

# SAHAYOG



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## UGC-DAE CSR Kalpakkam Node

UGC-DAE CSR and IGCAR Kalpakkam have been collaborating for a long time in the area of the Physical Sciences i.e in the field of Materials Sciences that include accelerator based materials research, studies on the physical properties of materials under extreme conditions of temperature, pressure and magnetic fields, and studies on defects in materials. Several research scholars from the university system have benefited from this collaboration. Encouraged by this success, this collaboration is being enhanced and will also include Engineering and Chemical Sciences, in which IGCAR has a strong presence and interest. This enhanced collaboration between IGCAR and UGC-DAE CSR has been formalized with the creation of a **UGC-DAE CSR Node at Kalpakkam** with the signing of MoU between UGC-DAE CSR and IGCAR Kalpakkam on January 16, 2007. The facilities created at this node will be accessible to the scientific community through the usual procedure of project proposal and peer review processes of UGC-DAE CSR.



The UGC-DAE CSR building consists of Physical, Engineering and central wings and the construction, which commenced in April 2009, was completed in April 2011. **The building was inaugurated by Dr. S. Banerjee, Chairman, AEC & Secretary, DAE on April 28, 2011.** Dr. Baldev Raj, Director, IGCAR and Prof. Ajay Gupta, Centre Director, UGC-DAE CSR, Indore Centre and other senior scientists from IGCAR as well as research students participated in the inaugural function. With the completion of the main wings of the building and arrival of instruments, scientific activities at the node have begun.



*UGC-DAE CSR, Kalpakkam Node consisting of Physical sciences wing (left), Engineering sciences wing (right) and Central wing (centre).*



*A section of the audience during the inaugural function*

## Equipment installation:

Advanced experimental facilities towards material synthesis and characterization have been installed at the Kalpakkam Node progressively from October 2010 onwards. These include Infrared float zone single Crystal Growth Furnace(M/S Crystal Systems, Japan, Model FZ-T-4000-H), Field Emission SEM (M/S Zeiss, Germany, Model-Supra 55), Field Emission TEM(M/S Zeiss, Germany, Model – Libra Model 200), Glancing Incidence X-ray diffraction (from M/S Bruker, Germany, Model – D8 Discover), High energy Ball Milling (M/S ZOZ GmbH, Germany, Model- Simolayer CM01), Ball Indentation (M/S Advanced Technology Corp, USA, Model- SSM-B4000) and Small Punch Creep (M/S Moritani Singapore Pte Ltd, Model-SERT-01C) which have been installed in Physical and Engineering science wings. The instruments are operational for regular use by University faculty/students. Apart from these facilities, it is planned to install Hot Isostatic Press (HIP) and related sample preparation facilities in due course of time.

## Collaborative research:

Based on the advanced experimental facilities envisaged as well as already installed, collaborative research with academic institutes is being pursued actively at Kalpakkam Node. During 2009-'10, a total of seven proposals were sanctioned under the collaborative research proposal scheme (CRS) of the UGC-DAE CSR - four of them in Physical sciences and three in Engineering sciences. Seven JRFs have been recruited in all these sanctioned proposals. A total of thirteen papers have been published and a few are under review.

In response to this year's call for CRS given in March 2011, forty four proposals were received in total in Physical, Chemical and Engineering sciences. These were screened and twenty two proposals were shortlisted. The project investigators (PIs) were invited to make a presentation before the Expert committee of the Node during July 7-8, 2011 at Kalpakkam. Of the twenty two proposals, the following sixteen CRS proposals were finally selected and approved for grant by the expert committee. Sanction letters were dispatched to the respective PIs in August 2011 to undertake the collaborative research. The following table provides details of these CRS.

S. N	P.I. Name & Institute	Title	Collaborator	Remarks
1.	Prof. V. Srinivas IIT Madras, Chennai	Studies on giant electrical transport anomalies induced by magnetic instability in Fe-rich intermetallics	Dr. A. Bharathi, IGCAR	Sanctioned with student support and consumables.
2.	Dr K. Suresh Babu Pondicherry University, Pondicherry	Engineering, Mechanical and Electrical Properties of Nanostructured Rare Earth Oxide Thin Films	Dr. R. Ramaseshan, IGCAR	Sanctioned with student support and consumables.
3.	Dr P. Thangadurai Pondicherry University, Pondicherry	Correlation of electrical properties with microstructure of nanostructured oxide materials	Dr. B. K. Panigrahi, IGCAR	Sanctioned with student support and consumables.
4.	Dr. R. Nirmala IIT Madras, Chennai	Studies of size effect on the physical properties of phase separated electron doped manganites and other novel oxide	Dr. T. Geethakumary, IGCAR	Sanctioned with student support and consumables.
5.	Dr. Sujoy Kar IIT Kharagpur	Phase transformation study in Boron added P91 alloy for steam generator application	Dr. C. Das/Dr. A.K. Bhaduri, IGCAR	Sanctioned with student support and consumables.
6.	Dr. S. Kaleemulla VIT University, Vellore	Investigations for Room temperature ferromagnetism in Cr, Fe, Ni and Cu-doped In <sub>2</sub> O <sub>3</sub> thin films for spintronic applications	Dr. G. Amarendra, IGCAR	Sanctioned with student support and consumables.
7.	Prof. V. S. Chakravarthy IIT Madras, Chennai	Investigating the neural substrates of motor preparation using high-density Electroencephalogram and Magnetoencephalogram	Shri M.P. Janwadkar, IGCAR	Sanctioned with student support and consumables.

8.	Prof. Thomas Muthaiah Bhartidasan University, Trichy	Synthesis, supramolecular interactions and properties of Uranyl complexes	Dr. K. A. Venkatesan, IGCAR	Sanctioned with student support and consumables.
9.	Dr. J. Jayapriya Anna University, Chennai	Detection and analysis of microbiologically influenced corrosion on stainless steel in seawater using electrochemical noise technique (EN)	Dr. U. Kamachi Mudali, IGCAR, Kalpakkam	Sanctioned with student support and consumables.
10.	Dr. N. Ponpandian Bharathiar University, Coimbatore	Ion beam synthesis and characterization of nanocomposite exchange spring magnets	Dr. S. Amrithapandian, IGCAR	Sanctioned with student support and consumables.
11.	Dr. Basavaraj Angadi Bangalore University, Bangalore	Synthesis and studies on magnetic properties of doped Zinc Oxide nano powders and thin films	Dr. K.G.M. Nair, IGCAR	Sanctioned with student support and consumables.
12.	Prof. M. Venkataramanaiah Sri Sathya Sai Institute of Higher Learning, Prasanthinilayam	Studies on thermoelectric performance of nanostructured Bismuth Telluride and Lead Telluride nanocomposites grown via novel solvothermal nano-plating technique	Dr. B.K. Panigrahi, IGCAR	Sanctioned with student support and consumables.
13.	Prof. A. R. Ballal Dept. of Metallurgical & Materials Engg., V.N.I.T., Nagpur	Characterization of tensile and fracture properties of Grade 92 steel using ball indentation technique	Dr. M. D. Mathew, IGCAR	Sanctioned with student support and consumables.
14.	Dr. Dilip R. Peshwe Dept. of Metallurgical & Materials Engg., V.N.I.T., Nagpur	Characterization of creep properties of Grade 92 steel using small punch creep testing method	Dr. M. D. Mathew, IGCAR	Sanctioned with student support and consumables.
15.	Dr. Mary George Stella Maris College, Chennai	Synthesis and humidity sensing properties of nanocomposites of lanthanum mixed metal oxide	Dr. G. Amarendra, IGCAR	Only consumables and the use of UGC facilities
16.	Dr. K. R. Balasubramanian NIT Tiruchirappalli	Modeling a A-TIG welding of austenitic stainless steels and prediction of residual stresses	Dr. M. Vasudevan, IGCAR	Sanctioned with student support and consumables.

Encouraged by the overwhelming response to collaborative research with universities, it is planned to gradually increase the students' strength to over 100 in the next five years.

### **Manpower Addition:**

Three Scientists (D), Dr. G.M. Bhalerao, Dr. Sujoy Chakravarty, Dr. Shamima Hussain have joined at the Kalpakkam Node of UGC-DAE CSR in October/November 2010. They have been provided with accommodation within the DAE township. They have also been extended Library and CHSS facilities. Dr. G.M. Bhalerao is in-charge of the TEM, Dr. Sujoy Chakravarty is in-charge of the GIXRD and Dr. Shamima Hussain is in-charge of the FESEM and material synthesis facilities.

### **Chemical Sciences wing construction:**

Construction activity for the chemical sciences wing laboratories has commenced and it is expected that it will be functional in the first quarter of 2012. Advanced chemical facilities such as X-ray photoelectron spectroscopy (XPS) and Nuclear Magnetic Resonance Spectroscopy (NMR) are planned to be installed in due course of time.

*G. Amarendra (ga@csr.res.in)*

## **New High Energy Planetary Ball Mill (HEPBM)**

A “High Energy Planetary Ball Mill (HEPBM)” with two grinding stations for simultaneous grinding / milling of two samples has been procured and installed at the Mumbai Centre.

The grinding jars of the HEPBM are arranged eccentrically on the sun wheel (main disk wheel). The direction of movement of the sun wheel is opposite to that of the grinding jars in the ratio 1:2 thus, the grinding balls are subjected to superimposed rotational movements in the grinding jars. The difference in speeds between the balls and grinding jars produces an interaction between frictional and impact forces, which releases high dynamic energies. The interplay between these forces produces the high and very effective degree of size reduction. The dual jar HEPBM offers a higher safety features and convenience of operation using a programmable interface.

Two different sets of jars and balls have been procured, that is zirconium oxide and tungsten carbide. Two 25 ml jars of ZrO<sub>2</sub> and WC along with 3 and 10 mm diameter balls of ZrO<sub>2</sub> and WC for grinding / milling purposes. The choice of feed material determines the usage of type of jar and balls. Each jar can take an initial 10 ml of feed (to be grinded) material. The maximum speed of the main disk is 650 rpm, which translates to 1300 rpm for the jars.

*V. Siruguri (vsiruguri@csr.res.in)*

## **National Workshop on “Science with ECR based keV ion beams**

A thematic workshop on science with ECR based keV ion beams was organized jointly by UGC-DAE CSR, Kolkata Centre and VECC, Kolkata during January 20-21, 2011. The aim of this workshop was to identify the research areas of overlapping interest so that collaborative research proposals from universities and other institutions may be initiated. The workshop was attended by about 70 participants from various universities and research institutions. Experts in this area from IUAC, New Delhi, IOP, Bhubaneswar, TIFR, Bombay, IGCAR, Kalpakkam, Utkal University, UGC-DAE CSR Indore Centre, IACS, Kolkata SINP, Kolkata and VECC, Kolkata presented the research areas open for investigation using low energy ion beams. Dr.D.Kanjilal (IUAC), Dr.K.G.M.Nair (IGCAR), Prof. D.P. Mahapatra (IOP), Dr. T. Som (IOP), Prof.Lokesh Tribedi (TIFR), Prof.N.C.Mishra (Utkal Univ.), Prof.B.N.Dev (IACS) and Dr.Ajay Gupta (UGC-DAE CSR Indore Centre) were invited to discuss the possible studies that can be taken up using the VECC ECR facility. Some of the research areas identified were nanopatterning of materials like formation of nano-ripples, nano rods for technological applications, synthesis of nano materials by ion implantation, synthesis of endofullerenes for drug delivery applications etc. The workshop concluded with a panel discussion where the participants expressed their interest in utilizing the VECC ECR facility for materials science research.

## **National Workshop on Nuclear techniques in Pure and Applied Sciences**

The National Workshop on Nuclear and Atomic Techniques based Pure and Applied Workshop was held from February 1<sup>st</sup> to 3<sup>rd</sup> 2011 at the picturesque campus of the Tezpur University. Organised jointly by UGC-DAE CSR, Kolkata Centre and Tezpur University, this workshop aimed to highlight research facilities at the Centers of the Consortium mainly Indore, Mumbai and Kolkata and the associated DAE institutions which would help to identify research areas of overlapping interest to finally culminate into collaborative research projects between Kolkata Centre and the different departments of Tezpur University such as the departments of Physics, Chemistry, Environmental Science and Biotechnology.

The workshop was attended by 155 delegates which included 16 Invited speakers and 139 selected participants from Benaras Hindu University, Andhra University, GITAM University, BITS, Ranchi, Viswa Bharati, University of Calcutta, Gauhati University, Dibrugarh University, North Eastern Regional Institute of Science and Technology, Itanagar, Tezpur University and affiliated colleges in the region.

The Vice Chancellor, Tezpur University, Professor Mihir K Choudhury, inaugurated the workshop at the Gallery, Dean Building, where he highlighted the growth of Tezpur University in the last few years specially in the field of

nano sciences and expressed hope of the future possibilities of collaboration with UGC-DAE CSR. Dr.A.K.Sinha, Centre Director UGC-DAE CSR Kolkata Centre gave a short overview of the workshop highlighting the role of the Consortium in reaching out to the Universities and colleges through such workshops resulting various academic collaborations.

The key note address was given by Dr. A.K. Sinha, who spoke on the probing of matter in various scales starting right from the microcosm to the macrocosm. Dr. S. Bhattacharya from VECC, highlighted the ion beam facilities at VECC and the nuclear physics research being carried out there using the cyclotron. Dr. N.P. Lalla from the Indore Centre of the Consortium spoke on the facilities available at Indore Centre and also gave an elaborate talk on the Principles and Applications of Transmission electron Microscope. Dr. V. Sirugiri from UGC-DAE CSR Mumbai Centre spoke on the Facilities and research programs at Mumbai Centre. The newly installed Low Temperature High Magnetic Field facilities and characterization of nano materials was discussed in detail by Dr. D. Das from the Kolkata Centre. Dr. Sandeep Ghugre discussed about the nuclear physics research being carried out at the Centre highlighting the collaborations using the INGA facility. Dr. Abhijit Saha presented the irradiation and various characterization facilities in the Centre for study of nano materials while Dr. Anindita Chakraborty highlighted the various research programs involving stress biology at the Centre. Dr. J.B.M. Krishna gave a talk on the use of ion beams in material science studies. Use of X rays in multidisciplinary trace element studies was presented by Dr. M. Sudarshan. Talks were also given by Prof. A Choudhury Pro Vice chancellor of Tezpur University, Dr. P. Deb, Dr. Gazi Ahmed and Dr. A.J. Thakur. They highlighted the various works in material sciences that were being carried at the Physics Department. The contributed talks had speakers from Andhra university, GITAM University, BITS, Mesra, and Tezpur University.



In all, the technical session consisted of 16 invited talks and 12 contributed talks. The contributed talks were held in parallel sessions on the 1<sup>st</sup> and 3<sup>rd</sup> day of the workshop. In addition a poster session was also held consisting of over 40 posters out of which 3 best posters were chosen. These 3 were then given the opportunity to present their work as a 15 minute presentation and were also given an award as encouragement. Mr. Rakesh Ranjan, research scholar from BHU got the best poster award.

This workshop was very successful and had talks in various fields of science ranging from Nuclear Physics, Materials Sciences, Biological, Environmental and Chemical Sciences, maintaining the theme of the workshop.

### **School on “Physics with Low Temperatures and High Magnetic Fields” UGC-DAE Consortium for Scientific Research during Mar 14-18, 2011.**

The UGC-DAE Consortium for Scientific Research (CSR), has established a series of front-line experimental facilities in the area of Low temperatures and High magnetic fields. They include but not limited to 14T systems for Vibrating Sample Magnetometer, resistivity and heat capacity measurements, 7T SQUID Magnetometer, 8/10T System for magneto transport, 8T Scanning Hall Probe / MFM system, 8T Mossbauer and MOKE facility, 14T Dielectric and thermoelectric power measurements, 8T Facility for Neutron Diffraction at Mumbai, 7T SQUID Magnetometer at Kolkata and 15T Facility for transport measurements at Kolkata. Apart from these, there are many

upcoming facilities like 8T System for dielectric and thermal conductivity at Indore, 8T High field XRD system at Indore, 7T SQUID-VSM at CSR Indore and 9T VSM at CSR Mumbai. In the last few years many researchers from the university system have utilized these. CSR Indore has organized a school, which was our fourth thematic meeting in the series during March 14-18. The objective of this school was to make potential users from universities and other academic institutions aware of the research possibilities with the low temperature and high magnetic field facilities established as said above. Pedagogical lectures culminating in the highlights of typical research resulted from these facilities were discussed with a focus on future possibilities. A wide range of problems that can be dealt with in the framework of low temperatures and high magnetic fields have been dealt with. Areas covered include superconductivity, highly correlated electron systems, vortex matter, phase co-existence, multiferroics, inter-metallic compounds and nano-structures.



After a brief welcome by Prof. Ajay Gupta, the workshop was started with an overview of historical developmental of LTHM facilities at CSR Indore by Dr. V. Ganesan. Fundamentals of Mossbauer spectroscopy and MOKE were covered by Prof. Ajay Gupta in the first day covering various types of physics that can be dealt with magnetic multi-layers, ferrites, nano-structures and so on. Basics on magnetic measurements were covered by Dr. Abk Banerjee, while Dr. R. Rawat covered the fundamentals the importance of low temperatures, high pressures and high magnetic fields. Neutron diffraction and its relevance to LTHM was introduced by Dr. P.D. Babu, while the various systems of magnetic interest was covered in depth by Dr. V. Siriguri.

After the above said introductory talks, the second level of talks continued. Dr. V. Ganesan has covered the importance of LTHM in the scenario of Metal-Insulator Transitions with special emphasis on Kondo insulators and in understanding the fluctuation effects in superconductors, especially the new Fe based systems. Dr. A. Banerjee has covered many mesoscopic and microscopic properties as well as the Phase co-existence with special emphasis on manganites using magnetic field and temperature as variables. Dr. R. Rawat introduced the heat capacity and resistivity, their relevance to various inter-metallics and manganites, while Dr. V.R. Reddy covered in-depth Mossbauer measurements with particular relevance to Ga ferrites, while Dr. A.M. Awasthi covered the importance of Dielectric Measurements in the context of multi ferroics. Dr. A. Lakhani covered the need of LTHM for understanding the shape memory alloys while Dr. R.J. Choudhary covered the need for LTHM XRD in understanding the magneto-structural transitions.

One of the highlights of the talks is the evolving concept of kinetic arrest and its relevance in the First Order Phase Transitions (FOPT). This was covered in depth with various examples by Dr. P. Chaddah including new measurement routines like CHUF (Cooling and Heating in Unequal Fields). Apart from the lectures, there were extensive lab visits where in various LTHM facilities, the back-bone facilities like liquid nitrogen and liquid helium were shown to the participants. There was a lot of time for the participants to discuss with the experts and among themselves. There were even small presentations by the participants. CSR students contributed heavily to the conference including academics. They even made presentations and demo. Special mention may be made to the tutorial on Rietveld analysis by the students of the CSR. In essence, the four and a half day workshop was received well and appreciated by all the participants.

## WORKSHOP ON X-RAY SPECTROSCOPY

A one day workshop on **X-ray Absorption Spectroscopy** was organized by UGC-DAE CSR, Indore Centre on 23<sup>rd</sup> May, 2011. The purpose of the workshop was to create a user base for the upcoming x-ray spectroscopy beamlines on Indus-2 and also to familiarize the potential users from universities and research institutes about topics of current research interest using such facility.



Dr. D.M. Phase welcomed the dignitaries and participants. The inaugural address was given by Dr. P. Chaddah, Director UGC-DAE CSR, in which he made some introductory remarks about the workshop which was followed by several presentations on x-ray absorption studies on catalysis (Prof. P.R. Sarode), shape memory alloys (Dr. K. Priolkar), thin films (Prof. Ajay Gupta), quantum dots (Prof. (Mrs.) S.K. Kulakrni), strongly correlated electronic systems (Dr. S.K. Pandey) as well as on describing the facilities viz. EXAFS beamline on Indus-2 (Dr. S.N. Jha) and EXAFS beamline on Elettra (Dr. V. Sathe). Workshop concluded by a special session which was organized in honour of Dr. A.V. Pimpale (who was superannuating on 31<sup>st</sup> May, 2011 after serving for ~ 20 years at UGC-DAE CSR, Indore, Kolkatta and Mumbai Centres) where his scientific contributions in the area of X-ray spectroscopy were discussed.

## CSR facility utilization awareness programmes in the North-Eastern States

Dr. G. S Okram made visits to nine institutes of the North-East during April 10-28, 2011 as a focused effort for CSR facility utilization awareness programmes in the North-Eastern States. He visited National Institute of Technology and Tripura University, Agartala, National Institute of Technology and Assam University, Silchar, Mizoram University, Aizawl, University of Dibrugarh, Dibrugarh, North-Eastern Regional Institute for Science and Technology, Nirjuli, Itanagar, University of Gauhati, Guwahati and North-Eastern Hill University, Shillong.



*Photographs taken during awareness programmes at Tripura University, Agartala and MZU, Aizawl*



## Foreign Visits by Faculty and Students of CSR

S No	Name	Place visited	Date	Purpose
1	Mr. Sanjay Singh	Grenoble, France	January 24 – 28, 2011	to attend the “FP SCHOOL-2011” held in Institut Laue Langevin
2	Mr. Uday Deshpande	ESRF, Grenoble, France	April 22-28, 2011	for NRIX measurements on ID18 beamline
3	Prof. Ajay Gupta	ESRF, Grenoble, France	April 23-27, 2011	for NRIX measurements on ID18 beamline
4	Prof. Ajay Gupta	Elettra, Italy	June 13-June 18, 2011	for performing XAFS measurements
5	Dr. S Barman	France	June 13-July 3, 2011	To visit ESRF and attending symposium FIESTAE XV 11
6	Ms. Jayita Nayak	ESRF, Grenoble, France	June 15-June 24 7, 2011	for performing experiments in ID31 and ID 32
7	Mr. Abhishek Rai	ESRF, Grenoble, France	June 15-June 24 7, 2011	for performing experiments in ID31 and ID 32
8	Mr. Sanjay Singh	ESRF, Grenoble, France	June 15-June 24 7, 2011	for performing experiments in ID31 and ID 32
9	Mr. S. M. Amir	PSI, Switzerland	June 21-July 7, 2011	Neutron reflectivity experiments
10	Dr. Mukul Gupta	PSI, Switzerland	June 21-July 7, 2011	Neutron reflectivity experiments

### Talks by CSR faculty

1. *Resonant photoemission studies of dilute magnetic semiconducting oxide thin films* by Dr. R.J. Choudhary at International conference on nanoscience and nontechnology, held at Swami Ramanand Teerth Marathwada University, Nanded 11-13 January 2011.
2. *Scanning Probe Microscopy is more than an imaging tool* by Dr. V. Ganesan on Jan 22nd, 2011 at NCRAMS-2011 held at Bhusawal.
3. *Magnetoresistance studies on Ni-Mn-Ga ferromagnetic shape memory alloy* by Dr. S.R. Barman at National Conference on Magnetic Materials and Applications, 24-25th January, 2011, Kolkata
4. *Mossbauer spectroscopy and applications* by Dr. V. R. Reddy at Winter School on Recent Trends in Physics of Atoms, Molecules and Lasers on 25th January 2011 held at Department of Physics, Banaras Hindu University, Varanasi. (two talks)
5. *Thin film platform for nano-materials and their applications* by Dr. R.J. Choudhary at National symposium on recent advances in physics, held at Holkar College, Indore on 15th February, 2011.
6. *Probing spin and orbital order in pervoskites by Raman spectroscopy* by Dr. V. G. Sathe in International Conference on Advances in Condensed & Nano Materials (ICACNM-2011) held at Department of Physics, Panjab University, Chandigarh on 23-26 Feb. 2011.
7. *Preparation and Study of Multiferroic Materials* by Dr. V. R. Reddy at National Conference on Spintronic Materials: Nanostructures and Devices (SMND-2011) on 3rd March 2011 held at Kongu Engineering College, Perundurai, Erode.
8. *SPM as a tool to characterize the nano structures* Spintronic Materials: nanostructures and Devices” by Dr. V. Ganesan at Kongu Engineering College, Erode during March 3-4, 2011.

9. *Nanomaterials, its Synthesis and Characterisation*, by Dr. T. Shripathi at, Acropolis Institute of Technology & Research, Indore, March 04, 2011
10. *Thin films of dilute magnetic oxide semiconductors* by Dr. R.J. Choudhary at National Seminar on Advances in Laser, Spectroscopy and Nanomaterial (NSALSN-2011), at Nehru Gram Bharati University (NGBU), Allahabad 5-7th March 2011.
11. *Raman Microscopy* by Dr. V. G. Sathe in National workshop on Scanning Probe Microscopy: Techniques and Application held at Department of Physics, Pune University, Poona on 11-12 March 2011.
12. *Iron Oxide Nanostructures*, by Dr. T. Shripathi at National Conference NAPRA-2011, Banaras Hindu University, March 16-18, 2011
13. *Effect of particle size reduction and growth of self assembled nano rods of  $Ni_2Fe_2O_4$*  by Dr. V. G. Sathe in National Conference on Nanomaterials & Applications: Present Position and Road Ahead , 16-18 March 2011 by Department of Physics, Banaras Hindu University, Vaaranasi.
14. *Raman spectroscopy for nano structures and "EXAFS and its applications* by Dr. V. G. Sathe at Workshop on "Characterization Tools for Nano Materials" at Department of Physics, Panjab University, Chandigarh on 22-2-2011.
15. *Growth and characterisation of magnetite thin films on different substrates* by Dr. D.M. Phase at National Symposium on "Scanning probe microscopy" held at Pune University, Pune, in March, 2011.
16. *Thermal Analysis- Methods and Practice* by Dr. A.M. Awasthi at UGC Networking Winter School BHU, Varanasi, 26<sup>th</sup> March 2011.
17. *Phase-coexistence in functional materials*, National Symposium for Advanced Technology NSMAT-2011 by Dr. P. Chaddah at Banasthali University, March 27-29, 2011.
18. *Iron Oxide Nanostructures*, by Dr. T. Shripathi at IIT., Roorkee, March 28, 2011
19. *Surfactant mediated growth of thin film multilayers*, by Dr. Mukul Gupta at University of Rajasthan, Jaipur, March 29, 2011.
20. Two lectures by Dr. Alok Banerjee in the Refresher Course in Pure and Applied Chemistry held in Goa University on 30-31 March, 2011.
21. *Scanning Probe Microscopy and its role in imaging sub-micron features (A tool which is more than a simple imaging one)* Dr. V. Ganesan at the Department of Physics, Pondicherry University on 31st March 2011 under the UGC-SAP VISITING Programme
22. *Resonance photoemission spectroscopy using Indus-1 Synchrotron Radiation Source* by Dr. D.M. Phase at M.L.S. University, Udaipur in March, 2011.
23. Phase-coexistence in functional magnetic materials, P. Chaddah, Invited talk at International Conference on Functional Materials, Allahabad, April 2-3, 2011.
24. *Low-Temperature Thermal Properties of Glasses- Rigidity Development in Network Glasses*, by Dr. A.M. Awasthi at GNDU, Amritsar, April 21, 2011.
25. *A Dielectric Perspective on Multiferroics*, by Dr. A.M. Awasthi at Guru Nanak Dev Univ. (GNDU), Amritsar, April 22, 2011.

### Awards (Users):

1. Dr. Piyush S. Solanki, Department of Physics, Saurashtra University, 1<sup>st</sup> Prize Poster Award, International Conference on Nanoscience & Nanotechnology, SRTM University, Nanded, January 11-13, 2011.
2. Mr. Ashish B. Ravalia, Department of Physics, Saurashtra University, 1<sup>st</sup> Prize Oral Presentation, Recent Advances in Materials Synthesis and Characterizations, Bhusawal, Maharashtra, January 22-23, 2011.

## Superannuation



Dr. A. V. Pimpale retired on May 31, 2011 after serving for about four years as Centre Director of Mumbai Centre. Prior to joining CSR Mumbai Centre, Dr. Pimpale, served Indore Centre of CSR as scientist for about 20 years. At the Mumbai Centre, Dr. Pimpale made significant contributions to neutron beamline program and developed the neutron ray tracing program for optimizing the beamline optics for the neutron powder diffractometer. He also developed ray tracing programs for triple axis spectrometer. A farewell meeting was organized in BARC Mod Labs on 27 May, 2011 in honor of Dr. Pimpale, where his scientific contributions were recollected by his colleagues and friends at CSR and BARC.

## New Appointments:



Dr. Vasudeva Siruguri has taken over as Centre Director of UGC-DAE CSR Mumbai Centre on June 1, 2011. Dr. Siruguri has been with the Mumbai Centre since 1993. His main areas of research include magnetism of rare earth intermetallic alloys and oxides using neutron diffraction technique. He was instrumental in setting up the high resolution neutron diffractometer with low temperature and high magnetic field sample environment at Dhruva reactor.

Mr. Devendra Kumar joined the Indore center of CSR in May 2011 as Scientist-D.



He has completed his M.Sc. under the MSc.-PhD Dual Degree program of Indian Institute of Technology Kanpur. His PhD work was done under the supervision of Prof. K. P. Rajeev and his thesis “Non-equilibrium features in solid state: A case study of the transition metal oxide  $\text{NdNiO}_3$ ” has been submitted in December 2010. In his doctoral studies, he has used resistivity, thermopower and magnetization measurements to study the dynamical features present across the first order metal-insulator transition in bulk, thin films and nanostructures of  $\text{NdNiO}_3$ . He is a condensed matter experimentalist and has interest in study of phase transition and related non-equilibrium phenomena, correlated electron systems, superconductivity and magnetism in low dimensional systems.



Devendra Singh  
Administrative Officer-I



Vishnu Kaushal  
Clerk-Typist



Meenakshi Gupta  
Clerk-Typist

## Resignation:

Mr. Gajendra Singh Meena resigned as Jr. Engg. B. We wish him the very best in his future career.

## Science Day 2011

Science Day was celebrated on 28<sup>th</sup> February at CSR, Indore centre. Two lectures were arranged on this occasion.

The first lecture was delivered by Prof. Lalit M. Kukreja of RRCAT, Indore. He started with a popular introduction to ZnO and its technological usages. This is followed by presentation of research work presently carried out at PLD laboratory of RRCAT on optical properties of ZnO quantum dots. Studies on ZnO quantum dots (ZQDs) are important to evaluate their potential for developing novel photonic and spintronic devices. Earlier their group found that the fundamental optical processes in ZQDs of sizes comparable to and smaller than the excitonic Bohr radius ( $\sim 2.34$  nm), called here as ultra-small quantum dots are radically different from those operating in their larger counterparts. In this talk Prof. Kukreja showed recent results on unusual behavior of ultra-small ZQDs in their photoluminescence (PL) related optical processes. Ten layered ensembles of alumina capped ZQDs of mean radius in the range of  $\sim 1$  to 4 nm were grown on (0001) sapphire substrates at 250 °C in oxygen ambient at  $1 \times 10^{-4}$  Torr by pulsed laser deposition using a KrF Excimer laser operating at 10 Hz and  $0.6 \text{ J/cm}^2$ .



Optical absorption and PL spectra followed the size dependent blue shift of the band-edges in conformity with the strong quantum confinement of electrons and holes localized in the ZQDs. Temperature dependent PL spectra of the ZQDs of mean radius of  $\sim 2.5$  nm in the range of 10 – 70 K consisted of two peaks of different donor bound electron hole recombinations at  $\sim 3.368$  and  $3.360$  eV and one acceptor bound recombination at  $\sim 3.333$  eV. At temperatures higher than 70 K while these peaks broadened, a new feature appeared at  $\sim 3.376$  eV which we attribute to the band-edge transitions of the strongly correlated electron hole pairs. The peak intensity of these transitions followed the normal law of thermal quenching. Band-edge of the ZQDs of mean radius 2.5 nm was calculated to be at  $\sim 3.558$  eV, but observation of the PL transitions at  $\sim 3.376$  eV suggests the Stokes shift, commonly observed in polar materials such as ZnO. Temperature dependent PL spectra also showed significantly intense LO phonon replicas of the above stated primary transitions, which confirmed strong coupling between the carriers and the LO phonon. Temperature dependence of FWHM of the PL peaks followed the Hellmann and O'Neill models with carrier-LO phonon coupling coefficient ( $\sim 980$  meV) close to its value for the bulk ZnO ( $\sim 963$  meV) and higher than that reported for the larger ZQDs. This anomaly is explained through the dominance of enhanced Coulombic interaction between the electrons and holes and the ensuing Fröhlich interactions over the other size related negating effects. The temperature dependent PL peak positions followed the well known Varshni's relation with fitting parameters close to that of the bulk ZnO. These anomalous observations have important implications on our understanding about the basic optical processes in ultra-small ZQDs.

The second lecture was given by Dr. Ram Janay Choudhary, UGC-DAE CSR, Indore on "Silence of  $1/f$  noise". In this talk he started giving importance of noise measurements. For any device to be applicable, it is desirable to estimate the signal to noise ratio, which finally settles on the eventual resolution available with the device made from these materials. Hence, noise measurement provides useful information concerning the limitations of the device. There are basically three kinds of noise sources in any device: White noise, Shot noise and  $1/f$  noise.  $1/f$  noise is known to be susceptible to any fluctuation or transition whether structural, electrical or magnetic. In this way the measurement of  $1/f$  noise gives input regarding the conduction mechanism in the system. Also  $1/f$  noise measurement may be a tool to probe the consequences of formation of defects on the charge transport process in thin films. Results of  $1/f$  measurements performed on a wide range of materials in thin film form such as  $\text{Fe}_3\text{O}_4$ ,  $\text{La}_{1-x}\text{Ca}_x\text{MnO}_3$ ,  $\text{La}_{1-x}\text{Ce}_x\text{MnO}_3$ ,  $\text{LaFe}_{1-x}\text{Ni}_x\text{O}_3$  are presented and its implications towards electrical and magneto-transport properties were highlighted. Its universal presence and occurrence in various types of natural phenomena were also discussed.

