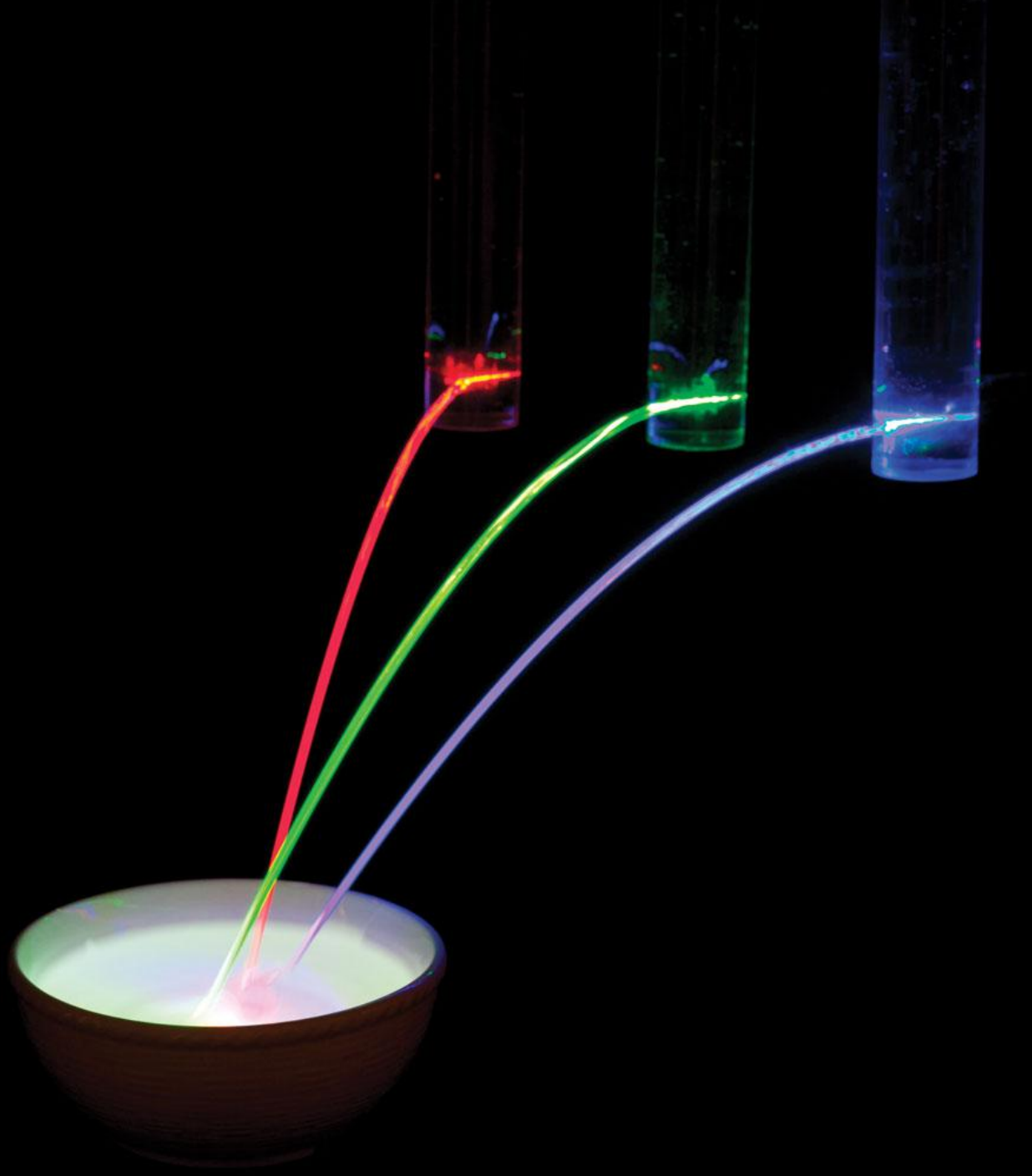
February 2013 | Volume 15 | International School of Photonics

PHOTONICS NEWS



Cochin University of Science and Technology

FROM EDITOR'S DESK...

Dear Photonians,

It is with great pleasure that we bring out the 2013 edition of Photonics News. This year International School of Photonics initiated one international Project in collaboration with Finland. This collaborative programme involves the exchange of faculties and students between the two collaborating institutes. Dr Kailasnath and Mr Mathew visited Finland under this programme while Prof Martti visited ISP who interacted with students and faculties. He also gave a talk on nonlinear optics of metal nano particles. There are several areas of mutual interest in which the two institutes can collaborate. Hope that this tie-up will grow strong with several branches.

Nobel Prize in Physics of 2012 was awarded to the topic of interest to Photonics. With careful optical excitation scientists were able to create the superposition of two states of Be ion trapped in a region of specially designed electric field distribution. With a pi/2 optical pulse Schrodinger cat type state was created in the trap. This experiment has far reaching consequences in quantum computing and information technology. Quantum mechanics with its strange properties like entanglement and teleportation is stepping into the domain of Engineering and Technology. In near future topics like Engineering Quantum Mechanics or Applied Quantum Mechanics will become a favourite field of engineers and technologists. This issue of PN give an outline of this wonderful work in quantum optics.

This issue of PN introduces a new branch of art called light sculpture developed by Paul Friedner who was a student of Physics in Cambridge. Nobel Laureate Prof Anthony Legget was one of his teachers. No doubt that there is a close link between art and physics.

Hope this issue of PN will be of interest to its readers.

Chief Editor
Prof V P N Namboori

Editors : Jaison Peter, Suneetha Sebastian, Manju Joseph, Sister Rosmin

ANNUAL PHOTONICS WORKSHOP 2012

Annual photonics workshop 2012 was held on 27th & 28th of February 2012. The focal theme of the workshop was "RECENT TRENDS IN PHOTONICS". The workshop was inaugurated by the Vice Chancellor Dr. Ramachandran Thekkedath. The chief guest released the annual magazine of the photonics department 'Photonics News 2012' during the event. About 80 participants from various parts of the country participated in the programme. The workshop was organized in collaboration with ISP-Finland, Indo–Finish project on Nanomaterials for multipolar Nonlinear optics, Tampere University of Technology, Finland and UKIERI Project on development of optical fiber based devices for sensing applications with ISP - The Robert Gordon University, UK. Ms. Melby Johny received the Nalanda Endowment which is given every year to the student who stands first rank in M.Sc. Integrated Photonics Degree Examination and the PSI prize is given to Mr. Alok Kumar Jha which is given every year to the student who stands first rank in M.Tech Degree Examination (OE&LT) of CUSAT. Dr. Bijoy Krishna Das from Electrical Engineering Indian Institute of Technology, Madras spokes on "Prospect of Silicon Photonics without CMOS Technology". His lecture was followed by a lecture on "Laser Ablated Materials" by Dr. Mahadevan Pillai, Head of the department of optoelectronics, University of Kerala, Trivandrum. Bose condensation of photonics by Prof. V. M. Nandakumaran, Amritha Vishwa Vidyapeetham, Amrithapuri Campus, Kollam. "Ultrafast Laser –driven Novel electron Accelerators" was introduced by Dr. Riju Issac, M A College, Kothamangalam.

On the second day there were six lectures. Prof. C. P. Girijavallabhan, Former Director and Emeritus Professor of ISP gave a lecture on National Science Day, "Ultra fast Laser spectroscopy" on Dr. Rajeev Kini Indian Institute of Science Education and Research Trivandrum. "Stokes holography A new polarization based imaging technique" by Dr. Rakesh kumar Singh IISST Trivandrum. Commodore K R Nambiar of Indian Navy (retd) gave a lecture on "Laser Plasma and their applications in space craft". Dr. Vinu V Namboori Indian Institute spoke on "Ultra Fast Nonlinear Raman spectroscopy" and Dr.Nibu George from Baselious College Kottayam on " Commercial Light Emitting Doide Lamps". There was one session for poster presentation and Laboratory visit.

Awards 2012

PSI Award to Chithira S.:

Ms. Chithira S. who topped the M. Tech Degree Examination in Optoelectronics and Laser Technology conducted by CUSAT, receives the Photonics Society of India prize. The PSI prize is given every year to the student who bags first rank in M.Tech Degree Examination (OE&LT) of Cochin University of Science And Technology. This prize is instituted by Prof. C.P. Girijavallabhan, former director, ISP. The prize includes cash, memento and a merit certificate.

Nalanda Endowment Award to Raju Kumar:

The Nalanda Endowment will be presented to Mr. Raju Kumar during APW 2013. The Nalanda Endowment prize is instituted by Prof. N.G. Devaki of Department of Hindi, CUSAT. The prize includes cash, memento and merit certificate and is given every year to the student who stands first in the First Semester Examination of Integrated M.Sc (Photonics) Degree of CUSAT.

C. V. Raman Award to Kumar Saurav:

The C. V. Raman award will be presented to Mr. Kumar Saurav during APW 2013. The prize includes cash, memento and merit certificate and is given to the student who present the best project for Integrated M.Sc (Photonics) Degree of CUSAT.

WE HERE THAT

A laser powerful enough to tear apart the fabric of space could be built in Britain as part of a major new scientific project that aims to answer some of the most fundamental questions about our universe.

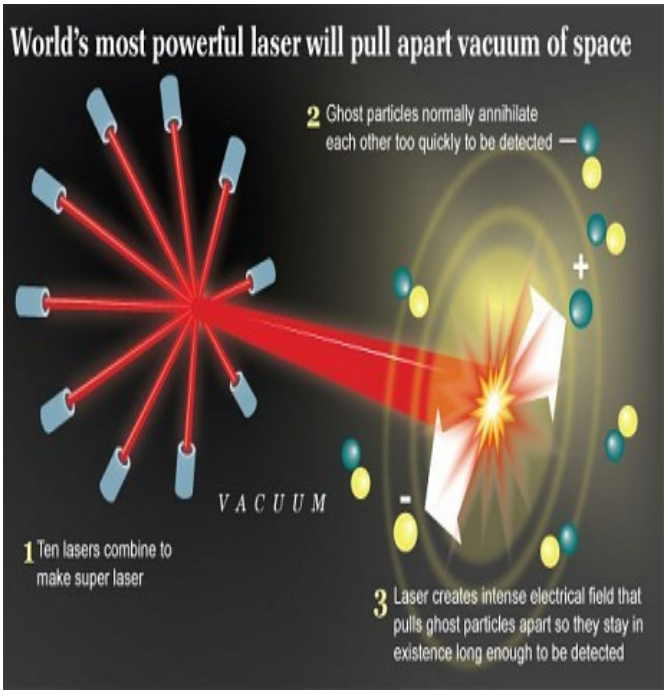
Due to follow in the footsteps of the Large Hadron Collider, the latest "big science" experiment being proposed by physicists will see the world's most powerful laser being constructed.

Capable of producing a beam of light so intense that it would be equivalent to the power received by the Earth from the sun focused onto a speck smaller than a tip of a pin, scientists claim it could allow them boil the very fabric of space – the vacuum.

Contrary to popular belief, a vacuum is not devoid of material but in fact fizzles with tiny mysterious particles that pop in and out of existence, but at speeds so fast that no one has been able to prove they exist.

The Extreme Light Infrastructure Ultra-High Field Facility would produce a laser so intense that scientists say it would allow them to reveal these particles for the first time by pulling this vacuum "fabric" apart.

They also believe it could even allow them to prove whether extra-dimensions exist.



Quantum optics Traps Scrodinger's Cat

Twentieth century witnessed two revolutions in the human knowledge namely theory of relativity and quantum mechanics. While the first one changed the world view of macroscopic world the second revolutionized our concept related to microscopic world. Marriage of theory of relativity with quantum mechanics has resulted into such wonderful ideas like anti particles. In 1905 Einstein developed the theory of photoelectric effect introducing dual nature of light namely wave nature and particle nature. Max Planck paved the way by developing a theory of black body radiation by hypothesizing the famous quantum theory. Black body is assumed to be constituting of large number of harmonic oscillators which will absorb or emit energy as packets of energy minimum value of which is $E = h\nu$ where ν is the natural frequency of the oscillator.

Einstein described light as stream of particles (which were later on named as photons) with mass $h\nu/c^2$ and momentum p as $h\nu/c$. This provides a relationship between the wavelength associated with photon and its momentum namely h/p. The particle nature of light is cofirmed later on by Compton effect and Raman effect. Thus the dual nature of light is described by interference and diffraction (wave property) and phenomena like Compton effect and Raman effect (particle nature). S N Bose made a concrete description of photons as indistinguishable particles which obey Bose – Einstein statistics and re-derived Planck's formula for black body spectrum.

Louis de Broglie in 1924 argued that Nature is not biased to light for its dual nature. He developed theory of matter waves according to which a particle of mass moving with velocity is associated with matter wave with wave length $\lambda = h/p$. Schrodinger showed that the dynamics of microscopic particles can be described by the so called Schrodinger wave equation

$$-\frac{\hbar^2}{2m}\nabla^2\psi + V(r)\psi = E\psi$$

The information about the state of the quantum system is embedded in the wave function ψ. In the case of classical wave equation like sound wave, the solution describe the

amplitude of the wave. But the solution of Schrodinger equation does not have any physical meaning like that of the amplitude of the matter waves since the phase velocity of the matter waves c^2/v is greater than that of light. Dynamical variables are represented by Hermitian Operators Expected value of any measurement on the quantum system will be the eigen value of the operator corresponding to the Ortho-normal states. The state of the quantum system (general solution of Schrodinger equation) will be superposition of the probable states (particular solutions).

$$|\psi\rangle = c_1|1\rangle + c_2|2\rangle$$

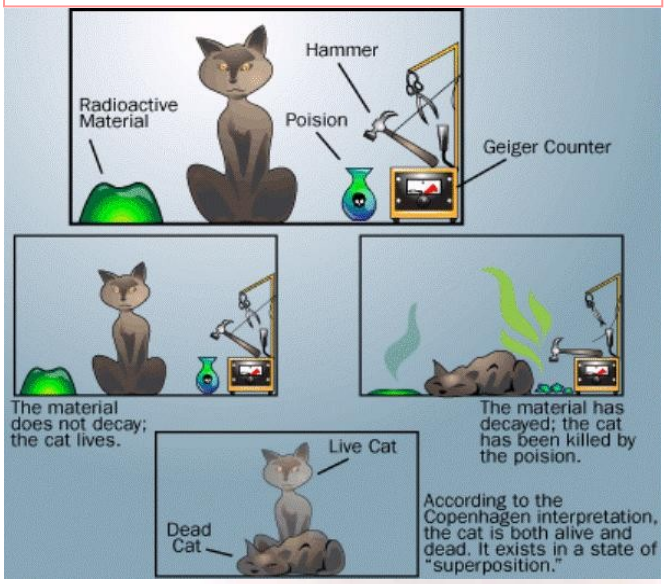
$$A|1\rangle = \lambda_1|1\rangle \quad A|2\rangle = \lambda_2|2\rangle$$

$$A|1\rangle = \lambda_1|1\rangle \quad A|2\rangle = \lambda_2|2\rangle$$

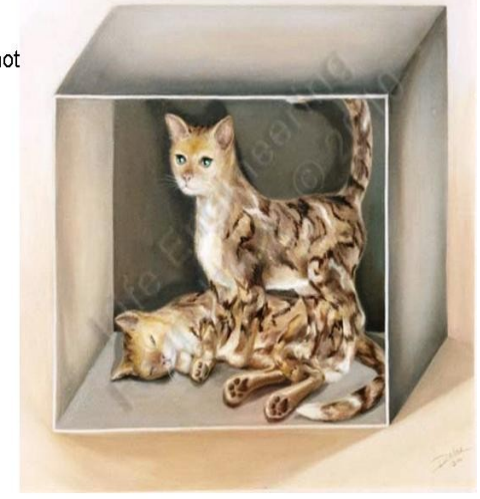
$$|c_1|^2 = \lambda_1 \quad |c_2|^2 = \lambda_2$$

$$on \quad observation$$

$$|c_1|^2 = 1|c_2|^2 = 0$$ **(collapse of wave function)**



As long as we do not
Open the door
QM describes
Superposition
Of two cat states.
Dead or alive



Schrodinger described a thought experiment in which a cat is enclosed in a box. There is a flask inside the box containing a radio active material and a hammer. Hammer strikes the flask, breaks the flask and the cat is exposed to the radiation. What is fate of the cat.

$$|\psi_1\rangle = |live\ cat\rangle$$

$$|\psi_2\rangle = |dead\ cat\rangle$$

$$|\psi\ \rangle = |cat\ state\rangle = c_1|live\ cat\rangle + c_2|dead\ cat\rangle$$

$$|c_1|^2 = probability\ of\ live\ cat$$

$$|c_2|^2 = probability\ of\ dead\ cat$$

When the box is opened no more uncertainty – cat is either dead or live cat Wave function is said to be collapsed to a paparticular state.

The idea that observation disturbs the quantum system lead to the belief that super position principle cannot be observed. Is it possible to observe the both states – dead and live cat- simultaneously. It is possible by a careful measurement without disturbing the quantum system A careful design of quantum optics based experiments can trap the superposition states. The experiment is entanglement of the cat with the single radio active atom Cat is live with excited atom and is dead when the atom de-excites To ground level after a definite decay time.

Cat is a complex system and open system and even though its individual atoms are described by QM, cat cannot be described by a wave function Says critics A system on superposition with different macroscopic states, information About this superposition is leaked to the environment so fast that De-coherence is set in. Is it possible to have a system which decays so slow that we have sufficient time to observe the superposition state? Answer to this question fetched 2012 NP.

The theoretical basis of the experiment is The **Jaynes–Cummings model (JCM)** which is a theoretical model in quantum optics. It describes the system of a two-level atom interacting with a quantized mode of an optical cavity, with or without the presence of light (in the form of a bath of electromagnetic radiation that can cause spontaneous emission and absorption). The JCM is of great interest in atomic physics, quantum optics, and solid state quantum information circuits, both experimentally and theoretically

JCM was originally proposed in 1963 by

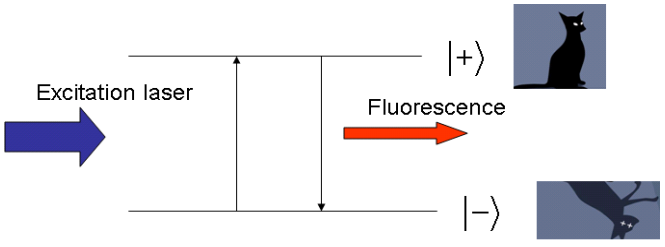
Edwin Jaynes and Fred Cummings in order to study the relationship between the quantum theory of radiation and the semi-classical theory in describing the phenomenon of spontaneous emission.

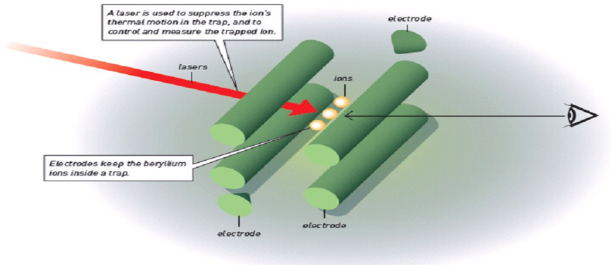
A quantum dot inside a photonic crystal nano-cavity is also a promising system for observing collapse and revival of Rabi cycles in the visible light frequencies. It was also discovered that during the quiescent intervals of collapsed Rabi oscillations the atom and field exist in a macroscopic superposition state (a Schrödinger cat). This discovery offers the opportunity to use the JCM to elucidate the basic properties of quantum correlation (entanglement)

Ion Trap Experiment by Wineland in Colarado

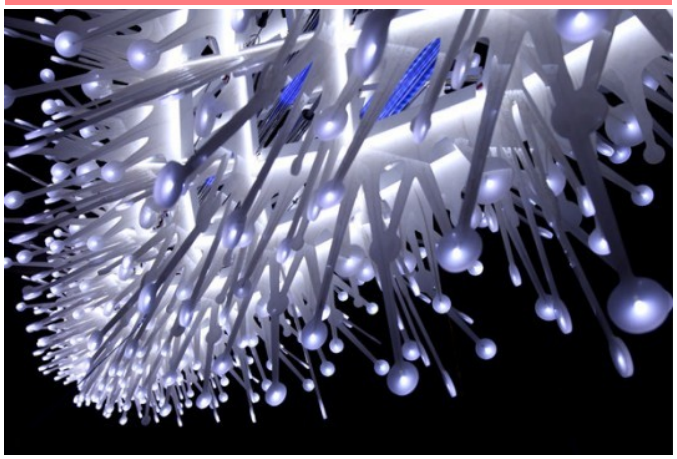
Be ion is trapped in an electric filed generated by system of electrodes and is allowed to interact with laser field Be ion has 2 hfs levels of ions ground state and act as a two level system Ion oscillates in one direction at 11.2 MHz And transition frequency between the states is 12 GHz. A polarized laser pulse excites the ion from lower level to upper level De-excites spontaneously by emitting fluorescence radiation. Excited state ion will not interact with laser pulse. One can arrive at conclusions that the observation **of Fluorescence emission** implies that ion in the lower level and No Fluorescence means that ion in the excited level.

Experimental set up to observe the entangled states of Be ion in an ion trap is shown above in schematic form. A $\pi/2$ laser pulse will exhibit the entangled state of Be ion. Superposition sates and their experimental realization will generate new era in quantum computing



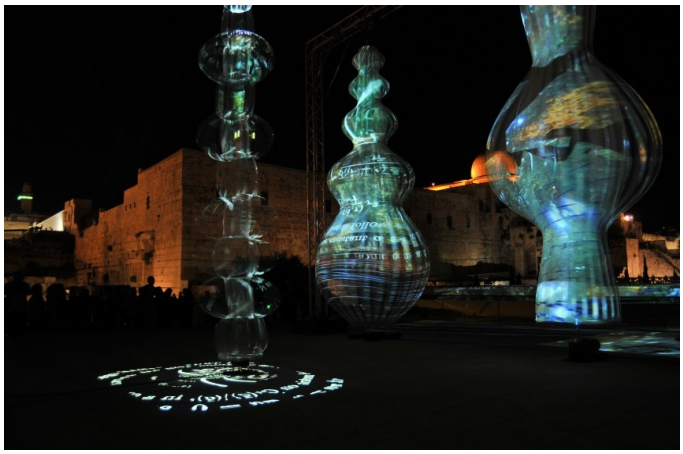


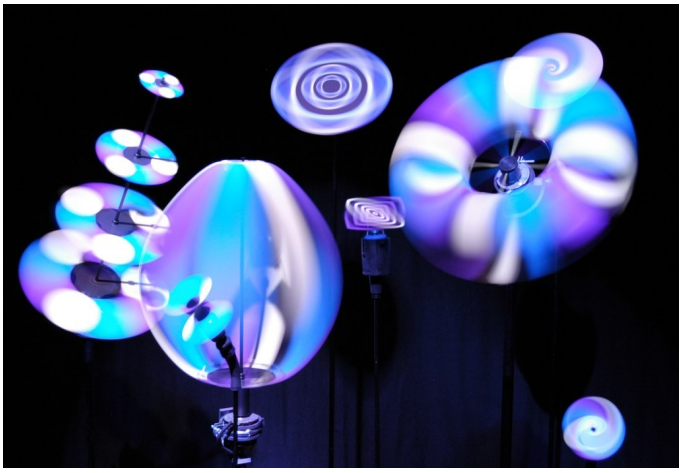
Installation- Sculptured Light

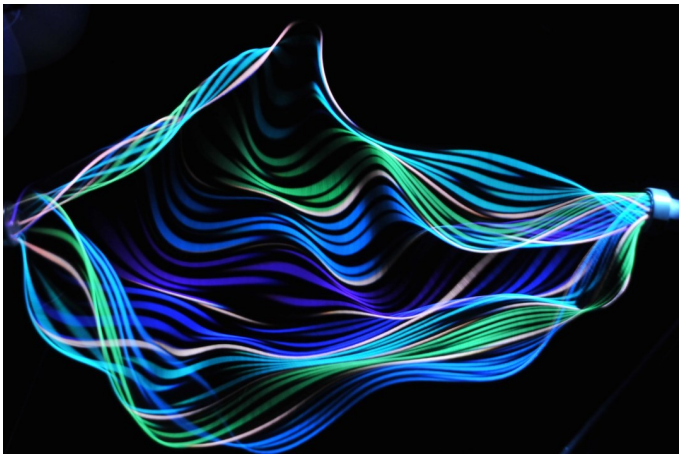


Paul Friedlander is a Physicist / Kinetic light sculptor who studied Physics in Cambridge where Professor Anthony Leggett was his tutor. Leaving his training in cosmology , Relativity and black holes, Friedlander evolved into a lighting designer and sculpts beautiful images and installations employing the magic of light. Friedlander designed light art to play behind the Electric Sound Orchestra, where he created light images to match the sounds the orchestra created. He later created a series of sculptures using chromastrobic light. The sculptures, when spinning give off light illusions. More recently, Friedlander has focused on light sculpture. He uses chromastronic light broadcast on string to create his illusions of bent and twisting light.

He won many prizes and awards including winner of Light Forms in 1998, New York, 2004 Kinetic Art Organization Prize Winner, UK. He exhibited his works in 3 continents and 12 countries. Some of his works are included in this issue of PN







MAGNIFICENT !!!!!!!

NEW DOCTORATES FROM ISP

Dr. Sony George has received his Ph. D for the thesis entitled "Application of Imaging to Study the Evolution and Dynamics of Laser Produced Plasma from Solid and Thin Films Li Targets". He has completed his doctoral work under the guidance of Prof. Dr. V P N Nampoori.

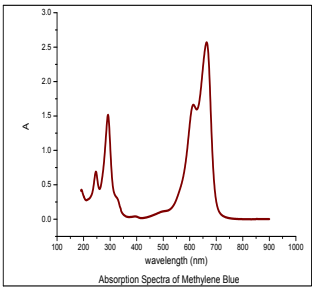
Dr. Nithyaja Balan has received her Ph. D for the thesis entitled "Photonic Applications of Biomaterial with Special Reference to Biopolymers and Microbes.". She has completed her doctoral work under the guidance of Prof. Dr. V P N Nampoori.

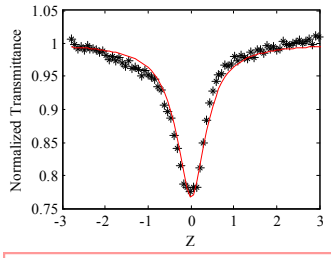
WORK FROM ISP AT A GLIMPSE…….

Optical characteristics of Methylene Blue sensitized Poly Vinyl Alcohol for holographic applications

Bini P. Pathrose

Storage requirements all over the world are increasing day by day, making data storage one of the biggest challenges in the market. The next generation of data storage system is expected to use optical holography, as one of the techniques, to store information of three dimensional volume of a material as a whole. The high storage density, fast access times, parallel search through databases, high data security, and high data transfer rates makes holography poised to become a compelling choice for next-generation storage and content distribution needs. Now holography techniques are offering capacities approximately 1 TB (terabyte) in a storage crystal with a size of a sugar cube having data transfer rate of 1GB/s at access times less than 100 µs/bit. The paper presents the optical characteristics of Methylene Blue (MB) sensitized PVA and explore the possibility of using the material for holographic applications. Among the different dye doped systems, MB doped polymers are of special interest owing to its sensitivity to the commonly available He-Ne laser. MB is a basic dye belonging to thiazine group with the molecular formula $C_{16}H_{18}N_3SCl$. It is a dark green colored powder having a molecular weight of 319.86 and the absorption peak, if pure resides at 668nm and 609 nm. The absorption peak shifts according to the pH of the solution. The photochemical reduction of MB results in the formation of leuco MB through the photoreduction of intermediate state. The spectral characteristics of MB sensitized PVA films used for holographic recording are investigated. The films are prepared by gravity settling method. The film prepared shows good optical nonlinearity and have a broad emission at 700 nm.



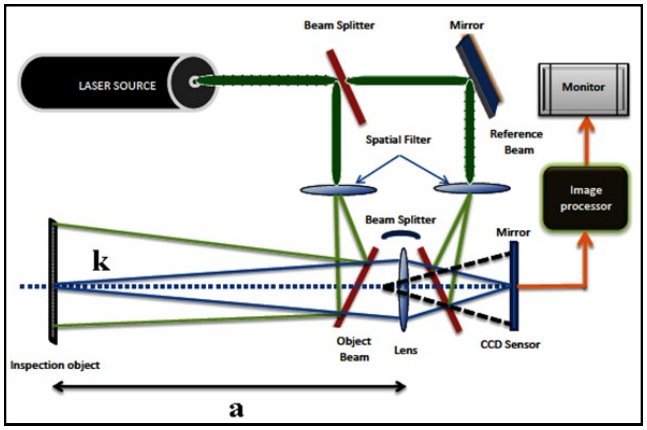


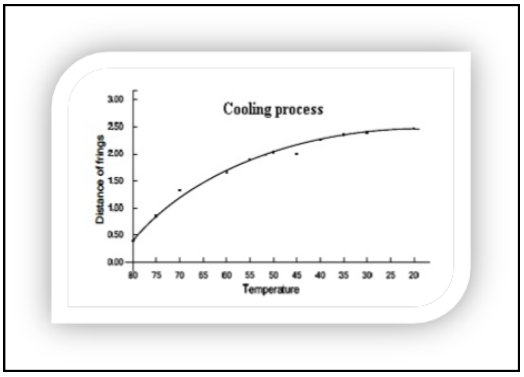
Open aperture z scan trace of Methylene Blue

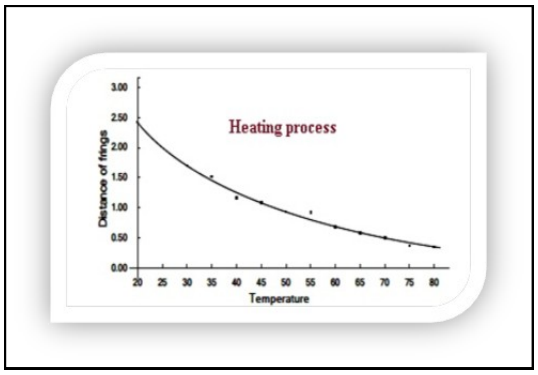
Thermal deformation analysis of metallic sample using Electronic Speckle Interferometry

Retheesh Raj

Thermally induced deformation analysis is having considerable importance in the mechanical and structural design application of many solid materials. The objective of monitoring the thermal distortion is to attain an image of the thermal map of its surface which facilitates detection of structural defects in materials. This thermal map can cover the entire surface or merely a region of it. Speckle interferometric techniques and their electronic and digital analogs have been effectively applied for such kind of thermal strain analysis today. The inspection object used for carrying out the experiment is an aluminum heat sink material with 60mm length, 60mm width and 15mm thickness. The thermal loading equipment employed in this experiment comprises of three heating filaments in it and the surface temperature is controlled by changing the voltage of these heating filaments. The surface temperature of the specimen is then progressively varied from 20^0Cto 80^0Cdegreecelsius and is monitored by grabbing the interference fringes recorded using an ESPI set up shown below.



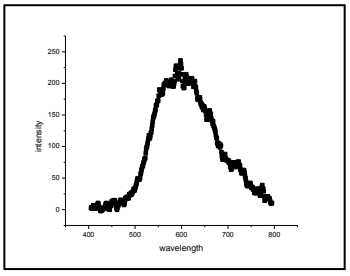


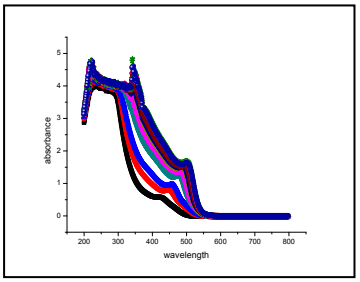


In the heating process, interference fringes are appeared more and more narrow and the interference fringes are shown opposite character while cooling as indicated by distance- temperature curves below. By the above analysis, we can find whether in heating or cooling process, those changing of the temperature all lead the metallic sample to deform with transforming the optical path difference.

Synthesis And optical Characterisation of CdSe nano particles

Sr. Anju K. Augustine



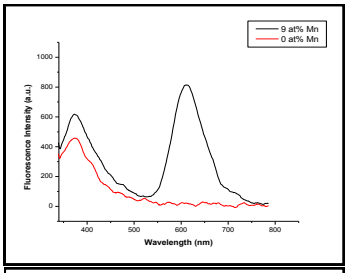


In recent years there has been considerable interest in semiconductors with nanometer size dimensions due to the quantum size effect exhibited by these nanosized semiconductors. Because of the high surface-to-volume ratio of nanoparticles, their surface properties have a significant effect on their structural, catalytic, mechanical, electrical and optical properties. The novel properties of nano materials are due to quantum confinement of charge carriers in these materials. Among inorganic quantum dots, Cadmium selenide (CdSe) having suitable band gap (1.74 eV at 300K) is a useful semiconductor material because of its strong size- dependent optical properties. Cadmium selenide (CdSe) is a useful semiconductor that is a binary compound of cadmium and selenium. Since these nanoparticles have a size dependent fluorescence spectrum, they are finding applications in optical devices such as laser diodes. This quantum dots have applications also in bio medical imaging optoelectronic device, nano sensors, solar cells, thin film transistors etc. CdSe nanoparticles prepared by aqueous method show a tunable band gap and size. Optical absorption studies show a red shift of absorption edge as the time increases which is due to quantum confinement effect. Photoluminescence spectra of the prepared sample have a strong emission around 560nm wavelength.

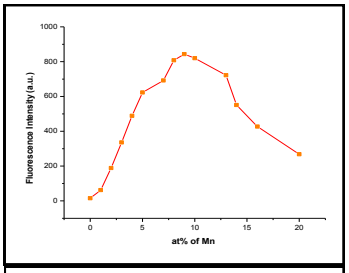
Enhanced Orange-red light emission from ZnS:Mn nanocrystals

Sabitha P. V.

The ability to manipulate the color output of colloidal nanomaterials is important for their applications as light emitting displays, lasers, and optoelectronic devices to multiplexed biological labeling. As compared with organic dyes, semiconductor nanocrystals possess apparent advantages, such as broad and strong absorption, tunable emission, zero scattering, reasonable stability, and solution processability. However, some problems, especially the intrinsic toxicity of certain materials, have cast a doubtful future in their practical applications. It is therefore a challenge to search for a kind of nanophosphors, which can overcome these concerns and yet maintain the advantages of the nanocrystal emitters. It is expected that semiconductor nanocrystals (especially ones not containing heavy metal ions) doped with intentional impurities can potentially meet these requirements. Among them, ZnS nanocrystals doped with transition metal ions such as Mn^{2+} ions have been regarded as a promising new class of nanophosphors, owing to their superior luminescent properties and potential applications in displays, sensors, and lasers. However, the development of effective doping strategies can be challenging. In our laboratory we have prepared highly efficient ZnS:Mn nanoparticles (2.6 nm) with varying concentration of Mn^{2+} ions by using simple solution processing technique at room temperature. Dopped nanocrystals show orange-red (600 nm) light emission and exhibit luminescence enhancement with increasing concentration of Mn^{2+} ion. The ZnS:Mn nanoparticles obtained with this method exhibit 50% enhancement in maximum photoluminescence intensity relative to undoped nanocrystals. The experimental results indicate the efficient energy transfer from the ZnS host to Mn^{2+} ion emission centers give rise to the orange-red emission and results in the enhancement of the photoluminescence.



Photoluminescence Emission spectra of undoped and doped ZnS:Mn nanocrystals



Emission intensity at 600 nm with various concentration Mn^{2+} ion (lex =310 nm).

Studies on natural dyes incorporated with low dimensional structures

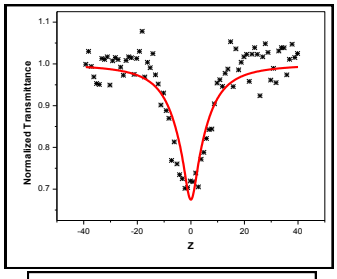
Aparna Thankappan

In recent decades there has been great interest in engineering and synthesizing different kinds and structures of solid and liquid media that posse's high nonlinear refraction (NLR) and/or nonlinear absorption (NLA). Optical materials with large coefficients of reverse saturable absorption (RSA) and nonlinear refraction can exhibit irradiance-dependent transmittance and phase shift, which cooperatively limit the throughput fluence (optical energy per unit of area). Materials exhibit non linear absorption are currently of interest because of their large third order non linearity, high damage threshold, instantaneous response time, ease of processing, structural modifications and are key elements in many l areas of photonics and optical technology such as all-optical switching (optical computer) devices, three dimensional fluorescence imaging, and optical limiting. However, most of the synthesized materials require elaborated preparation procedures and safety measures, use or generation of hazardous materials, costly materials, as well as fragile or chemically unstable structures

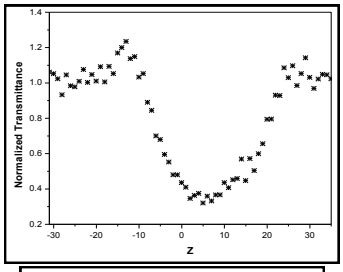
beyond certain threshold irradiance. Therefore, we suggest natural dye extracts as environment friend, safe, and inexpensive materials, as well as having high chemical stability during optical excitations with coherent light sources. Besides anthocyanins, chlorophylls, and carotenoids, betalain are the most common pigments in the plant kingdom. These natural pigments from plants have been extensively investigated as sensitizers for the DSSC, in which red beetroot pigments maximum conversion efficiency of 0.67%. Though the former have inherent limitations as sensitizers owing to weak absorption of green wavelengths, the absorption spectra of the latter have more favorable overlap with the solar spectrum. Both inter molecular and intra molecular H bonding has profound effect on the nonlinear optical properties of betanin.The influence of betanin on the non linear character of ZnO-PVA system leads to saturable absorption and again to RSA on increasing input fluence. The simultaneous occurrence of the non linear behavior of this system can be made use of in developing various photonic devices.

Optical nonlinearity in PicoGreen and the effect of DNA on its nonlinear absorption

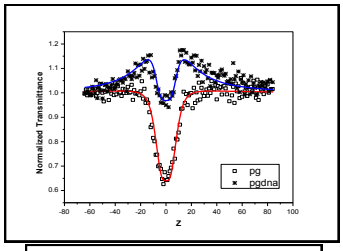
Pradeep Chandran



Open aperture Z scan curve of PicoGreen



Closed aperture Z scan curve of PicoGreen



Effect of saDNA on nonlinearity of Pi-

PicoGreen (PG) is a fluorescent dye developed and patented by Molecular Probes (Invitrogen). This asymmetrical cyanine dye is used as a nucleic acid stain in molecular biology. PG is commonly employed as quantitation reagent used to detect and quantify double stranded DNA (dsDNA) and has characteristic similar to that of SYBR Green I. This widely used dye is a fluorochrome which has a low intrinsic fluorescence as such. Its fluorescence enhances over 1000 fold as it binds to dsDNA, with high quantum yield. It can also significantly stain proteins, carbohydrates, free nucleotides, single stranded DNA (ssDNA) and RNA. Here we introduce PG dye as a nonlinear optical material that could be exploited in optical limiting applications, two photon microscopy and photonic devices. In the present investigation, we have employed the single beam Z scan technique using Q switched Nd:YAG laser (Spectra Physics LAB-1760, 532 nm, 7 ns, 10 Hz) with nanosecond laser pulses to measure the nonlinear absorption, nonlinear refraction and nonlinear susceptibility of PG. The data are analyzed by using the procedure described by Sheik Bahae *et. al.* and the nonlinear coefficients are obtained by fitting the experimental Z scan plot with the two photon absorption geometry. We could observe that the dye exhibits reverse saturable absorption and self defocusing effect. The result shows a significant value of nonlinear absorption coefficient, which is highly useful in optical limiting applications. In order to understand the detailed aspects of DNA biomolecule interaction with the dye, investigation on nonlinear optical properties of dye doped DNA are carriedout. On intercalating the dye with commercially available marine derived salmon DNA (saDNA), we observe a saturable absorption behavior at low incident intensity (away from the focus) and reverse saturable absorption at high incident intensity (at the focus).

These attractive properties of PG could be exploited in developing it as an optical limiter and as various photonic and optoelectronic devices. Thus it could be concluded that DNA plays an interesting role in tailoring the nonlinear absorption coefficient of PG dye. Such flexibility in controlling the optical nonlinear properties of dyes by saDNA could be exploited in developing various photonic devices. In comparison with our previous results relating to the effect of DNA in Rhodamine 6G, it could also be concluded that DNA can be used to switch the nonlinear behavior of intercalating dyes.

Nonlinear Dynamics of Multiple-Quantum-Well Lasers (MQWLs)

Bejoy Varghese

Due to the advancements in semiconductor laser technology, bulk semiconductor lasers, by large, are replaced by new generation lasers like Multiple-Quantum-well Lasers (MQWLs) or Quantum Dot Lasers. These Lasers have many new features in their dynamics, induced by its small size. Nonlinear Dynamics of such Lasers are not investigated in detail unlike the case with bulk semiconductor lasers. These new lasers are better candidates for pulse generation in optical communication. Practically, there can be many situations where the operating conditions of MQWLs are such that it can show nonlinear behavior. MQWLs have many desirable advantages over bulk semiconductor lasers like higher modulation bandwidths, lower currents etc. Presently we study a scenario in Distributed Multiple Quantum Well Lasers where chaos, induced by current modulation is suppressed by opto-electronic delay feedback.

Chalcogenide Glasses for Photonic devices

Musfir P. N.

Chalcogenide glasses are novel materials with very promising properties. Low losses and photo induced effects make these glasses suitable candidate for the fabrication of devices such as gratings and waveguides. Chalcogenide glasses are materials with high optical nonlinearities which make them attractive for all optical switching (AOS) applications at telecommunication wave length. Future trends would be towards fabricating materials with optimum properties for the production of efficient passive and active devices. Chalcogenide glasses based on sulphide have attracted considerable interest for their possible role as a new optical fibre materials. When doped with rare earths, these glasses by virtue of their low phonon energy and high refractive index open up the possibility of new transitions and significantly increased pumping efficiencies.

Fabrication of gold nanoparticle doped polymer optical fiber

Suneetha Sebastian

We report on the fabrication of gold nanoparticle doped polymer optical fiber. We incorporated gold nanoparticles directly into the monomer solution using Pulsed Laser Ablation in Liquid technique. We used Nd-YAG laser at the fundamental wavelength for laser ablation. Conformation of the nanoparticle formation is made using absorption spectrum and Transmission Electron Microscopy. Average size of the nanoparticle is found to be 7nm. The monomer solution containing gold nanoparticles is directly polymerised into a preform. In order to understand the optical properties of the preform, we took the absorption spectrum. It is found that there is a red shift in the surface Plasmon Resonance peak from the solution to the preform. Finally the preform containing gold nanoparticles is thus drawn into multimode polymer optical fiber of 500µm thickness. These fibers find application in Surface Enhanced Raman Scattering experiments.

SPECIAL SEMINARS….

➢24 September ’12 Seminar on ***"Gadgil's Report on western Ghats and Its Implications"*** by **Prof. Dr VPN Nampoori, ISP, CUSAT.**

➢14 September’ 12 Seminar on **"*Nanotechnology Advancement*" by Dr. Thomas Chakupurackal**

➢26 July’ 12 Seminar on ***“Laser based Sensor:A Photonic application in Aerospace industry”*** **by Mr.Yedhu Krishna, University of New South Wales, Australia.**

➢26 July’ 12 Seminar on ***"Ultrafast laser Inscription for novel Photonic Instrumentation"*** by Ms. Rose Mary, Institute of Photonic and Quantum Sciences, UK.

➢25 July Seminar on "***Optical Sensors***" by Dr. Radhakrishna Prabhu, Deputy Director (Medical Technologies, JRI), Northern Research Partnership (NRP), Robert Gorden University, Aberdeen, UK.

➢12 July Seminar on ***"Optical Hyperspace: Interaction of light with Hyperbolic Metamaterials"*** by Mr. Harish Krishnamoorthy, City University of New York.

➢15 June Seminar on "***Recent trends in Laser induced Plasma***" by Dr. Harilal. S. S, Purdue University.

➢6 June Seminar on ***"Dynamic processes on nanostructured surfaces and interfaces"*** by Prof. C. von Borczyskowski, Institute of Physics, Chemnitz University of Technology, Germany.

➢26 April Seminar **on** ***"Coherent Techniques in DWDM Fiber Networks for 40G, 100G and 400G Speeds"*** by Dr. Thomas Lee S, Technical Consultant, Tech Mahindra. 26th-Apr-2012, Venue: ISP Committee Room.

RECENT PUBLICATIONS FROM ISP

➢**“Impact of Intermediate localized states on nonlinear absorption of Ga-Ge-Se nanocolloidal solution”** Indu Sebastian, S. Divya, V.P.N. Nampoori, P. Radhakrishnan and Sheenu Thomas **Appl. Phys. Letter 102, 031115 (2013)**.

➢**“Nonlinear optical studies of DNA doped Rhodamine 6G-PVA films using picosecond pulses”** Sasidharan sreeja, Balan Nityja, Debasis Swain, V.P.N. Nampoori, P. Radhakrishnan and Soma Venugopal Rao **Optics and Photonics Journal 2012, 2, 135-139.**

➢**“Synthesis of monocrystalline zinc oxide microrods by wet chemicalnmethod for light confinement applications”** Aparna Thankappan, S. Mathew, Erni Rolf, Debajeet Bora, Artur Brain, V.P.N. Nampoori**. Physica E 44 (2012) 2118-2123.**

➢**“Effect of betanin natural dye extracted from red beetroot on the non-linear optical properties of ZnO nanoplates embedded in polymeric matrices”** Aparna Thankappan, Sheenu Thomas and V.P.N. Nampoori **Journal of applied Physics 112, 123104 (2012).**

➢**“Interfacial edge dislocation interaction with free-surfaces in nanocrystals”** A. Kumar, K.G. Kavitha and A. Subramanian **Journal of Nanoscience and Technology Vol. 12, 5096-5101, 2012**

➢**“A long period grating based biosensor for the detection and estimation of cholesterol”** Bobby Mathew C., T.M. Libish, J. Linesh, P. Biswas, S. Bandyopadhay, K. Dasgupta, P. Radhakrishnan **“International conference on fiber optics and photonics, OSA 2012.**

➢**“Pulsed laser ablation in methyl methacrylate to produce spherical gold nanoparticles and fluorescent nanodots”** Suneetha Sebastian, Animesh Aryan, Sooraj S., V.P.N. Nampoori and M. Kailasnath. **“International conference on fiber optics and photonics, OSA 2012.**

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