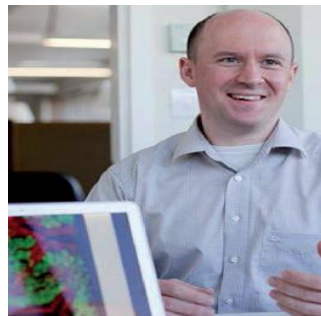
In general there are two far-field principles that lead to fluorescence-based microscopy with a resolution far beyond Abbe's famous diffraction limit. The first method is known as "super-resolved *ensemble* fluorophore microscopy" and the second as "super-resolved *single* fluorophore microscopy" respectively. The super resolved ensemble fluorophore microscopy was originally conceived and implemented by stimulated emission depletion (STED) of fluorescence from all molecules in a sample except those in a small region of the studied object. With saturating stimulated emission, the "active" region can be made arbitrarily smaller than the diffraction-limited size. By scanning the light spot defining the fluorescing region across the studied object and monitoring the fluorescence emission continuously a computer reconstruction of the object can be obtained (Hell, 2000). The principle can also be implemented by Saturated Structural Illumination Microscopy (SSIM) (Gustafsson, 2005). These methods can be used when the fluorescing regions contain ensembles of fluorophores as well as single fluorophores and are therefore generically referred to as "Super-resolved *ensemble* fluorophore microscopy". Their common denominator is that saturation of the excitation peaks in SSIM and saturation of the stimulated emission in STED both create spatial frequencies much higher than those allowed by Abbe's limit (Fig. 2). Their discovery had two distinct phases. The first relates to the

theoretical descriptions of the methods and the second to their experimental implementation. The second principle is based on the *a priori* knowledge that virtually all photons from an object detected at a given time come from single fluorophores that are separated from each other by distances larger than Abbe's diffraction limit. This information is then used to estimate the position of these emitting point sources with a precision that is much higher than that allowed by Abbe's diffraction limit. The second principle is here generically referred to as "Super-resolved single fluorophore microscopy". Its discovery may be described as three distinct steps. . The first relates to the discovery of single fluorophore spectroscopy in dense media, the second to the theoretical description of the principle and the third to its experimental implementation.

(Inputs from Royal Swedish Academy's Press Release)

2. Awards and Honours from International Commission of Optics (ICO)

2014 ICO Prize goes to Professor Martin Booth, Oxford University, U.K



Prof. Martin Booth

Prof. Martin Booth leads the Dynamic Optics and Photonics Group at the University of Oxford, UK. He has over 17 years of experience in research on optical and photonic engineering, specifically in the areas of active and adaptive optics for microscopy and photonic engineering.

The ICO Galileo Galilei Award 2014 goes To Prof. Chandra Shaker, IDDC, IIT Delhi, India



Prof. Chandra Shaker

"For outstanding contributions to the field of holographic and speckle metrology, which were achieved under comparatively unfavorable circumstances" (ICO News Letter)

3. International conference on Optics & Opto-electronics (ICOL-2014), IRDE, Dehradun

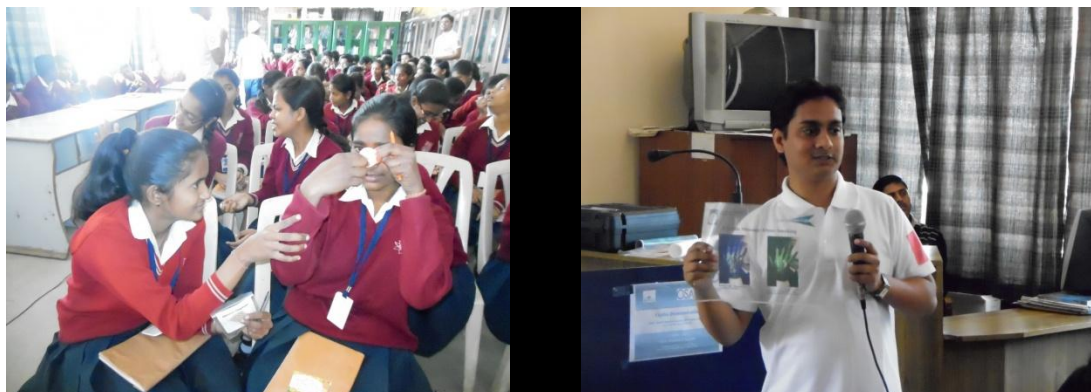


“We need educational institutions that can teach optics as career opportunities, in order to sustain growth; today there are few” stated Shri Avinash Chander, Scientific Adviser to Raksha Mantri, Secretary, Department of Defence R&D & Director General, DRDO, inaugurating International conference on Optics & Opto-electronics (ICOL-2014) at Instruments Research & Development Establishment (IRDE), Dehradun today. The conference being attended by over 500 delegates from India and abroad has been organized during **05-08 March 2014** on the occasion of Golden jubilee of Optical Society of India (OSI). Speaking on the occasion he said, “India had realized the importance of photonics , early and multiple R & D institutions including DRDO has started wide range of activities of photonics technology. At DRDO our thrust in photonics has been to develop technologies for surveillance, fire control, guidance, navigation computing, secure networking for defense and homeland security applications”. He highlighted the indigenous fibre optic gyro with integrated optic chip, wing laser gyro for inertial navigation system for guided missiles, handheld thermal imagers, laser range finders etc. as the initial successes. In the recent times, micro length arrays for high resolution imaging, LIDAR for detection of chemicals, development of commanders thermal imaging sights in form fit condition for T-72, T-90 and BMP vehicles have been developed. “We have the challenges that include night enablement of all our fighting platform and surveillance of our entire border and coast lines by electro-optic sensor in secured network environment, that will require deployment

of sensors in all available wave bands of optical and infrared wavelength regions”, stated by Shri Avinash Chander. “Like DRDO, ISRO has made great progress in indigenous of sensors”, he continued. He also highlighted achievements of other scientific departments in the area of photonics. He also emphasized need for 24/7 surveillance, that was possible through use of geo-stationary satellite, necessitating large optics with high resolution. He also highlighted some emerging areas of photonics such as hyper spectral imaging and blue – green lasers for under water communication. “To realize all this, technologies for mass-scale and efficient fabrication of optical components including spherical, aspherics and binary components need to be evolved”, he emphasized. Pointing towards future directions, he said, “Moore’s law is now saturating and further progress is expected by bringing together multiple processors linked to optic channels on the same chip”. Speaking about the role of ICOL-14, he stated, “DRDO has been successful in bringing together the niche community of photonics in our country. A lot has changed since the International community of researches that met at IRDE in last ICOL in 2005”. He urge the photonics community to take stock and chart out directions for future progress. “I would recommend each organization to identify an area of excellence and launch enabling programmes of directed research”. He also emphasized for an urgent need for national level fab. facility for fabrication of photonic and integrated components. Later, Shri Avinash Chander inaugurated an integrated facility for design, fabrication and evaluation of large diameter optics. The facility is the most modern and one of its kind in India. Professor B.P. Pal, President optical Society of India, IIT, Delhi, during his address told about the OSI, which is stepping up in to 50th year in 2014 hence we are organizing this conference as Golden jubilee conference. He informed that Defence Research & Development Organization (DRDO) and Department of science and technology (DST, Govt. of India) have sponsored this international conference. Conference is also technically co-sponsored by Optical Society of America (OSA), International Commission of Optics (ICO), International Society for Optics & Photonics (SPIC) and Optics & Photonics Society of Singapore (OPSS). Earlier, Dr A. K. Gupta, outstanding scientist & Director, IRDE and Vice chairman, Optical Society of India who is presently Programme Director of DRDO Photonics Programme, welcomed the dignitaries and all the delegates who are participating in the conference and the 38th Symposium of Optical Society of India. He brought out that the Optical Society of India (OSI) was founded in 1965 under the leadership of Dr C. S. Rao, the then Director IRDE, Dehradun and Prof. M. De, Professor Calcutta University to promote, diffuse and disseminate knowledge and encourage research in all branches of pure and applied optics. He informed that this conference (ICOL-2014) has received an overwhelming response and a total 600 national & international delegates are participating in the deliberations. About 85 invited talks are scheduled in 05 sessions presented by researchers, developers, academician, users and industry. Prof LN Hazra, Technical Chair – Calcutta university and Prof Anurag Sharma Technical Chair – IIT Delhi briefed the audience about the conference.

Ravi Kumar Gupta, DRDO, New Delhi

4. Optics Activities for students (OSA Chapter, ISM, Dhanbad)



During recent years, optical communication has become attractive in day to day life. A non-profit organization, **OSA (Optical Society of America)** is the world's leading professional association for the advancement of optics related technology. Keeping this perspective in mind, the Indian School of Mines, Dhanbad's OSA Chapter was constituted in the Department of Electronics Engineering, ISM Dhanbad under the leadership of *Shri. Santosh Kumar* and *Prof. Vishnu Priye*. The objective of this Chapter is to raise awareness of optics and science learning through participation in events at its institution and in the local seats of learning. The various modes through which it promotes scientific awareness is by devising activities such as science fairs, laboratory tours and classroom demonstrations. In this endeavour, members of OSA Chapter, ISM Dhanbad interacted with the science students of class X to XII of Indian School of Learning, Dhanbad during 9.00 am-12.00 pm on 12-Feb., 2014 and demonstrated some basic and interesting experiments of optics. The main aim was to guide them about their higher studies and carrier after 10th-12th class and motivate the students for higher education. They had shown the Happy and Unhappy Balls, which is a pair of black spheres which appear to be almost identical. The "unhappy" ball is formed from a proprietary rubber compound developed and manufactured under the trade name "Norsorex," while the "happy" ball is made of conventional neoprene rubber. Although the two balls appear to be quite similar, they exhibit marked difference in their physical properties. They also were shown the Heat Pack, which is a simple process-basically, these packs contain salt water. The solution in each pad is supersaturated sodium acetate, which is a form of food-grade salt and water, so it's completely safe. What makes it get hot is the "trigger" inside. The trigger is a stainless steel disk that creates friction when the fluid is slowly forced through the tiny perforations in the disk during the flexing process. The friction causes the salt in solution to crystallize in an exothermic reaction that releases heat. The maximum temperature of the pad will not exceed 130⁰F when triggered, and will remain at approximately 115⁰F for 20 minutes, or longer if well insulated. The packs may be recharged and reused

hundreds of times by boiling. When the pack is boiled, the salt crystals “melt” back to a clear liquid and then stay in liquid form indefinitely until activated again by friction from the disk. The demo also contains the Liquid crystals (LCs), which selectively reflect light, which means that when white light (from the sun or a lightbulb) shines on them, most of the wavelengths of light (colors) pass right through, but part of the light (a select color) gets reflected back. The color of the light that gets selectively reflected changes as a function of temperature for some LCs. Student chapter shown many small experiments, through students understand the phenomena of diffraction and polarization etc. Students enjoyed the optics demo and understood the basics of Optics. They are motivated for the higher education in science and technology. This was the first activity of the ISM-OSA chapter. The Chapter members also learnt many things during demonstration of optical phenomenon to students.

Santhosh Kumar, ISM, Dhanbad

5. Forth coming conferences (ICO Input)

1. 9–20 February 2015, Winter College on Optics, Trieste, Italy, Contact: Joe Niemela Tel: +39-040-2240555 smr2691@ictp.it
2. XXXIX OSI's International Symposium @ University of Calcutta, Kolkatta (ICOP-2015) February 20.02.2015 to 22.02.2015
3. 8–12 April 2015 Discussions on Nano & Mesoscopic Optics, (DINAMO-2015) El Chalten, Argentina, Contact: Andrea Bragas tel: +541145763426, bragas@df.uba.ar <http://dinamo2015.df.uba.ar/>
4. 29 June – 2 July 2015, Education and Training in Optics and Photonics (ETOP 2015) Bordeaux, France, Contact: Elisabeth Boéri, tel: +33 5 57 01 74 00, contact@etop2015.org <http://etop2015.u-bordeaux.fr>
5. 14–18 September 2015, Twelfth International Conference on Correlation Optics “Correlation Optics '15”, Chernivtsi, Ukraine, Contact: Oleg V Angelsky, tel: +380372244730; fax: +380372244730, angelsky@itf.cv.ua, www.itf.cv.ua/corrupt15/

6. In loving memory of *Professor Adolf Lohmann* (1926-2013)



(Professor Adolf Lohmann, Photo courtesy ICO News Letter)

I was lucky to listen to *Professor Adolf Lohmann* in the first winter college on Optics held at ICTP, Trieste, Italy in February 1993 on Optical Computing. That year many Professors who

were resource persons in that winter college on optics, used over head projectors for their presentations and power point presentation using PC. *Professor Lohmann* took directly a chalk piece and started his lectures by writing on the black board. He gave us the participants a brilliant lecture about optical computing with his witty style by cracking jokes in between lectures. Giving a lecture and that too on a topic which many of us at that time were new to it and coming from various background and countries and make us understand nicely was really brilliant. Such was the excellence of *Professor Lohmann*. In fact he came by train from his home town in Germany to Trieste as he preferred train journey in Europe.

Adolf Lohmann was born in Germany in 1926 and graduated from University of Hamburg, with a B.Sc degree in 1949. He obtained his M.Sc. in 1951 and Ph.D(Physics) in 1953 again from University of Hamburg, Germany. In 1953, *Lohmann* joined as Assistant Professor in the Physical Institute at the Technical University Braunschweig, Germany, and became Associate Professor at the same Institute. During the 1958-59 academic year, *Lohmann* worked as a guest researcher at the Institute of Optics at the Royal Institute of Technology in Stockholm, Sweden. In 1961 he moved to USA and became consultant to the IBM Development Laboratory in San Jose, California and was named Manager of the Optical Signal Processing Division of the IBM Research Laboratory in 1963. *Lohmann* continued in this position till 1967 and in that year he joined at the University of California San Diego (UCSD) as Senior Lecturer in 1967 and became Professor. Professor *Lohman* in 1973 took up full Professorship and Chair of the newly created Department of Applied Optics at the University of Erlangen, Germany. He retired from University of Erlangen in 1992. After that Professor *Lohmann* was visiting Professor at Weizman Institute of Technology, Israel, University of Valencia, Spain; INAOE (National Research Institute), Mexico; Tel Aviv University, Israel; and he also served as Adjunct Professor at the University of Arizona College of Optics, Arizona, USA.

Adolf Lohmann, was a pioneer and leader in the area of optical information processing. He has contributed to many original ideas in many fields of holography and information processing like, computer generated holography, classical interferometry, speckle interferometry, 3D wave fields, self-imaging, partially coherent optical processing, digital optical computing, the Wigner distribution and fractional transformations in information optics, super resolution, temporal optical processing, and flatland optics. While explaining basics of computer generated hologram, at the first winter college on optics in 1993, he told us that one student came to him and told that he knows only computing and *Lohmann* replied that he knows only holography and when they joined computer generated hologram was born. That was *Professor Lohmann* who can easily create new ideas at ease. Thus his highly original ideas, which linked optics with signal processing, were delivered in an intellectually elegant and simple manner. *Adolf Lohmann* was simply a genius and hardworking person with a magnetic personality and a profound sense of generosity.

Professor Lohmann in his illustrious career received numerous awards and honors like, the OSA Max Born Award in 1984, the C.E.K. Mees Medal in 1987, the first recipient of the Emmett N. Leith Medal in 2008, IBM Invention Award (1964), IBM Outstanding Invention Award (1967), Federal Medal of Merit (Germany, 1981), and the SPIE A. E. Conrady Award (2008). He was member of OSA for 54 years, and served on the Board of Directors from 1991-1993. He also served as president of the International Commission for Optics (ICO) from 1978-1981, and as a member of the Board of Directors of the German Society for Applied Optics

(DGAO) in 1987-1989. *Lohmann* was a member of the German Physics Society (DPG), the Royal Swedish Academy of Engineering, and the Bavarian Academy of Sciences. *Lohmann* was named an OSA Fellow in 1968 and was an honorary member of the Chinese Academy of Engineering, the German Optical Society for Applied Optics, and the European Optical Society. He authored or co-authored approximately 350 journal articles and held numerous patents. Over a period of several decades, Professor Lohmann inspired and attracted many students and visiting scientists from around the world to work with him and members of his prestigious groups, both at the University of California at San Diego in La Jolla, USA, and at the Friedrich-Alexander University in Erlangen, Germany respectively. The Applied Optics group in Erlangen was a truly outstanding international centre for the conduct of research in a friendly environment and for many of his students and visiting researchers, it was like home and Professor Lohmann treated them as family members and it came as no great surprise to his friends and colleagues that nearly 100 “Lohmann optics” people attended a symposium in 2006 celebrating his 80th birthday. He exhibited a sky-clear style when writing scientific papers and he explored nonconventional topics in novel ways.

Professor Adolf W. Lohmann, died on 15 December 2013 at the age of 87 and is survived by his daughters Sabine, Johanna, Luise, and Eva; and by his grandchildren Franka and Max. It is a great loss to the international optical community and his many former students, co-authors and friends around the world, will sorely miss him. **Optical Society of India deeply mourns his death and his loss is irreplaceable to optics community.**

C S Narayanamurthy

Acknowledgements

I thank Optical Society of India, Professor Bishnu Pal, Dr.Sanjay Mishra, IRDE, Dehradun and Mr. Santhosh Kumar, ISM Dhanbad, ICO News Letter and Royal Swedish academy for various inputs to make this News Letter reality.

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

