VOLUME 21 FEBRUARY 2019

PHOTONICS NEWS

INTERNATIONAL SCHOOL OF PHOTONICS

NATIONAL PHOTONICS SYMPOSIUM 2019

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Keerthana S H

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Nishanth N

FROM THE DIRECTOR'S DESK.....

Prof. (Dr.) A Mujeeb, Director

It is with great pleasure and deep sense of satisfaction that we bring out this edition of Photonics News. We are proud to state that Photonics continues to be the most important subject of research for enabling science as well as life. The ground breaking inventions in the field of optics were recognised much in the last year by way of Nobel Prize. Optical tweezers and ultra fast optics elevated the power of lasers to a life saving machinery from its role as a scientific or research tool. International School of Photonics is also continuing its thrust area of human resource development in Photonics with much dedication and satisfaction.

The current volume of the News mainly documents the academic, research, administrative and other related achievements during the last year. We could move forward with much acceleration in the progress of our school after the rewarding remark by the NAAC team in their visit during 2016. The entire university was rejuvenated and delighted when the University was recognised with the Chancellors Award in 2017. Apart from the new additions of books in library and equipments such as optic items, lasers, cameras, computers etc., in the research lab, 18 new experimental set ups for M.Sc./M.Tech students, and new facilities for research were added, namely CCD spectrograph under intensive research department scheme, 6 GHz Oscilloscope from RUSA, RF co-sputtering system from DST PURSE, ICCD camera under DST FIST and from the university fund. A 20 KVA UPS with 30 tubular batteries back up is now available for the laboratory. Along with the renovations of fiber lab and laser lab in the ground floor with new flooring, the long cherished dream of construction of new academic space in the first floor for six major laboratories (Photonics Lab I, Photonics Lab II, M.Tech Lab, Computer Centre, Chemical lab and Characterisation Lab) and six faculty rooms are being completed after strengthening the existing building. Now our department is friendly for physically challenged candidates and safe and secure under CCTV surveillance, as stipulated by AICTE. With the new UPS room outside the building, all the corridors are free from batteries and equipments. With the new fume hood, safety conditions will be observed in the new Chemical laboratory with a fire escape ladder. The renovated office and Directors chamber in ISP is now one of the offices with best ambience and working atmosphere.

For the last three years, the funding to the department has reasonably increased. DST Purse, FIST, RUSA etc., were the main channels for research upgradations in addition to the regular funding from the university. ISP took active part in the first celebration of International Day of light in 2018, and initiated charity activities outside the circle also, along with outreach programmes. The Optics kit and laboratory equipments sponsored by OSA, were distributed to the needy Government schools in and around the flood affected area.

CSIR national eligibility test for lectureship and junior research fellowship has been successfully co-ordinated four times from our side with much satisfaction and involvement.

New thrust area of research has been established in the field of laser speckle metrology with the award of a Ph.D degree in that area in the last year. In addition to the OSA travel lecture, the richness of various academic activities include, invited talks by Professors from various universities such as Japan, Sweden, Ireland, Switzerland etc.

After academic auditing, the syllabi and regulations for the five year integrated MSc. course has been modified and revised. The strength of faculty has been enhanced by inducting inspire faculty along with permanent, contract and visiting professors. Starting with a university post doctoral fellow in 2016, now we have PDFs from other funding agencies. No position in teaching and non teaching are vacant now.

Since 2017, after converting the Annual Photonics Workshop (APW) into National Photonics Symposium (NPS), we have been publishing the research articles as separate proceedings with ISBN number to balance the need of stake holders and researchers. In addition to this, now we have printed and published a compendium for the readers showcasing all the activities and published papers of our department for the last five years. SIGN IN in 2016, IONS and Etch New in 2017, KSC curtain raiser programme in 2018, International Day of Women and girls in Science in 2019, were the other major co-curricular events. The proceedings for NPS 2019 will also be released shortly.

The International School of Photonics is entering its silver jubilee year in the next academic year. We need renovation of C V Raman auditotium, new staff rooms, store, etc. in the ground floor. We must have new plans and strategies for funding from both state and central governments through our university in recognition of silver jubilee.

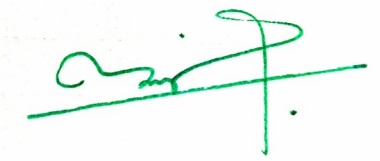
I am glad to see that ISPians have published good number of papers in reputed peer reviewed journals and are placed in various good Indian companies and in various universities and institutes abroad that gives visibility and fame of our school to the outside world.

I congratulate the editorial team members and the contributors to this Photonics News for making the issue interesting to its readers.

I offer thankful prayer to Almighty for the tremendous blessings. I have received immense support from the Vice Chancellor to the Section Officer. The love and affection extended by the Research Scholars, M.Sc, M.Tech students are worth mentioned. I am happy with all my peers, faculty, parents, technical and administrative colleagues for their co operation and service. Officials from engineering department and CPWD extended their whole hearted support in all the developmental activities.

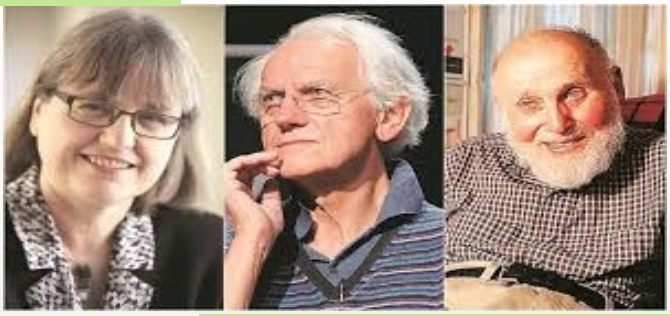
Thank you all

With love and prayers



A MUJEEB

LASER SCIENTISTS



GET 2018 PHYSICS NOBEL PRIZE

No less than 22 scientists have received Nobel prizes for their work in lasers and related fields. With 2018 Physics Nobel prize also going to the laser specialists, their total number now becomes 25. We celebrated the centenary of the discovery of Stimulated Emission a couple of years ago; now we are ready to celebrate the diamond jubilee of the invention of lasers. Perhaps no other invention has penetrated to such diverse human endeavors like medicine, general relativity, nuclear fusion and cosmetology! No wonder that laser scientists continue to receive the highest accolades every year.

This year the Physics Nobel prize winners are Arthur Ashkin, Gerard Mourou and Donna Strickland for their "ground breaking inventions in the field of laser physics". Half of the prize money (about $ 1.131) goes to Dr. Ashkin while the rest is shared equally between Mourou and Donna Strickland. Ashkin gets the prize for his work on "optical tweezers and their application to biological systems". Gerard Mourou and Donna Strickland win the prize "for their method of generating high intensity ultra short optical pulses". Donna is first woman physicist to get the prize in last 55 years after Maria Goeppert Mayer (for her work on shell model of the nucleus).

In 1970 Ashkin showed that tiny dielectric particles can be manipulated by a laser beam using the force arising from scattering effect. In 1986 he demonstrated that using a single properly focused laser beam it is possible to trap tiny particles employing the gradient forces arising out the intensity variation of the focused laser beam. Such optical traps known as "optical tweezers" can be very useful in capturing and manipulating particles of size ranging from tens of nanometers to few microns. Virus, bacteria and living cells come within this range and Ashkin immediately noticed the usefulness of such optical traps in biological research for handling single cells and bacterium. Now optical tweezers have become an invaluable tool in biophysics.

Arthur Ashkin was born in New York city in 1922. In 1947 he completed his degree in Physics from Columbia University. He got his Ph.D. from Cornell University in 1952. He joined Bell Labs in New Jersey and remained there until his retirement in 1992. At 92 he is oldest person ever to receive Nobel Prize In Physics.

Amplifying laser pulses to enhance their peak power has always been a problem. Beyond a few gigawatts, they begin to damage the optics constituting the laser system. In mid 1980's Mourou and Strickland in Rochester devised a method to produce ultra short femtosecond laser pulses of peak power from terawatts to petawatts. The method is called "chirped pulse amplification" (CPA) which now lies at the heart of most high power laser systems in the world. In CPA, short laser pulses from a standard mode locked laser system is stretched out in time domain using dispersive elements like a grating pair and then it is amplified when the peak power level is low. Thus after enhancing the pulse energy by a factor of

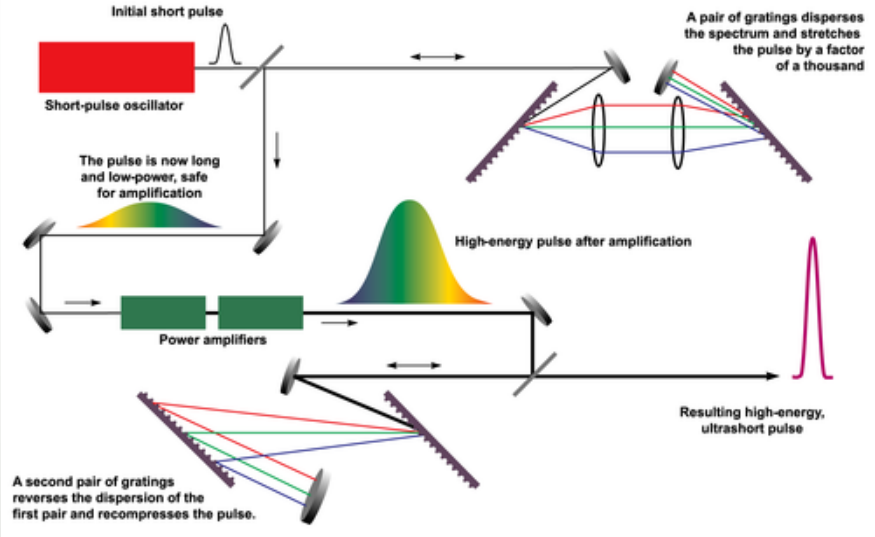


Fig: Chirped pulse amplification process - Schematic

"..ultra short laser pulses are invaluable in the study of ultrafast atomic and molecular processes. These are also useful in eye surgery and micromachining in addition to gene manipulations. In addition to X-ray generation, even nuclear excitations can be produced with such petawatt laser pulses."

10^{10} to 10^{12} or more it is further compressed by reverse dispersion to produce an ultra short pulse when the peak power reaches terawatt to petawatt level. Such ultra short laser pulses are invaluable in the study of ultrafast atomic and molecular processes. These are also useful in eye surgery and micromachining in addition to gene manipulations. In addition to X-ray generation, even nuclear excitations can be produced with such petawatt laser pulses.

Gerard Mourou was born in 1944 in Albertville in France. In 1967 he took his degree in Physics from Grenoble. Following his Ph.D. in 1973 from Paris, Mourou joined University of Rochester in US. In 1991 he became the Founder Director of Centre for Ultrafast Optical Sciences in University of Michigan, Ann Arbor. In 2004 he returned to France to become the Director of Laboratory for Applied Optics at Ecole Polytechnique.

Strickland is a Canadian woman born in Guelph in 1959. She took her degree in engineering physics from Mc Master University in 1981. Her Ph.D. in Optics was from University of Rochester in 1989. Interestingly Gerard Mourou was her doctoral supervisor in Rochester. She worked as a research associate at NRC, Canada till 1991. Later she joined Advanced Technology Center for Photonics and Opto-electronic Materials in Princeton University and finally moved to the Physics Department at University of Waterloo in 1997. After Marie Curie (1903) and Maria Goeppert Mayer (1963), Donna Strickland is only the third woman to win the Physics Nobel prize.

Prof. (Dr.) C P Girijavallabhan
Founder Director
International School of Photonics
Cochin University of Science and Technology

LI-FI – NEW ENTREPRENEURS HEAVEN

Philosophically it was believed that light connects people and eventually leads us to destinations. Recently, this is being felt technologically as LIFI emerges as potential technology to replace wifi. Machine to machine learning along with other technologies like IoT reaches out for other disciplines, to establish Artifical Intelligence. In this search, LIFI has ubiquitous pie and sooner will become major contributor. During 2011, in a TED talk Prof Harald Haas coined the word Li-Fi for an optical network with bulbs as router for the first time. LIFI is not enjoying popularity like IoT and other emerging technologies.

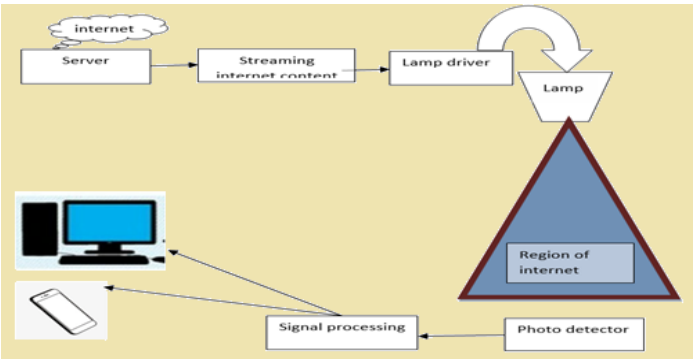


Figure: Schematic of an office/home LIFI

"LIFI enjoys the advantage of being operated in visible light,100 times faster than wifi and avoids cumbersome antenna design…..LIFI would be future technology which will realise, high energy efficiency, higher data rate, less radiation hazard…..When lights are off, your LIFI system compels you to mind sleep seriously and will not allow browsing till your eyes are tired"

On par with wifi, full duplex communication is possible (as illustrated in the picture) and was demonstrated by pureLIFI which is one of the leading groups in LIFI technologies. Only six companies in the world are actively engaged themselves in LIFI research and pureLIFI is one of them. The streamed internet data if fed to the LED or the light source through appropriate lamp driver. Anywhere in the cone, internet strength will be good and by placing appropriated detector and signal conditioning and processing network, the streamed data could be processed or used.

LIFI enjoys the advantage of being operated in visible light, 100 times faster than wifi and avoids cumbersome antenna design. Its limitations like line of sight process are perceived as distinct advantage when closed room confidential communications are carried out. More precisely tower to tower communication (longhaul) needs a higher data rate and line of sight is not a hurdle in it.

Geo fencing for improved security, restricting multiple users per LIFI access point and other challenges LIFI faces, give way to incorporation of integrated optical devices in LIFI systems. Integrated optical devices, which are primarily used in analytical instruments presently, will be deployed in LIFI soon for data security and encryption as well. The protocol used in LIFI is derived from wifi and presently IEEE 802.15 protocol is used for LIFI communication. With a little effort, smooth transition from wifi to LIFI is possible and probability of LIFI replacing wifi soon is higher. With all these advantages and scope to soar further LIFI would be future technology which will realise, high energy efficiency, higher data rate, less radiation hazard. On a lighter note, a pessimistic view suggests that, when lights are off, your LIFI system compels you to mind sleep seriously and will not allow browsing till your eyes are tired!!!

Dr. V Manickam
Assistant Professor
International School of Photonics
Cochin University of Science and Technology

INTERPRETING LASER DOPPLER PERFUSION IMAGING VIA TEMPORAL CORRELATION ANALYSIS

Laser Doppler Perfusion Imaging (LDPI) is a full-field imaging technique that generates a two-dimensional map of blood flow. Using LDPI approach, skin perfusion is obtained by measuring the Doppler shift introduced by coherent light reflected by both static tissue as well as the moving scattering centers (such as red blood cells, RBC). LDPI can provide perfusion maps over a surface up to 50×50 cm^2. Depending on the laser wavelength and properties of the tissue, the sampling depth is typically from 1 to 2 mm.

LDPI has widely been utilized for many biomedical applications, for instance to diagnose burns, to study cerebral blood flow in small animals, for drug uptake studies, to measure microvascular dysfunction in Raynaud's phenomenon, and diabetes, assessment of microvascular perfusion in the skin, and many other applications including chronic pain, cancer and angiogenesis, In clinical and research applications, an average perfusion value is often computed serially over time by using the LDPI signal. This, however, undermines the advantages of the LDPI technique. To aid in performing this task, we have proposed an algorithm, the temporal correlation analysis for which no mean value is computed and a perfusion evolution in time can be monitored without computing mean value over a stack. The method has been shown to be of utility to monitor fluctuations in the perfusion level in healthy subjects. The fast changing perfusion levels and the perfusion variations in a longer continuous LDPI measurement were monitored using the temporal correlation function. The algorithm is fast (typical run time between 5-10 seconds) and so the analysis can be used to interpret the LDPI data to follow the perfusion variations for a clinical application.

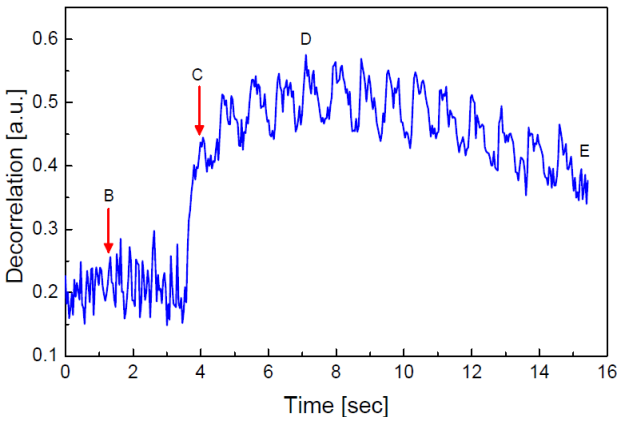


Fig. Decorrelation of a perfusion signal (continuous recording of 128×16 pixel) as a function of time. To follow the perfusion variations in a longer continuous LDPI measurement, an occlusion was applied by inflating a blood pressure cuff around the upper arm of a healthy subject.

Fig. shows the results of the correlation analysis as function of time of a continuous LDPI signal. It clearly depicts an increase in perfusion level just after release of an occlusion. As can be observed, the average time between the correlation peaks of the LDPI signal is 829 milliseconds, which results in the normal regular heartbeats frequency of around 73 beats per minute.

Dr. Md Zaheer Ansari,
Post Doctoral Fellow
International School of Photonics
Cochin University of Science and Technology

Welcome to

New comers!!!!!

Full time Research Scholars

No	Name	Topic	Guide
1.	Ms. Karthika Sankar	Design, Simulation and Fabrication of one dimensional Photonic crystals	Dr. Priya Rose T
2.	Mr. A K Sooraj Viswam	Modelling, Simulation and Experimental validation of certain Laser Speckle Imaging Techniques	Prof. A Mujeeb
3.	Mr. Titu Thomas	Light Matter interaction using thermo optic studies	Dr. Manu Vaishakh
4.	Mr. Jayaprasad K V	Light Matter interaction using Laser based Thermo optic effect and coherent interactions with different types of media	Dr. Manu Vaishakh

Part time Research Scholars

No	Name	Topic	Guide
1.	Mr. Adarsh K J	Synthesis and Characterisation of selected nano materials and composites for Photonic applications	Prof. A Mujeeb
2.	Mr. Nishanth N	Study of some security issues and their remedies for Wireless/Optical Networks.	Prof. A Mujeeb

HALL OF FAME

Awards and

Achievements.....

Ajina C,
Research Scholar
Best Researcher Award
(2018—2019)

Fathima R,
Research Scholar
Best oral presentation
ICCPM 2018, St Thomas College, Thrissur

Musfir P N,
Research Scholar
Best oral presentation,
28th Swadeshi Science Congress,
NIIST,
Trivandrum

Anitha Prakash,
Research Scholar
Best poster presentation
NPS, 2018
ISP, CUSAT

HALL OF FAME

Anupama V
Research Scholar
received appointment as
Assistant Professor,
S N College, Nattika

Awards to our PG's....

Mashboob C M

PSI Award [Highest CGPA - M.Tech.]
&
Satish John Memorial Award
[Best Project- M.Tech.]

Biveen S Lal

Gemini Chandra

Prof. Leggett Award
[Highest CGPA - M.Sc. Tenth Semester]

Akshay Viswanathan
C V Raman Award
[Best project,
M.Sc. Tenth Semester]

Aiswarya C B
Nalanda Endowment Award
[Highest CGPA,
M.Sc. First Semeter]

Hridya T S
Best Mini Project Award
[M.Sc. Sixth Semester]

HALL OF FAME

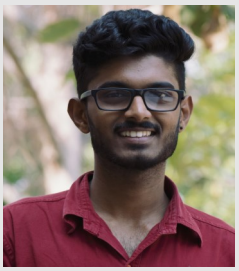
Hurray!!! We are placed.....

M.Tech. 2016-2018

Mashboob C M
Assistant Professor
Ilahia college of
Engineering and Technology
Ernakulam

Syamily Balakrishnan
Optical Engineer
Methode Electronics
Bangalore

M.Sc. 2013—2018



Sreerag C T
Optical Engineer
Valeo India Pvt. Ltd.
Chennai

Lakshmipriya K A
Design Engineer
SFO Technologies Pvt. Ltd.
Cochin

Jayesh J Nair
Applications Engineer
Advanced Photonics
Mumbai

Krishnendu P S
Optical Engineer
Valeo India Pvt. Ltd.
Chennai

Summayya Samad
Intern
Opsitek Scientific Technology & Consultancy
Cochin

HALL OF FAME

Maria Merin Antony

M.Tech. (2017-2019)

Ms. Maria Merin Antony, received the best poster presentation award at the IONS Manipal 2019 international conference conducted by Manipal OSA student chapter, Manipal Academy of Higher education during January 11th-14th,2019. Maria is currently doing her project work at Nanyang Technological University, Singapore in the topic "High resolution probe metrology for fluidic and optofluidic channels"under the supervision of Prof. Murukeshan Vadakke Matham. She had also completed a summer fellowship programme at IIT Madras during June-July 2018.

Ashika Ashok

M.Tech. (2017-2019)

Ms. Ashika Ashok, MTech (2017 –2019) is doing project work at , Department of Physics, National Taiwan University in the topic "Detection of Chlorophyll Fluorescence Dynamics from a Single Chloroplast with Deep Tissue Two-photon Microscopy" under the guidance of Prof Shi-Wei Chu.

Rahul A R

Parvathy T B

M.Tech. (2017-2019)

Mr. Rahul A R and Ms. Parvathy T B attended the summer school programme titled "Orientation Course on Accelerators, Lasers and related Science and Technologies (OCAL)" at RRCAT, Indore during May-July, 2018.

Gautham V

Krishna Kumar

M.Sc (2014-2019)

Mr. Gautham V did a summer internship at RRCAT, Indore as part of Young Scientist Research Programme. Mr Krishna Kumar did his intership in the group of Prof. Vitali in the Dept. of Physics, University of Gothenberg during May-July 2018.

HALL OF FAME

Indo-Sweden Collaboration: Phase 2

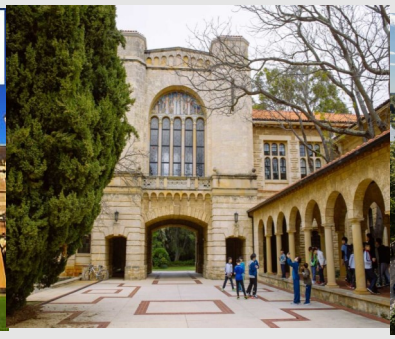
The European Union, had sanctioned a collaborative research funding for student exchange under the Erasmus Plus pro-gramme, for a research proposal jointly submitted by Prof. M. Kailasnath, ISP, CUSAT and Prof. Dag Hanstorp, University of Gothenburg. In this regard, an Inter institutional agreement was signed by Prof. David Peter S., Registrar, CUSAT and Mr. Johan Ahlgren, Erasmus Plus Institutional Coordinator, in the year 2015. The collabrative programme is in the second phase now. As part of it, two MTech students, Ms Meena K and Ms Parvathy T B are carrying out their project work at the Department of Physics, University of Gothenberg for a period of one year in the team of Prof Dag. The students of ISP were also fortunate to attend a series of lectures by Prof Vitali Zhaunerchyk, a senior lecturer from the University of Gothenberg, as part of the agreement. The lecture series were based on various topics including introduction to lasers systems, synchrotron and free electron lasers and infrared laser spectroscopy. Interactive sessions were also organized for MSc, MTech and PhD students so as as to discuss about the research facilities available at the University of Gothenberg, which could pave way for future collaborations between ISP and University of Gothenberg.

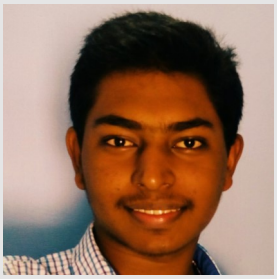
Parvathy T B

Meena K

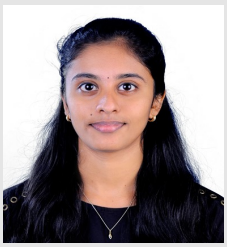
Prof. Vitali Zhaunerchyk with the research scholars at ISP

Our master fellows abroad……..





Mr. Arjun K S is doing his project in Basic study on three dimensional measurement using optical low coherence interferometer" at the Graduate School of Science and Engineering., Yamagata University, Japan.



Ms. Harsha Surendran is doing her project in "Laser Induced Forward Transfer (LIFT)" for 3 Dimensional Bio-printing" at LP3 - Lasers, Plasmas et Procédés Photoniques , France.

Mr. Akhil Kuriakose is doing his project in "Investigation of nuclear fusion rate in graphite for Inertial Electrostatic Confinement (IEC) devices" in theFusion-Plasma Group at The University of Sydney, Australia

Ms. Stephy V J is doing her project in "In-vivo retinal imaging using Polarization-Sensitive Optical Coherence Tomography" at the University of Western Australia

Mr. R Eruthuparna is doing his project in "Ultrafast electron diffraction" in ultrafast imaging group at Ludwig Maximilian University of Munich, Germany.

Ms. Poornima Balachandran is doing her project in "Surface Enhanced Raman Spectroscopy using Optical Tweezers " in Department of Physics, Umeå University, Umeå, Sweden

Ms. Osheen Joseph is doing her project in " Photocatalytic water treatment and fluorescence based detection of microplastics" in Robert Gordon University, Aberdeen, Scotland.

NEW DOCTORATES FROM ISP

Bobby Mathews C

Design and Development of Optical Fiber Grating Based Sensors for the Determination of Cholesterol

Under the Supervision of Prof. P Radhakrishnan

Towards the end of last century, investigations brought out the higher probability of occurrence of cardiovascular diseases in human beings having increased levels of cholesterol. Since then, researchers started to think loud about developing simpler cholesterol sensing schemes at lower cost and better sensitivities. The focus of this research was the design and development of optical fibre grating based sensors, mainly those with surrounding medium refractive index (SRI) sensitivities, for the measurement of cholesterol. Applications of long period gratings (LPGs), fiber Bragg gratings (FBGs) and tilted fiber Bragg gratings (TFBGs) as refractometers to measure the concentration of total cholesterol were investigated during the course of this research. A biopolymer which has an affinity to cholesterol, namely chitosan, was employed as an overlay coating around the grating region in order to enhance the sensitivity of the sensor heads.

As stated earlier three different types of optical fiber gratings were fabricated and employed as a total cholesterol sensor, exploiting the sensitivity of these gratings to the changes in the SRI. The chitosan coated sensor heads exhibited enhanced sensitivities compared to their uncoated versions. The LPG based sensor heads are easier to handle and exhibited good linear response. The fabrication and usage of etched FBG based sensor is tedious. The sensitivity of the LPG sensor heads was found to be much better than that of the FBG sensor heads. Unlike the spectral analysis followed for LPG and FBG, TFBG sensors rely on power measurements. This makes the experimentation simpler and less expensive.

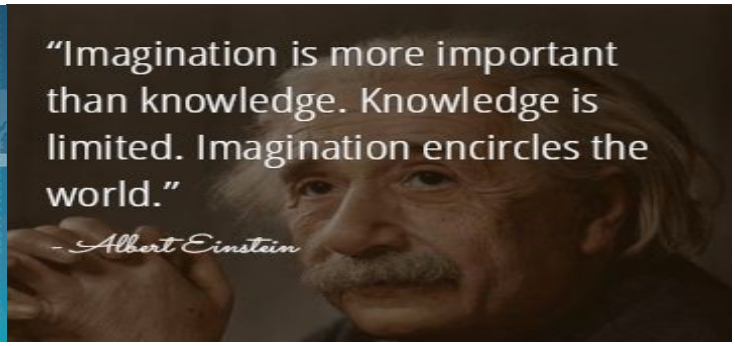
Retheesh R

Investigations on Laser Speckle Techniques For Certain Engineering and Biological Applications

Under the Supervision of Prof. A Mujeeb

Modern industries have strong necessity of advanced non-destructive testing (NDT) techniques for material characterization and quality evaluation. The significant developments in optical non-destructive measurement techniques based on laser speckle phenomenon over the last few decades have led to the emergence of new area of coherent optics called Speckle Non-destructive testing (SNDT). SNDT primarily enfolds three robust classes of experimental techniques such as speckle photography, speckle interferometry and speckle shearography for the use of laboratory and industrial environments. The use of high-resolution image sensors, fast computer interfaces and advanced fringe analysis algorithms has revitalized the viability of these techniques to a great extent. This research work outlines the major experimental investigations made on certain engineering and biological specimens using two well-established optical non-destructive techniques such as speckle photography and electronic speckle pattern interferometry (ESPI).

Mr Nishanth N, research scholar, ISP published a book titled " Digital Communication" [Pub: Cengage Learning India Pvt Ltd] The book was released by Hon'ble Vice Chancellor, of CUSAT, Prof. (Dr.) J Letha.



Re-searching Photonics...

In-house Eureka!!!

Vijesh K R

Spacial Self phase modulation of Graphene Oxide decorated Carbon dots with different input power

Graphene, a monolayer of sp^2 - bonded carbon atoms has stimulated vast scientific interest due to its unusual properties like very high electronics conductivity, good mechanical properties and high thermal conductivity. The sp^2 hybridized carbon atoms change to sp^3 which modify graphene structural planes and form the Graphene Oxide (GO). Graphite which is an inexpensive and ubiquitous resource is used as a raw material for the preparation of graphene and gepahene oxide.Normally, GO is synthesized from the exfoliation of graphite or chemical vapour deposition. The design of organic molecules with large nonlinear optical properties and fabrication of advanced materials are highly interesting. This type of nonlinear materials lead to new applications like optical limiting, optical modulators and frequency conversion. In the nonlinear optical experiment, a quartz cuvette of 10 mm thickness was used to contain the graphene oxide decorated carbon dots in water. A linearly polarized beam from a 403 nm TEM_{00} mode cw laser was focused onto the graphene suspension by a lens of focal length 100 mm. The distance between the lens and the front surface of the cuvette was 100 cm. We have observed spatial self-phase modulation (SSPM) in Graphene oxide decorated Carbon dots in various input power. A linear relation between the number of diffraction rings and input power was obtained in all the solvents.

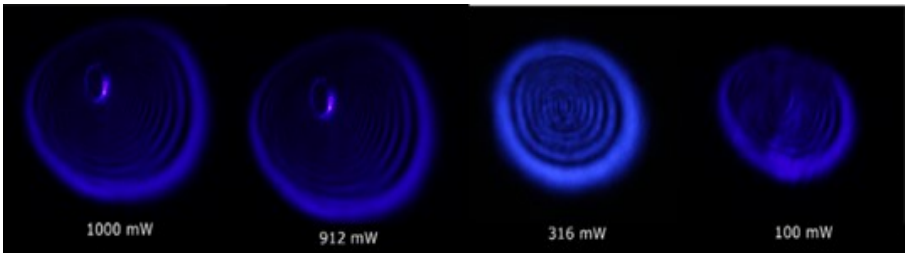


Fig: Variation of rings with respect to input power

Musfir P N

Integration of chalcogenide glass on graphene

Chalcogenide glasses being multifunctional, due to their high nonlinearity and photosensitivity can be directly deposited and patterned on a wide variety of 2D materials (Graphene, MoS_2, etc) which are of tremendous interest to Integrated Photonics. The Chalcogenide glass can function as the light guiding medium, a gate dielectric and a passive layer for 2D materials. The photonic integration of 2D materials using chalcogenide glass as the potential optical materials is due to the fact that they can be deposited at high rates via simple single-source thermal evaporation with the substrate kept at room temperature. In addition to their amorphous nature and good Van der Waals adhesion to different substrate without surface modification, the extremely low thermal budget allows epitaxy free chalcogenide glass coating with reduced thermal and structural damage to the substrate. ChGs can be deposited on a wide variety of 2D materials without altering their structure and optoelectronic properties. The low-temperature Chalcogenide glass deposition does not introduce structural defects into grapheme and other 2D materials (MoS2, black phosphorus, InSe and hexagonal BN). Such integration facilitates the fabrication of unconventional multilayer structures incorporating 2D materials to optimally engineer their interactions with the optical mode. We can utilise the giant optical anisotropy of graphene and modal symmetry in graphene-sandwiched waveguides to demonstrate an ultra-broadband polarizer and thermo-optic switch with high energy efficiency.

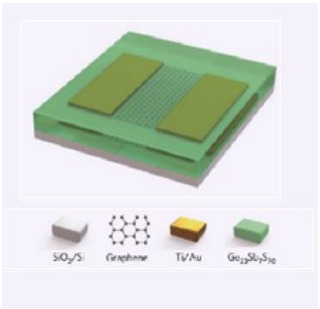


Fig: A schematic of the ChG/Graphene overlayer

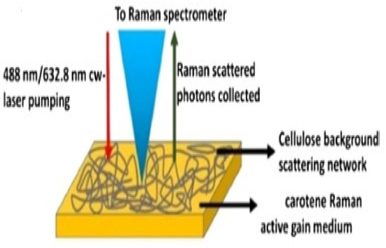
Jessy Simon

Synthesis and characterisation of nanophotonic materials

Laser processing of materials has become an important tool in many areas of technology. Laser radiation is used for welding, cutting, and drilling, and also for applications such as production of complex surface patterns or modification of the physical or chemical microstructure of materials. In many applications, the removal of material from the surface of metals and semiconductors folowing irradiation with picosecond or femtosecond laser pulses called laser ablation, plays an important role. The ablation process depends on the thermal and optical properties of the materials and on laser parameters such as wavelength, laser intensity and repetition rate. The operating principle of this technique was introduced by Alan Gray in 1985. For direct analysis of the elemental composition of solids, mostly solid state lasers such as Nd:YAG laser systems operating at 1064nm (fundamental wavelength) have been investigated.

Stokes mode Raman random lasing in carrot medium using coherent back scattering of light

Prof C Vijayan and his Photonics group at IIT Chennai demonstrated Raman random lasing in a continuous-wave (CW) excited, completely biocompatible and biodegradable carrot medium naturally composed of fibrous cellulose scattering medium and rich carotene Raman gain medium. The CWlaser-induced photoluminescence threshold and linewidth analysis at the Stokes modes of carotene show a characteristic lasing action with a threshold of 130 W/cm^2 and linewidth narrowing with mode Q factor up to 1300.



Prof C Vijayan in his lab

Ref: (Vol. 43, No. 23 / 1 December 2018 / Optics Letters)

Karthika Sankar

Fabrication and Characterisation of one dimensional photonic crystals

Photonic crystal is a periodic optical nanostructure that affect the motion of photons in a same way an ionic crystal lattice control the motion of electrons in solids, ie, actually photonic crystal is an optical analogue of regular solid crystals where the atoms and molecules are replaced by macroscopic media with differing dielectric constants and the periodic potential is replaced by a periodic dielectric function. We can design and construct photonic crystals with photonic band gaps preventing light from propagating in certain directions with specified frequencies. Hence, they are called frequency filters. If for some frequency range a photonic crystal prohibits the propagation of electromagnetic waves of any polarisation travelling in any direction from any source, the crystal is said to have a complete photonic band gap. A crystal with a complete band gap will obviously be an omnidirectional reflector. Photonic crystals can be classified as one-dimensional, two-dimensional and three- dimensional photonic crystals according to the nature of variation of dielectric constant. Among these simplest is 1d photonic crystals such as Bragg stack and Bragg mirrors. They can be formed by an array of periodically located parallel stacks of two different dielectrics.

Sony U

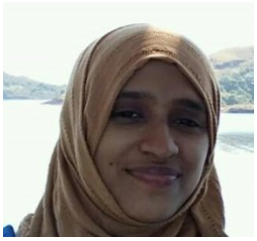
Gold Nanoparticles as a Probe for Amyloid-β Oligomer and Amyloid Formation

Alzheimer's disease (AD), a progressive neurodegenerative disease and the leading cause of dementia in the aging population, affects 46.8 million people worldwide in 2015 and this number is believed to be close to 50 million people in 2017. This number will almost double every 20 years, reaching 75 million in 2030 and 131.5 million in 2050. One of the primary pathological hallmarks of Alzheimer's disease is the presence of insoluble neuritic plaques, composed primarily of β-amyloid peptide (Aβ), in the cerebral cortex. Aβ peptide, a natural metabolic byproduct, results from the proteolytic cleavage of the amyloid precursor protein, either in the membrane or while undergoing endosomal processing. The resulting 39-42 amino acid long peptides are released into the extracellular space. These species have a strong propensity to aggregate. Many hypothesize that aggregation of Aβ triggers a cascade of events that brings about neuritic dystrophy and neuronal death. Amyloid fibrils containing characteristic cross-β-sheet structure can be detected by commonly used Thioflavin T (ThT) and other amyloid binding dyes. characteristic cross-β-sheet structure can be detected by commonly used Thioflavin T (ThT) and other amyloid binding dyes. However, these fibril-specific dyes are not sensitive to the early formed oligomers, limiting their use in detecting oligomeric species. Identification of protein oligomeric intermediates still remains a challenge. To the best of our knowledge, a continuous assay to sensitively monitor the formation of oligomers is scarce. Sensitive molecular tools or methods are thus desired for exploring the kinetics of protein oligomerization and fibrillation in order to advance the understanding of the fundamental mechanisms of protein. aggregation. Gold nano particle (AuNP) can be used for prob-ing Aβ oligomer and amyloid fibril formation. The intensity of the SPR band of the AuNPs is sensitive to the presence of Aβ40 amyloids. The value of the SPR band intensity change shows a dose-dependent trend proportional to the amount of Aβ40 amyloids. The change of the value of the SPR band intensity change shows a dose-dependent trend proportional to the amount of Aβ40 amyloids. The change of SPR band intensity of AuNPs can also be used to follow the kinetics of Aβ40 fibril formation. Furthermore, our results show that the SPR band intensity of AuNPs is also sensitive to the oligomeric structures of both Aβ40 and the Aβ40-K16Nle mutant.

Fathima R

Investigations on the thermo-optical properties of laser synthesized gold-silver alloy nanoparticles

The bimetallic nanoparticles of silver and gold are of greater importance as the resulting optical, electrical and catalytic properties can be tuned by controlling their composition. Both silver and gold have well defined SPR band in visible region of the spectrum. Silver-gold bimetallic nano particle can be used as a model system to study the composition and structural dependant change in properties of NPs. Also both have simple fcc lattice structure with matching lattice constants, 4.0783°A for Au and 4.0862°A for Ag . Gold nanoparticles have great chemical stability, better bio compatibility, bio conjugation and surface functionalization properties than silver. But silver NPs have better plasmonic features like stronger molar absorption co-efficient, narrower plasmon line width and a more sensitive SPR peak.Combining all the properties of silver and gold, the resulting silver- gold alloy nanoparticles are more promising as they have greater plasmonic features than gold, and increased stability and bio compatibility than silver. Considering these enhanced properties, the application of alloy NPs can be extended further. Even though gold NPs have no acute citotoxicity reported, silver NPs have some toxicity and protein denaturation issues. But when they form alloys the resultant toxicity decreases, and hence it is suitable for several biological applications.



Safna Saif

Photonic Crystals

Photonic crystals (PCs) are the optical analogue of electronic crystals, in which due to the periodic arrangement of alternating dielectrics, there arises a spatial periodic variation of refractive index. These macroscopic structures could therefore control and manipulate the flow of light. The striking feature of photonic crystals is the photonic band gap(PBG), somewhat analogous to the electronic band gap in semiconductors. Photonic band gap refers to a specific range of frequencies that cannot propagate through the crystal and hence gets reflected back. A 3D PC with a complete photonic band gap can therefore inhibit spontaneous emission which was said to be a compulsory reaction following excitation. A PC working in the optical region will have the periodicity in the order of nm, that in the microwave region will be of the order of cm, that in the x-ray regime will have the periodicity in the order of angstroms and so on. Natural opals, wings of butterflies, layers of pearl are all examples of natural photonic crystal structures. Sub-micrometer colloidal spheres, i.e., silica or polymer spontaneously organize themselves on a crystalline lattice and are termed as opals in nature. Similarly, those formed in laboratory are called synthetic opals analogically. They need not possess a complete 3D photonic band gap even though they are PCs as the porosity is too small. But using this opal as the template, infiltrating a high refractive index material into the lattice voids and then removing the template using calcination or dissolving in appropriate solvents could yield what is called as an inverse opal. This structure could possess a complete PBG if there is a refractive index contrast >2.8.PCs can have wide range of applications; for eg, as filters, switches, sensors, etc. In short, efficient use of PCs can lead to all-optical circuits, minimizing energy losses and optimizing speed and performance.

Jayaprasad K V

Light- matter interaction using laser based thermo optic effect and coherent interactions with different types of media

The topic of research to be undertaken is the investigation of light- matter interaction using laser based thermo optic effect and coherent interactions with different types of media. Several aspects of radiation and medium can be understood using such coherent interactions employing different techniques. A systematic study of light matter interaction helps to analyze the thermal and optical properties of novel materials using thermo optic studies and stimulated scattering of light. Materials that exhibit efficient optical non-linearity, fluorescent quantum yield and high values of stimulated Raman scattering cross section are potential candidates for efficient photonic materials. Photo-thermal Spectroscopy along with stimulated Raman scattering and coherent back scattering are highly sensitive technique to study various aspects of weak optical absorptions and coherent optical processes which can be used to investigate optical and thermal characteristics of samples.

Nishanth N

Studies on certain security issues and their remedial measures in Wireless/Optical networks

Wireless communication brought a revolution in data networking, telecommunication and also made ubiquitous networking a reality. When nodes do not depend on any pre-existing infrastructure, wireless networks take the name of *wireless ad-hoc networks*. Though efficient in many ways, these networks are vulnerable to various attacks due to open network architecture and constrained resources. One such attack is denial of service (DoS) attack that targets the power supply of the mobile node and restricts the computational capability of mobile nodes. It is possible to develop an efficient security scheme for defending DoS attack in Wireless Ad-Hoc Network with minimum detection delay and maximum detection rate. As the volume of data traffic carried on wireless networks is growing at an unprecedented speed, Free Space Optical (FSO) networks is considered to be a strong alternative for radio frequency (RF) based wireless communication. Hence the work can be extended in this perspective to study the feasibility of Free Space Optical (FSO) networks in wireless communication.

Pradeep Kumar V

Nickel Oxide as Thin Film UV Sensor

Metal oxide semiconductor nanoparticles are widely used for the design and development of UV photo detectors because of the wide optical band gap. Nickel oxide and zinc oxide are popular among these. Nickel oxide nanoparticle is a p type transition semiconductor, having a band gap from 3.6 eV to 4 eV and high chemical stability had been extensively utilized in this area. Single layer of NO thin film with sufficient thickness is a natural absorber of UV light in the range of 360 nm. Number of approaches had been developed in design considerations for improving the performances of UV detectors by designing P-N and P-i-N junction devices. An n type material with sufficient carrier lifetime, electron affinity and band gap can create a P –N junction device with better quantum yield. Intrinsic layer can be incorporated to improve the carrier storage by providing a high reverse breakdown voltage. The n type nanomaterials like ZnO, Si, TiO_2 , SiO_2 , MgO, IGZO and PbI_2 are widely used along with NiO to make UV photodiode. Purity and surface roughness are other key aspects for the better performance of thin film device. The impurities present in the material results different energy levels in the junction that leads to the different slope regions of ohmic I-V characteristics of device which is termed Space Charge Limited Current Process (SCLS). Spin coating method can be used as simple level technique and RF sputtering can be used for high quality film fabrication process.

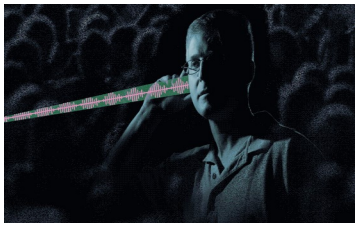
Sooraj Viswam

Laser speckle imaging techniques

A speckle pattern is the granular dark and white spots formed on a screen due to the constructive and destructive interference of light coming from a monochromatic, coherent source. In 1970, the scientist Leedertz recognized that the speckle pattern is the signature of the object surface. The ability to observe and extract useful information from the temporal evolution of a speckle pattern gave birth to dynamic speckle analysis. Dynamic speckle analysis is used to study objects that display changes with time, for example the drying of paint and dispersions, temporal characteristics of a biologically active cell/tissue etc. With the advancement in computational technology and better recording equipment the field continues to grow. The speckle imaging technique can be used for non- destructive testing of a variety of phenomena. The scope for this field has been continuously improving with the advancement of image processing and data analysis techniques. It has been already used for a variety of applications like, determining the roughness of a surface, displacement of a surface due to various phenomena, movement of objects of interest, speed of motion of particles etc.

Photoacoustic communications: delivering audible signals via absorption of light by atmospheric H_2O

Ryan M. Sullenberger, et al MIT Lincoln laboratory in Lexington, have demonstrated that lasers could send messages to a listener's ear like whispering secrets from long distances. Using a laser tuned to interact with water vapor in the air, scientists created sounds in a localized spot loud enough to be picked up by human hearing if aimed near a listener's ear. It's the first time such a technique can be used safely around humans.



Ref: (Vol. 44, No. 3 / 1 February 2019 / Optics Letters)

Soumya S

Chalcogenide glasses for photonic devices

Research work on chalcogenide glasses of different compositions have potential applications in the field of Photonics because of its notable physical, optical, thermal and electrical properties. Chalcogenide glasses are fully amorphous semiconductor materials and are primarly made up of 16^{th} group elements (sulphur, selenium, and tellurium) in covalently bonded to network formers such as arsenic, germanium, gallium, antimony etc. Some of the important characteristics of chalcogenide glasses over silica and fluoride glasses that renders them to use in photonic devices applications are low optical band gap, high refractive index that can be increased further on doping, high optical nonlinearities etc. Broad IR transmitting window 1.5-20 μm make the chalcogenide glass material ideal for designing chem/bio sensors based on vibrational spectroscopy since the vibrational signature of biomolecule lies in the infrared region between 6-12 microns. Chalcogenide glasses are widely used in passive applications which include the passive devices such as lenses, windows, fibres and are extensively used in active applications such as laser fibre amplifiers and non-linear components. Chalcogenide glassy material-based devices are highly sensitive and cost effective devices. They have a numerous potential application in civil, medical and military areas. The area of chalcogenide glasses is still open for further investigation.

Lakshmi B

Magnetoplasmonics: Magnetism and plasmonics joining hands

Magnetoplasmonics is a field that combines magnetism and plasmonics. The two-fold effect of this field may be seen as enhancing magneto-optical (MO) properties of nanostructures by incorporating plasmonic parts into them as well as by modifying the plasmonic properties of nanostructures with an applied magnetic field. Both, localised plasmon resonances and surface plasmon polaritons play a role in the enhancement of MO properties. It is also possible to modify MO effects in the vicinity of plasmonic resonances. Modifying plasmon properties with an applied magnetic field, on the other hand results in controlling of light propagation in nanostructures which can be of great applications in visualising the dream of all photonic circuitry for data communication. This budding field of research has widespread applications also in the fields of refractive index and magnetic field sensing and in high density magnetic data storage.

Adarsh K J

Nanomaterials Synthesis and Characterization

The recent advances in nanomaterial research have accelerated their adoption in the biomedical applications including in cancer therapy, imaging, drug delivery etc. In material science related industries nanomaterials has been used for reinforced plastic, nano pigments, super plastic ceramic, conductors, industrial catalyst etc. It has wide spread applications in environmental field used for pollution monitoring, waste water treatment, UV protection and as pollution scavengers. The demand for development and synthesis of nanoparticles in industrial application became significant in the current scenario. The need for scalable and reproducible synthesis in materials allowing for high levels of control of size, shape and functionality is the need of the hour. Advances in the synthesis of well-defined nanomaterials have enabled control over their unique optical, electronic, and chemical properties stimulating tremendous interest across a wide range of disciplines. Tremendous improvement has been made in different applications of the nanomaterials research using different metals and non-metals. The specific applications are based on materials properties.

Message of Dr. ECG Sudarshan to Indian Students

***(E C G Sudarshan talks to Urjit A Yajnik*, Resonance, March 2015)**

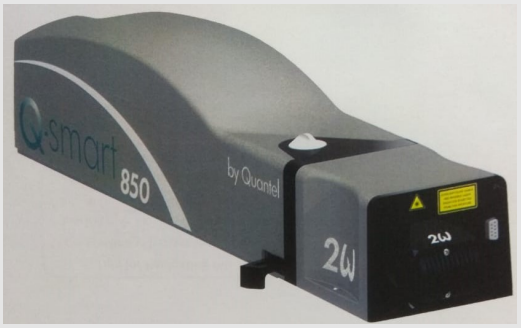
Question: "What is your message for students opting for research in pure physics today?

Dr. Sudarshan's reply:

"When I was a research student, it was considered an opportunity to be able to work on something. Nobody had to ask you to do this. They suggested that may be you can look at this And then you did it. If you did not know enough you read up about it. Or you asked various other people. Somehow, this culture of doing things out of one's own curiosity and by one's own efforts or by discussion with other people is gone from students. Our education has gone down. At Madras [MCC], I learnt more than people now learn in the course of their PhD. It is not that they are not sophisticated. But somehow the idea that physics is a connected subjecthas gone. If you are a physicist, you must know about melting of ice. You know, melting of ice is a very complicated subject because there are so many allotropic modifications of ice. The thing is that these things are connected, very closely connected. You should realise that what You know about quantum mechanics is related to why water behaves the way it does. But nobody thinks like that. They say, ah, water is water.'. Once you develop this habit, nothing is outside your scope Raman also had a theory about vibrating strings. And it may even seem funny to some that such a great man should worry about musical instruments. But he elevated these investigations to inspired inquiry**. The same sense of inspired inquiry needs to be brought into the honours class**."

New facilities to our lab!!!!

Compact Pulsed Nd-YAG laser



The newly installed pulsed Nd:YAG laser system, Q-smart by Quantel, funded by DST SERB is a very compact and easy to use laser with an energy of 450 mJ for the principal wavelength of 1064 nm. Pulses of width 6 ns and a repetition rate of 10 Hz are available from this system. Separate modules, which can be attached to the main system are available for second and third harmonic generation. Being very compact and easy to operate, Qsmart will find applications in many of the research activities of the students including ablation, lasing and Z scan experiments.

R F Sputtering Unit

A highly sophisticated computer controlled radio frequency magnetron sputtering equipment is being available in the department. On an atomic level, sputtering is the process whereby atoms are ejected from a target or source material that is to be deposited on a substrate - such as glass, quartz, silicon wafer - as a result of the bombardment of the target by high energy particles. RF sputtering can sustain plasma throughout the chamber with a lower pressure and overcomes the problems like disappearing anode, arcing, race track erosion etc. Magnetron sputtering deposition uses magnets behind the negative cathode to trap electrons over the negatively charged target material so they are not free to bombard the substrate, allowing for faster deposition rates. Since an evaporation source is incorporated inside the deposition chamber, it also allows reactive sputtering and annealing of the thin film without breakage of vacuum. This method provides uniform coating of high quality thin films including that of dielectrics on wide variety of substrates. Various processing parameters like RF power, substrate to target distance, substrate temperature, ambient gas atmosphere, target-substrate orientation, deposition rate and time etc. can be varied to get high quality thin films. The unit is funded by DST PURSE.

New facilities to our lab

Hall Effect Measurement System

Hall effect is an important tool for the electrical characterization of semiconductor materials. It provides a direct determination of resistivity, doping type, mobility and carrier density. The basic setup consists of a thin film material to be studied is placed in a magnetic field oriented right angles to the film. A current is made to flow through the sample and voltage ifference is measured using Van der Pauw method. The measurement system is funded by DST SERB.

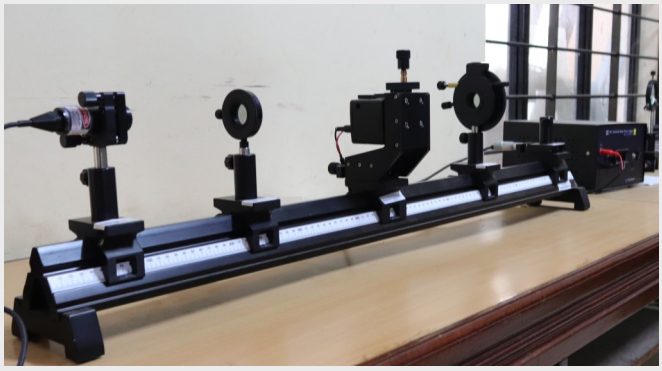
Intensified Charge Coupled Device Camera

iSTAR Intensified Charge Coupled Device (ICCD) Camera from ANDOR used in our laboratory has CCD sensor with total matrix size of 1024 X 1024 pixels and effective pixel size of 13 µm X 13 µm. The photocathode used in the image intensifier is WE-AGT type (Gen II) detecting 180-850 nm wavelength regions. They hold a fully integrated software-controlled Digital Delay Generator (DDG) with gate delay as well as width adjustable from 0 ns to 10 s in 1ps steps. The minimum optical gating of intensifier is <2 ns. This highlighting features of Intensified CCD makes it capable of capturing images of transient phenomena with very fast gate times (ultrafast Imaging) and achieves nano-second time-resolved spectroscopy. For imaging purpose the ICCD is coupled with a UV-VIS lens for wide aperture slit. Accurate nanosecond-scale gating of image intensifier-based detectors can be used to sample plasma dynamics. ICCD has been widely used also for automated 2D elemental mapping by LIBS, laser induced florescence spectroscopy and Thomson scattering. The ICCD camera is funded by DST FIST.

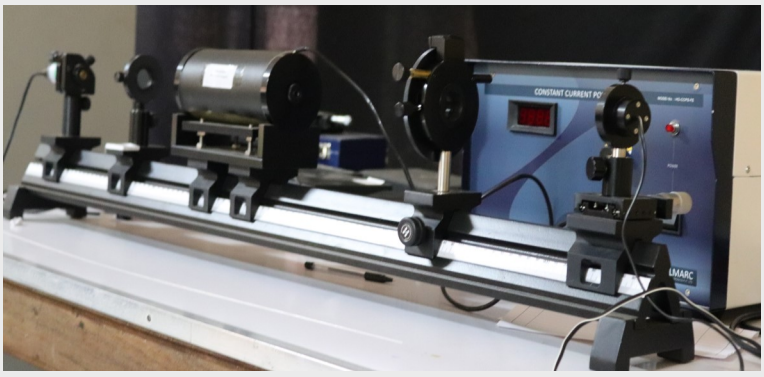
New facilities to our lab

List of other FIST funded lab equipments for MSc and MTech courses

Sl.No.	Name of Item
1	Fabri-Perot Interferometer
2	Acousto-Optic Effect
3	Optical Fiber Characterisation Apparatus
4	Software for Optical Fiber and planar waveguide simulation
5	Mach-Zehnder Interferometer
6	Pockel Effect Apparatus
7	Brewster Angle Apparatus
8	Geometrical Optics Experimental Setup
9	Laser source and Detectors
10	Optic Components
11	Opto Mechanical Components
12	Lab Jack
13	Translation Stages
14	Hall Effect Apparatus
15	Spectrophotometer
16	Faraday Effect Apparatus
17	Laser Optics Lab
18	Speckle Interferometry Setup



Experimental set up for Pockel's effect



Experimental set up for Faraday effect

Thursday Seminars

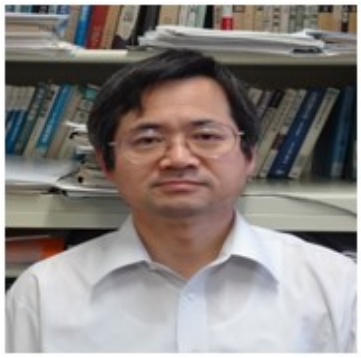
Weekly/special seminars are organized possibly on every thursdays by ISP members and invited guests. These seminars are sponsored by ISP's Student Chapters of SPIE, the International society for optics and photonics, Optical society of America and Photonics Society of India.

SEMINAR TOPIC	PRESENTED BY
Rudimentary x-ray powder diffraction refinement	Mr. Adrine Antony Correya
Molecular rotor as micro viscosity and PH probe	Mr. Sony U
Ultra wide spectral response of CIGS Solar cells integrated with luminescent down shifting quantum dots	Mr. Raj Sha M M
Multiselective spectro electrochemical fiber optic sensor	Mrs. Priyamvada V C
Agony and ecstasy in quantum optics	Prof. V P N Nampoori Visiting Professor, ISP
Whispering gallery mode active resonators for bio-sensing applications	Mr. Anand VR
Understanding the solvent molecules induced spontaneous growth of uncapped pellurium nanoparticles	Ms. Ramya M
Next generation high performance carbon quantum dots with narrow band emission for multicoloured LEDs	Mr. Vijesh K R
Lanthanide doped upconverting luminescent nanoparticle	Ms. Pooja Gitty
Packaged chalcogenide microsphere resonator with high Q factor	Ms. Soumya S
Nobel Prize in 2018-Optical Tweezers and Ultrafast Optical Pulses	Prof. V P N Nampoori Visiting Professor, ISP
Broadband plasmonic silver nanoflowers for high- performance random lasing covering visible region	Ms. Anitha Prakash
Nonlinear optics in daily life	Mr. Musfir P N
Dual-comb spectroscopy of laser-induced plasmas	Ms. Divya D Pai
Accelerating heterogeneous catalysis: Synergy between theory and experiments	Dr. C S Praveen Inspire faculty
Perovskite solar cells with ZnO electron-transporting materials	Ms. Hajara P
Surface plasmon enhanced UV detection	Mr. Pradeep Kumar V
Optical dating in a new light: A direct, non-destructive probe of trapped electrons	Dr. Amit Kumar Prasad Visiting Faculty,ISP

Special Seminars…

Prof. Martin J Leahy from TOMI, Centre for Photonics and Imaging, School of Physics, NUI Galway, Ireland, delivered a special seminar on "STARSTEM : Reaching for the stars to drive stem cell therapy"

Dr. Aju Mathew, Diretor, Kerala Cancer Centre, Kochi, gave an enlightening talk on the topic " "Sifting the truth from the fake-health news in 21st century "



Prof. Manabu Sato, Professor in the department of Electrical Engineering, Yamagata University Kerala Cancer Centre, Kochi, delivered a talk on "Optical Measurements and Techniques"

OUR MENTORS...

Faculties at ISP

Dr. A Mujeeb

Professor & Director

Dr. M Kailasnath
Professor

Dr. Pramod Gopinath
Professor

Dr. Sheenu Thomas
Professor

Dr. Saji K J
Assistant Professor

Dr. Manu Vaishakh
Assistant Professor

Mr. Muhammed Rishad K P
Assistant Professor

Dr. Priya Rose T
Assistant Professor

Dr. Bini P Pathrose
Assistant Professor
[On Contract]

Dr. Retheesh R
Assistant Professor
[On Contract]

Dr. V Manickam
Assistant Professor
[On Contract]

Dr. Praveen C S
Inspire faculty

Dr. C P Girijavallabhan
Visiting Professor

Dr. V P N Nampoori
Visiting Professor

Dr. P Radhakrishnan
Visiting Professor

Dr. M Rajendran
Visiting Faculty

Dr. T R Ananthakrishnan
Visiting Faculty

Prof. A Varadarajan
Visiting Faculty

Dr. Amit Kumar Prasad
Visiting faculty

Administration

Mr. Siraj S
Section Officer

Technical EVENTS At ISP

National Photonic Symposium 2018

The 2nd National Photonic Symposium, NPS-2018 was organized by the International school of photonics, CUSAT from 27th February to 1st March 2017. The focal theme of the symposium was "Light-Matter interaction". The symposium was intended to facilitate the free exchange of scientific information about various trending areas of research, strengthen the scientific rigor of the field of health systems research including concepts, frameworks, measures and methods and to promote greater research collaboration across disciplines, sectors etc. The Lectures and plenary talks from experts opened a new window of research possibilities and opportunities.

NPS 2018 started off with an Invited Talk by Dr. R S Jayasree, Sree ChitraTirunal Institute for Medical Sciences and Technology on the topic "Materials with photonic and magnetic properties for biomedical applications", followed by the inaugural function. Prof. J Letha, Hon. Vice chancellor, CUSAT inaugurated the function. The lectures of various eminent scientists and professors flourished the function.

Technical Events at ISP

Dr. J Jayabalan, RRCAT, Indore, Prof. Narayanamurthy, IIST Thiruvananthapuram, Prof. N V Unnikrishnan, School of pure and applied physics, M G university Kottayam, Dr. Renu John, Department of Biomedical Engineering, IIT Hyderabad, Dr. Manu Jaiswal, IIT Madras etc. delivered the invited lectures on various topics covering Nanophotonics, Meta materials, Bio photonics, Laser-matter interaction, etc. There were 16 oral presentations and 12 posters presentations. The conference concluded with a validatory function on 1st March at 2pm.

International Day of Light 2018

The International School of Photonics, Cochin University of Science and Technology celebrated the International Day of Light on May 16th 2018 as declared by UNESCO.

At the onset, the International School of Photonics organized a programme including a varied list of interesting events related to light. At the inaugural ceremony, Dr. Saji K J, Assistant professor, ISP and co-ordinator-IDL 2018, welcomed the gathering. The presidential address was delivered by Prof. A Mujeeb, the Director, ISP. Starting with a philosophical outlook, he briefly explained the history and growth of research studies related to light based technology in Kerala starting from the mysterious story of Aranmula mirror then passing on to the role of eminent personalities like Prof. S Gopala Menon, Prof. A O Mathai and Dr. V Unnikrishnan Nair in the same. He talked about the research history of International School of Photonics. The school was established under the leadership of Prof. C P Girijavallabhan, the Founder Director and then the activities were accelerated by a team of ingenious Professors - Prof. V P N Nampoori, Prof. P Radhakrishnan and Prof. V M Nandakumaran. He also hinted on an endeavor to outreach the less fortunate of the society.

Technical Events at ISP

The programme was inaugurated by the Hon'ble Pro-Vice Chancellor of CUSAT, Prof. P G Sankaran by lighting the lamp. In his inaugural address, he congratulated the ISPians for conducting the program and cited the overall ranking of CUSAT in national and international levels. He exhorted the faculties and students to put in sincere effort to elevate the standard of research He also congratulated the new social outreach venture of ISP.

Following this, *Compendium 2018*, a five-year profile encompassing the merits and developments of International School of Photonics through the last five years, was released by Dr. P G Sankaran, by handing it over to Emeritus Professor, Dr. C P Girijavallabhan, Founder Director, ISP.

The highlight of the day's celebrations was the offering of a helping hand to a deserving student with the aim of "spreading light into longing eyes". The endeavor was taken up by the members of the department by collecting an amount in order to facilitate the eye surgery of a student at the Little Flower Hospital, Ernakulam. This humble venture was decided to be continued through the forthcoming IDL celebrations also. Prof. A Mujeeb, Director, ISP presented a memento to the Pro-Vice Chancellor, Dr. P G Sankaran. The inaugural session concluded with a vote of thanks by Mr. Muhammed Rishad K P, Assistant Professor, ISP .

The theme talk on "International Day of Light 2018" was delivered by Emeritus professor, Dr. P. Radhakrishnan, Former Director, ISP enunciating UNESCO's motive of celebrating IDL and the importance of light-based technology in various fields to achieve the Global Goals. A presentation, "*Paying tribute to two legends*" to the recently demised Prof. Stephen William Hawking and Prof. E C G Sudarshan was also played. Various activities like "Candle lighting - From the darkness of ignorance to the light of wisdom", honoring the teachers, quiz and games were also carried out.

In connection with IDL 2018 celebration, a talk entitled " Agony and Ecstasy in Quantum Optics: Remebering E C G Sudarshan" was delivered by Emeritus Professor, Prof. V P N Nampoori on May 23rd, 2018.

International Day of Women and Girls in Science

As part of the Optical Society of America's celebrations of 11th February as the International Day of Women and girls in Science, a talk by Dr. S Jayalekshmi, Emeritus Professor, Department of Physics, CUSAT was organised in the department on 14th of February 2019. The function was also attended by Mrs. Biya, an administrative officer from University of Gothenberg, who had come to visit the School as part of a signed MOU. Prof. A Mujeeb, director, ISP, falicitated both the guests and specially recognised and appreciated Dr. S Jayalekshmi for her meritorious achievements in the field of Science. The talk was on the topic " A new direction in the design of rechargeable cells: Li-S cells." Prof. Mujeeb handed over momentoes to both Dr. Jayalekshmi and Mrs. Biya.

Technical Events at ISP

Optics to school

The optics to school is a major outreach program of the ISP OSA student chapter. The Optics kit is a venture launched by the student chapter as part of optics to school program, funded by the optical society. The kit comprises various optical elements which explain all the basic properties of light. In the context of the recent floods in Kerala, many schools were affected and suffered a huge loss with regard to their lab equipments and infrastructure. Considering this, International School of Photonics decided to help them to rebuild their schools as soon as possible. For this ISP, conducted a survey on the extent of damage the floods had caused in science laboratories across the state. After shortlisting a few schools that had previously collaborated with the department through participation in the annual optics fair conducted, two government schools namely GVHSS Kadamkudy and GHSS Kongorpilly, that suffered the maximum damage were identified. ISP collected maximum number of equipments for the Physics and Chemistry laboratories which included apparatus like sonometer, dynamo ac dc combined model, resonance apparatus,

Professors under Erudite Scheme

Prof. Ayodhya Tiwari with students

The staff and students of the International School of Photonics took part in the interactive sessions with two eminent professors, Prof. Suresh C Pillai from Centre for Precision Engineering, Insitute of Technology, Sligo, Ireland and Prof. Ayodhya N Tiwari, a senior Scientist (Leader of the Photovoltaic Materials and Devices Group) in Thin Film Physics Group, Institute of Quantum Electronics, Swiss Federal Institute of Technology , Switzerland, under the Erudite Scholar in Residence Program and interacted with the students on 4th January 2019. Prof. Suresh C Pillai gave a talk on 8th January 2019, on how effectively, can research scholars manage their time while during the period of PhD. Prof. Tiwari addressed the students and described the current research in the field of thin films and photovoltaics.

Prof. Suresh C Pillai giving talk

Technical Events at ISP

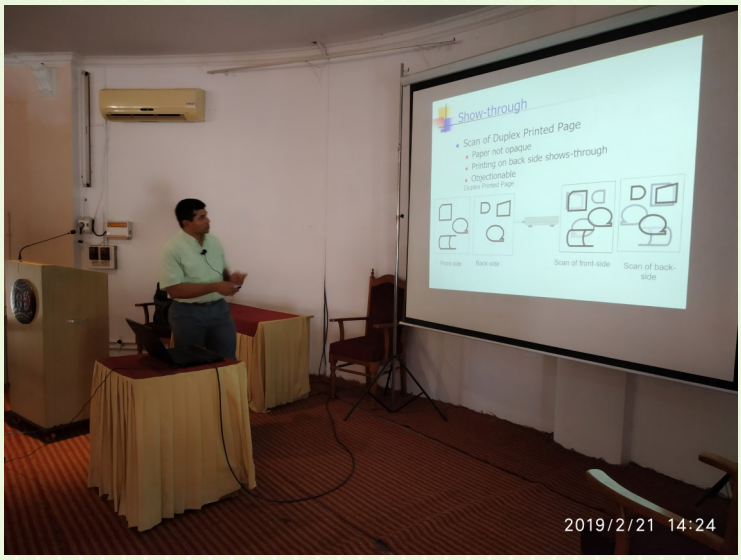
OSA Travelling lecture program

Dr. Charles Middleton, Principal Investigator of Photonics at Harris Corporation, USA visited ISP on 10th January 2019 as a part of the OSA travelling lecture programme and gave a talk on "Integrated Photonics and career development". This programme was arranged to facilitate the interactions of our M.Sc/M.Tech/Ph.D students with Dr. Charles Middleton. Apart from sharing his rich experience in the area of Integrated Photonics, he could also give a good exposure to career possibilities in this field.

Lecture Series under Erasmus plus programme

The students of ISP were fortunate to attend to a series of lectures by Prof. Vitali Zhaunerchyk, a senior lecturer from the department of Physics, University of Gothenburg, Sweden as part of the MOU signed with CUSAT under the Erasmus Plus programme. While two of our MTech students Mrs. Meena K and Ms. Parvathy T B are carrying out their project work in the Department of Physics, University of Gothenberg, Prof. Vitali visited ISP as part of the student exchange programme according to the signed agreement. A total of three lectures covering topics such as Laser fundamentals, Molecular Spectroscopy with Table-Top lasers, Sytnchrotrons and free electron lasers, Inrfared Spectroscopyg etc were given by the Professor during 8th and 9th of January, 2019. The lecture sessions were followed by interactive sessions held separately for M.Sc., M.Tech. and research students which were very helpful in understanding the research facilities as well as career possibilities available at Gothenberg University. It is envisaged that the discussions and interactions with Prof. Vitali Zhaunerchyk, will open up future collaborative programmes between University of Gothenburg and CUSAT.

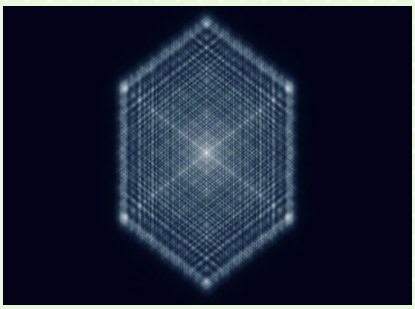
SPIE travelling lecture programme



Prof. Gaurav Sharma, a distinguished professor from the Dept. of Electrical Engineering, University of Rochester, visited ISP as part of the SPIE travelling lecture programme and spoke on the topic "Imaging Arithmetic: Physics U Maths > Physics + Maths." The talk was organised on 21st February, 2019. Various modelling techniques used in the field of image processing were discussed with the thrust given to using the concepts of Physics and Maths together for imaging rather than iusing each individually. The examples given were very comprehensive and interesting. The talk was attended by M. Sc., M.Tech.

Fractal light from lasers

A group of scientists headed by Hend Sroor from National Laser Centre, South Africa and University of Glasgow ,UK, demonstrated fractal light from lasers. Fractals, complex shapes with structure at multiple scales, have long been observed in nature: as symmetric fractals in plants and sea shells, and as statistical fractals in clouds, mountains, and coastlines. With their highly polished spherical mirrors, laser resonators are almost the precise opposite of nature, and so it came as a surprise when, in 1998, transverse intensity cross sections of the eigenmodes of unstable canonical resonators were predicted to be fractals [G. P. Karman *et al.*, Nature (London) 402, 138 (1999)]. Experimental verification has so far remained elusive. Here a group of scientists from National Laser Centre, South Africa and University of Glasgow ,UK, observe a variety of fractal shapes in transverse intensity cross sections through the lowest-loss eigenmodes of unstable canonical laser resonators, thereby demonstrating the controlled generation of fractal light inside a laser cavity. Their work offers a significant advance in the understanding of a fundamental symmetry of nature as found in lasers.



Ref: (Hend Sroor, Darryl et al Phys. Rev. A **99**, 013848 – 25 January 2019)

List of invited talks by our faculties

Prof. A MUJEEB

⇒ Online live telecast entitled " *Science of Tomorrow: Photonics - Technology using light"* given to Kendriya Vidyalaya Students at All India Level on January 10th , 2019.

Prof. M KAILASNATH

⇒ National Seminar on Advanced Materials, School of Pure and Applied Physics, Mahatma Gandhi University, Kottayam, March 23rd, 2018.

Prof. PRAMOD GOPINATH

⇒ "Optical Nonlinearity in ZnO-Graphene nano-hybrid materials" at the Two day National Seminar on Nonlinear Optical Materials and Devices at The Cochin College on February 20th, 2018, co-sponsored by KSCSTE.

Dr. SAJI K J

⇒ "*Two Dimensional Materials for Photovoltaics: Prospects and Chalenges"* , National Workshop in Recent Trends in Photovoltaics, March 17, 2018 conducted at Department of Physics, CUSAT.

⇒ "*Recent Developments in Photovoltaic Research",* National Seminar on Theoretical Physics and Materials Science, October 5th, 2018, Govt. Victoria College, Palakkad.

Dr. PRIYA ROSE T

⇒ "*Nobel Prize in Physics 2018,"* St.Paul's College, Kalamassery on October 16th, 2018.

Dr. PRAVEEN C S

⇒ " *Expediting Heterogeneous Catalysis: Synergy Between Theory and Experiments* "at the International Conference on Advance Materials (ICAFM-2018) jointly organized by the Dept. of Chemistry at SB College Changanacherry and DST-SERB on October 10th, 2018.

⇒ One day seminar on Quantum mechanics for the undergraduate students at BCM college, Kottayam, October 11th, 2018

⇒ *"Accelerating Heterogenous Catalysis by Theorical Methods."* at the National Seminar Organised by St. Pauls College, Kalamassery, in association with Academy of Physics Teachers on October 16th, 2018.

RECENT

Journal Publications.....

1. Vijesh K R, Mathew S, Nampoori V P N and Sheenu Thomas 2019 Carbon dots decorated graphene oxide nanosheets prepared by a novel technique with enhanced nonlinear optical properties *AIP Adv.* 9 015219
2. Musfir P N , Mathew S, Nampoori VPN, Sheenu Thomas, "Investigations on Frequency and Temperature dependence of AC conductivity and dielectric parameters in Ge20Ga5Sb10S65 quaternary Chalcogenide glass", *Optik* (2019)
3. Arindam Sarkar, Roopa Venkataraj, V.P.N. Nampoori, M. Kailasnath, "Silver nanoparticles filled hollow polymer fiber laser with enhanced photostability", Optics & Laser Technology, Volume 112, pp. 255-260, 2019 (ISSN 0030-3992)
4. Anand, V. R., Mathew, S., Linslal, C. L., Radhakrishnan, P., & Kailasnath, M Microring embedded hollow polymer optical fiber for Refractive Index Sensing. Journal of Luminescence. (2019).
5. Boni Samuel, Mathew S, V P N Nampoori, A Mujeeb. "Defect passivation introduced through surface reconstruction in TOPO capped CdSe quantum dots for enhancement in quantum yield", Optical Materials 88 (2019) 204-209
6. Anitha Prakash, Bini P. Pathrose, V. P. N. Nampoori, P. Radhakrishnan, and A. Mujeeb. "Thermal diffusivity of neutral red dye using dual beam thermal lens technique: A comparison on the effects using nano pulsed laser ablated silver and gold nanoparticles." Physica E: Low-dimensional Systems and Nanostructures 107 (2019): 203-208.
7. Roopa Venkataraj, Arindam Sarkar, C. P. Girijavallabhan, P. Radhakrishnan, V. P. N. Nampoori, and M. Kailasnath, "Fluorescence resonance energy-transfer-based fluoride ion sensor," Appl. Opt. 57, 4322-4330 (2018)
8. Anand, V. R., Mathew, S., Linslal, C. L., Peter, J., Radhakrishnan, P., & Kailasnath, M. Tunable amplified spontaneous emission from dye doped hollow polymer optical fiber. Journal of Luminescence, (2018).
9. M. Ramya, T. K. Nideep, K. R. Vijesh, V. P. N. Nampoori, and M. Kailasnath, "Synthesis of stable ZnO nanocolloids with enhanced optical limiting properties via simple solution method," Opt. Mater. (Amst). 81, (2018).
10. T. K. Nideep, M. Ramya, V. P. N. Nampoori, and M. Kailasnath, "Optik Optical limiting and optical properties of water soluble CdTe quantum dots prepared through a colloidal chemical route," Opt. - Int. J. Light Electron Opt. (September), 0–1 (2018).
11. Sony Udayan, Raj Sha M M, Mathew Sebastian, V.P.N. Nampoori, Sheenu Thomas,"Two photon induced amplified spontaneous emission at low threshold from Styryl 7 dye incorporated DNA template", Optical Materials 86 (2018) 492–497
12. Priyamvada V C, Ajina C, Radhakrishnan P, "Coating configuration dependency of fiber optic silver coated U bent plasmonic sensor surfaces in concentration sensing measurements", Optoelectronics Letters,Vol 14,No.6,1 November 2018
13. Retheesh R, Ansari M Z, Radhakrishnan P, Mujeeb A. "Application of qualitative biospeckle methods for the identification of scar region in agreen orange", Mod. Phys. Lett. B (MPLB) (2018) 32(9) 1850113.
14. Ansari M Z, Mujeeb A and Nirala A K. " Assessment of biological leaf tissue using biospeckle laser imaging technique." Laser Phys. 28 (2018) 065608.
15. Ansari M Z, Mujeeb A. "Modelling of laser speckles of heterogeneous dynamics in drying and aging of paint dispersions using a view based temporal template methgod". Laser Phys. 28 (2018) 085603.
16. Ansari M Z, Mujeeb A. "Assessment of microscopic repair dynamics in self-healing polymer by modelling laser speckle images". Laser Phys. 28 (2018) 126003.

17. Retheesh R, Thomas D, Ansari M Z, Varghese B, Radhakrishnan P and Mujeeb A. Application of laser biospeckle technique for the analysis of artificially introduced local dynamics in apple fruit. Laser Phys. 28 (2018) 115601.
18. M. M. Raj Sha, S. Mathew, S. Udayan, V. P. N. Nampoori, A. Mujeeb, "Ultra-pure silicon nanofluid by laser ablation: thermal diffusivity studies using thermal lens technique.", Applied Physics B, 19 0ctober 2018
19. Anupama Viswanathan, Sony Udayan, PN Musfir, VPN Nampoori and Sheenu Thomas, "Enhancement of Defect States Assisted Thermal Diffusivity in Solution-Processed GeSeSb Chalcogenide Glass Matrix on Silver Incorporation", Journal of Non-Crystalline Solids – Elsevier.
20. Anupama Viswanathan and Sheenu Thomas, "Novel amorphous nanowires from solution processed $Ge_{25}Se_{65}Sb_{10}$ chalcogenide glass.", Journal of Materials Science: Materials in Electronics.
21. R Fathima and A Mujeeb., Laser induced synthesis and concentration dependent thermo-optical properties of silver-gold alloy nanoparticles. 2018 Mater. Res. Express 5 125011
22. Anitha Prakash, Bini P. Pathrose, S. Mathew, V. P. N. Nampoori, P. Radhakrishnan, and A. Mujeeb. "Variations in thermo-optical properties of neutral red dye with laser ablated gold nanoparticles." Optical Materials 79 (2018): 237-242
23. Ajina Cheruvalath, V P N Nampoori, Sheenu Thomas, " Oblique angle deposited silver islands on $Ge_{20}Se_{70}Te_{10}$ film substrate for surfaceenhanced Infrared spectroscopy", Sensors and Actuators B: Chemical 287 (2019) 225 –230

Conference Publications.....

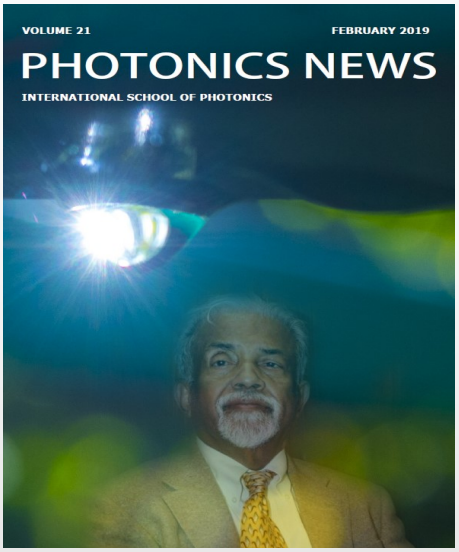
24. V Pradeep kumar, K R Vijesh, P. Radhakrishnan, and A Mujeeb ' concentration dependent thermal diffusivity of Nickel oxide nano particles prepared by thermal precipitation method' at international conference Photonics 18, IIT Delhi from 12 to 15 December 2018. ISBN 978-93-88653-41-1.
25. Alina C Kuriakose, V.P.N Nampoori and Sheenu Thomas 'Energy transfer studies in dye: QD binary mixture', International Conference on Physics and Chemistry of Materials", St. Thomas College, Thrissur, 19-21, Dec 2018.
26. Roopa Venkataraj, Arindam Sarkar, P Radhakrishnan, V P N Nampoori, M Kailasnath, "Optical sensing of fluoride ion using dye coated hollow glass capillary", Photonics 2018- International Conference on Fiber optics and Photonics, December 12-15, 2018, IIT Delhi, Paper No. FA1-C3, Proceeding of Photonics-2018 ISBN 978-93-88653-41-1
27. Arindam Sarkar, Roopa Venkataraj, V P N Nampoori, M Kailasnath, "Spectral tuning and amplified laser emission in dye-silver nanoparticles filled hollow polymer optical fiber", Photonics 2018- International Conference on Fiber optics and Photonics, December 12-15, 2018, IIT Delhi, Paper No. TP124, Proceeding of Photonics-2018 ISBN 978-93-88653-41-1
28. Jessy Simon, V.P.N. Nampoori, M. Kailasnath, "Effect of ablation time on femtosecond laser ablated gold nanoparticles", 28th Swadeshi Science Congress, National Seminar, NIIST, Thiruvanathapuram, 7-9 November 2018.
29. Jessy Simon, V.P.N. Nampoori, M. Kailasnath, "Gold nanoparticles: Synthesis by nanosecond and femtosecond laser ablation", National level Annual Physics Symposium APS 2019, St. Teresa's College, Ernakulam, January 7-8, 2019.
30. V R Anand, S Mathew, C L Linslal, P.Radhakrishnan, M. Kailasnath "Modulated whispering gallery mode laser emission from double layered dye doped hollow polymer optical fiber", National Laser Symposium (NLS-27), Dec 2018, RRCAT Indore, India.
31. V. R. Anand, S. Mathew, P. Radhakrishnan, M. Kailasnath, "Dye doped hollow polymer fiber microlaser for Refractive Index Sensing" International Conference on Fiber Optics and Photonics (Photonics-2018), Dec 2018, IIT Delhi, India.
32. P N Musfir, Sheenu Thomas "Non Linear optical absorption studies in Ge-As-S Chalcogenide glass thin films" 28th Swadeshi Science Congress(National Seminar), NIIST, Trivandrum, 7-9 November 2018.
33. P N Musfir, V Anupama and Sheenu Thomas "Optical Characterisation of Ge-As-S Chalcogenide Glass Thin Films for Photonic Applications" National Laser Symposium(NLS-27)" RRCAT, Indore, MP, India. 3-6 December 2018.
34. Ajina C, Musfir P N, V P N Nampoori and Sheenu Thomas "Effect of Germanium addition on Physical, Thermal and Optical Properties of GeSeTe Glass" Proceedings of International Conference on Chemistry and Physics of Materials (ICCPM-2018)" 19-21 December 2018, St Thomas College(Autonomous), Thrissur, Kerala. ISBN:978-81-935819 1-9.
35. P N Musfir and Sheenu Thomas "Refractometric Studies of quaternary $Ge_{20}Ga_5Sb_{10}S_{65}$ Chalcogenide glass thin films" International Conference on Optoelectronic and Nano Materials for Advanced Technology" (iCONMAT-2019), Cochin University of Science and Technology(CUSAT), Kochi, Kerala. 3-5 January 2019.

36. P N Musfir, S Soumya, C V Anees Mehaboob, V Raseem Ali and Sheenu Thomas "Tunable Optical Bandgap in Ternary Ge-As-S Chalcogenide Glass". International Conference on Optoelectronic and Nano Materials for Advanced Technology" (iCONMAT-2019), Cochin University of Science and Technology(CUSAT), Kochi, Kerala, 3 –5 January, 2019.
37. Lakshmi B, Anniemol Thomas, Pramod Gopinath, " Enhanced room temperature ferromagnetism in chemically synthesized Co3O4 nanopartilces." International Conference on Optoelectronic and Nano Materials for Advanced Technology, Cochin University of Science and Technology, Kochi, Kerala, 3 –5 January, 2019.
38. Priyamvada V C, Ajina C,Radhakrishnan P "Configuration Dependence of Fiber Optic Silver Coated Plasmonic Sensor Surfaces in Concentration Sensing", , Photonics 2018, IIT Delhi, Dec 12-15, 2018.
39. Anupama Viswanatahan and Sheenu Thomas,"Linear and nonlinear optical properties of amorphous GeSeSb thin film". 28 th Swadeshi Science Congress, 7 to 9tNovember 2018 at CSIR- NIIST
40. Anupama Viswanathan and Sheenu Thomas, "Solution Processed Chalcogenide Glass Nanolayer Based PCF for Temperature Sensing". at St Thomas College (Autonomous) Thrissur from 19 to 21 december 2018.ISBN: 978-81-935819 1-9.
41. R Fathima, A Mujeeb 'Laser assisted synthesis of silver-gold alloy nano particles' at the international conference on Chemistry and Physics of materials organized by St Thomas College (Autonomous) Thrissur from 19 to 21 december 2018
42. Vijesh k R, Musfir P N, Ramya M, V P N Nampoori and Sheenu Thomas "Carbon Dots Decorated Graphene Oxide and Pyrromethene597 Composite for White Light Emission" Photonics2018,IIT Delhi, December 12-15,2018.
43. Vijesh k R, Musfir P N, Manu Vaishakh Ramya M, V P N Nampoori and Sheenu Thomas Enhanced nonlinear optical response with viscosity in Carbon dots decorated Graphene Oxide dispersions, NLS2018, RRCAT, Indore.
44. Vijesh k R, V P N Nampoori and Sheenu "Nonlinear Optical properties of highly fluorescent Carbon quantum dots" NPS 2018, ISP, CUSAT.
45. Anitha Prakash, Bini P Pathrose, P Radhakrishnan, A Mujeeb, 'Effects of laser ablated gold nanoparticles on the thermal diffusivity of neutral red dye' National Photonics Symposium (NPS-2018), February 27 - March 1, 2018, ISP, CUSAT
46. Anitha Prakash, Bini P.Pathrose, P.Radhakrishnan, A.Mujeeb,'Excitation power dependence on thermal diffusivity values of neutral red dye incorporated with metal nanoparticles' ISBN: 978-81-935819-1-9, International conference on chemistry and physics of materials (ICCPM – 2018), December 19-21, 2018, St.Thomas college , Thrissur.
47. AnithaPrakash, Bini P.Pathrose, P.Radhakrishnan, A.Mujeeb. 'Enhancement in the Nonlinear Optical Properties of Neutral Red Dye with Laser Ablated Silver Nanoparticles' International Conference on Optoelectronic and Nano Materials for Advanced Technology (icONMAT-2019), January 3-5, 2019, Organized by CAM & IUCND, CUSAT.
48. Fathima R ,A Mujeeb, 'Laser induced synthesis of necklace shaped gold silver alloy nanoparticles', International Conference on Optoelectronic and Nano Materials for Advanced Technology (icONMAT-2019), January 3-5, 2019, Organized by CAM & IUCND, CUSAT.
49. Pooja Gitty, M Kailasnath, V P N Nampoori, "Synthesis and characterization of erbium doped hydroxyapatite nanoparticles",ICCPM 2018 held at St.Thomas College,Thrissur, during 19-21 December 2018.
50. Nideep T K, Ramya M, V P N Nampoori and M Kailasnath ,"Two photon absorption and optical limiting behaviour of colloidal CdTe quantum dots", , PHOTONICS 2018: International conference on fiber optics and photonics, December 12-15, 2018, IIT Delhi, New Delhi, India.
51. Nideep T K, Ramya M, M.Kailasnath,"Third order nonlinear optical properties of colloidal CdTe quantum dots", International Conference on Physics and Chemistry of materials, (ICCPM), December 19-21, 2018, St. Thomas college, Thrissur, India.
52. Ramya M, Nideep T K, V P N Nampoori and M Kailasnath,,"Nonlinear optical properties of ZnO nanostructures of different morphologies using Z–scan technique" PHOTONICS 2018: International conference on fiber optics and photonics, December 12-15, 2018, IIT Delhi, New Delhi, India.

About the Cover Page…..

The Agony and Ecstasy in the Pursuit of Knowledge:

George Sudarshan 's World of Research

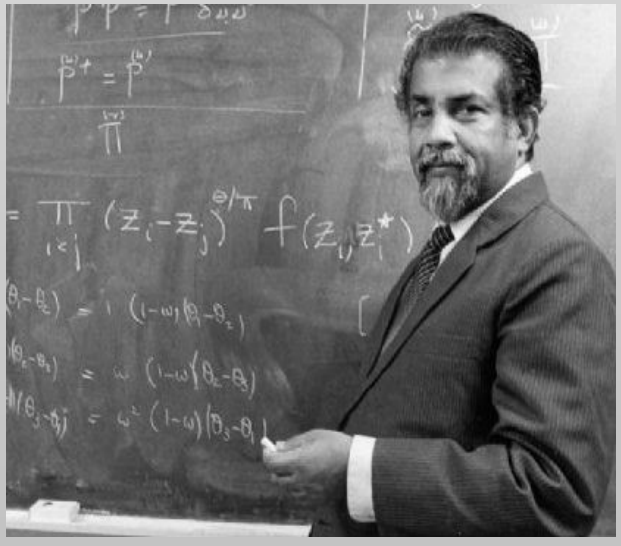


The story of agony and ecstasy related to the trail of George Sudarshan (1931 – 2018) in the world of research with the quest of knowledge can be nut shelled in the inspirational poem *The Road Not taken* (1915) of Robert Lee Forest (1874-1963). This narrative type poem with an unusual structure of five line stanzas with a strange rhyming symmetry of the first line rhyming with third and fourth lines while the second line with the fifth (of pattern ABAAB) concludes with following lines (an unusual symmetric structure of Poem to describe an extra ordinary paths of evolution from E C George to E C G Sudarshan)

I shall be telling this with a sigh/ Somewhere ages and ages hence: / Two roads diverged in a wood, and I -/I took the one less travelled by, / And that made all the difference.

Sudarshan, who got nominated for Nobel Prize nine times, was the Kerala's contribution to the class of the most brilliant theoretical physicists of the world during the second half of the 20th century .Sudarhan's research spanned a wide range of topics (like V-A theory of weak interactions, Tachyons, Quantum Optics, quantum Zeno effect, Symmetry, Spin & statistics and open systems) for more than six decades and in each of them, his insights could make deep and outstanding contributions of fundamental nature. Two of his works are worth of Nobel Prize and in fact one really fetched the Prize but to a different person. Sudarshan was also interested in blending science and spirituality like Schrodinger, Heisenberg and others.

Unlike in the rest of the world, unfortunately, in India he was not recognized to the level he could have , except for some prizes like Padma award and the award of Kerala Government bestowed to him. Even the recently concluded National Science Congress or the Kerala Science Congress forgot to remember Sudarshan . At least Kerala should not have left him unsung . It should be mentioned here that the Swadeshi Science Congress , Kerala which was conducted at NIIST, Trivandrum during November 7 -9, 2018 had a special session on Sudarshan's Contributions to the world of research. George Sudarshan wanted to contribute in building up of basic research in India. Once he was invited to lead Indian Institute of Science, Bangalore. But local politics resisted this move and instead , he was requested to establish the Centre for Theoretical Studies in IISC. This gave an opportunity for Sudarhan to nurture brilliant theoretical physicists in India. On an another occasion Sudarshan accepted a challenge to direct Institute of Mathematical Science in Chennai . He developed the Centre to an international level with high visibility and enhanced financial inflows converting the Institute as a destination to brilliant students and academicians. However the Indian character of resistance made Sudarshan to leave India without completing the full term and go back to US.



Born in Pakkil village near Pallam, Kottayam, Kerala in 1931, Sudarshan obtained his BA degree in Physics from CMS College Kottayam ,Masters[(BSc (Hons)] from Madras Christian College,Chennai and worked at the Tata Institute of Fundamental Research in Mumbai(1952-55), before moving to the University of Rochester in New York for his PhD in 1955 under prof Marshak. He got PhD within three years' period and thus compensated for the years lost in Mumbai. It was while working for his PhD dissertation that Sudarshan produced the first of his many important contributions to physics namely theoretical foundation to weak nuclear force which describes phenomenon like beta decay.

It had been shown a couple of years earlier that the weak nuclear force that is responsible for phenomena like beta radioactive decay of certain material, violated what is called parity symmetry, unlike the other three fundamental forces of nature , strong nuclear force, electromagnetic force, and gravitation , follow.

Suppose, a physical event is seen to occur in nature. It was believed that the mirror image of the event was also a possible . But it was shown that under the influence of weak force, this is not so. Sudarshan extended this finding in his PhD thesis and showed that the weak force acts only on particles with a particular orientation, called 'left-handed'. This was his biggest achievement during the period when the studies created a confused situation in the case of weak interaction. It came when he was still a PhD student and it had been missed even by stalwarts like (Nobel laureate and celebrated physicist) Richard Feynman. Feynman, who developed his theory further, later acknowledged the fact that it had originated in Sudarshan's work. Fynman acknowledged Sudarshan's work who said " We have a conventional theory of weak interactions invented by Marshak and Sudarshan – I call it the conventional theory of weak interactions - the one which is described as the V-A theory." .Nobel Laureate Abdussalam commented that the V-A theory of Sudarshan opened up the door to the first step of field unification leading to electro weak interactions. Even as he missed the Nobel prize several times, Sudarshan openly expressed his anguish when the Royal Swedish Academy of Sciences chose to give a prize to RJ Glauber in 2005 "for his contribution to the quantum theory of optical coherence", ignoring Sudarshan's work.

In a letter to the Academy, he said: "In the announcement of the 2005 Physics Nobel Prize, the Swedish Royal Academy has chosen RJ Glauber to be awarded half of the prize. The prize winners are chosen by the Royal Academy, but no one has the right to take my discoveries and formulations and ascribe them to someone else! The correct formulation of the quantum mechanical treatment of optics was carried out by me in my paper in 1963. In that I showed that every state can be represented in the diagonal form…This diagonal representation is valid for all fields.

The irony of the situation is that in spite of all these facts being available in print, the diagonal representation instead of being referred to as the Sudarshan representation is dubbed as either the P-Representation (as if Glauber discovered and named it first) or at best as 'Glauber-Sudarshan' Representation. While the distinction of introducing coherent states as basic entities to describe optical fields certainly goes to Glauber, the possibility of using them to describe 'all' optical fields (of all intensities) through the diagonal representation is certainly due to Sudarshan. Thus there is no need to 'extract' the classical limit [as stated in the Nobel citation]**. Sudarshan's work is not merely a mathematical formalism. It is the basic theory underlying all optical fields. All the quantum features are brought out in his diagonal representation...** It is my belief that the Royal Swedish Academy was impartial and that to assure the proper priorities it has a Committee in Physics, with members competent to examine and understand the published work. It was also my belief that the members of the Committee did their work diligently and with care. I am therefore genuinely surprised and disappointed by this year's choice. It would distress me and many others if extra scientific considerations were responsible for this decision. It is my hope that these glaring injustices would be noted by the Academy and modify the citations. *Give unto Glauber only what is his."*

The agony experienced by Sudarshan is reflected in this concluding biblical quote ."When I lecture about coherence, I only talk about my diagonal representation, and not the P-representation," says Sudarshan. "This is just like the way I would refer to my sons by the name I gave them." A petition indicating the miscarriage of justice , signed by ten Indian scientists , was submitted to the Academy, reads, "It is difficult to understand how the work for which Glauber is cited could be honoured in isolation from Sudarshan's published discoveries and formulations, which were initially criticized and subsequently adopted by Glauber."

Another important work of Sudarshn carried out with his student B Mishra in 1976 is The Zeno's paradox in quantum theory They developed a quantum-theoretic expression for the probability that an unstable particle prepared initially in a well defined state p will be found to decay sometime during a given interval. It was argued that probabilities like this which pertain to continuous monitoring possess operational meaning. A simple natural approach to this problem leads to

the conclusion that an unstable particle which is continuously observed to see whether it decays will never be found to decay. Later on experiments conducted in several laboratories in the world confirmed this conclusion

Sudarshan's well known work on Tachyons have yet to be proved in the laboratories. Hope that this will finally get confirmed which will revolutionize several fields like communication and interstellar explorations. Sudarshan tried to find common grounds between science and spirituality He said in an interview *"I was born in an Orthodox Christian family. I was very deeply immersed in it, and so by the age of seven I had read the entire Bible from Genesis to Revelation two or three times.* I was not *quite satisfied with Christianity, and gradually I got more and more involved with traditional Indian ideas".* To a question *"Did your training as a scientist contribute at all to your growing dissatisfaction with the church?" Sudarshan answered "No. It was simply that I found that the people who professed to practice were really not practicing. In other words, there was a great deal of show and not that much genuine spiritual experience. Further, a God "out there" did not fully satisfy me. God is not an isolated event, something separate from the universe. God is the universe"*

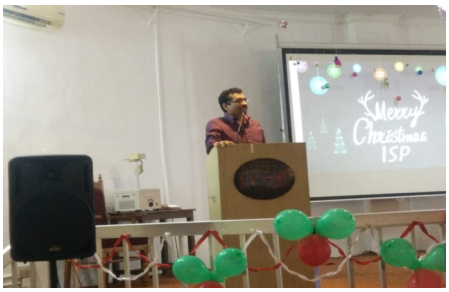
Sudarshan had the following message to the students of India **"When I was a research student, it was considered an opportunity to be able to work on something. Nobody had to ask you to do 'this'. They suggested that may be you can look at this.And then you did it. If you did not know enough you read up about it. Or you asked various otherpeople. Somehow, this culture of doing things out of one's own curiosity and by one's ownefforts or by discussion with other people is gone from students. Our education has gone down. At Madras [MCC], I learnt more than people now learn in the course of their PhD".**

E C G Sudarshan's loss to the world of science can never be compensated . Photonic News and International School of Photonics, CUSAT pay homage to this brilliant son of the Mother India.

Prof. (Dr.) V P N Nampoori
Former Director
International School of Photonics
Cochin University of Science and Technology

Glimpses of Life at ISP





Jingle Bells, Jingle all the way!!!!!


Sweet Memories of NPS 2018




Welome to our new office staff; Ms. Shiny C S, Mrs. Rema S, Mrs. Shamla Beevi T A and Mr. Biju P T


Visit by AICTE Team

A Charity endeavour to Little Flower Hospital


Meetings with Parents...

In discussion with the administrators of Gothenberg University

Glimpses of Life at ISP

New ramp... New entrance...

Toilets for the specially abled

Construction work at ISP in progress

Building nearing completion

Director with CPWD engineers and contractors

Administrative office of ISP, new look

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CSIR Officials at ISP

June 2018

Dec 2018

ISP members in flood relief activities

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