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Poornaprajna Institute of Scientific Research

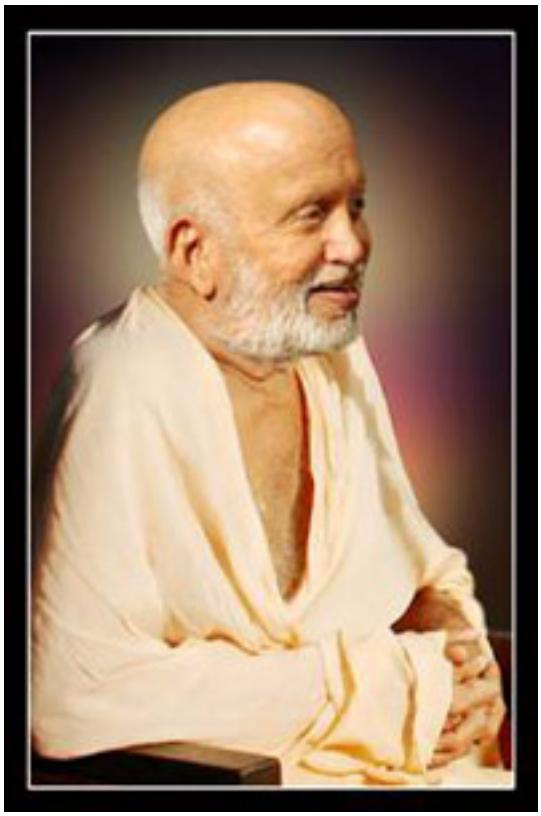
ANNUAL REPORT

PPISR

2011-2012





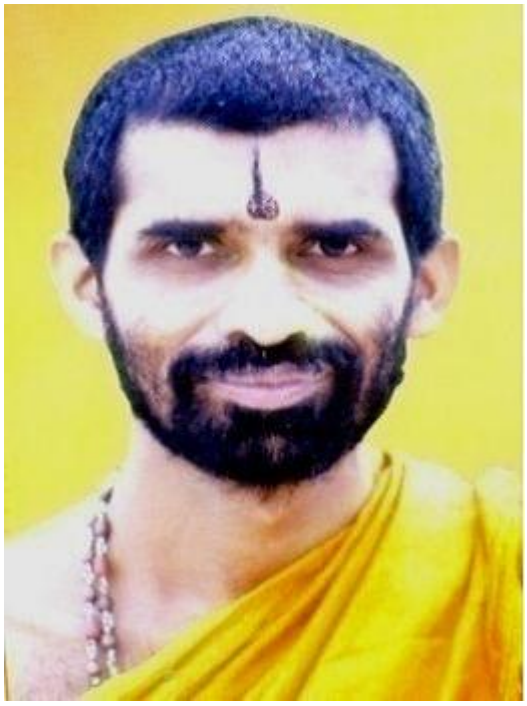



Knowledge is Power:

Providing facilities to do research in the Pure Sciences has become very necessary. Our brilliant youth go outside the country to do research and settle there. Until we check this trend, India can't make real progress in any field. Hence the attempt to establish the Poornaprajna Institute of Scientific Research (PPISR) under the guidance of many eminent scientists of this country. More the investment by the nation in science and technology, stronger the country will evolve. All well wishers of this country are approached hereby for all possible assistance to this project, so that India may better serve the world. I pray for divine guidance. May the Lord grant necessary strength to develop this institute for the benefit of the nation and the world.

HH Sri Vibhudesha Teertha Swamiji,
Founder, PPISR

HH Sri Vishwapriya Theertha Swamiji's message



It fills my heart with joy that Poornaprajna Institute of Scientific Research (PPISR) is now taking a new lease of life with the recruitment of new faculty members and admission of the first batch of students for PhD and moving steadily in the direction of fulfilling the dream of its founder, my beloved Guruji HH Sri Vibhudesha Theertha Swamiji, who regarded PPISR as the crest-jewel among the family of Poornaprajna institutions.

I am happy that like the Theoretical Sciences department, founded earlier, the Materials science and Biological Sciences departments, which were established recently, have also developed strongly, winning both academic and corporate recognition. Our scientists have not only won recognition as scientists, but have shown themselves to be enthusiastic organizers of scientific meetings, conferences, seminar activity, etc. PPISR also conducted summer and winter schools for students from various colleges, which is especially pleasing to me, because it helps to create more budding scientists, who are our nation's future.

I wish that the research activities undertaken here are continued in this manner, pursued with the same zeal and spirit of curiosity, as was undertaken by the ancient Indian sages into the spiritual sciences, for bringing benefits to this nation and all humankind. May Lord Sri Krishna bless and guide the members of PPISR!

HH Sri Vishwapriya Teertha Swamiji
Chairman, AMEF

Contents

Message from the Secretary, AMEF and AMEC

HH Sri Vibudesha Theertha Swamiji, unusual for a pontiff of a traditional Indian monastery (Sri Admar Mutt, Udupi), was a scientific visionary, patriot and educator. It never ceased to amaze me how he donned all these roles with equal enthusiasm and unwavering energy right from the beginning until he attained the Lotus Feet of Lord Sri Krishna. I, among many others, have been inspired to appreciate his heritage and to be involved in keeping the torch burning high for achieving his vision through development of integrated personality of the youth through proper training of their intellect, spirit, mind and body.

Pooyja Swamiji was the Founder President of Udupi Sri Admar Mutt Educational Council (AMEC), which oversees 30 Poornaprajna schools founded by Him and founder Chairman of Admar Mutt Educational Foundation (AMEF), which manages the Poorna Prajna Institute of Scientific Research (PPISR), which is the crowning Jewel of all Poornaprajna Institutions founded by Him. AMEC and AMEF are twin bodies bequeathed with the sacred responsibility of continuing this unusual partnership between an ancient spiritual tradition system and modern science and education.

His Holiness Sri Vishwapriya Theertha Swamiji, the present Pontiff of Sri Admar Mutt, Udupi, is now the President of AMEC and Chairman of AMEF and is also a great visionary and renowned scholar in philosophical doctrines.

The past few years have shown that this trust has been well vindicated in terms of founding two additional departments, i.e., Biological Sciences and the Materials Science, which have joined the Theoretical Sciences department in pursuing quality research, while training our students to pursue their PhD degrees. Based on my close interaction with the Director, faculty members and students, I am sure that we are on track to fulfill Senior Swamiji's vision of creating a world class institute. Since 2010, we have had a steady stream of events, like Karnataka Vision Group sponsored meetings, summer schools and winter schools in the different scientific disciplines, in our effort to disseminate scientific knowledge to college lecturers and students.

After renewal of our affiliation with Manipal University, we at PPISR now have 10 students pursuing their PhD. We have obtained recognition by the Department of Scientific and Industrial Research (DSIR), Govt. of India. The latter two departments, which we founded recently, have now joined the rank of the Theoretical Sciences department, in publishing papers of quality research in international journals of repute. We have also received a project in the area of catalysis from M/s GTC, USA based on the sincere efforts of our Director. We have also secured industrial projects from M/s Shell Technologies India Pvt. Ltd. and M/s HPCL during this year. We think these are good indicators of the future of healthy and steady growth at PPISR.

Dr. K. Srihari,(Hon. Secretary, AMEC and AMEF)
Professor (Rtd), UAS, Bengaluru

Foreword from the Director, PPISR

With great pleasure that I am presenting the second Annual Report on account of research and academic activities of Poornaprajna Institute of Scientific Research (PPISR) for the year 2011-12.

I had the privilege of taking this responsibility as the Director of this Institute two years back. We have been able to consolidate many of our academic activities in terms of establishing new scientific facilities, appointing new faculty members and also recruiting Junior Research Fellows. Several new research projects have been initiated with sponsorship from Government agencies like VGST, DST & DBT. Based on our ongoing research projects, many of our students and faculty members have presented research papers at various National and International Conferences and have won prizes for best presentations.

It gives me great pleasure to inform that all our faculty members have become Ph.D. guides with Manipal University (MU) and also our students have registered for Ph.D. degree in Theoretical, Materials and Biological Sciences.

We had organized events like Founder's Day Celebration, Three-Day Faculty Development Programme for Under graduate lectures in association with Vision Group on Science and Technology, Govt. of Karnataka, One-day scientific review meeting for Ph..D scholars in association with the Luminescence Society of India, Karnataka Chapter, Summer school and Winter Schools for under-graduate students of Poornaprajna College, Udupi.

The Institute has made a significant achievement by successful completion of one year of sponsored research project of M/s. GTC Technology, USA. They have acknowledged our catalysis group in recognition of their dedicated research in the development of modified zeolite catalyst and also for enabling continued commercial exploration of this important aromatics technology. Other leading R&D corporate Centers like M/s. Shell Technology India, M/s. Hindustan Petroleum Corporation Ltd, have shown keen interest to collaborate with PPISR on their research work.

Seminars and invited lectures on various topics delivered by our Faculty Members have provided significant exchange of scientific knowledge among researchers across the country.

The science outreach programmes like Summer School for undergraduate students have been successful. Several young INSPIRE Fellow students from various colleges have spent their vacation to carry out short term projects with our faculty members.

We are confident with the enthusiastic support of Admar Mutt Education Foundation, Trustee members, ands also unstinted support and blessings from our President H. H. Sri Vishwarpriya Theertha swamiji, PPISR will be poised for growth from strength to strength.

Board of trustees of AMEF

Chairman

HH Sri Vishwapriya Theertha Swamiji
Head of Admar Mutt, Udupi

Members

Sri. Rajendra J Hinduja, Industrialist

Sri. Laxmisha G Acharya, Industrialist

Sri. K R Prasad, Advocate

Prof. K J Rao Professor, SSCU, IISc, Bengaluru FASc, FNA, FNASc

Sri. B R Prabhakara, IAS , Former Chief Secretary, Govt of Karnataka

Prof. P Rama Rao, Ex. Secretary, Ministry of S & T FASc, FNA, FNASc

Dr. U Shankar Rao, Medical Director, National Hospital, Chennai

Dr. Gautham Nadig, Director, Metahelix Life Sciences Pvt Ltd

Dr. V R Prahalada, Vice Chancellor, Defence Institute of Advanced Technology, Pune

Dr. K Srihari , Hon. Secretary, AMEF and AMEC Professor (Retd.), UAS, Bengaluru

Sri. M Ashok Kumar, Hon. Treasurer, Chartered Accountant, Bengaluru

Financial Advisor

Sri. P Sreenivasa Rao,
Former Sr. Dy. General Manager, Finance and Vigilance, Bharath Electronics Ltd. Bengaluru

Administrative and Support Staff

Mr. Kishore L. Gaikwad	Administrative Officer
Mr. R. Nagarajan	Accountant
Mrs. Latha Srinivasan	Administrative Secretary
Mr. Subramanaya	Estate-in-charge
Mr. Praveen Kadam	Support staff

Research Advisory committee

Dr. V. R. Prahalada, chairman (DIAT, Pune)
Prof. T. M. Aminabhavi, UGC Emts Scientist
Prof. S. Ramakumar (IISc, Bengaluru)
Prof A. Jagannadha Rao (IISc, Bengaluru)
Prof. G.U. Kulkarni (JNCASR, Bengaluru)
Prof. N. Kumar (RRI, Bengaluru)
Prof. C. Sivaram (IIA, Bengaluru)
Prof. T. N. Guru Row (IISc, Bengaluru)
Prof. K.R. Krishnamurthy (IIT-Madras, Chennai)
Prof. Anand B. Halgeri (Member Secretary)

Adjunct and Honorary Faculty

Adjunct Professors	Honorary Professors
Prof. T N Guru Row, IISc (Crystallography)	**Prof. K.J. Rao,** IISc (Glasses & Ceramics)
Prof. S A Shivashankar, IISc (Thin films)	**Prof. N.J. Shetty,** Bangalore University (Biology)
Prof. S Asokan, IISc (Glasses & Sensors)	**Prof. B.S. Jaiprakash,** BIT/IEHMM (Catalysis)
Prof. Y S Bhat, BIT (Catalysis)	**Prof. K.G. Satyanarayana,** Ex.Director, RRL (Polymers)
Prof. Suryaprakash, IISc (NMR Studies)	**Prof. T. M. Aminabhavi,** UGC Emts Scientist (Polymers)
Prof. Dipshikha Chakravortti, IISc (Biology)	**Prof. B.K. Sadashiva,** RRI (Liquid crystals)

About the institute

Poornaprajna Institute of Scientific Research (**PPISR**) was conceptualized and founded by the late Sri Vibudhesha Teertha Swamiji, the chief pontiff of the Udupi Admar Mutt to create a serene and congenial environment where scientists would be inspired to carry out innovative and original research in fundamental and applied sciences. The vision of the institute is "**To promote and nurture excellence in fundamental and applied sciences for the advancement of scientific knowledge and benefit of mankind".**

The institute is situated at Bidalur, near Bengaluru International Airport on a sprawling area of 32 acres and is funded by Udupi Admar Mutt Education Foundation (AMEF). The foundation is a trust sponsored by the Admar Mutt Education Council (AMEC) and registered under the Karnataka Trust Act. The AMEC is presently running more than 20 Poornaprajna Education Institutions which have earned a name for themselves in providing quality education at school and college levels. A board of trustees consisting of eminent personalities was constituted to oversee the growth of PPISR. Since March 2010, the present chairman, HH Sri Vishwapriya Teertha Swamiji has taken up the responsibility of fulfilling his Guru's dreams. The foundation stone for the research campus was laid in 1998 by the then Prime minister of India, Sri A. B. Vajpayee.

The first phase of buildings which provided office and laboratory space, also consisted of an auditorium with a capacity to seat 35 people and a modern kitchen. The building was inaugurated in May 2003 by the then deputy Prime Minister Sri L. K. Advani. The first phase of hiring of post-docs and faculty started in 2003. Initially faculty in Theoretical Sciences were hired.

During March 2010, Dr. Halgeri, an eminent scientist from Reliance Petrochemicals, one of India's top industries, took charge as Director of PPISR. He along with the support of Prof. K. J. Rao, Emeritus Scientist at IISc, pioneered the expansion of PPISR into Materials Science and Biological Sciences departments. The research campus at Bidalur went through phenomenal changes in terms of infrastructure and procurement of equipment in the last two years. A Laboratory dedicated to Materials Science has been built and inaugurated by the present Chairman, Sri Vishwapriya Teertha Swamiji. The Biological Sciences division has been growing with the induction of two faculty members and procurement of instruments, chemicals etc., for pursuing molecular biology, mycology and protein crystallography research.

Initially in order to initiate research programmes in Materials and Biological sciences at the centre about 14 distinguished professors from other renowned institutes IISc, RRI, BIT, Bangalore University etc, graciously agreed to be associated with PPISR as adjunct and honorary professors. New faculty appointments have been made and new research directions identified. A number of young student researchers have been selected to pursue their doctoral studies at PPISR.

Currently in PPISR, there are three divisions, (A) Theoretical Sciences, (B) Materials Sciences, and (C) Biological Sciences where research programmes of advanced nature are in progress. The research laboratories are now equipped with state of the art instruments to give every advantage to the students and faculty pursuing research here. In addition to research, PPISR has ambitious plans for outreach activities to develop innovative and imaginative platform for pedagogy aimed at school and college students and teachers.

The mission of PPISR is to carry out world-class quality research involving multidisciplinary collaborations nationally and internationally and thus help graduate students reach their full potential by providing research guidance and technical skills required to live and work in a complex technological society. PPISR also aims to develop teaching material for core courses in Physics, Chemistry and Biology in order to strengthen the basic foundations of science in doctoral students.

The institute is recognized by DSIR, Govt. of India, New Delhi. PPISR is also recognized as a research centre by Manipal University (MU), Manipal, Karnataka. Further all the faculty members are recognized as official PhD supervisors of MU and all the students are registered for their PhD degrees with MU.

Core faculty and students

Theoretical Sciences

Dr. Sujit Sarkar (Quantum Many body Physics), Asst. Professor	
Dr. R Srikanth (Quantum Information and Foundations), Asst. Professor	Mr. Omkar Srikrishna, Research Scholar Mr. Aravinda Srinivasamurthy, Research Scholar
Dr. S G Bhargavi (Astronomy & Astrophysics), (Hon) Asst. Professor	

Biological Sciences

Dr. K Ananda (Mycology), Asst. Professor	Mr. L Sathish, Research Scholar Ms. N. Pavithra, Research Scholar
Dr. U A Ramagopal (Structural Biology), Asst. Professor, Ramalingaswami Fellow	Dr. Raghurama P Hegde, Research Associate Mrs. G C Pavithra, Research Scholar
Dr. Prasad Koka (HIV/AIDS research), Professor, Ramlingaswami Fellow	Dr. R Bharati, Research Associate

Material Sciences

Dr. A B Halgeri (Catalysis), Professor and Director	
Dr. A V Raghu (Polymers), Asst. Professor	Mr. D P Suhas, Research Scholar
Dr. G V Shanbhag (Catalysis), Asst. Professor	Dr. S Ramesh, Postdoctoral Fellow Mrs. B V Swetha, Research Scholar Mr. Vijay S Marakatti, Research Scholar Mr. Janardhan H L, Research Scholar Mr. Satish Burlas, Project Assistant
Dr. Nalini G Sundaram (Nanomaterials), Asst. Professor	Ms. S M Swetha, Research Scholar Mr. R Srinidhi, Research Scholar

Research Divisions

Materials Science

The Materials Science Division was established in PPISR under the aegis of AMEF in May 2010. The present Director Dr. A.B. Halgeri initiated the setting up of the division with the help of Prof. K. J. Rao Chairman, Executive Committee of AMEF. In the course of a few months, some enthusiastic scientists joined as core faculty with varied research interests and expertise in Materials Science. In the meantime, a new materials synthesis laboratory was also constructed. Many bright students with a passion for research were interviewed and inducted for the Doctoral Programme in the Department. Currently, the Materials Science Department at PPISR includes faculty and students from diverse backgrounds such as chemistry, industrial chemistry,

biochemistry etc. working on various thrust areas of fundamental and applied materials science research. At present there are six students pursuing research and diligently working towards their Ph.D degrees. The research laboratories are now equipped with state of the art instruments to give every advantage to the students and faculty pursuing research here.

The mission of the Materials Science department is two pronged: To innovate, design and develop novel multi-functional materials that have wide applications in various fields like catalysis, nanotechnology etc., and thus pave way for fruitful academic-industry partnership. The division is committed to train a number of doctoral students through a research program that promotes excellence and original thinking. The division also has interacted with many national academic research institutions through collaborations, educational training and other outreach activities

Academic and Research Highlights of the Division

The first year heralded the building of research groups and expertise in the chosen areas of the division. This year, the division members and students have made considerable progress in their respective areas. The Materials science division also strengthened industry-academic camaraderie by inviting companies such as Shel to the institute for mutually beneficial scientific interactions. Scientists from India and abroad presented many interesting and thought provoking invited talks in X-ray crystallography, solar cell research etc.

A one year industry project titled “Design and development of environmentally benign catalytic process hydrocarbon conversions” sponsored by GTC Technology, USA in collaboration with Süd-Chemie, India was successfully completed in January 2012. Funds for the first year of the DST project titled “Design and development of nanocrystalline layered bismuth compounds for photocatalytic degradation of dyes and organic pollutants in the visible region was released and the project officially initiated in January. A VGST sponsored project on "Development and characterization of polymeric membranes for use of pervaporation separation of ethanol-water mixture and their sugar

industrial applications" has started. Another project on designing eco-friendly solid catalyst for transformation of waste bio-glycerol into value added products such as glycerol carbonate, acrolein and acetins is under progress. Research on the Photoluminescence of two polymorphs of rare earth tungstates is nearing completion and paper writing for publication is in progress. Pore size engineering of zeolite catalysts for shape-selective organic transformations such as ethylation of ethylabenzene to form PDEB is another important project.

All the doctoral research students in the materials science division are now registered with Manipal University(MU)

and all the faculty members are recognized guides with MU. The students are now well into the second semester of their course work and would be completing their first year of research in a few months. The Doctoral advisory committee(DAC) for each student have met to assess the first six month progress in research and we are happy to say that the comments of the distinguished members of the DAC on the research problems has been very encouraging. The faculty and students of the Materials Science division have been working in tandem to greatly improve the research growth and output of the division.

For further details about the Materials Science Division please visit:
http://www.poornaprajna.org/materials.htm

Faculty Profile

Dr. A. B. Halgeri
Director, PPISR

Educational Qualifications

- Master's Degree in Chemistry from Karnataka University, Dharwar
- Ph.D fin Physical Chemistry (Heterogeneous Catalysis) from Bangalore University
- Post-Doctoral researcher under UNESCO fellowship on Zeolite Catalysis at Department of Tokyo institute of Technology

Broad Areas of research

Development and Commercialization of Zeolite based catalyst for xylene isomerization
Alkylation of Aromatics using modified Zeolites as Eco-friendly catalysts
Development of refroming catalysts for Gasoline and BTX production, paraffin dehydrogenation catalysts for Linear Alkyl Benzene (LAB) production. On returning back to India, he joined in a newly established Research Centre of Indian Petrochemicals Corporation Ltd (IPCL), Baroda – Gujarat in 1976. He was involved in the development and commercialization of Zeolite based catalyst for Xylene Isomerisation process in 1985, the first petrochemical catalyst developed in India. He was also associated in the development and manufacture of several petrochemical catalysts from concept to commercialization. He has provided leadership for the development of reforming catalysts for Gasoline & BTX production, paraffin dehydrogenation catalysts for Linear Alkyl Benzene (LAB) production (Raw material for soap manufacture), catalysts for purification of Hydrocarbons in PET plant, development of hydrogenation/dehydrogenation catalysts for petrochemical industry. All the above indigenously developed catalysts helped to put India in the world map of petrochemicals.

He has extensively worked on Alkylation of Aromatics using modified Zeolites as Eco-friendly catalysts. He has developed Zeolite based catalyst for Alkylation of Toluene to produce selectively para-Xylene which is raw material for polyester industry and transferred for the first time to advanced country to M/s. GTC Technology Inc. USA. Subsequently, super selective pore size engineered modified Zeolite catalyst has been successfully developed and commercialized for the manufacture of speciality chemical para-diethyl benzene (PDEB) of 10,000 MTS capacity plant at Reliance Petrochemicals Industry at Surat, Gujarat.

After the merger of Indian Petrochemical Corporation Ltd (IPCL) with Reliance Industry Ltd, he had provided sustained leadership as Vice President and Head of R&D, Baroda, led a team of 150 Scientists/Engineers and coordinated the entire research and development activities for Petrochemical/Refinery catalysts, Polymer Science and Technology, Materials Science and Applied Biology groups for all Reliance Industries at

different locations. He also worked as Senior Scientific Advisor at Reliance Research & Technology Centre at Navi-Mumbai.

Awards and Recognitions

In recognition of his outstanding contribution in the area of heterogeneous catalysis for three decades, he has received several National awards and Honors for his achievements in Chemical Technology.

1] I.C.I. India Ltd Award of Indian Institute of Chemical Engineers has been conferred to him for Excellence in process/Product development for para-diethyl benzene.

2] Hari Om Ashram Prerit- Prof.S.S. Bhatnagar Endowment Research Award for Excellence in Applied Catalysis.

3] Lifetime Achievement Award "**Eminent Scientist in Catalysis"** by the Catalysis Society of India, Indian Institute of Technology, Madras.

4] Elected as "**Fellow of Institute of Chemical Engineer**" by Indian Institute of Chemical Engineers, Kolkatta.

5] Vividhalaxshi Audyogik Samshodhan Vikas Kendra, Mumbai, **VASVIK** Industrial National Award in Chemical Sciences and Technology - 2005.

6] Prof. K.G. Naik Memorial Gold Award of M.S. University, Baroda – 2007 for outstanding achievements in Chemical Sciences.

7] Awarded as "**Pride citizen of Baroda**" in recognition of significant contribution for Science & Technology from Community Science Centre/Rotary Club of Baroda - 2008.

He has been advisory member of several professional bodies, Department of Science & Technology, CSIR, IOCL (R&D) and Reliance Industry. He has travelled widely and presented several invited lectures in both National and International symposia.

He has published over 105 Research papers in peer reviewed national and international journals and has obtained 35 Indian/International patents. He has been life member of many scientific and professional bodies both in India and abroad.

He is currently working as Director of Poornaprajna Institute of Scientific Research and coordinating the entire research activity in Theoretical Science in Physics, Mathematics, and also expanding to new areas Materials science & Biological Sciences. His area of interest includes Nano catalysis, Heterogeneous catalysis, mesoporous materials, novel Zeolites, Solid Acid Catalysts, Industrial Refinery/petrochemical processes, adsorption, Eco-friendly processes, and Biodiesel/Biofuel, alternate energy feed stocks etc.

Dr. A V Raghu
Assistant Professor

Educational and Professional Qualifications

- Ph. D. in polymer science, Karnatak University, Dharwad
- Lecturer, Centre of Excellence in Polymer Science, Karnatak University, Dharwad.
- Postdoctoral Scientist, Department of Chemistry, University of Ulsan, South Korea.
- Manager, Reliance Industries Limited, Mumbai, India

Broad Areas of Research

- Synthesis and characterization of various types of polymeric nanocomposite for PEMFC and Pervaporation separation applications;
- Synthesis of nanographene/GO based waterborne polyurethanes for electrostatic charge applications.
- Synthesis and characterization of Novel Polymers for various applications.

Synthesis and antibacterial study of some novel Indole derivaties.
Total no of publications in international journals: 28 (two communicated)

Participation in workshops, conferences and symposiums: 17

Awards and achievements

Member of International Scholarly Research Network (ISRN) Nanomaterials Editorial Board
Member of International Scholarly Research Network (ISRN) Polymer Sciences Editorial Board

Scientific reviewer (about 15 international Journals) ACS Nano, Journal of Polymer Science Polymer Chemistry Part A, Journal of Applied Polymer Science, Journal of Membrane Science, Carbohydrate Polymers, Polymer International, European Polymer Journal, Desalination, etc.,

SEED MONEY FOR YOUNG SCIENTIST 2011-12 award from VGST, Government of Karnataka

Membership of Professional bodies

Life Member of the Society for Polymer Science, Dharwad Chapter, INDIA

Establishment of laboratory in Center of Excellence in Polymer Science, Karnatak University

Resource person, Vision Group on Science and Technology, Department of IT, BT and Science & Technology, Government of Karnataka

Representative publications:

A.V. Raghu, H.M. Jeong, Y.R. Lee, C.M. Shin, "Preparation and Physical Properties of Waterborne Polyurethane/Functionalized Graphene Sheet Nanocomposites" **Macromol. Chem. Phys**, 209, 2008, 2487 - 2493.

A.V. Raghu,* G.S. Gadaginamath, H.M. Jeong, N.T. Mathew, S.B. Halligudi, T.M. Aminabhavi, "Synthesis and Characterization of Novel Schiff Base Polyurethanes". **J. Appl. Polym. Sci**., 113, 2009, 2747–2754.

N. D. Anh, Y.R. Lee, **A. V. Raghu,** H. M. Jeong, C.M. Shin, "Properties of waterborne polyurethane/functionalized graphene sheet nanocomposites prepared by an in situ method", **Polymer International**, 58, 2009, 412-417.

K.R. Reddy**,** H. M. Jeon**g,**Y. Le**e, A.V. Raghu**,* "Synthesis and Structural properties of MWCNTs-Core/Thiophene polymer-Sheath Composite Nanocables by a Cationic surfactant-Assisted Chemical Oxidative Polymerization" **J. Polym. Sci. Polym. Chem.,**48, 2010, 1477-1484**.**

P.V. Kulkarni, C.A. Roney, P. Antich. F. J. Bonte, **A.V. Raghu**, T. M. Aminabhavi, "Quinoline-n-Butylcyanoacrylate-based Nanoparticles for Brain Targeting for Diagnosis of Alzheimers Disease", **Wiley Interdisciplinary Reviews: Nanomedicine and Nanotechnology**, 2, 2010, 35-47.

N. D. Anh, **A. V. Raghu,** H. M. Jeong, C.M. Shin, "Properties of Thermoplastic polyurethane/functionalized graphene sheet nanocomposites prepared by an in situ method", **Polym. Polym. Compos**.18, 2010, 351-358.

Current Projects

Pervaporative dehydration of C1-C3 alcohols by using ZSM-5 loaded PVA and NaAlg membranes (Effect of Si/Al ratio).

Background: Pervaporation is a membrane based separation process which is considered to be an energy efficient alternative for separating liquid-liquid mixtures. In the present study we are preparing different ZSM-5 loaded PVA and Na-Alg membranes by incorporating ZSM-5 of five different Si/Al ratio's i.e., 38, 84, 187, 272, 408. These membranes will be tested for dehydration ability of different alcohols like methanol, ethanol, 1-propanol, 2-propanol. It is very interesting to note that by increasing the Si/Al ratio hydrophilicity decreases and by increasing the carbon chain attached to the alcohol its polarity decreases. The main aim of this study is to find a relation between Si/Al ratio of the filler and its ability to dehydrate alcohol-water binary mixture.

Graphene composite NaAlg membranes for Pervaporation dehydration of alcohols.

Graphene is the material which took research world by storm. We are interested in graphene filled materials for improving membrane quality, basically because of two reasons. Firstly due to high surface area of graphene even small quantity of material is enough to get desired changes. Secondly, because of its nano-size it creates a torturous pathway which allow passage of small molecules like water through it. The present research would involve physico-chemical analysis using sophisticated instruments and also the results will be discussed using suitable diffusion dased models.

An Alternative Energy: Development of Polymeric/ nanocomposite Proton Exchange Membrane for Fuel Cell Applications.

A new series of polymer ionomers containing functionalized graphene groups has been synthesized for the applications to polymer electrolyte fuel cells (PEFCs). The parent graphene were region selectively substituted with sulfonic acid groups to give the ionomers with the ion exchange capacity up to 2.0 mequiv/g. The resulting nano graphene based polymeric membranes gave a tough, flexible, ductile, and transparent membrane by casting from the solution. Thermal stability with decomposition temperature and glass transition temperature was confirmed for the ionomers membranes using TGA study. To study the stability to oxidation and hydrolysis as confirmed in the accelerated testing in hot Fenton's reagent or in the atmosphere at 140 °C and 100% relative humidity. The polymer modified graphene based nonocomposite can expected to exhibit better mechanical properties (lower elongation and higher strength) than those of pristine polymer. The gas (H_2 and O_2) permeation was compared with exiting Nafion 117 membrane.

The primary objective of this project will be to convert the proton exchange membrane system to a cost-effective commercial product for mass penetration into the energy market. Therefore, development of polymeric membranes for cost reduction will be given top priority. Once the cost requirements for the components and processes become suitable for commercializing as a product, the objective will be directed for scale up processes (2 kW, 5 kW etc.). Parallel studies may be required for performance and durability improvements.

Dr. Ganapati V. Shanbhag
Assistant Professor

Educational Qualifications

- M.Sc. in Chemistry (Specialization: Organic Chemistry), Karnatak University, Dharwad, 1999.
- Ph. D in Chemistry (Heterogeneous Catalysis) from University of Pune (Place of work: National Chemical Laboratory, Pune), 2008.
- Research Scientist (Post Doc), Dept. of Chemistry, Korea Advanced Institute of Science and technology (KAIST), Daejeon, Republic of Korea, 2008-2010.

Broad Areas of Research

1. Design and development of shape selective catalysts for commercially important organic transformations
2. Novel multifunctional materials and their catalytic applications
3. Studies on catalytic conversion of biomass and biorefinary byproducts into fuels and value added chemicals

Total no of publications in international journals: 19

Participation in workshops, conferences and symposiums: 10

Achievements

Successful completion of the 1st year **GTC project** in January 2012. Based on this performance the project was extended for one more year.
An Industrial collaborative project was sanctioned by **Shell technology Center,** Bangalore in March 2012.

Representative publications:

Sulfated zirconia; an efficient and reusable acid catalyst for the selective synthesis of 4-phenyl-1,3-dioxane by Prins cyclization of styrene, V.S. Marakatti, G.V. Shanbhag and A.B. Halgeri, Applied Catalysis A Journal (2012) In press.

Mesoporous sodalite: A novel stable solid catalyst for base catalyzed organic transformations, Ganapati V. Shanbhag, M. Choi, J. Kim and Ryong Ryoo, *Journal of Catalysis*, Volume 264, 2009, 88-92.

Chemoselective synthesis of β-amino acid derivatives by hydroamination of activated olefins using AlSBA-15 catalyst, G. V. Shanbhag, S.M. Kumbar and S.B. Halligudi, *Journal of Molecular Catalysis A: Chemical,* Volume 284(*1-2),* 2008, 16-23.

Heterogeneous intermolecular hydroamination of terminal alkynes with aromatic amines, Ganapati V. Shanbhag, S.M. Kumbar, T. Joseph and S.B. Halligudi , *Tetrahedron Letters, Volume 47 (2), 2006, 141-143.*

Research highlights

The Catalysis group at PPISR has expertise in pore size engineering of zeolites and other microporous materials for shape selective organic transformations and hydrothermal synthesis of zeolites and mesoporous Materials and their applications in green chemistry. The group is also working on designing eco-friendly solid catalysts for glycerol transformations to value-added products and biodiesel synthesis from transesterification of non-edible oils.The group especially working on designing new heterogeneous acid and base solid catalysts and their utilization in organic transformations such as Prins cyclization, Baeyer-Villiger reaction and photo catalysis.

Current projects

Design and development of a catalyst and process for selective methylation of toluene to produce *p*-xylene (Industrial Project sponsored by: GTC Technology, USA ($1, 20, 000/ Year)

A one year project sponsored by GTC Technology USA was successfully completed on 31st Jan 2012. The project focused on developing a novel catalyst for vapor phase toluene methylation by methanol to produce xylenes with high selectivity for *p*-xylene. Utilization of methanol towards xylenes was also an important factor while designing the catalysts. The challenge in this project was to get high selectivity for *p*-xylene, to reduce the methanol to olefins side reaction and to reduce the coke formation. The important outcomes of the project are as follows

1) A novel and stable catalyst was designed and developed for the toluene alkylation by methanol reaction. 2) As high as 97% selectivity for *p*-xylene was achieved 3) The developed process works with steam only as co-feed and expensive H_2 was totally avoided in the process. 4) Time on stream run of 600 hours was demonstrated without any catalyst deactivation. 5) High methanol utilization of ~ 70 % was achieved for this catalyst.

Utilization of chemicals from biorefinery: Conversion of bioglycerol to glycerol carbonate by carbonylation and transesterification reactions.

Synthesis of glycerol carbonate has been performed using dimethyl carbonate and ethylene carbonate by transesterification reaction using KF/Al_2O_3 as a catalyst. In this study, KF was impregnated on various supports like acidic Al_2O_3, SiO_2, amphoteric ZnO, and

ZrO_2 and a non oxide, activated carbon. The effect of KF loading with respect to various supports has been investigated and based on the activity, it is concluded that the support also plays a major role in this reaction. The formation of K_3AlF_6 phase, when KF reacts with Al_2O_3 plays a major role in high conversion of glycerol. The amount of KF depends on the monolayer volume on the support. KF content was optimized and the catalyst was characterized with various techniques such as XRD, FTIR, N_2 Sorption etc. Structure activity correlation is being established.

Sulfated zirconia- an efficient and reusable solid acid catalyst for selective synthesis of 4-phenyl-1, 3-dioxane by Prins reaction of styrene.

Prins reaction of styrene with paraformaldehyde is carried out over sulfated zirconia catalyst to produce selectively 4-phenyl-1,3-dioxane. The chemicals derived from Prins cyclization find their wide applications in organic process as solvents, protecting groups and an intermediate for the synthesis of target molecules in Pharmaceuticals. Especially 4-Phenyl-1, 3-dioxane obtained from Prins cyclization of styrene is applied in industry as high boiling solvent, plasticizer, curing agent, and pigment dispersant. Furthermore it employed in the production of plastic polymers as a monomer and additive. The sulfated zirconia catalysts were synthesized by precipitation method with different sulfur impregnation and characterized by the XRD, FTIR, elemental analysis, N_2 sorption, N_2 sorption etc. The physico-chemical properties of catalysts were correlated with activity and selectivity of Prins reaction. The performance of sulfated zirconia catalyst was superior when compared with other solid acid catalysts. The optimization conditions like sulfur loading, nature of solvent ,temperature ,catalyst amount , mole ratio of reactants and reusability of catalyst have been investigated. The sulfated zirconia catalyst synthesized by impregnating 2N sulfuric acid is found to be highly selective for the synthesis of 4-phenyl-1,3-dioxane(93%) with almost complete conversion of styrene (99.8%).The catalyst is recycled up to 4 cycle with minimal decrease in the yield of 4-phenyl-1,3-dioxane.

Pore engineering of ZSM-5 zeolite by phosphorous oxide modification for the shape selective synthesis of *p*-diethylbenzene (PDEB) by alkylation of ethylbenzene with ethanol.

PDEB is an important chemical used in the separation of *p*-xylene by PAREX process. ZSM-5 is a medium pore zeolite with pore size similar to the molecular size of PDEB. A novel modification of ZSM-5 is going on using phosphorous compounds to achieve high selectivity for PDEB. Catalysts with different P content were prepared and characterized with XRD, FTIR and ^{31}P MAS NMR and TPD of ammonia measurements. Preliminary studies indicated that shape selectivity improved with phosphorous modification and about 95% PDEB selectivity was achieved. Selectivity for PDEB improved further to 98% after doing silylation on P-modified ZSM-5 catalyst. Interestingly, ethyl benzene conversion also enhanced with P loading. Further studies are under progress.

Designing novel eco-friendly solid catalysts for the transformation of waste bioglycerol into value added products via esterification and dehydration reactions.

Glycerol is a waste byproduct of biodiesel synthesis by transesterification of vegetable oils. The project aims at converting glycerol into value added products. Glycerol dehydration reaction yields acrolein which is used in the production of acrylic acid esters, superabsorber polymers and detergents. Esterification of glycerol with acetic acid yields mono, di and tri acetins. The monoacetin and diacetin have applications in cryogenics and as raw material for the production of biodegradable polyesters while triacetin has applications going from cosmetics to fuel additive. Preliminary screening of different catalysts is under progress.

Dr. Nalini .G. Sundaram
Assistant Professor

Educational and Professional Qualifications

- Ph. D. in Solid State Chemistry, Indian Institute of Science, Bangalore, India
- *Post Doctoral Scholar*, University of California Santa Cruz, California, U.S.A
- *Post Doctoral Researcher***,** Los Alamos National Laboratory, New Mexico and Stanford Synchrotron Laboratory, Stanford, U.S.A

Awards and achievements

Recipient of the **Joshi award** for securing first rank in M.Sc. (Physical Chemistry)

Senior Research Fellowship from Council of Scientific and Industrial Research (CSIR) Government of India

Invited to interview for a post doctoral fellowship at the Los Alamos National Laboratory from India and eventually secured the position.

Awarded funds for the Project titled "Design and development of nanocrystalline layered bismuth compounds for photocatalytic degradation of dyes and organic pollutants in the visible region" by the DST under the ***Fast Track Proposals for Young Scientist*** scheme for three years 2011.

Membership of Professional bodies

Member of National crystallographic Association

Broad Areas of Research

1. Investigation of photoluminescent oxides for solid state lighting devices
2. Design of Ceramic Nanomaterial Photocatalysts for Degradation of Organic Dyes
3. Synthesis of Nanostructured perovskites for fabrication of Gas Sensors

Representative Publications

Jiang, F. Bridges, **N. Sundaram**, D.P. Belanger, I.E. Anderson, J.F. Mitchell, and H. Zheng Study of the local distortions of the perovskite system La1-xSrxCoO3 using the extended x-ray absorption fine structure technique, *Phys. Rev. B* ***80*****,** 144423 2009

N. Sundaram, Y. Jiang, I. E. Anderson, D. P. Belanger, C. H. Booth, F. Bridges, J. F. Mitchell, Th. Proffen and H. Zheng, Local Structure of La1-xSrxCoO3 determined from EXAFS and neutron PDF studies, *Physical Review Lett*ers, 2009, 102, 026401

Ombretta Masala; Darin Hoffman; **Nalini Sundaram**; Katharine Page; Thomas Proffen; Gavin Lawes; Ram Seshadri, Preparation of magnetic spinel ferrite core/shell nanoparticles: Soft ferrites on hard ferrites and vice versa, *Solid State Sciences v.8, No.9*, 1015-1022,2006

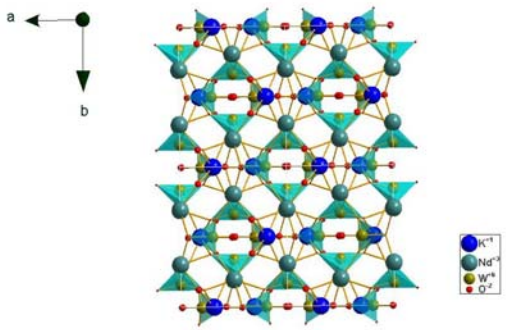
Research Highlights

Research in our group focuses on the synthesis and structure-property correlation of functional materials in micrometer as well as nanometer sizes. The bulk material is synthesized using conventional techniques such as the Ceramic method, while the nanomaterials are synthesized using a variety of techniques such as sol-gel method, hydrothermal methods, polymeric precursor methods etc.

Current Projects

Investigation of photoluminescent oxides for solid state lighting device

Synthesis of bulk and nano alkali metal rare earth doped tungstates is a hot area due to the applications of these nanophosphors in solid state lighting devices, LED's etc. For example doping of Nd in $KNdW_2O_8$ would give either enhanced red which is very useful for producing white light by coating on LED's. These materials are synthesized, characterized and a detailed structure-property study is carried using X-ray diffraction and Photoluminescene measurements. These results would help us in generation of more nanoparticles are can be developed into devices for efficient light usage



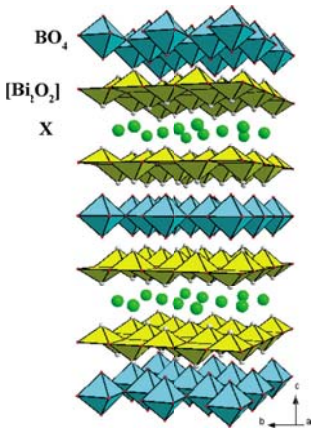
Synthesis and Characterization of Substituted Metal β- Diketonate to obtain Metal oxides for CVD process

A number of metal oxides have been examined as potential alternative gate dielectrics. $Ga_2O_3$and Cr_2O_3 has received a considerable amount of attention for alternative dielectrics due to their excellent thermal stability. The complexes of some metals (e.g. Chromium, gallium, indium etc), with β – diketonate as the homoleptic ligand, form an important class of precursors. $(Ga_xCr_{1-X})(acac)_3$ have been synthesized in this study by co-

synthesis, as opposed to co-crystallization. Single crystal studies of these complexes at low temperature (150 k) show a compositional phase transition from centrosymmetric and nonsymmetric space groups which could indicate the non-linear optical nature of these crystals. The structural elucidation is currently in progress.

Design of Ceramic Nanomaterial Photocatalysts for Degradation of Organic Dyes

Heterogeneous photocatalysis is regarded as one of the important methods to decompose harmful organic and inorganic pollutants. Bi-based ceramics have drawn attention for their potential application as novel photocatalysts owing to their unique layered structures and high chemical stabilities. Doping the perovskite layer with certain ions like Ti, W etc. is known to increase the photocatalytic activity. In our laboratory we synthesize both the bulk and nano powders of these Bi-ceramics such as Aurivillius phases and measure their photocatalytic activity on dyes such as methyl orange in visible and UV light. Detailed crystal structure and electronic structure analysis for these phases are also carried out which would give us insights for the generation of more efficient photocatalysts in this family.



Theoretical Sciences

Theoretical Sciences division was established in 2005, in terms of induction of its first member, Dr. Sujit Sarkar, though it was formally recognized as a Division, during the renewal of registration with Manipal University (MU), in May 2010, along with the Divisions for materials science and biological sciences. The Director, Prof. A. B. Halgeri and Prof. K. J. Rao of AMEF, suggested that scope of the Division should be made broad so as to include philosophical studies, apart from mainstream work in theoretical physics that was then pursued by the existing members, Dr. Sujit and Dr. R. Srikanth. By 2010, bright graduate students who were passionate for research in physics were interviewed, and accepted for the PhD program. As of now, Mr. Omkar registered for his PhD with MU in September 2011, and Mr. Aravinda in February, 2012. In early January, the scope of the Division was broadened to include Astronomy, when Dr. S. G. Bhargavi joined us as a faculty member.

The three broad areas are (a) quantum physics of many-body systems and condensed matter; (b) quantum information processing and the foundations of quantum mechanics; (c) Gamma ray burst and UV astronomy.

Specific problems pursued by the Division include (1) dynamics of entanglement in spin-chain systems; (b) quantum spin pumping and superconducting quantum dots; (c) basic two-fold classification of quantum cryptographic protocols in terms of whether or not security requires the use of non-orthogonal quantum states; device-independent quantum cryptography (d) unification of local and global aspects of quantum mechanics; (e) the science of free will and the problem of individuation of indistinguishable particles in quantum physics; (f) Multi wavelength studies of gamma-ray bursts, UV astronomy, optical spectroscopy of hard X-ray sources.

Researchers in the Division have published over 70 papers in prestigious international peer-reviewed journals over the last 7 years, presented various invited talks in India and abroad, served as referees and in editorial capacity for international journals of repute.

Both doctoral students in the Division have completed most of the required course work, and their first 6-month Doctoral advisory committee (DAC) meeting, comprising of distinguished researchers in the respective fields. It is a matter of pride for us that both students were adjudged to have made good progress in their work.

For further details of the department, please visit:
http://poornaprajna.org/theoretical.htm

Faculty Profile

Dr. Sujith Sarkar
Assistant Professor

Educational and Professional Qualifications

- Ph. D in Quantum Many Body Physics, Saha Institute of Nuclear Physics, India
- Post-Doctoral Experience, Department of Physics IISc ; Bar-Ialn University, Max-Planck Institute, Germany
- Guest Scientist at The Weizmann Institute of Science

Broad Areas of Research: Quantum Condensed Matter Problems in Many Body Systems.

1. Mesoscopic Physics, especially Superconducting Quantum Dot System.
2. Physics of Decoherence and Dissipation in Mesoscopic System.
3. Geometric Phase and Physics of Quantum Enatanglement in Quantum Many Body System.
4. Quantum Spin System and Linear Quenching.

Representative Publications:

Josephson relation in superconducting charge qubit lattice, Sujit Sarkar, Physical Review Letters (revised version, under appeal stage with Divisional Associate Editor).

Non-universal Tunneling Resistance at Quantum Critical Point of Mesoscopic SQUID Array, SujitSarkarJournal: International Journal of Mod. Phys. B 26, 1250099, (2012).

Josephson Decoupling Phase in Superconducting Qubit Lattice, Sujit Sarkar, Int. Jour. Mod. Phys. B 26, 1250108 (1012).

Quantum Field Theoretical Study of an Effective Spin Model in Coupled Optical Cavity Arrays, Sujit Sarkar Physica B 407, 44 (2012).

Current projects

Ground State and Thermal Entanglement in a Two Qubit Cavity Quantum Electrodynamics System

We study the ground state and thermal entanglement in a two-qubit cavity quantum electrodynamic system. We show that the ground state entanglement is independent of the inhomoginity of detuning field. Thermal entanglement at the fixed temperature can be enhanced when the intermediate interaction strength increases. At finite temperature detuning field play an important role.

Quantum Correlations for Two Superconducting Charge Qubit in Presence of Magnetic Flux

We are studying the quantum entanglement and quantum discord physics of two superconducting charge qubit. We have also considered the presence of magnetic flux in this system which yield important
Results. We will submit this research papers within two weeks.

Josephson relations in superconducting charge qubit lattice

In this study, Dr. Sujit found several Josephson relations for the superconducting charge qubit lattice. These relations are not the universal. He also consider the presence of magnetic flux for tuning the charge qubit lattice.

Quantum Correlations in Optical Lattice

Dr. sujit has studied quantum entanglement and quantum discord physics of a optical lattice system, in this collaborative research work. The progress of this work is positive and smooth.

Dr. R. Srikanth
Assistant Professor

Educational and Professional Qualifications

- Ph. D. in Solar Physics, Indian Institute of Astrophysics, Bangalore, India
- Research Associate, Center for Theoretical Studies, Bangalore, India
- Postdoc, Raman Research Institute, Bangalore, India

Awards and achievements

Visiting Scientist (2007 – , Raman Research Institute, Bangalore, India).
Invited as **Editor** to Quanta, a journal dedicated to the foundations of quantum mechanics (http://quanta.ws)
Joint organizer of the Nalanda Dialog on Science and Philosophy, organized every year in Nalanda Mahavihara, Nalanda (http://nalanda-dialogforum.org)
Referee for various prestigious international journals, including Quantum Information Processing, Europhysics Letters, Quanta.

Broad areas of research

1. Quantum information processing: effect of noise
2. Foundations of quantum mechanics
3. Quantum cryptography

Representative publications:

The quantum cryptographic switch, N. Srinatha, S. Omkar, **R. Srikanth**, S. Banerjee and A. Pathak, Accepted for publication in **Quantum Information Processing**.

Quantumness of noisy quantum walks: A comparison between measurement-induced disturbance and quantum discord, Balaji Rao, **R. Srikanth**, C. M. Chandrashekar and Subhashish Banerjee. Phys. Rev. A 83, 064302 (2011).

2N-qubit mirror states for optimal quantum communication, Sreraman Muralidharan, S. Karumanchi, Sakshi Jain, **R. Srikanth**, and Prasanta K. Panigrahi,, Euro. Phys. Jl. B 61, 757 (2011).

Quantumness in decoherent quantum walk using measurement-induced disturbance, **R.Srikanth**, Subhashish Banerjee, C. M. Chandrashekar, Physical Review A 81, 062123 (2010). arXiv:1005.0183.

Complementarity in atomic and oscillator systems, **R. Srikanth** and Subhashish Banerjee, Physics Letters A 374, 3147 (2010).

Research highlights

Our group currently focuses on the research studying the effect of noise on quantum systems, in particular dissipative and non-dissipative noise in one-qubit and two-qubit systems. In the foundations of quantum mechanics, we are exploring the possibility of unification of the local and global aspects of quantum mechanics, in specific, contextuality and nonlocality using diverse mathematical formalism. We are also interested in examining from a philosophical perspective, issues like identity and individuation of indistinguishable particles, nature of probability in quantum mechanics and scientific notion of free will. In cryptography, we are working on multiparticle generalization of orthogonal-state crypto-systems and device-independent quantum secret sharing.

Current Projects

The operator sum-difference representation for the two-qubit amplitude-damping channel

The derivation of the Kraus repesentation of a 2-qubit system interacting dissipatively with a vacuum bath is considered. On account of the Abel-Galois arithmetic no-go theorem for the solution of polynomials above quartic, the eigenvalue problem and the associated characteristic equation cannot be solved in general via radicals. We provide a way around this impasse by trying to construct Kraus operators for individual invariant subspaces of the evolution. The result is a complete set of `positive' and compensatory `negative' Kraus operators, whose number exceeds the sucient 16. The minimum output entropy and channel capacity of the 2-qubit amplitude-damping channel is studied and shown to depend on entangling capacity of the channel.

Towards a unification of local and global quantum mechanics

The nonclassicality of a theory, in particular quantum mechanics (QM), is described as the problem of whether there exists a joint probability distribution (JD) for random variables defined in the theory. The question of whether a conflict between the theory and JD involves a commitment to local-realism, noninvasive-realism or non-contextual realism is irrelevant to the formal notion of non-classicality. Indeed, the classical bound for a Bell-type inequality is the same irrespective of whether the experimental correlations pertain to the same or different particle, or come from joint measurement of commuting observables or sequential measurement of non-commuting ones. A nontrivial feature of QM, which we call universal non-classicality, is that the theory is non-classical under commitment to each of these three assumptions, underscoring the close connection between the local and global facets of QM. In particular, a local QM encompassing only two-level systems and no entanglement would be non-classical by virtue of the statistics derived from sequential measurements of non-commuting observables. Finally, we attribute the universality of quantum non-classicality to non-commutativity in the local sector.

Generalization of the Goldenberg-Vaidman QKD Protocol

The Goldenberg-Vaidman (GV) quantum key distribution (QKD) protocol, which uses orthogonal encoding states, works by restricting the class of operations available to an eavesdropper. We point out that its security arises ultimately from duality, whereas that of BB84-class protocols arises from Heisenberg uncertainty. We generalize the GV protocol to protocols based on encoding with multi-partite orthogonal states, by modifying existing schemes for quantum secure direct communication (QSDC). However, the method of timing the wavepackets, crucial to GV, is no longer needed, and is replaced with a procedure for re-ordering the particles. The security of the extended GV protocol is shown to arise from monogamy of entanglement, which may in this sense be regarded as generalizing duality. The tolerable error rate is determined under a simple single-qubit attack model.

The Biological Sciences

Driven by curiosity to understand Nature's ingenuity in creation, starting from simple atoms to the generation of molecules, assemblies and their controlled interaction culminating at continuously evolving creatures appears to be a never ending endeavour. We at the biological sciences division are striving to play our part towards this journey and our mission is to advance knowledge of basic biological sciences and apply research discoveries in ways that improve human health, protect environment and improve our economic status. We strive to fulfill our mission every day educating and preparing the next generation of scientists in biological sciences.

Biological Sciences division currently has core faculty working in frontier areas in mycology, protein chemistry, structural-biology, virology and stem cell research. The biological science division has research facility with more than 3000 sq. ft. of lab space is equipped with all facilities for microbial studies like isolation, identification of microorganisms, biochemical studies like anti-microbial assay and anti-oxidant assay systems. Plant and microbial secondary metabolites extraction systems such as Soxhlet extractor and rotary vacuum evaporator are available. Molecular biology facilities are also established for the cloning, recombinant expression, characterization and crystallization of key biomolecules. Facilities for virology and stem cell research will be built in due course.

Broad Areas of Research:

1. Endophytic fungi from medicinal plants and their secondary metabolites, bioactive compounds, enzymes from endophytic fungi.
2. Bioconjugation and PEGylation technology: Chemical modification of therapeutic proteins and drugs using linker chemistry and polyethylene glycol to enhance their activity and half-life.
3. Structure based functional characterization of key molecules of biological and medicinal importance.
4. De novo design of self-assembling proteinaceous materials exploiting intrinsically symmetric and stable protein motifs.
5. Study on cancer stem cells and on HIV/AIDS using immunodeficient mouse models.

The faculty members are recognized guides with Manipal University (MU) and the doctoral research students currently working at the biological science division are registered with MU. The students are now well into the second semester of their course work and would be completing their first year of research in a few months. The Doctoral advisory committee (DAC) for each student have met to assess the first six month progress in research and we are happy to say that the comments of the distinguished members of the DAC on the research problems has been very encouraging.

For further details of the department, please visit http://poornaprajna.org/biological.htm

Faculty Profile

Dr. Udupi A. Ramagopal
Ramalingaswami fellow (DBT)

Educational and Professional Qualifications

- Ph. D. in Biocrystallography, Indian Institute of Science, Bangalore, India
- Visiting Fellow, National Institute of Health, USA
- Senior Research Associate, Dept. of Biochem., AECM, USA
- Associate of Biochemistry (Faculty), AECM, USA
- Instructor, Albert Einstein College Of Medicine (AECM), USA
- Visiting Faculty, Albert Einstein College Of Medicine (AECM), USA

Awards and achievements

Ramalingswami fellow, DBT (2011 - current).

Visiting Fellow (2001 – 2003, NIH, USA).

Best thesis "**Kumari L. A. Meera Award and Gold Medal**", 2001, Indian Institute of Science, India.

Invited Instructor (from 2003-2010) at ***RapiData***, a comprehensive course offered at Brookhaven National Laboratory for budding crystallographers around the world (http://www.bnl.gov/rapidata/).

Proposal reviewer: Macromolecular Crystallography, APS, Argonne National Laboratory.

Served in the "User Executive Committee 2002-2003" of National Synchrotron Light Source, Brookhaven National Laboratory, USA.

Acknowledged in prestigious publications by various groups for initial phasing and structure solution of difficult structures.

Jeffery Award (poster award - IUCr 2002, co-author).

Contributed >**200** protein structures to World Wide Protein Data Bank (wwPDB).

Served as **referee** for International journals.

Invited Chief-Guest-Editor "Journal of Amino Acids" .

Membership of Professional bodies

Member of National crystallographic Association

Broad Areas of Research

1. Costimulatory molecules: Biology and therapeutic intervention.
2. Structural study of enolases.
3. Designing soft-smart materials with protein supramolecular assemblies

Representative Publications:

Samanta, D., **Ramagopal, U. A**., Nathenson, S. G., Almo, S. C. **2011**, *Structure of Nectin-2 reveals determinants of homophilic and heterophilic interactions that control cell-cell adhesion*. **Proc. Nat. Acad. Sci.** (USA). 108(33), 13682-13687

Samanta, D., Mukherjee, G., **Ramagopal, U. A**., Chaparro, R. J., Nathenson, S. G., DiLorenzo, T. P., Almo, S. C. **2011**, *Structural and functional characterization of single-chain peptide-MHC that modulate both naïve and activated CD8+ T cells*. **Proc. Nat. Acad. Sci.** (USA). 109(37), 14836-14840.

Chattopadyay, K., **Ramagopal, U. A.**, Brenowitz, M., Nathenson, S. G., Almo, S. C. **2008**. *Evolution of GITRL immune function: Murine GITRL exhibits previously unrecognized structural and biochemical properties within the TNF ligand superfamily.* **Proc. Nat. Acad. Sci.** (USA). 105(2), 635-640.
News:http://stke.sciencemag.org/cgi/content/abstract/sigtrans;1/3/ec30

Ramagopal, U. A., Thirumuruhan, RA., Fedorov, L., Dauter, Z., Almo, S.C. **2005**. *Radiation-induced site-specific damage of mercury derivatives: phasing and implications.* **Acta Cryst.** D61, 1289-1298.

Ramagopal, U. A., Dauter, M., Dauter, Z. **2003**. *Phasing on anomalous sulfurs: What is the limit?* **Acta Cryst.** D59, 1020-1027. NSLS Newsletter: http://www.nsls.bnl.gov/newsroom/publications/newsletters/2003/03-nov.pdf

Ramagopal, U. A., Ramakumar, S., Saha,l D., Chauhan, V. S. **2001**, *De novo design and characterization of an apolar helical hairpin peptide at atomic resolution: Compaction mediated by weak interactions.* **Proc. Nat. Acad. Sci.** (USA) 98(3): 870-874.

Research highlights

Our group currently focuses on the structure-function studies of molecules of biological and medicinal importance using techniques like crystallography, bioinformatics and various biochemical, biophysical techniques. These studies play an important role in understanding key biological processes at the molecular level that could lead to the development of novel therapeutics. We are also interested in *de novo* design of self-assembling proteinaceous materials exploiting intrinsically symmetric and stable protein motifs.

Current Projects

Structural study of two enolases: A putative glucarate dehydratase from *Acidaminococcus* and a D-glucarate dehydratase from *Pseudomonas mendociana.*

The Enolase superfamily consists of enzymes related by their ability to catalyze the abstraction of the α-proton of a carboxylic acid to form an enolic intermediate. Although each reaction catalyzed by these enzymes is initiated by this common step, their overall reactions as well as the stereochemical consequences of the *β*-elimination reactions are diverse. Glucarate hydratase is one such enzyme catalyzing the reaction **D-glucarate <-> 5-dehydro-4-deoxy-D-glucarate + H_2O** as part of metabolism of D-glucarate, a natural product that can serve as a growth substrate for a number of bacteria. We were able to solve two protein structures from this family. Both the structures have been successfully completed and deposited in the Protein Data Bank (PDB), with PDB id 4HN8 for the D-glucarate dehydratase from *Pseudomonas mendociana* and 4HRY for the putative glucarate dehydratase from *Acidaminococcus*, making them the first protein structures to be deposited from PPISR.

The structure based functional characterization of an unusual restriction endonuclease KpnI.

KpnI is a type-II Restriction-Modification (R-M) system originally isolated from the organism *Klebsiella pneumoniae* strain OK8. It recognizes the hexameric sequence GGTACC and catalyzes the hydrolysis of the phosphodiester bond between the two cytosines. The cognate methyltransferase methylates the N^6 position of the adenine in both strands using Adenosyl methionine as the cofactor. Both the enzymes function as dimers. *R.KpnI* has been widely used in molecular biology experiments. However, its structure, mode of DNA binding and the key interaction responsible for its mechanism of action are not well understood. We believe that the structure characterization of R.KpnI will help us to understand the mechanism of action and aid in the generation of mutants with altered specificity.

Structural mimicry of CTLA-4 lignad binding surface and moderate modification of B7 family of ligands (future project).

Costimulatory receptors and ligands are essential for both innate and adaptive immunity. Soluble versions of these receptors and their cognate ligands, as well as monoclonal antibodies targeted against these proteins, represent a major class of protein-therapeutics for the manipulation of immune responses to treat a wide range of infectious diseases, autoimmune diseases and malignancies. These efforts have already resulted in several proteinaceous therapeutic products, approved as biopharmaceuticals, mainly for cancer and autoimmune diseases. For example, Orencia (Abatacept) marketed by *Bristol-Mayer Squibb* is a fusion protein formed by the extracellular domain of CTLA-4 and the Fc region of immunoglobulins (Ig), known as CTLA-4-Ig is a drug for rheumatoid arthritis. A complimentary treatment is blocking CTLA-4 signaling using monoclonal antibodies to augment T cell mediated responses against tumors. Again, the recent FDA approval of CTLA-4 antibody known as MDX-010 and marketed as Yervoy suggest that controlling the response of these molecules is an effective strategy to control the immune response and hence to treat autoimmune diseases and cancer. We are interested in designing and characterization of peptide mimicking the ligand-binding surface of CTLA-4. Similarly, we also aim to modify the receptor-binding surface of B7 family members (receptors for CTLA-4 and CD28), which will also provide the mechanistic difference between the B7 isoforms and their role in immunological synapse.

Dr. Ananda K
Assistant Professor

Educational and Professional Qualifications

- M.Sc. in Biosciences, Mangalore University, Mangalagangotri, India
- Ph. D in Biosciences, Mangalore University, Mangalagangotri, India
- Research Associate, Institute of Wood Science and Technology, Bangalore, India
- Lecturer, P.A. College of Engineering, Mangalore, India
- Post-Doctoral Fellow**,** Albert Einstein College of Medicine, New York, U.S.A

Broad Areas of Research

1. Endophytic fungi from Medicinal plants and their secondary metabolites.
2. Bioconjugation and PEGylation of therapeutic proteins to improve their pharmacokinetics and pharmacodynamics.
3. Studies on Mangrove and Marine filamentous fungi.

Membership of Professional bodies

Life Member of Mycological Society of India, India

Recent Publications from the list of 21

Sathish L., Pavithra N and **Ananda K**. Antimicrobial Activity and Biodegrading Enzymes of Endophytic Fungi from *Eucalyptus*. *Int J Pharm Sci Res* 2012; Vol. 3(8): 2574-2584.

Pavithra, N., Sathish, L., **Ananda, K**. (2012) Antimicrobial and Enzyme Activity of Endophytic Fungi Isolated from Tulsi. *Journal of Pharmaceutical and Biomedical Sciences. 16 (12)*:1-6

Remadevi, O.K., Rao,K.S., **Ananda, K**., Veeranna,R., Tarakanadha, B., (2011) Status of insects and fungi intercepted from wood imported into India. J Indian Acad Wood Sci. 8(2):139–142

Ananda, K., Manjula, B. N., Meng, F., Acharya, V. N., Intaglietta, M., and Acharya, S. A. (2012) Packing Density of the PEG-Shell in PEG-Albumins: PEGylation Induced Viscosity and COP are Inverse Correlate of Packing Density. *Artif Cells Blood Substit Immobil Biotechnol*. 40(1-2):14-27.

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Research Highlight

Main focus of our group is on bioactive compounds of endophytic fungi isolated from medicinal plants. At present we are looking for antimicrobial compound from natural sources which can control most of the multidrug resistant pathogenic microorganisms. We are also interested to identify some antioxidant compounds of endophytic fungi isolated from these medicinal plants. The other aspect of our research is also to find out some anti-diabetic compound/s from the endophytic fungi. There are advantages of fungi over plants due to their fast growth and easy to harvest compounds of interest. The one more wing of our interests is on chemical modification of therapeutic proteins to improve their half life and pharmacokinetics. This field is yet to be initiated at PPISR.

Current Projects

Antimicrobial and anti oxidants of endophytic fungi from Medicinal plants

The present project is focusing on isolation of endophytic fungi from plants which are already been proven for medicinal values for the treatment of various diseases. We are isolating endophytic fungi from these plant and screen for anti microbial activity against various pathogenic microorganisms and also we study their anti oxidant properties. The active endophytic fungi which are showing preliminary activity will be further grown in large scale and extraction of secondary metabolites will be done. The secondary metabolites are further tested for the activity. Those fungi which posses' good anti-microbial activity and anti-oxidant properties will be identified based on molecular DNA technology. Secondary metabolites are further separated using various techniques by solvents and chromatography to get a pure compound. Finally, we check for the activity and characterize the compound for biophysical and biochemical parameters.

In this project we have already isolated more than 80 endophytic fungi and screened for their antimicrobial and antioxidant properties. Out of which about a dozen endophytic fungi were giving very good activities either again microbes or as antioxidant properties. We have grown them in large flasks (250 ml and 500 ml) for the extraction of secondary metabolites. Using the various solvents raging from low to high polarity were used for the extraction of the compounds. These extracts were dried in rotary vacuum evaporator and collected in a vials. The solid extracts were further dissolved using standard solvents and used for the test.

Anti-diabetic compounds of endophytic fungi from medicinal plants used for the treatment of diabetes.

There are hundreds of medicinal plants being used for the treatment of diabetes. In many cases herbal usage was done without knowing the active compound against diabetes. From the recent studies it is understood that these compounds are

either produced as plants secondary metabolites or by the endophytic fungi living inside these plants. The present project is focusing on the antidiabetic compounds from the endophytic fungi living inside the medicinal plants. We are isolating endophytic fungi from various antidiabetic medicinal plants and screening them for their activity against various inhibitors. Some endophytic fungi are showing positive for some kind of inhibitors which controls glucose production from parent molecules. Preliminary studies using plate methods and biochemical assays showed that there are some compounds which are inhibiting the activity of degradation of starch.

Those fungi which are showing positive for these inhibitors were grown in large 250 or 500 ml flasks in a broth for several days. The mycelia and broth were used for the secondary metabolite extraction using solvents. The solvent was evaporated to dryness using the rotary vacuum evaporator and remaining solid was weighed and used for test. Many of the fungi showed positive for the preliminary test were also showed positive in the second stage. These encouraging results are leading to further detailed study of these compounds by fractional purification and characterization.

Modification of Insulin molecule to improve its half life and other therapeutic properties.

Activated Polyethylene glycol (PEG) is an attractive non-protein polymer used for the conjugation of proteins or conjugated to a protein for surface decoration. The specific characteristics of PEG moieties such as water solubility, high mobility in solution, lack of toxicity and its nature to decrease or eliminates antigenicity by shielding the molecule are of very much relevant for pharmaceutical applications. More than these PEG molecules are known to increase circulatory half life by improving the hydrodynamic volume of the therapeutic protein. PEG is easily cleared from the body through kidney. The most important is that PEG's are approved by food and drug administration (FDA) for use as a vehicle or base in foods cosmetics and pharmaceuticals. The proposed project is to modify the insulin protein either conjugation to certain amount of PEG molecules or bioconjugation of insulin to the albumin or other proteins of interest. Modification of selected amino acids on the insulin protein is a challenging task without altering its activity and increasing the half life. Different conjugation chemistry will be applied to achieve this modification. After each modification the modified compound will be separated using column chromatography and will be analysed further for their physicochemical properties. Biophysical parameters such as alteration in native structure, site of modification and number of modifications, nature of chemical bonding can be analysed using various techniques. Functional activity can be analyzed using the in-vitro experiments and later in small animal models. The pharmaceutical improvement in insulin protein by these chemical modifications might increase half-life of insulin there by it will have biomedical application.

Academic Activities

Graduate Student Programmes

Since, May 2010, doctoral programmes in Theoretical physics, Materials Science and Biologial Science disciplines have been started at the research campus of PPISR. All the students are registered for their Ph. D programme with Manipal University. The first batch of students are expected to finish their work by end of 2013 and would be awarded the degree in the year 2014. The aim of this programme is to introduce and stimulate bright research scholars into carrying out cutting edge research in various areas of science so that their findings are published in many national and international journals and result in valuable patents. The vision is to conduct research in areas that are of direct relevance to today's society while keeping in mind the importance of basic sciences.

The response for this programme has been very good and at present there are 12 students residing and working at the research campus in various exciting research areas. The students have the opportunity to collaborate with many of the well known institutes like NCL Pune, IISc Bangalore, JNC and IIT's for their research. They are also given the opportunity to attend and present papers and posters at national seminars for open exchange of ideas.

Eligibility requirements of students to join the Doctoral Programmes:

Candidates who have scored first class in their M.Sc/integrated M.Sc degrees are eligible to apply. UGC-CSIR-NET/GATE/DBT-JRF cleared candidates and INSPIRE fellows are given preference. Candidates have to go through a rigorous interview process, where they are interviewd by a panel of experts from other sister institution in Bangalore to ascertain that their foundations in science are sound. Selected students admitted into PPISR receive a scholarships that is more than adequate to take care of their tuition and living expenses.

We belive that the research scholars who are registered for their Ph. D. should go through rigorous training activities such as presenting their findings in effective way, extensive literature survey and posses deep knowledge of current status of science in the area of interest and the project they are working. Towards this goal, students are required to give a talk almost every week in rotation. Also, they participate in arranging summer and winter schools for science graduate students, conduct hands-on sessions with advanced instruments.

They are also required to finish the course-work covering minimum ten credits. We also encourage selected graduate students from science collages to come and spend their holiday time in PPISR, where again, our research scholars spend their time on mentoring junior students together with faculty members. Following are the representative talks give by students and the list of sudents from other colleges who underwent training at PPISR.

In-house seminars by students

1. Ms. Pavitra N.
   "Production of Anti-diabetic Compounds by Endophytic Fungi Isolated from Medicinal Plants" Date: April 8, 2011

2. Mr. Janardhan H L
   "BIOMASS - The Future Source of Energy and Chemicals." Date: April 29, 2011.

3. Mr. Srinatha N.
   "Quantum Cryptography" Date: May 27, 2011

4. Mr. Srinidhiraghavan.
   " Amine Terminated PETIM dendrimer attached Silica back bone and their metal Scavenging studies Date: July 15, 2011

5. Mr. Omkar S.
   “Libertarian Free Will and Quantum Randomness” Date : August 05, 2011

6. Ms. Swetha BV
   " Eco friendly synthesis of BIODIESEL." Date: January 20, 2012.
7. Ms.Sapthami
   " Sol-gel Synthesis of nano materials." Date: January 20, 2012 20/01/2012.

8. Mr. Sanman
   "Solvothermal synthesis of nano materials." Date: January 20, 2012

9. Mr.Omkar S
   “Not completely positive maps and non-Markovianity in open quantum systems." Date: February 3, 2012

10. Mr. Srinidhi
    " Preparation & Optical properties of Highly crystalline , colloid , Size controlled Indium oxide Nanoparticles.” Date: February 17, 2012

11. Mr. Sathish L
    "Exploring Endophytic fungi for bioactive volatiles with potential for commercialization." Date: March 6, 2012

Student visitor from other institutes.

1 Mr. S.S. Poojary and Ms. S.K. Sapthami students of final year of MSc Industrial Chemistry, Kuvempu University, Shivamoga completed their project work entitled "Synthesis and Characterization of Novel Polyurethanes" under the guidance of Dr. A.V. Raghu.

2 Ms. D.D. Mamatha, Faculty, Dept. of Physics, MIT Manipal visited the Materials Science division in order to collect data at the X-ray diffraction facility for her thesis work.

3 The following external students have been working with Dr. R. Srikanth, funded either by RRI or an ***INSPIRE*** scholarship: Pavan Iyengar, Preeti Yadav, Ashima Arora, Siddhartha Das and Bangaru Sai.

4 Ms. Manasa Tantry, BSc student from Poornaprajna College Udupi, secured ***INSPIRE*** fellowship and initiated a project on "lignin degrading enzymes from endophytic fungi from medicinal plants", under the guidance of Dr. Ananda.

5 Ms. Anusha Achara BSc (***INSPIRE*** fellow) student from Poornaprajna College, Udupi, initiated her project work on "Photocatalytic test for degradation of dye by bismuth based layered materials" under the guidance of Dr. Nalini Sundaram.

6 Ms. Vibha Hande, a II PUC student from Poornaprajna PU college, Udupi is working at PPISR to get a hands on experience in research in biological sciences under the guidance of Dr. Ananda.

7 Mr. Amey Deorukhkar and Mr. Rahul Rajeev MSRIT, Bengaluru, carried out their two month BTech project work at PPISR under the guidance of Dr. Shanbhag and Dr. G.M. Madhu, MSRIT.

8 Mr. Satish Burla, M. Tech student from Gayatri Vidya Parishad College of Engineering, joined Dr. Shanbhag's group for **1 year M. Tech project** in Nov 2011.

9 Mamatha D Daivajna, Faculty Dept of Physics, MIT Manipal visited the Materials Science division in order to learn X-ray diffraction and collect data at the X-ray diffraction facility for her thesis work.

10 Preeti Yadav RRI, Bangalore; topic: exploring particle creation through breakdown in quantum correlations in early cosmological times; generalizing Goldenberg-Vaidman quantum cryptographic protocol.

11 Subrahmanya Hegde, Yuvraja College and RRI; topic: understanding quantum computational speed-up without reference to entanglement.

12 Himanshu Sharma, NSCB College, Delhi; topic, Gleason's theorem and the no-signaling principle.

13 Srinatha Narayanaswamy, Bangalore University; Quantum secret sharing; Sep 2010--Sep 2011.

14 Himanshu Sharma, NSCB College, Delhi; topic, the quantum frequency operator; Oct-Nov-2011.

15 Atul Mantri, IISER, Mohali; topic, structure of nonlocal boxes as a subset of signaling correlations; Sep-Oct 2011.

16 Balaji Rao, IISc, Bangalore; topic, quantum walks; Sep 2010 to Aug 2011.

17 Sameep Chandel, IISER, Mohali; topic, Quantum contextuality and nonlocality; Jan, 2011.

18 Chandan Kumar, IISER, Mohal; topic, Quantum contextuality and nonlocalit; Jan, 2011.

Events and Achievements

Academic achievements of faculty members and students are the integral part of any institute and are the yard-sticks to measure the quality of the progress. PPISR has made huge strides in establishing itself as a basic and applied research oriented institute. The students and faculty have attended many conferences, given many invited talks, written many projects to different agencies to obtain funds and also have quite a number of publications in many international peer reviewed journals. Details of the projects carried out at PPISR and representative publications are listed in the individual faculty profiles. In the following pages we provide some details of seminar/talks given by our faculty members and students, poster presentation in meetings and other academic and non-accademic achievements.

Achivements

1. Dr. Ramagopal received the prestigious Ramalingaswami Fellowship from Department of Biotechnology, India.
2. Dr. Raghu received award of SEED MONEY FOR YOUNG SCIENTIST 2011-12 From VGST, Government of Karnataka.

3. Dr. Prasad Koka new faculty at PPISR received the prestigious Ramalingaswami Fellowship from Department of Biotechnology, India.
4. Dr. Nalini Sundaram received the award and funds for the Project titled “Design and development of nanocrystalline layered bismuth compounds for photocatalytic degradation of dyes and organic pollutants in the visible region” by the DST under the ***Fast Track Proposals for Young Scientist*** scheme for three years.
5. Dr. A.V. Raghu was selected as Editor for IRNS Nanomaterial international journal.
6. Dr. Ramagopal was selected as an Editor for special issue on peptides in Journal of Amino Acids.
7. **Successful completion** of the 1st year **GTC project** in January 2012 by Dr. Shanbhag and Dr. Halgeri. Based on this performance the project was extended for one more year.
8. An industrial collaborative project was sanctioned to Dr. Halgeri and Dr. Shanbhag by **Shell Technology Center,** Bangalore in March 2012.
9. Mr. S. Aravinda acted as a respondent in chair in the conference "Perception, Individuation and Identity in Physics, Philosophy and Neuroscience" held at Nava Nalanda Mahavihara, Bihar, India on Jan 14th to17th January 2012.
10. Mrs. B.V. Swetha was awarded SRF for 3 years by CSIR, Govt. of India, New Delhi based on her project proposal based on the “Catalyst design for the synthesis of Biodiesel” in March 2012.

11. Mr. S. Aravinda, joined the PhD programme at PPISR *via* the ***INSPIRE*** scholarship, DST, INDIA. His work concerns the foundational concepts of quantum nonlocality and contextuality.

12. All the faculties are recognized as PhD guide (Aug. 2011) from Manipal University.
13. Ms. Swetha S. M. was awarded JRF fellowship of UGC, Govt. of India, New Delhi.
14. All the students presented their thesis-synopsis at Manipal University, Manipal starting November 2011 and were **successfully registered for their PhD** degree at Manipal University.

Scientific meetings, talks and posters

1. All the faculty members in the material science division were invited to give lectures in different areas of materials science/chemistry for FDP, VGST, Govt. of Karnataka, and UGC, refresher course for PU Lecturers, conducted by Bangalore University on March 27th 2012.
2. Dr. Nalini Sundaram and Dr. A.V. Raghu were invited by the The Microtron Advisory Committee (MAC), BRNS to present their respective research proposals on April 27th, 2012, at the Microtron Centre, Mangalore University.
3. Dr. Nalini Sundaram presented a talk on "Overview of Research in Structure-Property Correlations in Functional Nanomaterials " for the Founder's day held at PPISR, on July 7th 2011.
4. Dr. Nalini Sundaram participated in the International Conference on the Chemistry of the Organic Solid State (ICCOSS XX) held at the Indian Institute of Science from 25-30 June, 2011.
5. Dr. Nalini Sundaram delivered a lecture on "*Local Structure of* $La_{1-x}Sr_xCoO_3$ *Determined from Neutron Pair Distribution Function Studies* "at the one day seminar held in the SSCU, IISc, on 19th Dec 2011, on the occasion of 60th Birthday celebrations of Professor. T. N. Guru Row.
6. Dr. Raghu has been selected by VGST as a resource person in Chemistry and for the International Year of Chemistry,2011 he was invited to give talks in various educational institutions in Karnataka in the field of recent development in polymers and their nanocomposite applications.
7. Dr. A.B. Halgeri was invited to present a lecture on "Industrial Catalysis" at R & D centre, M/s. Shell Technologies and "Recent advances in catalysis and its application to chemical industries" at Corporate R & D Center at M/s. Hindustan Petrochemical Corporation Ltd.
8. Dr. A. B. Halgeri presented various lectures in the area of catalysis science and technology at RLS Institute of Science-Belgaum, KLE Society Nijalingappa College of science and arts, Siddaganga Institute of Technology, Tumkur, Karnataka University; Dharwar, Govt. College.
9. Dr. A. B. Halgeri chaired the Technical Session at the 64th National Congress of Institute of Chemical Engineers held at MSRIT on 28th December 2011.
10. Dr. Shanbhag participated in **CHEMCON-2011**, 64th international conference by Indian Institute of Chemical Engineers from December 27 to 29, 2011 in MSRIT, Bangalore.
11. Dr. A.B. Halgeri was invited to present a lecture at Hassan for the celebration of International Year of Chemistry, 2011 state-wise campaign organized by VGST.
12. Dr. A.B. Halgeri was invited as a Chief Guest for the Inaugural Function of Govt. Science College, Bangalore University.
13. Dr. R. Srikanth presented a talk titled "The world is not hard enough" on 24-26 March 2011, ICQOQC 2011, JIIT, Noida, Delhi

14. Dr. R. Srikanth was invited by Prof. Dipankar, Bose Institute, Kolkata, and Prof. Archan Majumdar, S. N. Bose National Center for Basic Sciences, during 9th to 15th March, 2012 for an academic visit for discussions with them. And presented a talk on the frequency operator in quantum mechanics.
15. Dr. R. Srikanth presented a talk titled "Born rule, the frequency operator and the infinite limit" -- 19--22 Dec ISCQI 2011, IOP, Bhubaneswar .
16. Dr. Sujit Sarkar presented an invited talk titled "Perfect Entanglement Transport in Quantum Spin Chain System" one in Center for Excellence at Basic Science, Mumbai and another one in S. N. Bose Institute Kolkata.
17. Dr. Sujit Sarkar gave an invited lecture titled "Perfect Entanglement Transport in Quantum Spin Chain System" in Taiwan.
18. Dr. Sujit Sarkar gave a talk on "Quantum Phase Transition of Light in Optical Cavitity QED" on 02/11/2011
19. Dr. Sujit Sarkar has visited Taiwan and presented three lectures.
20. Dr. S.G. Bhargavi, contributed three lectures in "The Galaxy and Galactic dynamics" as a part of astrophysics course for the REAP program of JN Planetarium during Feb-March 2012.3.
21. Dr. Bhargavi gave an Invited talk on "Search for the afterglows of Gamma Ray Bursts", at IIA Bangalore, in a conference to commemorate the silver jubilee of 2.34m Vainu Bappu Telescope on Aug. 10-11, 2011.
22. Dr. Bhargavi has been teaching quantum mechanics to BSc II year students under the REAP program of the Bangalore Planetarium. (Dr. Bhargavi…please check whether the information is correct)
23. Dr. Bhargavi, Participation in mini symposium on cosmology & Galaxies, Nov 28 2011, at IIA, Bangalore
24. Dr. Bhargavi presented a series on lectures under the REAP program at the Jawaharlal Nehru Planetarium, Bangalore.
25. Dr. Ananda, presented an oral presentation on Research paper entitled "Alpha Amylase Inhibitors from Endophytic Fungi Isolated from Medicinal Plants used for Diabetes" at the National Seminar on Fungi and Health Care from 6th & 7th Jan 2012, organized by Dept. of Botany of Mithibai College in association with the Mycological society of India, Mumbai, India.
26. Ms. N. Pavithra attended orientation programme on Good Laboratory Practices (GLP) organized by Regional Occupational Health Centre (NIOH-ICMR), Devanahalli, Bengaluru on 30-31 March 2012.
27. Ms. Swetha. B.V. and Vijay. M attended the 12th orientation programme in Catalysis Research held at IIT madras from 19th November to 6th December, 2011.
28. Swetha. S. M. Attended a workshop titled "Preschooling on Photocatalysis" held on 9-10th 0f December 2011 at IITM, Chennai.
29. Ms. Swetha B.V. **presented** the work as poster titled "Designing the bifunctional solid catalyst for the eco-friendly production of glycerol carbonate from glycerol-a waste biorefinery byproduct" in the aforementioned National symposium.
30. Swetha. S. M. presented talk titled "Synthesis and Crystal Structure of Rare Earth Tungstates for Application in Solid State Lighting Devices" at the conference "Recent trends in materials science and engineering" held on 29th-30th of September 2011 at RNSIT Bangalore.
31. Mr. Satish L and Ms. Pavithra N, attended and presented a poster at a National Symposium on "Emerging Trends in Biotechnology" from September 1st to September 2nd 2011, organized by Cochin University of Science and Technology, Cochin, Kerala.
32. Mr. Satish L and Ms. Pavithra N attended and presented posters in the National Conference on "Bio-Pharmaceuticals and Health-Care" held at Sir M Vishveswaraiah Institute of Technology, Bangalore on 4th and 5th November 2011.
33. Dr. Ramagopal and L. Sathish participated in International Conference on "Bengaluru INDIA BIO 2012" organized by Dept. of Science and Technology, Govt. of Karnataka and Vision group of Biotechnology held at The Lalit Ashok Bengaluru.
34. Dr. Ramagopal participated in "Bengaluru NANO 2011", organized by Dept. of Science and Technology, Govt. of Karnataka and Vision group of Biotechnology held at The Lalit Ashok Bengaluru.

Invited talks

Dr. Veda Ramaswamy, retired Scientist G from Chemical Physics laboratory, Central Leather Research Institute (CLRI), Chennai gave a talk on "**Structural studies of microporous, crystalline molecular sieves of MFI type by Powder X-ray diffraction under non-ambient conditions"** on 21st September 2011

Dr. Dr. K. S. Rane, former Head of Chemistry Department, Goa University was invited to PPISR and he gave a talk on **"Metal complexes as catalysts in enhancing oxygen scavenging action of hydrazine in boiler feed water"** on Monday i.e. October 10, 2011 at 12 p.m. in Bidalur campus.

Prof. Fun Hoong Kun, Professor, School of Physics, Universiti Sains Malaysia spoke on **"Structure determination of Natural products by X-ray"** on 15th December 2011

Prof. Prashant V. Kamat, John A. Zahm Professor of Science in the Department of Chemistry and Biochemistry and Radiation Laboratory and Concurrent Professor in the Department of Chemical and Bio molecular Engineering University of Notre Dame, Notre Dame USA. visited PPISR and delivered a lecture on **"Nanostructured assemblies and light energy conversion" and "Publish or perish-Increasing the impact of scientific research"**

Dr. Balachandra Hegde, Dept. of Biochemistry and Molecular Biology, Zilkha Neurogenetic Institute of University of Southern California, USA. Presented a talk on "Application of Electron Paramagnetic Resonance (EPR) in the Structural Study of Membrane Bound Proteins" on 25th May 2012.

Dr. G. Murali Dhar, Formerly, Director Grade Scientist, Indian Institute of Petroleum, Dehradun presently, Senior Professor at Chemical Engineering Dept. GVPCE, Visakhapatnam, visited PPISR on 7th June 2012 and delivered lecture on **"Nanostructured ordered Mesoporous Materials as Supports for Hydrotreating Applications."**

Sanjeev Maradur, Dept. of Chemistry and Biochemistry, Stephenson Life Sciences Research Center, University of Oklahoma, Norman, USA gave a talk on **"Carbon materials from biomass utilization and catalysis for biomass conversion/refinery"** on 14th May 2012.

Online lectures were conducted for PPISR students by **Dr. B. Vishwanathan,** NCCR, IIT Madras and topics covered during the online sessions are: **"Effect of nitrogen doping in TiO_2 for photo catalytic applications", "Chemical and electrochemical energy systems"** and **"Acidity and basicity of catalysts"**.

Collaborative visits

Visit by MRPL, Mangalore

Mangalore Refinery and Petrochemicals Ltd (MRPL) is a subsidiary of ONGC, Govt. of India. The Refinery has got facilities to process petroleum crudes of various API and with a high degree of

Automation. Mr. S. Ramesh, General Manager (QC and R & D) visited PPISR on 7th March 2012 and discussed the possibility of collaborative research and technical service.

Visit by a team from HPCL Corporate R&D Centre, Bangalore

Hindustan Petroleum Corporation Ltd (HPCL) is a premier Govt. of India Enterprise which operates two major refineries at Mumbai and Vishakapatnam producing a variety of petroleum fuels and specialties. HPCL is in the process of setting up its Corporate R & D Centre at Bengaluru with nine research laboratories including Crude Evaluation and Fuels, Hydro processing, FCC, Catalysis and Bio-processes. On 8th March 2012, four delegates including Dr. N. V. Choudary, General Manager (R & D), Mr. Sriganesh Gandham, Executive Director (R & D) visited PPISR, and showed interest in collaborating with PPISR. In connection to that HPCL team of Dr. P.V.C. Rao, (DGM, R & D), Dr. R. Ravishankar and Dr. K. Ramesh visited PPISR on 5th April and discussed with Catalysis group about a collaborative project in the area of catalysis.

GTC team visit

An industrial project sponsored by GTC technology, USA was initiated in Materials Science department in Feb 2011. This project is based on the design

and development of novel, eco-friendly solid catalyst for TM technology. For this project, a fully automated micro-reactor catalyst testing unit was procured and installed at the Institute during the first week of April. After 5 months of research work, the concerned scientists from GTC, USA, Süd-Chemie, Germany and SCIL visited PPISR during 22-25, June 2011.

Dr. ZhongYi (GTC), Dr. Köhler, Dr. Olivier (Süd-Chemie, Germany), Dr. Sabde (SCIL) and Dr. Prasad Rao (consultant to GTC) attended the 4 days meeting along with Dr. Halgeri and Dr. Shanbhag from PPISR. In addition to the research work, the matters related to filing of patent and FTO were also discussed. The members in the meeting expressed their full satisfaction over the progress made during the last 5 months.

Visit by a team from shell technology centre

Shell Technology Centre, Bangalore, a part of Royal Dutch Shell, is involved in R & D of upstream exploration and downstream chemical, gas and petroleum refinery operations, and bio fuels. A meeting was held on 1st December 2011 at PPISR for research collaboration to work in an area related to the Shell's interest. Dr. Laxmi Narasimhan, General Manger, R&D and **Dr. Madusudan Rao, Scientist, attended the meeting** on behalf of Shell India and all the members of Materials Science were present on behalf of PPISR. Later, PPISR team visited Shell Technology Centre, Bangalore to see their advanced research facilities in Catalysis.

Visit by a team from Axens, France.

Axens is a French company involved internationally in advanced technologies**,** catalysts, adsorbents and services to the refining, petrochemical, gas and alternative fuels industries. **Mr. Jean Sentenac,** Chair and CEO and **Mr Jean-Paul Margotin,** Managing Director**,** from Axens, France and Mr. Suresh, Chairman Axens India visited PPISR on 19th November 2011 and discussed about the possibility of a research collaboration

Visitors views

"PPISR is the "KOHINOOR" of the institutions of learning and teaching and Research in Materials Sciences, Life Sciences and Catalysts"

Dr. V. Prakash
Distinguished Scientist of CSIR CFTRI,
Former Director, Mysore

I am deeply impressed by the infrastructure, experimental facilities in the Institute. It is an ideal place to do creative research and development into industrial products.

Prof. K.C. Patil (Retd)
IPC, IISc, Bengaluru

Excellent environment and facilities for innovative research. Impressed on rightly motivated and young research staff. Thank you for invitation and wish you the best for future research.

Mr. S. Ramesh,
General Manager (QC, R & D)
MRPL, Mangalore

Impressed with the whole place, Laboratories, building architecture. The place is quite, away from the city, close to nature. Excellent work is being done at the centre is useful for mankind in line with the vision. Great experience visiting the institute and interacting with Dr. Halgeri and his colleagues.

Dr. N. V. Choudary
General Manager (R & D)
HPCL, Bengaluru

I was very much impressed with the enthusiasm of young scientists and the leadership role of Dr. Halgeri. I look forward to visiting you again. Enjoyed the wonderful hospitality. Best wishes for success in future.

Prof. Prashanth V. Kamath,
University of Notre Dame, USA

Beautiful serene atmosphere to do research. Labs are immaculate, good work in surface chemistry, Bio Sciences & polymer section. I wish bright future to all researchers.

Dr. S. Ananth Raj, Executive Secretary,
VGST, DST, Govt. of Karnataka,
Bengaluru.

PPISR is founded on a noble mission to propagate science for the total benefit of the community. This place has a wonderful setting to contemplate and do ver useful science including R & D. Very best wishes.

Dr. M A R Iyengar, Ex-BARC,
Environment consultant.

Awesome facilities in the most natural way. Conducive to research. Captures your mind. Also wonderful people. Thanks for your hospitality and all the best for future for getting to the top as a research institute

Dr. ASHUTHOSH PANDE, Texol
Engineering, Pune

Swamiji's Soul is vibrating. Scientists will feel it.

Dr. K S RANE, Co-ordinator, PG
Course, Rani Chennamma University,
Belgaum

Research Facilities

Poornaprajna Analytical Facility

PPISR has procured several analytical instruments that are vital for the faculty and students to pursue advanced research in basic and applied areas. The Analytical Facility has several instruments that are necessary for general analysis like Spectrometers and some specific for Materials Science users such as X-ray diffractometer, Conductivity Bridge, Gas Chromatograph etc. The instruments are available for use mainly by the scientists and the research students at PPSR and our collaborators. This facility is also extended to other interested external organizations, especially users from academic institutions for a nominal sum after appropriate review. Interested individuals can analyze their samples under the guidance of a PPISR member, or submit their sample for analysis.

The facility consists of several equipments such as:

1. **Atomic absorption spectrophotometer (AAS):** This instrument from Perkin-Elmer is used for the qualitative and quantitative determination of chemical elements employing the absorption of optical radiation (light) by free atoms in the gaseous state. In analytical chemistry the technique is a spectroanalytical procedure, used for determining the concentration of a particular element (the analyte) in a sample to be analyzed.. We are capable of elemental analysis of Iron, Copper, Silicon, Aluminum, Zinc, Calcium, Sodium, Phosphorous and Magnesium in water, soil and other raw materials by digesting in acids and aspiration in the AAS for elemental analysis.
2. **Fourier Transform Infrared Spectroscopy (FTIR):** The Instrument is from BRUKER with Attenuated Total Reflectance (ATR) facility by which solid (crystal, amorphous), liquid and gels samples can be analyzed. The pH range of the samples should be in between 4 and 8. The spectral range will be from 500 to 20000 /Cm with scan rate of 32. The major advantage of this instrument is samples can be analyzed without making pellets.
3. **Ultra Violet-Visible Spectroscopy (UV-VIS):** The instrument is from Perkin-Elmer and the lamp source used is deuterium lamp for UV region and tungsten halogen lamp for visible region. Both solid and liquid samples can be analyzed by UV-Vis. Solid samples are thin films, powder samples and the liquid sample are the microbiological medias and plant pigments etc. We can measure Absorbance, Transmittance, Diffused Reflectance for liquids and Absorbance, Transmittance for solids can be measured by UV-Vis spectrophotometer.
4. **Powder X-Ray Diffractometer (PXRD):** The D2 PHASER " table top X-ray Powder Diffractometer from Bruker is equipped with a ceramic sealed X-ray tube (Cu Kα source) and Ni filter and is ideal for qualitative, quantitative and structure analysis of polycrystalline samples. It is also outfitted with the LYNX-EYE(TM) 1-D Solid State Fast Detector to collect high quality data in the range 3-90 degrees in 2θ with unprecedented speed and 150 times

faster than a conventional detector system. The X-ray diffraction data can be collected for organic, inorganic, polymer and other solid samples in powder form.

Other Facilities

Institute is also equipped with emergency generators (2 generators, 50Kev and 25 Kev) to power the campus, including student and faculty apartments. Additionally, experimental labs are supported by separate UPS-systems. A dedicated tower maintained by Tulip Telecom connects the campus to the world through a dedicated unlimited download link. Thirty desktops/servers and two super-computers used for intensive calculations are also a part of the common facility provided by the institute for scientists.

In addition to the above mentioned Analytical Facility, there are also several sophisticated equipment used by each division according to their needs.

The Biological Sciences division is set up in more than 3000 sq. ft lab space equipped with advanced instruments for research in molecular biology, microbiology and crystallography. Major instruments include PCR machine, shaker incubator, phase contrast microscope with attached camera, laminar air flow system, -20°C freezer, nitrogen storage dewars, hot air oven, BOD incubators, autoclave, pH and conductivity meter, magnetic stirrer, gel electrophoresis systems, state-of-the art protein crystallization tools and kits and other minor instruments required for everyday laboratory use. In addition to these we also house a powerful computer installed with all crystallography software required for macromolecular crystallography.

The Materials Science division has a well developed, large laboratory which houses furnaces, ovens, a high precision electronic balance, autoclaves, syringe pumps, heating mantles, stirrers and other basic apparatus/ glassware for materials synthesis. In addition to basic synthesis lab, it is also houses the catalytic reactor where gram level catalysis testing is undertaken. A Gas chromatorgraph is also available for analyzing the products of any reaction.

The Theoretical Sciences division has sufficient computational facilities for theoretical calculations. The division is equipped with two **Supercomputers** with Intel Xeon 8 core machines with 32 GB RAM each. These are also outfitted with multi-core DDR3 based powerful Nvidia GPU's for CUDA computing

Library

PPISR has a well-maintained library of over 1000 books spanning Maths, Physics, Chemistry, Biology, Materials Science and other inter-disciplinary subjects. It is open all 24 hours for reference. Apart from books with scientific and technical content, it houses books of general interest, magazines and daily newspapers. The library also contains a reasonably good collection of Indian and international journals in print and a reasonably large collection of e-journals.

Campus Life

The campus

The bidalur campus houses hostel rooms for students and faculty apartments facing the beautiful view of famous **Nandi-hills**.

Graduate students who are selected for the doctoral course are encouraged to stay in campus and provided ample and comfortable hostel facilities. Each furnished two-bedroom apartment with a large living area and kitchen is shared by two research scholars.

Various kinds of recreational activities are organized in the PPISR campus to relieve the students from the monotony of day-to-day research studies. Since PPISR is situated in the outskirts of Bangalore, the greenery and clear air, untainted by the hustle and bustle of the city, is a nature lover's paradise. It is a pleasure to witness the sunrise every day while exercising, jogging etc in the campus. The research students have started a "Poornaprajna Badminton club" which operates between 6-8 am.

After a full day's work, students also play cricket in quadrangle in front of the main building between 5-6:30 pm. This helps them relieve the stress and tensions of the day. For students interested in Indoor activities, Table Tennis (TT) , Carom, chess games are ideal and provided. Every fortnight movies in various languages are screened in the auditorium; initiative for screening these movies is taken by a couple of students.

A tree of remembrance

The beautiful campus away from the busy life of Bengaluru city is a free resort for students and faculty. The visitors to the campus are requested to plant a tree of remembrance. We believe that this tradition not only keeps the memory of a visitor but also make our campus more greener.

Outreach Activities

PPISR also strives to conduct outreach activities. High School of Bidalur village visited the institute to know more about the research activities here. In this context, the students were given a tour of the research equipments available at the institute and the research fellows explained the applications of each instrument for research. The head of the institute expressed his heartfelt gratitude for allowing the student to get a glimpse of research activities at PPISR. At the end of the visit, the Director and other faculty members addressed the students and urged them to take up research in sciences as their future career

problems related to gynecology and diabetics were undertaken. More than 200 people including students were benefited in this camp and free medicines, spectacles were provided to the participants on this occasion. PPEC, Sadashivnagar donated notebooks, textbooks, pens, bags and clothes to the school children.

Medical Camp

Rural Service Trust of Admar Mutt, Udupi, in association with PPISR on Sunday, 29th January 2012, organized medical Check-Up Camp. Seven eminent doctors from Columbia Asia Hospital and other Hospitals from different disciplines offered a free medical service. The camp helps an awareness programme on health and hygiene for the villagers of Bidalur. Medical Check-Up like dental, general

Scientific Review Meeting

A one-day Scientific Research Review Meeting for PhD scholars from our institute and elsewhere, in association with Luminescence Society of India, Karnataka Chapter (LSIKC), Bengaluru, was conducted at PPISR, on 3rd March 2012. The main objectives of this programme were to bring together *research scholars* from different

institutions to acquire knowledge on recent advances in materials science. Dr. A.B. Halgeri, PPISR, Dr. K.G. Satyanarayana, and Prof. Y.S Bhat, BIT, Bengaluru, chaired different sessions of this programme. Ten PhD registered candidates presented their progress research work and also visited the laboratories at PPISR

Summer and Winter Schools

A Summer School for science students of Poornaprajna College, Udupi was held at the PPISR Bidalur campus, Devanahalli from May 29, 2011 to June 2, 2011 in Chemistry and Physics and from June 5 , 2011 to June 9, 2011 in Chemistry and Biological Sciences. The objective of this Workshop was to create the awareness among the students about the recent advances in Physics, Chemistry and Biological Sciences through lectures from our Faculty Members. Also, we had practical sessions on various sophisticated instruments. Similarly a winter school was held during November 13th to November 17th and November 29th to December 3rd. These are part of the outreach programmes of PPISR.

A batch of winter school-2011 held from November 13th to November 17th, 2011. Inauguration of the winter school held on November 13th and Dr. Dr. S K Srivatsa M D, Brain Stars Academy, Bangalore gave an inaugural talk which created many ideas in students regarding solving the problems in their life. Followed by there were eight lectures in various fields of theoretical sciences on 13th and 14th November, 2011. Most important topics covered to be mentioned are Quantum information theory and quantum computation, Mesoscopic Physics at Nanoscale, Survey of astronomy, Astronomical facilities in India, Introduction to quantum cryptography, Nano Electronics fabrication and characterization, Introduction to quantum formalism. Chemistry lecture topics were on Alternative Energy Fuel Cell & their applications , Introduction to Catalysis, Nano material's , Characterization of Materials and Combustion synthesis, Biomass-Future of Energy and Chemicals, Characterization Techniques used for different instruments, Polymeric membranes for pervaporation separation application and Synthetic methodology of material design. Practical session was conducted every day after noon where our research scholars trained everyone to have hands on experience on various instruments. Dr. Nagabhushana, Professor, Department of Chemistry, MSRIT, Bangalore was the chief guest for the valedictory function. He was accompanied by Dr. M.A.R. Iyengar and Dr. B. A. Patil.

Second batch of winter school was conducted from November 29th to December 3rd, 2011. Dr. Vijayan from Indian Institute of Science inaugurated the winter school and inspired students by giving examples of many leading scientists and their achievements in the field of chemistry and biology. Followed by his talk there were lectures in biological sciences and Chemistry.

In biological sciences most of the topics covered were on Form and Function in Proteins; T-cell co-stimulation from structural perspective; Endophytic fungi from Medicinal plants :their secondary metabolites and enzymes; PEGylation and conjugation of therapeutic proteins; Pro-biotic in human Health; Genetic, cytogenetic, biochemical and toxicological studies of insecticide resistance in mosquito vectors; Diabetes : Insulin pathways and control of disease; An Introduction to Human Cytogenetics etc.

The lectures in chemistry were the same as for the previous batch. Biology practical's included hands on experience especially in the field of microbiology, crystallography, genetics and microscopy. The students also enjoyed a visit to the research laboratory of Indian Council of Medical Research. On the last day of the winter school an interactive session with faculty and the participating students was arranged, where the students raised a number of questions in an informal setting about the program and were motivated to take a research career in their future.

Faculty Development Programme

A three day Faculty Development Programme (FDP) for Under Graduate Lecturers titled *"**FRONTIER ARES IN CHEMISTRY**"* held at the PPISR, in association with Vision Group on Science and Technology (VGST), Govt. of Karnataka, from 7th to 9th February, 2012.

The main objective of this programme is to educate faculty of undergraduate colleges about the frontier areas in chemistry. The FDP covered the recent development in areas such as Catalysis, Polymer Science and Nano-material. The chief guest Dr. V. Prakash Distinguished Scientist of CSIR, Former Director, CFTRI, Mysore, in his inaugural talk highlighted that herbal knowledge is a very ancient and traditional science and can be used for prevention of diseases on food based approach. Dr. S. Ananthraj, Executive Secretary, VGST, briefed the participants about vision group activities and explained the VISION group's role in improving science education and research in the Karnataka state. Eminent scientist from Indian Institute of Science and other prestigious institutions presented their talk on topic like A journey through industrial catalytic processes/ Solid acid catalysed reaction under microwave irradiation/ Eco-friendly solid catalysts for the conversion of biomass to energy and chemicals/ Futuristic polymer materials/ Composite polymers/ Industrial polymers and their applications to the chemical industry/Combustion synthesis of nanomaterials/ Bio-inspired nanomaterials/ Photo-luminescent quantum dots. Meanwhile, all the participants were given hands-on experience on various instruments at PPISR like GC, Catalytic Reactor, XRD, ABS, FTIR, UV, Pervaporation separation, etc. The participants showed appreciation for the efforts taken by VGST, GOK and PPISR in conducting such FDP.