PHOTONICS NEWS

Bulletin from the International School of Photonics **04 February 2002**
In association with Photonics Society of India

Contents

ISP to launch its website soon

International School of Photonics of Cochin University of Science & Technology is all set to launch its own website, which is nearing completion. The site presents a compilation of the all round activities of the School in frontier areas of Photonics.

Aimed at reaching worldwide viewers, the website aspires to attract research collaborations of other leading research groups with ISP. Besides, it reaches out to the student community with information regarding the courses as well as research programmes offered by the School in Photonics.

The website is designed keeping in mind the ever-growing nature of the various branches of Photonics. There are separate pages devoted to the research activities as well as the facilities available in the laboratories at the School. The newsletter 'Photonics News' also goes online with the launch of this website.

A major attraction of the ISP website will be a knowledge portal, which contains a large collection of links to various resources that may be useful to people working in Photonics and related fields. The resources covered include Photonics groups, careers, conference sites, free Photonics journals etc. This portal is reportedly *one of the largest online information sites*.

Yet another venture is the online alumni association of the School. The site will thus cater to all Photonics related needs of both research groups and students. The URL of the site will be announced soon.

Workshop on Optoelectronics for College Teachers –Some of the participants and resource persons.

ISP and International Collaboration

Workshop on Optoelectronics for College Teachers

The Workshop on Optoelectronics for College Teachers was organized by ISP during January 7 to 21 under ISP – MHO project. College teachers from all over India took part in this unique workshop.

One of the main objectives of ISP is to generate manpower in the field of Photonics. Apart from offering its own courses at M. Tech., M. Phil. and Ph.D. levels, ISP helps other institutions, especially colleges, to frame syllabus and course materials through extension lectures and workshops. A major problem faced by the teachers and students is the lack of a self-contained instruction material in the field of Optoelectronics constituting a syllabus drawn

Editor: Dr. V. P. N. Nampoori
Creative Team: Dilna S., Geetha K., Pravitha Ramanand, Rekha Mathew, Santhi A., Sreeja R.

at UG / PG levels. It was against this background that ISP proposed the conduct of a workshop for college teachers to prepare a curriculum and course material for Optoelectronics at UG level.

The workshop was designed based on the syllabus of Optoelectronics followed in the curriculum of M G University, Kottayam, Kerala. Teachers from all over the country were invited to take part in the workshop. Out of about 60 applicants; 20 were selected. The seminar was inaugurated on 7th January, 2002 by Prof. C P Girijavallabhan, Chairman of the Board of Studies in Photonics in CUSAT. The workshop consisted of tutorial lectures by resource persons, laboratory work and participants' seminar. The workshop came to a close on 21st January with a concluding session, which was inaugurated by the Vice Chancellor. Prof. C P Girijavallabhan and the Registrar Dr. K. V. Kunhikrishnan gave felicitation speeches.

Participants prepared course materials related to topics allotted to them during the workshop. The materials will be compiled and published as the teaching material for Optoelectronics course at under graduate level. This will be the indicator of the workshop.

Photonics News

From the Editor's Desk

It is with great pleasure that we bring this edition of Photonics News to scientists, technologists and our well wishers. As usual, the year 2001 was also rich in activities both at academic and cultural fronts, for ISP. Nonlinear Optics and Their Applications was the focal theme of the February 27-28 workshop organized by ISP during 2001. About 50 researchers participated in this workshop. A unique workshop of two weeks' duration was also organized by ISP during January 7 – 21, 2002. The objective of this workshop was to develop course material for Optoelectronics at undergraduate level. The workshop was organized under the Dutch assisted ISP-MHO project. The course materials prepared during the workshop will be published so as to make them available to teachers and students during the next academic year. This publication will form the indicator of the workshop.

University – industry interaction is one of the important factors in the technological advancements of a country. Such interaction is very weak in India. As a part of the international collaboration Mr. J Nuijten from Eindhoven University of Technology in Eindhoven in The Netherlands carried out a market survey in India to study the prospects of ISP – industry interaction through technology and knowledge transfer. An abstract of the study is included in this issue of Photonics News. This issue also contains the regular features like news from ISP as well as from other laboratories.

During this period of 2001-2002 we lost two of the legendary laser scientists Basov and Prokhorov and one of the pioneers of Radio Astronomy Hanbury Brown. They will remain immortal in our memory.

Conference News

Workshop on Photonics for Professionals

A Workshop on Photonics for professional engineers and medical practitioners will be organized during February 22-26 by International School of Photonics. This workshop is being conducted as part of the ongoing ISP – MHO Project. The workshop will consist of tutorial type lectures by experts in diverse fields of Engineering and Medicine.

Workshop on Fiber Optics and its Applications

ISP is organizing a National Workshop on Fiber Optics and its Applications during February 27-28, 2002. The workshop covers areas like electromagnetic wave propagation through optical fibers, fiber optic sensors, optical networks etc.

For more details regarding these workshops contact: **Dr P Radhakrishnan, Coordinator, Indo- Dutch Workshop & WOFOAP, International School of Photonics, Cochin University of Science & Technology, Cochin 682022. Email: radhak@cusat.ac.in**

ISP - Industry Interaction

The model for transferring technology

Jeroen Nuijten

(*Mr. Nuijten is from Faculty of Technology Management, Technical University, Eindhoven, Netherlands working on Technology innovation policy in developing countries. Currently he is with ISP under the students' exchange programme.*)

A key question in development research is why innovation and technical change can be so influential in economic development is some countries but so much less in others. Innovation, which is the motor that drives a firm in its search for competitive advantages against the forces that oppose its survival, is a continuing process in the search for "discovering new and better ways of doing things". There are numerous definitions of innovation, but all acknowledge the fact that a learning process is involved (Porter, 1990).

Kline and Rosenberg (1986) designed a very useful model of innovation called "the chain-linked model". This model explains the relation in most developed countries between basic research and the innovative firm. It also explains the basic actions that an innovative firm takes. The model of Kline and Rosenberg operates in a national environment. Clearly, there are more factors that influence the innovation process. The model of Kline and Rosenberg can be adapted to the following conceptual model formulated specifically for the research at the International School of Photonics. The R&D institutes use the knowledge from the universities, and transform the knowledge into practical applications. Sometimes (or even in most cases) the firms themselves have R&D institutes that perform the transformation process.

Government policy influences every aspect of the conceptual model of innovation. Another useful concept in this model is called "Transfer of foreign technology" which is pretty self-explanatory. This concept influences the competitiveness of ISP with other institutions. Because of the fact that competition with foreign technology institutes is very difficult, ISP should focus on applications in firms in Kerala, which have never considered the use of these technologies, because that is where their competitive advantage lies.

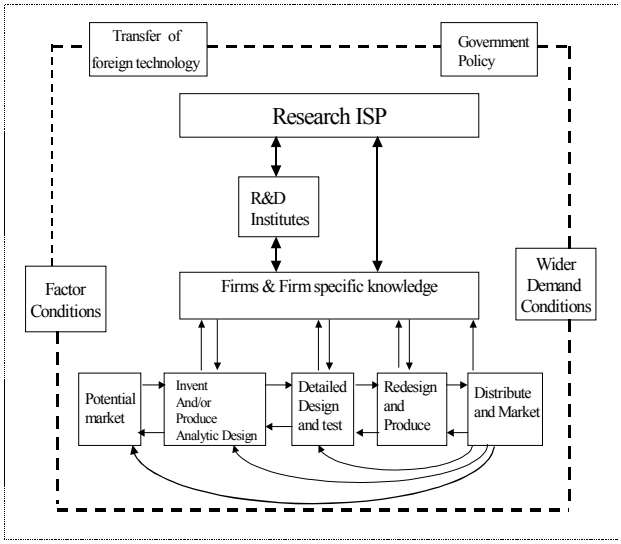

Fig. 1: Conceptual model based on Kline and Rosenberg theory

The transfer of technology from ISP may follow the different stages as represented in the following research model.

Identification of possible applications

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Development of applications

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Adaptation

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Selection of firms

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Technology transfer

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Implementation -Innovation

This transfer concerns the basic research of ISP and not the flow of its students. This model explains the different stages that are concerned when the ISP would want to apply its fundamental research into application within the industry.

The concerned stages are:

1. ***Identification of possible technological applications***. From the basic research projects done at ISP, possible applications for markets must be identified. The applications must be directed at the factors that can assimilate the technology. The chosen technology should be appropriate in terms of local market conditions, local resources, labour supply and quality of workforce, environmental and geographic conditions, cultural features and national objectives and policies.
2. ***Development of these applications***. In this stage the university develops the applications (or let a third party do that). In all of the stages the university should pay attention to the difficulty of one stage reflected on the other, and against the expected revenues that they receive in the future for the technology. This requires organisational capability from the side of the university. This could be difficult, because of the nature of the institute. However, it is necessary if commercialisation is to succeed.
3. ***The adaptation stage.*** The purpose of adapting a technology is to develop a system that will function optimally in the domestic industry. Quality and quantity of the technical and non-technical participation in the project determine the outcome of this process.
4. ***The selection of firms for the technology transfer stage.*** This phase involves interesting firms in the new technology, persuading them to accept it and selecting the firms with the greatest potential for successful implementation. Confronting characteristics of the technology with characteristics of the firm assesses a firm's potential.
5. ***The technology transfer stage***. The actual transfer of the technology not only involves the sale of the equipment and information, but also the transfer of the knowledge needed for operating and maintaining the technology.
6. ***The implementation of the technology within the selected firm.*** The technology, normally involving a production process, must be made operational at the firm's premises. Especially during the first period of operation, the entrepreneurs should be supported in the process of making the technical and organisational changes required. These stages suggest a linear transfer model from a technology institute to the selected firms. The development process however is everything but linear. The stages are represented to make the model easier to understand, but in fact, they are all inter-linked. The stages could easily be placed in another order. For example, the fourth stage can easily be performed before the first stage or even during the other stages. One can model a nonlinear process by introducing feedback loops between relevant loops in the diagram.

References:

Bongenaar, B. 1997. *Analyzing Technology Development, Part 1:Evaluation of the Role of the Tanzania Industrial Research and Development Organization*, Eindhoven Technical University, The Netherlands

Government of Kerala 2000 *Economic Review 2000*, State Planning Board, Government Press, Thiruvananthapuram, India

ISP. 1998 "Strengthening of the International School of Photonics at the Cochin University of Science and Technology, India; Project Proposal", Eindhoven Technical University, The Netherlands

Kline, S.J. and Rosenberg, N. 1986. *The Positive Sum Strategy, Harnessing Technology for Economic Growth* "An Overview of Innovation", National Academy Press, Washington D.C., USA

Lundvall, B. 1992. *National Systems of Innovation*, Pinter Publishers, London, United Kingdom

Porter, M.E. 1990. *The Competitive Advantage of Nations*, Macmillan Press Ltd., London, United Kingdom

From the Photonics World…

Laser Tweezers to Manipulate DNA

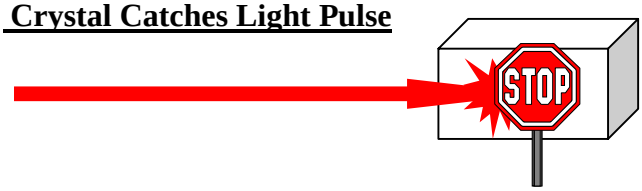
Laser tweezers can now be used to grip and manipulate DNA molecules across a chosen point along its length. In the already available technique, laser moves a bead that must be chemically bonded to the end of a DNA strand. The bead alters the chemical make up of the molecule and cannot be removed.

Tweezers developed by Hirano and his team exploit the dielectric properties of latex nano beads (~ 200 nm diameter) which are added to a solution of DNA molecules (~ 40 microns long). A 600 mw laser beam is focussed on to the desired section of the selected molecule. Beads are attracted to the centre of the focussed beam

where the field is most intense, thereby, trapping the strand, which can be stretched or bent by moving the translator stage on which the solution is kept. The DNA molecules can be released by switching off the laser.

This technique will provide a valuable test for gene therapy, physical properties of different molecular sites, assembly of micromachines etc. The trapping force depends on the refractive index difference between the beads and the surrounding medium. Hence this technique will work in gas or vacuum environment.
(K Hirano etal., 2002, Appl.Phys. Lett.**80**, 515)

Crystal Catches Light Pulse



A group of researchers from MIT slowed and stopped light in a solid (Yttrium based crystal) for the first time. Alexy Turukhin and his group slowed light pulses to 45 m/s, then trapped and released it afterwards. This effect previously shown only in gases can now be applied to develop high-density information storage devices for quantum computing. The method is that of the electromagnetically induced transparency in an absorbing medium using a coupling laser and a pump laser. They were able to trap a pulse from a third laser by switching off the coupling laser. The crystal is of 3 mm thick, but it had to be cooled down to 5K to trap the light pulse inside.
(A. Turukhin etal 2002 Phy. Rev. Lett. **88 023602**)

Visible light liberates hydrogen from water

Hydrogen is a limitless source of clean fuel, which can be extracted from water using visible light with the help of a semiconductor, Indium tantalum oxide doped with Ni. Zhigay Zou of NIAIST in Japan found that this semiconductor is a good catalyst, which can employ visible light (47% of solar energy) instead of already known photocatalytic agents making use of UV light (nearly 4% of solar energy). Hydrogen is liberated when the semiconductor immersed in water is irradiated by visible light. At present the efficiency is only 0.66% which can be improved to better values in the near future.
(Z Zou et. al., 2001 Nature **414**, 625)

The Quantum after Burner Laser

Marlan Scully of Texas University in US has calculated that energy from a heat engine could be used to power a laser. This would improve the engine performance beyond that of the ideal Otto cycle without violating the laws of thermodynamics. Scully has already worked out a method to test his idea in the lab and has conceived several novel laser systems. This idea of 'quantum after burner' is equivalent to the devices, which extract useful energy from the exhaust of a jet engine.
(M Scully 2002, Phy. Rev Lett. **88 050602**)

And Now Table Top Black Holes

Physicists could soon create an artificial black hole in the lab, thanks to Ulf Leonhardt of St. Andrews University in the UK. Black holes have the unique property that light becomes trapped inside its perimeter- known as the 'event horizon'- and hence nothing occurring within this distance can be observed from outside. While there have been suggestions that an analogue of a black hole could be created in the lab by trapping sound or light waves in fluids that are traveling more quickly than the waves; many such schemes would be plagued by Doppler effect that arises from the moving medium. Leonhardt has solved this problem by considering a black hole with *no moving parts*. A laser beam called the control beam would manipulate the optical properties of

either an ultracold gas or crystal in order to permit the transmission of a second beam of light known as the probe beam. The trick is to calculate the quantum effects of varying the intensity of the control beam parabolically along the length of the medium. Leonhardt calculated that such an intensity variation would result in a *singularity* similar to that associated with black holes. Pairs of photons emitted from the gas would be similar to Hawking radiation, which is thought to emanate from black holes but has never been observed.
(U. Leonhardt 2001 Nature **415,** 406)

Electrical Pulses Break Light Speed Record

Pulses that travel faster than light have been sent over a significant distance for the first time. Alain Haché and Louis Poirier of the University of Moncton in Canada transmitted the pulses through a 120-metre cable made from a coaxial 'photonic crystal'. To create their cable, the Canadian researchers joined together five-metre sections of coaxial cable with alternating electrical impedance. They sent electromagnetic pulses with frequencies between 5 and 15 MHz through the cable, and found that the group velocity reached 3 times the speed of light for frequencies in the absorption band. This was remarkable in comparison with many existing information systems that are based on coaxial cables with data speed of just two-thirds the speed of light. The achievement that utilized the back-reflection caused by impedance mismatch raise hopes that data could travel through electronic communications systems at almost the speed of light.
(A Haché and L Poirier 2002 *Appl. Phys. Lett.* **80** 518)

Light diffracts matter - Observation of the Kapitza-Dirac Effect

The Kapitza-Dirac effect was proposed shortly after the famous Davisson and Germer experiment that established the wave nature of electrons. The proposed effect was analogous to the diffraction of the light but with the roles of the wave and matter reversed. The electron and light interact extremely weakly, via the 'ponderomotive potential' and so attempts to measure the Kapitza-Dirac effect had to wait for the development of laser.

In the recent experiment conducted by the research group at the University of Nebraska, an electron beam crosses two counter propagating laser beams which form the standing wave light grating. To reach sufficiently high laser intensities, an Nd:YAG laser with 10ns pulses and energy of 0.2 J per pulse was made use of. A 380-eV electron beam is collimated by two molybdenum slits and a third slit cuts the height of the beam to that of the laser beam waist. Subsequently, the electron beam crosses the standing wave about 1cm after the third slit. A fourth slit downstream from the interaction region scans the electron beam profile. The electrons are detected as a function of time with an electron multiplier. From the time spectra of electrons taken at various locations, the diffraction pattern is obtained.
(D L Freimund, K Aflatooni, H Batelaan, 2001 Nature **413,** 142).

Entangling Of Macroscopic Objects

Two macroscopic objects have been 'entangled' for the first time as reported by Eugene Polzik and colleagues at the University of Aarhus in Denmark. They entangled two samples of Cesium atoms, each containing about 10^{12} atoms, for half a millisecond- a long time by quantum standards.

Entanglement is a quantum mechanical feature by which a measurement on one part of an entangled system reveals the properties of the other part, even if they are physically separated. To entangle the atoms injected into two cylindrical glass cells lying end to end, Polzik and

co-workers passes a single polarized laser pulse through both cells. The momentum of the light changes the spin of the atoms in each cell slightly, by an equal and opposite amount. This means they are entangled-the exact spin of the atoms in each cell is unknown, but a measurement of the spin of one sample would reveal the spin of the other sample. The spins of the atoms also change the momentum of the light as it passes through. A measure of the light as it exits the second cell revealed the average spin of the two samples. This effect lasted for about half a millisecond and is a record for macroscopic objects. This demonstration could form the basis of new forms of 'quantum teleportation' and quantum computers.
(B Julsgaard et. al. 2001 Nature **413,** 400)

NLO properties of Phthalocyanines

Nonlinear optics is an actively pursued area of research world over and interest in this field arises from the fact that many nonlinear optical effects have immense possibility of application in frontier areas of technology like optical communications, optical computing etc. In line with these trends measurement of NLO parameters of some important photonics materials viz. phthalocyanines(Pc's) and their derivatives are being carried out in our labs. Third order NLO parameters are of our main interest. Third order susceptibility and second order hyper polarizability of a number of metal Pc's (MPc's) have been measured using DFWM at 532 nm. It was observed that these materials possessed fairly high third order NLO parameters. Absorptive nonlinearity was also studied using open aperture Z- scan technique. They were observed to be good optical limiters around green region of the visible spectrum. Currently we are investigating the dispersion of nonlinear coefficients of MPc's using Z-scan technique. This study is expected to give some interesting results like changeover from reverse saturable absorption to saturable absorption along the shoulder of absorption peak.

PA studies of low dimensional structures

Photothermal methods are widely used for the measurement of optical absorption and thermophysical properties of materials such as polymers, plants, ceramics, semiconductors etc. Photoacoustic method extends its realm of application to the study of the thermal and transport properties of semiconductors. In our lab, we study the influence of doping concentration and different types of dopants on the thermal and transport properties of semiconductors using a home made open photoacoustic cell.
Conductors such as InP, GaAs, layered samples etc. are used in the fabrication of optoelectronic devices. Our recent studies show that doping can influence the heat generation mechanism in InP and it reduces the thermal diffusivity value. It is also seen that the carrier recombination time, carrier recombination velocity etc. of the epitaxial layers also depend on the doping concentration. Our studies reveal that in an intrinsic compound semi conductor, ambipolar diffusion is more important in determining the thermal properties rather than diffusion of minority carriers.

Fibre optics technology

The momentum gained in the research of fiber optic sensor technology during the past few years continued in the year 2001 also. The work based on fiber optic pH sensing with sol-gel

technology that started in the year 2000 was completed. The sol-gel technique was also used in thin-film technology to fabricate various integrated optic components. Pollution monitoring using optical fibers was another area of interest. Different fiber optic sensors were fabricated using the reagent-mediated technique, which could detect trace amounts of dissolved ammonia, nitrites and chromium, in water. Use of a reference fiber and high frequency detection scheme enhanced the reliability of the measurements.

The cheapest of all optical fibers available, the plastic fiber, was shown to be a potential candidate for evanescent wave sensing, a technique that had been thought to be possible only with unclad fibers. The modification applied to the plastic fiber was in the form of permanent microbends on a portion of the fiber. Various fiber optic sensors fabricated using the bent fibers included pH sensors, iron trace detectors etc. Apart from the intensity modulated sensors described above, some interferometric sensors are also in their infancy. Efforts are underway to develop dye doped polymer waveguides so as to get fiber amplifiers operating in the visible region.

Two photon absorption using thermal lens effect

Active research is going on at ISP in the field of thermal lens spectroscopy (TLS) and its applications. Recently the ISP group used TLS to study two photon absorption in aniline and related compounds. Thermal and optical characteristics of dye doped (singly and doubly doped) polymer amples were also studied using this technique.

A view of the set up for thermal lens studies using the OPO as the pump source.

Dye doped polymer discs are found to be suitable for the design of threshold logic gate elements based on TL effect.

Nonlinear dynamics of the Neural System & Neural Networks

Nonlinear dynamical studies on complex physiological signals such as the EEG are gaining popularity in the scientific world. The group at ISP involved in related work is currently investigating the effect of time scales on the unfolding phenomenon of neural attractors and its implications to the dynamical behaviour of the human brain both under normal as well as pathological conditions. The characterization of the brain state under no task conditions as well as during cognitive tasks such as mental arithmetic using invariant parameters that include the newly introduced Coherence Index is underway. The group at ISP has got a boost from the recently sanctioned STED project for Rs. 3 lakhs entitled "Nonlinear dynamical analysis of brain functions with special emphasis on clinical aspects". An in-house EEG machine being developed as part of the group's activities is nearing completion. This would enable the group to conduct cognitive experiments and thus gather a large amount of data the analysis of which can be carried out using the techniques developed. The ultimate aim would be to develop an online diagnostic tool that would

be of use to clinical neurologists in assessing the brain conditions of patients. Besides the time series study, efforts are on to develop models for the system by making use of stochastic AR models as well as artificial neural networks, leading finally to the fabrication of optical neural networks.

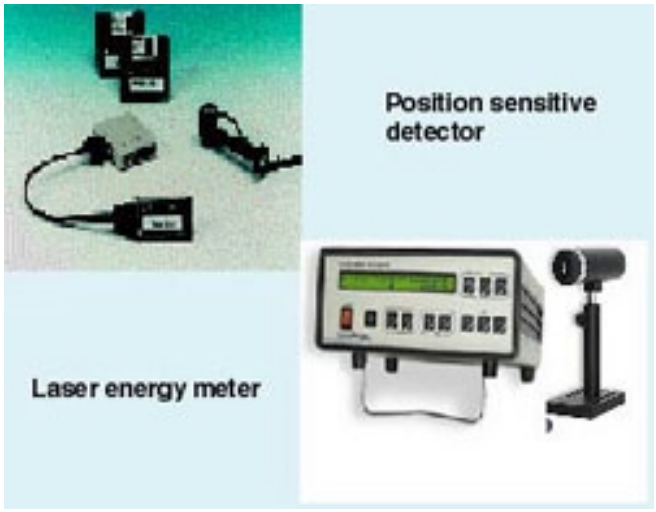
Studies on Laser induced Plasma

The plasma group is currently concentrating on the study of laser induced colliding plasma. The Department of Science and Technology has recently sanctioned financial assistance to the tune of Rs. 10 lakhs to carry out a research project to conduct studies in this direction. This group has recently studied selective excitation of certain lines in multi component plasma.

Laser Chaos

The present interest of the group is in the numerical investigation of synchronization and control of chaos in an array of N coupled semiconductor diode lasers where N varies from 3 to 10. The coupling is provided by giving a part of the output of the first laser to the input of the second and the output of the second to the input of the third and so on until the output of the last laser is given to the input of the first one. This system shows many interesting features. The synchronization and the nature of the output depend upon the strength of coupling and the number of array elements. This work is still in progress.

New Additions to the ISP Lab



Conferences organized by ISP during 2001-2002

1. Workshop on Nonlinear Optics
   WONLOP, February 27-28, 2001
2. Workshop on Opto-electronics for College Teachers, January 7- 21, 2002

In the limelight

Mr. Nibu A George was awarded Ph.D. under the faculty of Technology, CUSAT, for his thesis entitled "Photoacoustic and photothermal deflection studies on selected photonic materials." He is currently a Post Doctoral Fellow in the Applied Physics Group, Delft University, The Netherlands.

Seminars by Visitors

1. Dr. Geetha K Varier,
   Weizmann Institute, Israel.
   Conducting Polymers
   22nd February, 2001

2. Dr. Reji Philip,
   Raman Research Institute, Bangalore.
   Ultrafast Phenomena
   1st March , 2001

3. Dr. C. V. Bindu ,
   University of California, Santiago.
   FIR Lasers
   30th April, 2001

4. Dr. V M Murukesan,
   Nanyang Technological University, Singapore
   Fiber Optics in Smart Sensors and Speckle Interferometry
   9th May, 2001.

5. Dr. Joby Joseph,
   Indian Institute of Technology, Delhi
   Theory of Wavelets
   Optical Neural Networks
   12th July , 2001.

6. Dr. A V Ravikumar,
   Institute of Plasma Research, Ahmedabad
   Recent Advances in Free Electron Lasers
   29th October, 2001.

7. Prof. R. Unnikrishnan,
   Dean of Engg. and Computer Science, California State University, USA
   Knowledge based economy and the new realities in the US: Perspectives from an engineering profession
   January 18, 2002

Immortal Legends

❖ *Nikolai Basov*

The Russian physicist, whose pioneering work led to the invention of the laser, died in July, 2001. Basov shared the 1964 Nobel Prize for Physics with Aleksander Prokhorov and Charles Townes for fundamental research in Quantum Electronics, which forms the foundation on which modern laser technology stands.

❖ *Aleksander Prokhorov*

The Russian physicist whose path breaking work led to the invention of the laser, died in January, 2002. Throughout the early 1950s and while at the Laboratory of Oscillations, P N Lebedev Physical Institute, Moscow, Prokhorov and his collaborators used microwave spectroscopy to research molecular structures. By 1957 he had discovered that ruby would make a suitable laser material. He was awarded the Noble Prize in 1964 along with colleague Nikolai Basov and Charles Townes of the US for fundamental work in quantum electronics that led to the construction of oscillators and amplifiers based on the maser-laser principle.

❖ *Robert Hanbury Brown*

One of the pioneers of radio astronomy, Robert Hanbury Brown passed away in January, 2002. After an early stint as an engineering consultant, he joined Sir Bernard Lovell who was building the Jordan radio telescope at Manchester University at that time. In 1956, Hanbury Brown with Richard Twiss invented the Hanbury Brown and Twiss interferometry technique which went on to be widely used in astronomy and quantum optics.

ACCOLADE

- **Dr. V P N Nampoori**, Professor, ISP has been selected by the University Grants Commission for the **UGC Research Award** for the year 2002. A research grant for three years has also been sanctioned as a part of the award.

- The paper entitled ”An LED based Fiber optic Evanescent wave sensor for the detection of trace

nitrites in water" by **P Suresh Kumar**, C P G Vallabhan, V P N Nampoori, V N Sivasankara Pillai, P Radhakrishnan, fetched the award for the **Best Poster in the DAE-BRNS National Laser Symposium** held at CAT, Indore, during Dec 19-21, 2001.

- **Dr. V. Vidyalal**, an ISP alumni and former Research Associate in ISP has been made the **Vice-President and CTO** of the Dallas based telecom giant **Uni-Tel**. We congratulate Dr. Vidyalal for his rise to the top echelons of the US high tech firm.

Recent publications from ISP

1. Fiber Optic pH sensor with dye doped multilayer sol-gel coatings
   Thomas Lee S, Gin Jose, C M Manju, Betty Joseph, Shelly M John, P Radhakrishnan, V P N Nampoori, C P G Vallabhan, N V Unnikrishnan
   Proc. SPIE-Int.Soc.Opt.Eng,4417, pp546(2001).
2. Use of an open photo acoustic cell for the thermal characterization of liquid crystals.
   George N A, C P G Vallabhan, V P N Nampoori, George A K, P Radhakrishnan.
   Appl.Phys.B: Lasers Opt, 73(2), pp145 (2001).
3. Influence of laser irradiance and helium ambient on the expansion of laser produced carbon plasma.
   S S Harilal, C V Bindhu, V P N Nampoori, C P G Vallabhan.
   Proc. SPIE-Int.Soc.Opt.Eng,4424, pp520 (2001).
4. Nonlinear absorption and optical limiting in solutions of some rare earth substituted phtalocyanines.
   K P Unnikrishnan, Jayan Thomas, Binoy Paul, Achamma Kurian, Pramod Gopinath, V P N Nampoori, C P G Vallabhan.
   J.Nonlinear Opt.Phys. Mater,10(1),pp113(2001)).
5. Open cell photoacoustic investigation of the thermal effusivity of liquid crystals.
   George N A, C P G Vallabhan, V P N Nampoori, A K George, P Radhakrishnan.
   Opt.Eng, 40(7), pp1343 (2001).
6. Chemical sensing with microbent optical fiber.
   Thomas Lee S, Nibu A George, P Sureshkumar, P Radhakrishnan, C P G Vallabhan, V P N Nampoori
   Opt.Lett, 20, pp1542(2001)
7. A sensitive fiber optic pH sensor using multiple sol-gel coatings
   Thomas Lee S, Gin Jose, V P N Nampoori, C P G Vallabhan, N V Unnikrishnan, P Radhakrishnan
   J.Opt.A:Pure Appl.Opt. 3, pp355 (2001)
8. Effect of time scales on the unfolding of neural attractors.
   R Pravitha , P Indic, V P N Nampoori, R Pratap
   Int. J .Neuro Sci (In press)
9. Chaotic encryption using long wavelength directly modulated semiconductor lasers.
   V. Bindu, V M Nandakumaran.
   J. Optics A- Pure & Appl. Optics (In press)
10. Dynamical aspects of coupled Rossler oscillators:Effect of noise.
    R Pravitha , P Indic, V P N Nampoori
    Phys.Lett.A 294(1), pp.37(2002)
11. Study of energy transfer in Organic dye pairs using Thermal Lens technique.
    Achamma Kurien, K P Unnikrishnan, Pramod Gopinath, V P N Nampoori, C P G Vallabhan
    J.Nonlinear Opt.Phys.Mater.Vol10(4) (In press)
12. Third order nonlinear optical studies in europium naphthalocyanine using degenerate four wave mixing and z-scan.
    K P Unnikrishnan, Jayan Thomas, V P N Nampoori, C P G Vallabhan
    Optics Comm.(In Press)

A slice of life at ISP

Cultural evening at ISP held as a part of the Optoelectronics workshop- Ms Usha Nangiar performing Nangiar Koothu, the solo woman dance theatre of Kerala

The ISP family during an outing to the picturesque waterfalls of Athirappally near Cochin

Address for correspondence:
Dr. V P N Nampoori
International School of Photonics
Cochin University of Science & Technology
Cochin 682 022
E-mail: vpnnampoori@cusat.ac.in

And the last word….

My work always tried to unite the true with the beautiful; but when I had to choose one or the other, I usually chose the beautiful.

-Hermann Weyl

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