CMPRC

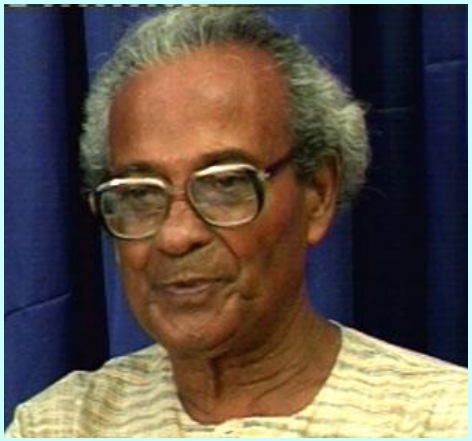
PHYSICS DEPARTMENT

Jadavpur University

A short profile

Condensed Matter Physics Research Centre

Our Founder –
Prof. Shyamal Sengupta (1924-2003)
Emeritus Professor, Presidency College
Visiting Professor - JU
Continues to be our source of inspiration



Founder Members:
Prof. A. N. Basu
Prof. D Roy
Coordinator: Prof. S Tarafdar

We have about 40 members, including faculty and research Scholars from JU and other institutions in and around Kolkata

Contact: sujata_tarafdar@hotmail.com

CMPRC: Objectives of the Centre

- We try to network with groups working in - condensed matter, statistical physics, material science and related areas in and around Kolkata.
- We arrange regular seminars and discussion sessions.

Highlights of research activities of members follows:

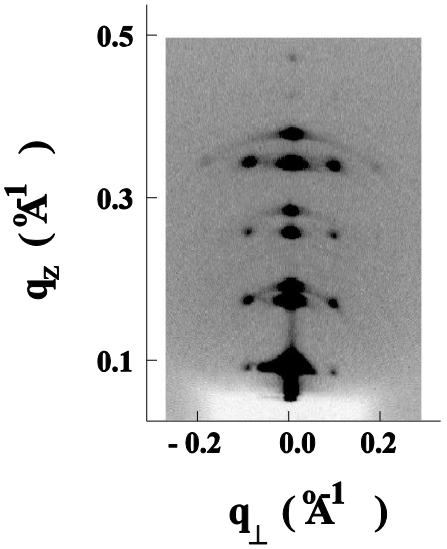
Experimental work

Research Interests of Dr. Sanat Karmakar

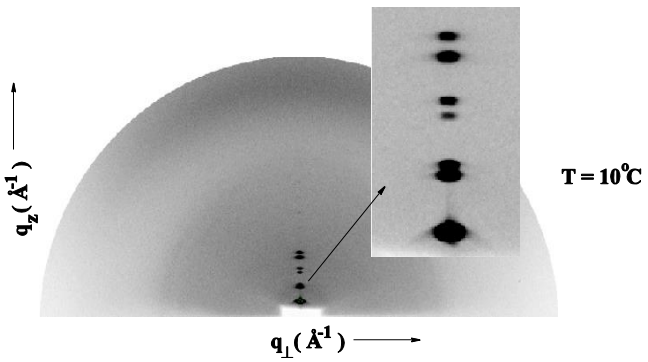
Experimental Soft Condensed Matter and Biophysics

1. Structure and phase behavior of lipid-cholesterol membranes.

Small angle x-ray scattering

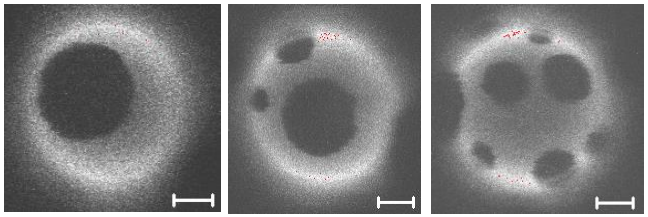


Binary lipid-cholesterol mixture



Ternary lipid-cholesterol mixture

Optical Microscopy

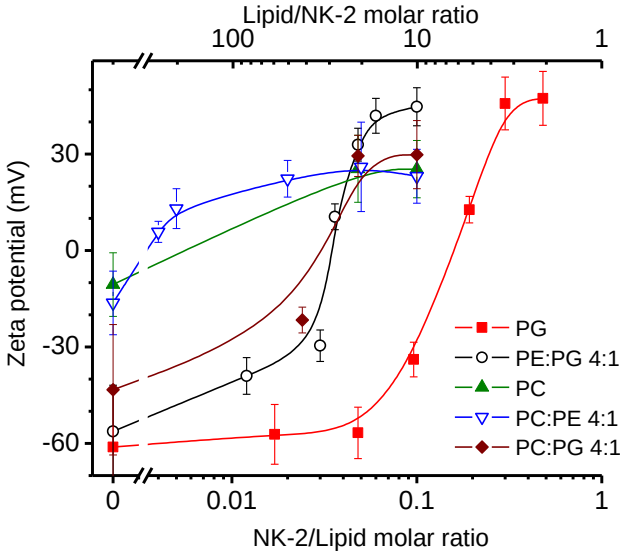


Micrographs of giant unilamellar Vesicles made from equimolar Ternary Lipid-cholesterol mixtures, Showing coexistence of liquid-ordered and liquid disordered phases.

Sanat Karmakar and V. A. Raghunathan, X-ray diffraction and confocal fluorescence microscopy studies on the effect of cholesterol on phospholipid membranes *Physics express 2014, 4:6*

Contd….

2. Interaction of various ions, antimicrobial peptides and other bio-molecules with phospholipid membranes.



Experimental Techniques:

- **Optical microscopy**
- **Dynamic light scattering**
- **Zeta potential**
- **Isothermal titration calorimetry**

3. Vesicles as microreactor

4. Polymer vesicles

Sanat Karmakar, *Zeta potential and dynamic light scattering measurements of phospholipids vesicles.* Proceedings of National conference on Laser and Advanced Materials, ISBN No: 978-81-922256-6-1 (2012).

Dr. NABIN BARAN MANIK
BOYSCAST FELLOW, DST, GOVT. OF INDIA,
ASSOCIATE PROFESSOR, DEPARTMENT OF PHYSICS
JADAVPUR UNIVERSITY

AREA OF RESEARCH	OBJECTIVES
ORGANIC PHOTOVOLTAIC CELLS	By using different organic dyes and polymers, we fabricate photovoltaic devices of varied structures and characterise them.
LOW TEMPERATURE PHYSICS	We characterise different light emitting diodes and photodetectors at low temperature for defecnce applications.
INSTRUMENTATION	We perform low level signal processing and fabricter sensors of various kinds.

PROJECTS

- Study on the gas absorption property of the activated charcoal
- Study on the electrochromism effect on polymer based solid-state thin film
- Development of a continuous liquid level meter for cryogenic liquid with opto-sensor
- Investigation of the trap charge effects on photovoltaic property of different dye synthesized organic/polymer semiconductors in different device architectures
- Study on the performance of IR emitter and photodetectors at low temperature applicable in space and defence research (ongoing project)
- Study and development of donor-acceptor type organic photovoltaic devices
- Study on trap charges and photovoltaic properties of organic solar cell
- Study on the effect of carbon nanotubes on organic solar cell (ongoing project)
- Study on the effect of different nanoparticles on crystal violet dye based organic photovoltaic cells

P.hD scholars

Completed: 7 **Submitted: 1** **Registration: 4**

Publications

more than **45** publications

Conference

Attended more than **20** international/national conferences

2 presentations have received **Best Award**

Information about Organic Nano-Piezoelectric Devices Laboratory group

DIPANKAR MANDAL

Students:

No. of PhD Students: 7

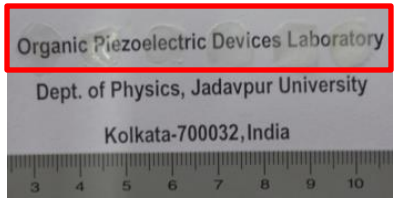
No. of Master Students: 2

Collaborators:

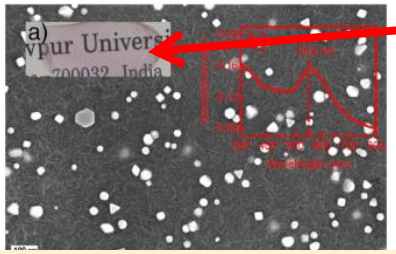
1. Prof. D. Schmessier, BTU, Cottbus, Germany.
2. Dr. K. Henkel, BTU, Cottbus, Germany.
3. Prof. K. J. Kim, KHU, South Korea.
4. Dr. Bipan Tudu, IEE, JU
5. Prof. S. Ram, IIT Kharagpur
6. Prof. B. Khatua, IIT Kharagpur
7. Dr. S. Sen, CGCRI, Kolkata
8. Dr. S. Achariya, IACS, Kolkata

Research Area:

❑ Development of Flexible Ferroelectric & Piezoelectric Films

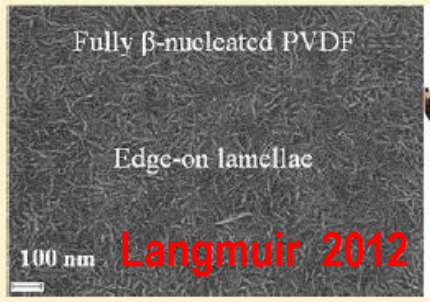


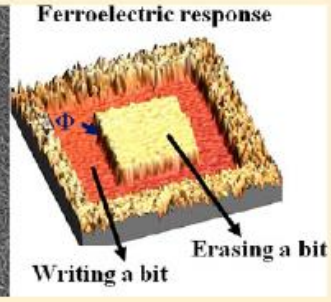
Transparent Piezo Films



Gold NPs doped Piezoelectric Film

Materials Lett. 2012





Profile link: http://www.jaduniv.edu.in/profile.php?uid=433

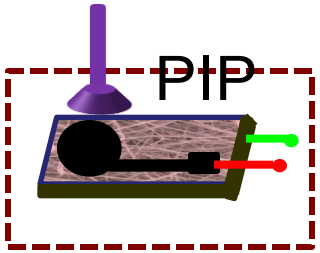
E-mail: dipankar@phys.jdvu.ac.in; **H.P.** +91-94333-73530

h index: 7
Patents: 2
Journals: 16
Proceedings: 5
Book/ch: 3

Organic Nano-Piezoelectric Devices Laboratory (ONPDL) group

❑ Design of Energy Harvesting Devices

- Nanogenerator
- Nanopressure sensor
- Biomedical devices

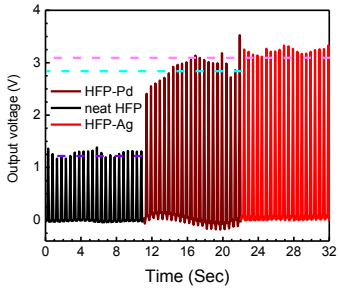


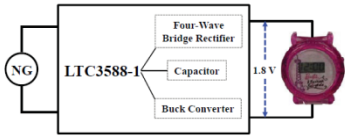
One of the target:

Materials Views — ADVANCED MATERIALS

Replacing a Battery by a Nanogenerator with 20 V Output

*Youfan Hu, Long Lin, Yan Zhang, and Zhong Lin Wang**





We have achieved up to 8 V output and current density 2 μA/cm²

This work has been presented in "3rd International Conference on Materials and Applications for Sensors and Transducers", 13-17 Sept, 2013, *Prague, Czech Republic*

❑ RE-doped Sol-gel glass/RE-NPs synthesis

LASER glass

One step RE-NPs preparation

- *Recent Publications:*
- *Referred Journals*

1. *Materials Letters*, 2012, 73, 123-125.
2. *Applied Surface Science*, 2012, 261, 209-213.
3. Langmuir, 2012, 28, 10310-10317.
4. *J. Phys. Chem. B, 2011*, 115, 10567–10569.
5. *Macromolecular Rapid Communications*, 2011, 32, 831-837.
6. *Physica Status Solidi (a)*, 2011, 208, 330-342.

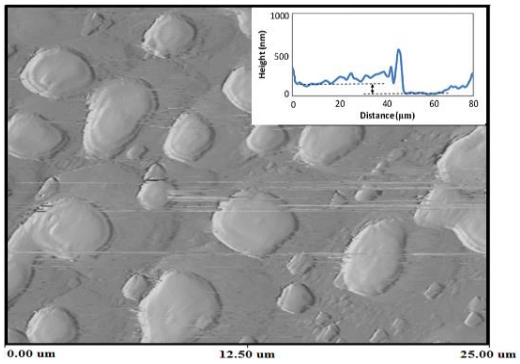
- Books/Chapters

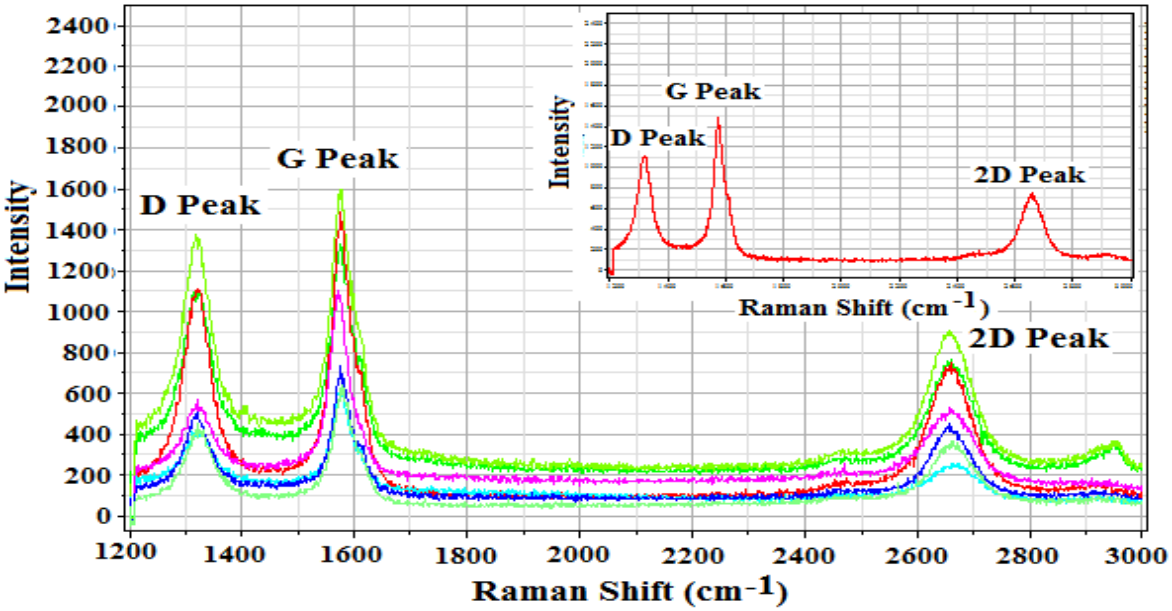
1. Ch8 in Soft Fibrillar Materials: Fabrication and Applications, WILEY-VCH Verlag GmbH & Co. KGaA(Online ISBN: 9783527648047;Print ISBN: 9783527331628), 2013.
2. Ultra-thin Films of a Ferroelectric Copolymer: P(VDF-TrFE), LAP LAMBERT Academic Publishing[ISBN:978-3-659-14195-9], 2012.

Profile link: http://www.jaduniv.edu.in/profile.php?uid=433

Jayoti Das
Assistant Professor

Area of interest covers gas sensing application of mesoscopic thin films and multilayer graphene
No. of Ph.D. students: 04





The Raman spectra throughout the CVD grown multilayer graphene surface. The uniform distribution of graphene layer in a small area is shown in the inset.

1. ZnO-SnO2 based composite type gas sensor for selective hydrogen sensing, B. Mondal, B. Basumatari, **J. Das**, C. Roychaudhury, H. Saha, Sensors and Actuators B: Chemical, 194,389-396 (2014).

2. Growth of multilayer graphene by chemical vapor deposition (CVD) and characterization, D. Dutta, A. Hazra, **J. Das**, S. K. Hazra, V. N. Lakshmi, S. K. Sinha, A. Gianoncelli, C. K. Sarkar and S. Basu, Journal of Nanomaterials and Molecular Nanotechnology, Accepted for publication.

THIN FILM AND NANOSCIENCE LABORATORY
GROUP LEADER: Dr. K.K. CHATTOPADHYAY

FIELDS OF INTEREST

- NANOSCALE PHYSICS AND PHENOMENA
- CARBON NANOSTRUCTURES: CNT, GRAPHENE, NANODIAMOND AND THEIR COMPOSITEs
- SEMICONDUCTOR NANOSTRUCTURES: ZnO, SnO2, ZnS, CdS etc.
- GIANT DIELECTRIC CONSTANT MATERIALS: CCTO & ITS NANOSTRUCTURES
- P-TYPE TRANSPARENT CONDUCTING OXIDES
- DENSITY FUNCTIONAL THEORY BASED FIRST PRINCIPLES STUDY

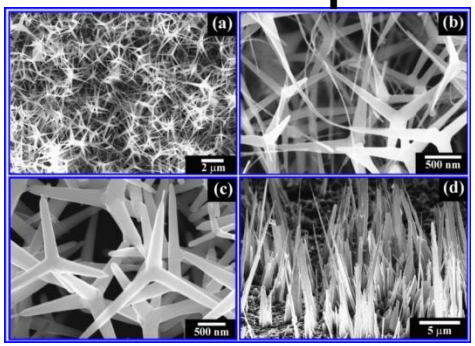
At a glance:

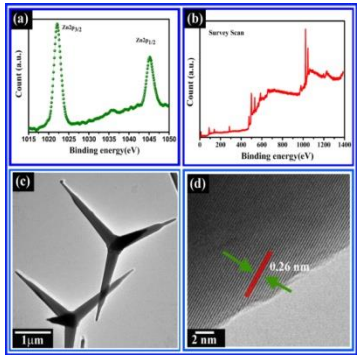
- No. of Ph.D. Supervised: 15 (Awarded); 2-Submitted
- Total Publication (In Int Journals) > 200
- Total Citations: > 2800

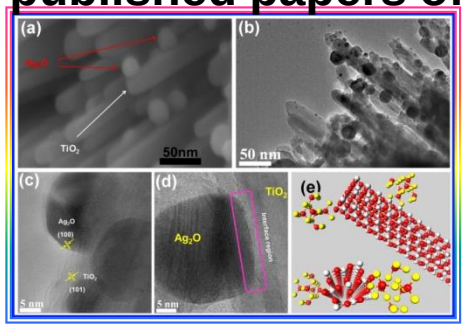
SOME RECENT REPRESENTATIVE PUBLICATIONS:

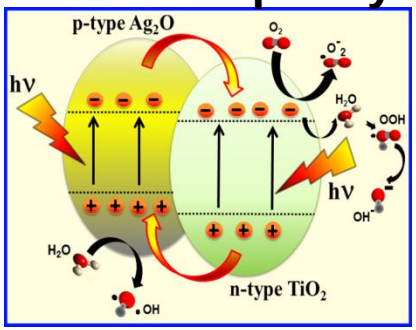
1. S. Maity & K.K. Chattopadhyay, *Nanotechnology (In Press)*
2. N. Majumder, K.K. Chattopadhyay et al. *Journal of Physical chemistry Letters (In Press)*
3. K.K. Chattopadhyay and U.N. Maiti et al, *Nanoscale, 3 (2012) p. 4135*
4. S. Maity & K.K. Chattopadhyay, *J. Mater. Chem C (2013) 1, p. 4940*
5. D. Sarkar & K.K. Chattopadhyay *ACS Appl. Mater & Interface,* 5, (2013) 331.
6. S. Kumar, K.K. Chattopadhyay, *Journal of Physical Chemistry C, 116 (2012) p. 16700*
7. B. Choudhuri, K. K. Chattopadhyay et al., *Appl. Phys. Lett. 102, 233108 (2013)*
8. Nilesh Mazumder and K. K. Chattopadhyay, *J. Phys. Chem. C 2013, 117, 6454*
9. Subhajit Saha and K. K. Chattopadhyay, *Dalton Transactions, 2013, 42, 12965*
10. J. C. Dhar and K. K. Chattopadhyay, *J. Appl. Phys. 113, 174304 (2013)*
11. D. Sen and K. K. Chattopadhyay, *Int. Journal of Hydrogen Energy 38 (2013) 3041*

Some presentative results from published papers of K.K. Chattopadhyay









Journal of Materials Chemistry C

RSC Publishing

PAPER

View Article Online
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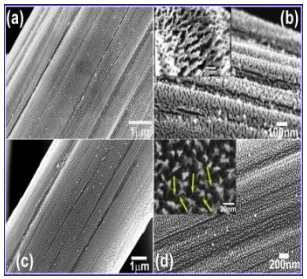
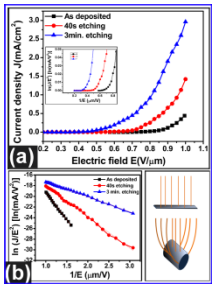
Controlling the sharpness of ZnO tetrapods by restricted zinc oxidation in the open air: a low turn-on field emitter stabilized by graphene†

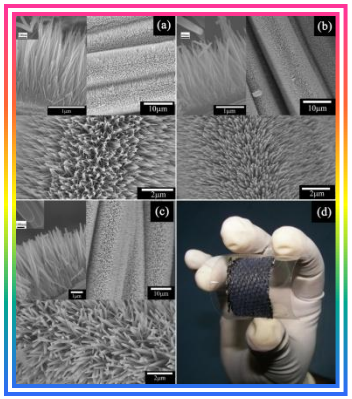
Cite this: *J. Mater. Chem. C*, 2013, **1**, 4940

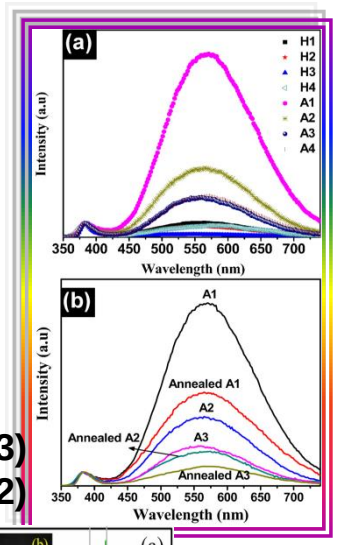
Soumen Maiti,[a] Uday Narayan Maiti,[b] Bhaskar Chandra Behera,[a] Shreyasi Pal[a] and Kalyan Kumar Chattopadhyay*[a]

ACS Appl. Mater. Interface (2013) 5 (2) , pp. 331-337.



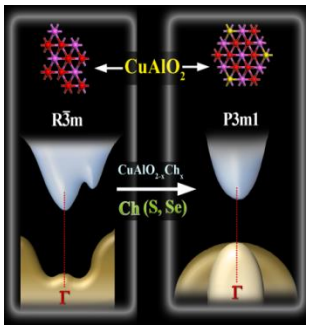


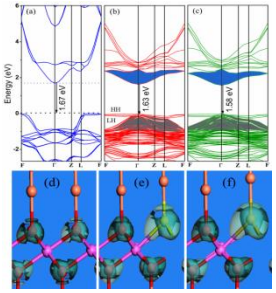


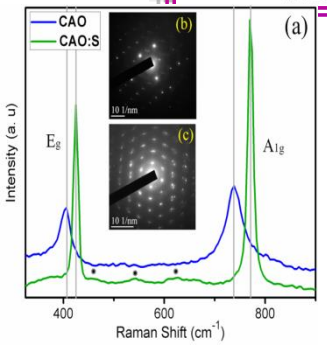


Nanotechnology (2013)
Nanotechnology (2012)

***Nanoscale*, 3 (2012) p. 4135**





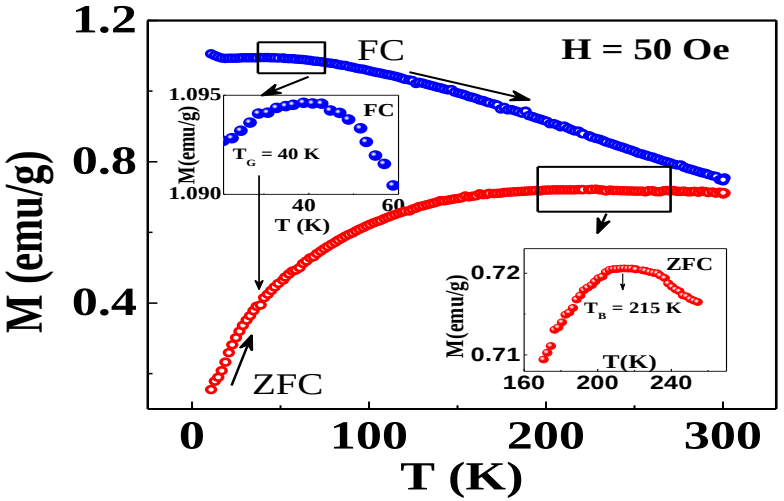


J. Physical Chem. Lett. 2013 (In Press)

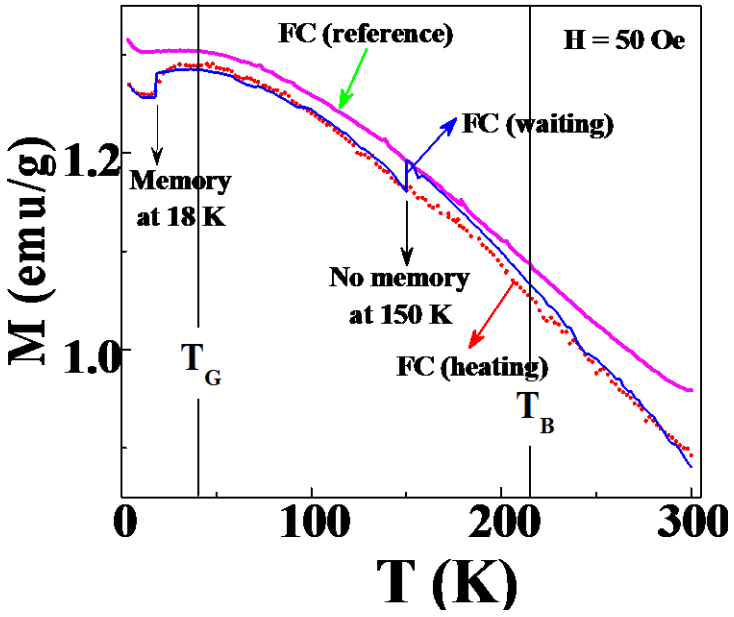
Magnetic and transport properties of nanostructures

Ruma Ray
Department of Physics, Jadavpur University

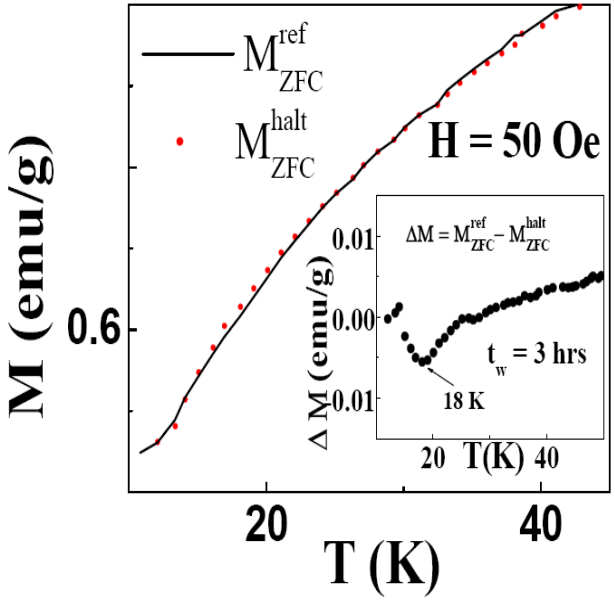
Unusual magnetic memory effects in Fe / γ-Fe_2O_3nanostructures



❖Memory effect in thermal variation of magnetization

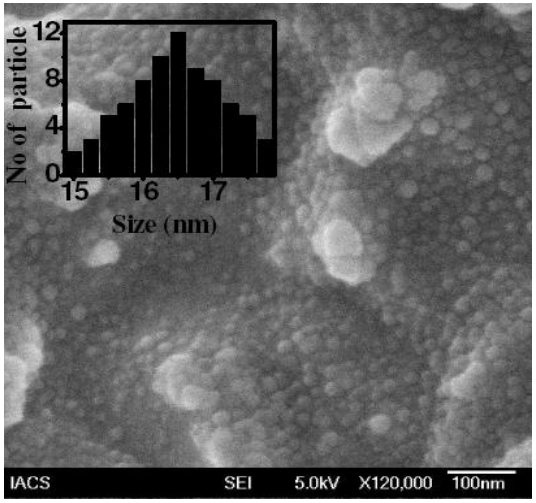


- Ageing is done at 150 K and at 18 K for 3 h each in FC magnetization.
- Memory effect is demonstrated by a wriggle at 18 K which is absent at 150 K
- ZFC memory effect confirms this intrinsic memory effect

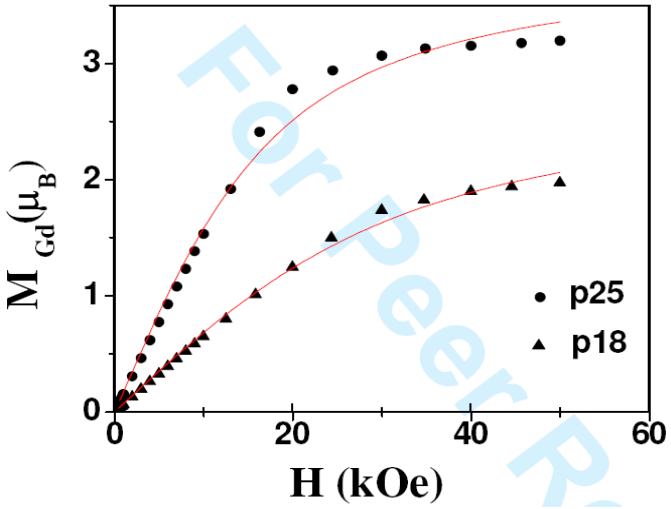


S. Biswas, Sk. Sabyasachi, A. Bhaumik and R. Ray, IEEE T. Magnetics (accepted, 2013)

Sol-gel derived superparamagnetic Gd2O3 nanoparticles

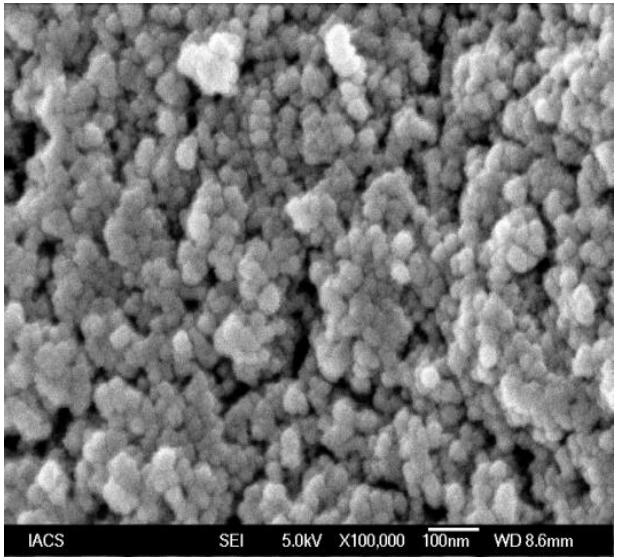


- Superparamagnetic at 5 K
- Saturation magnetizations per Gd^{3+} ion at 5 K are found to be ~3.9 μ_B and 2.8 μ_B

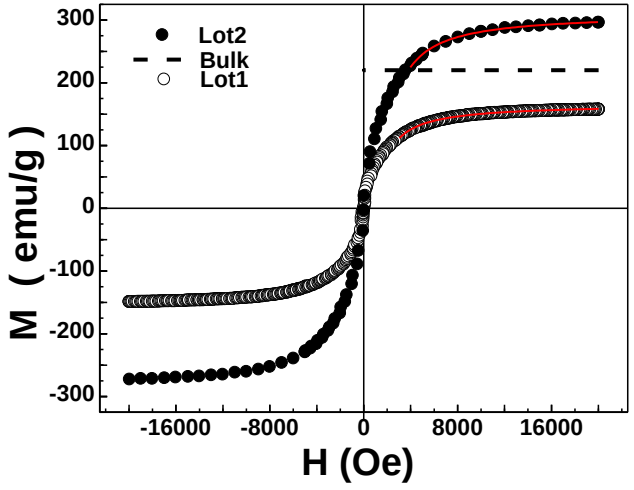


R. Ray, Sumita Biswas, S. Das, and M. Patra, AIP Conf. Proc. 1447(2012)319

Iron nanoparticles from a electrochemical route



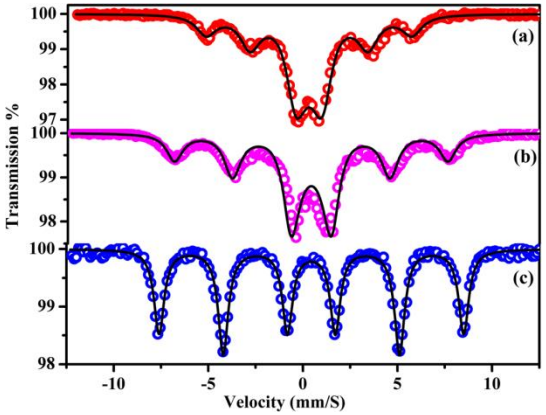
- Superparamagnetic at 300K
- Saturation magnetizations are 1.66 μ_B /atom and 3.10 μ_B /atom
- Experimentally found effective magnetic moment per atom is 2.2 μ_B for bulk Fe

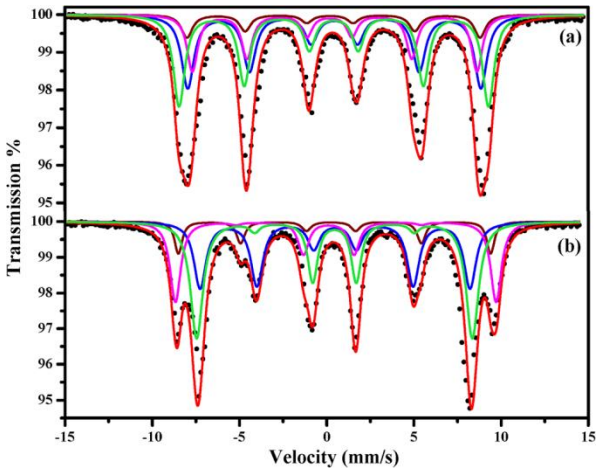


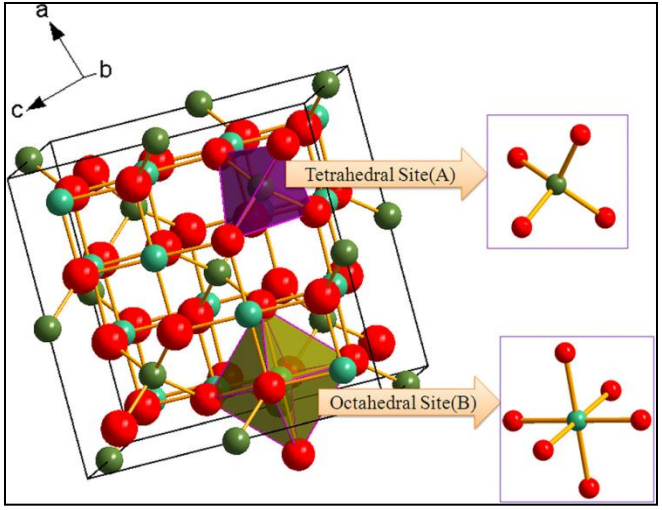
R. Ray, S. Das, M. Patra and M. Thakur, J. Nano Sc. Method Vol. 1 (2012) 1–8.

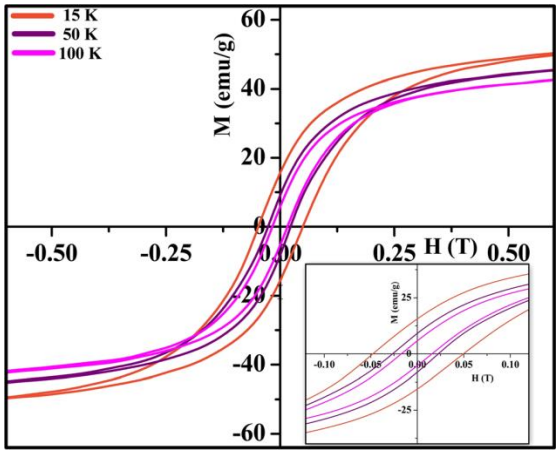
Dr. Sanjay Kumar

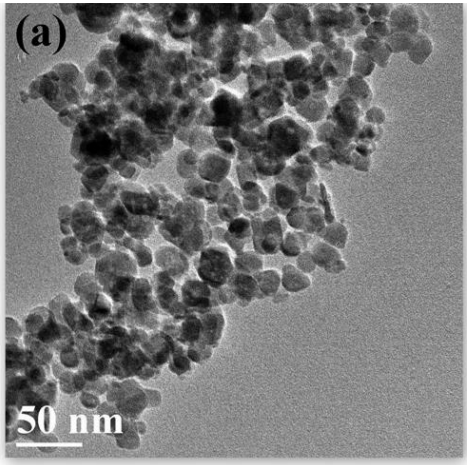
Assistant Professor
Department of Physics
Jadavpur University

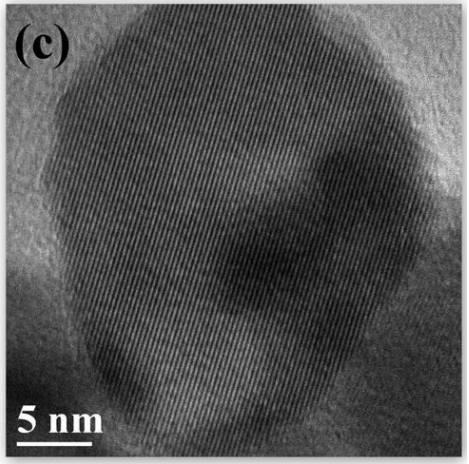


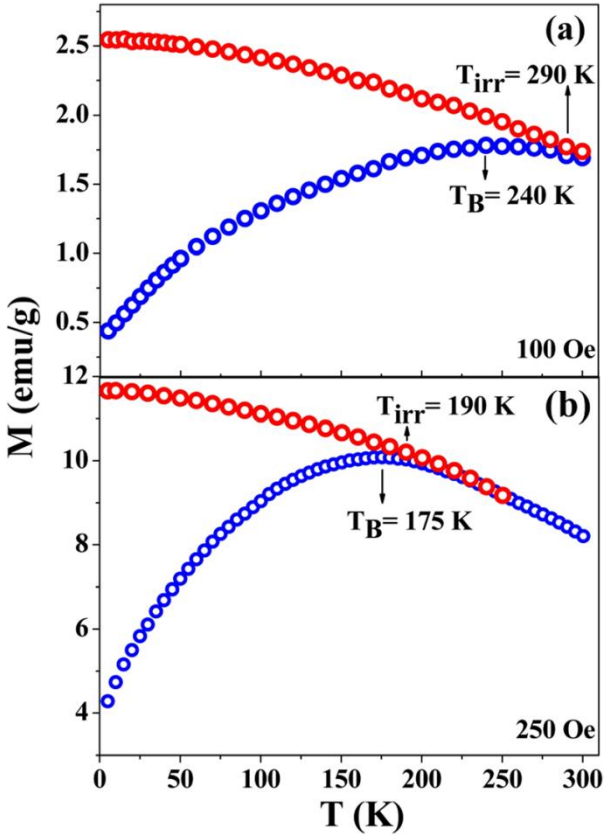




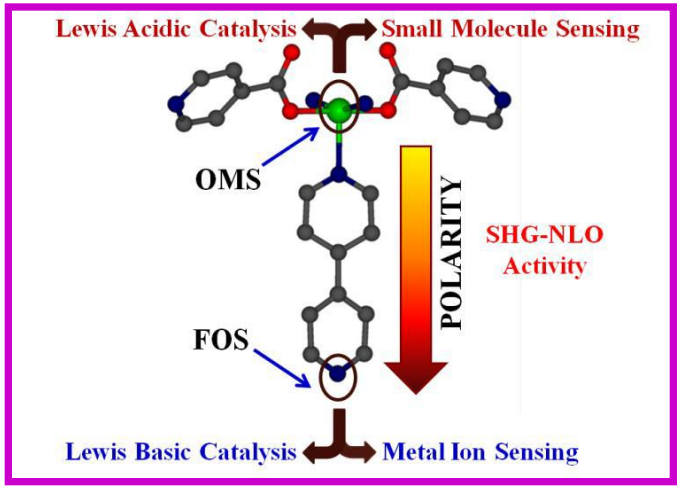


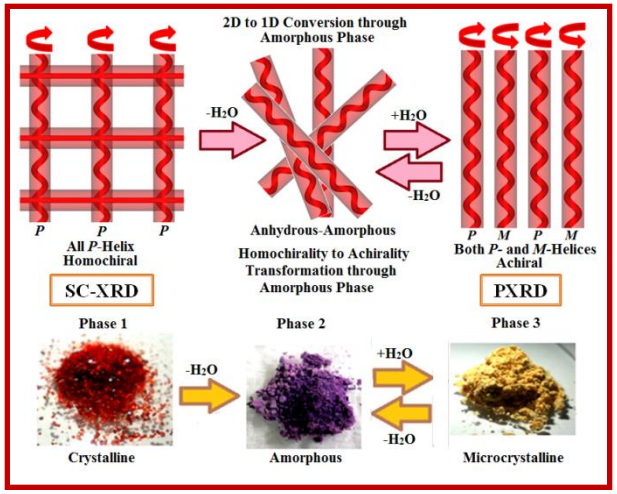


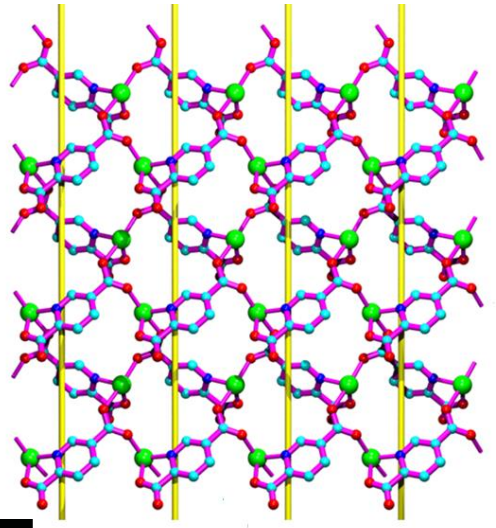


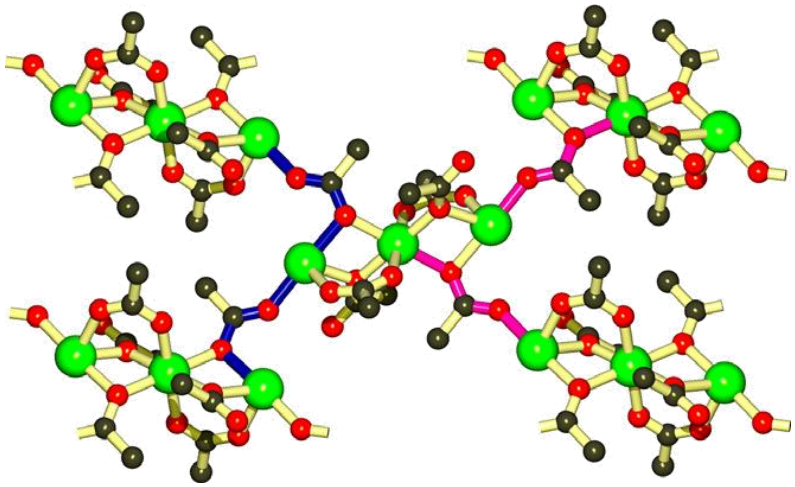


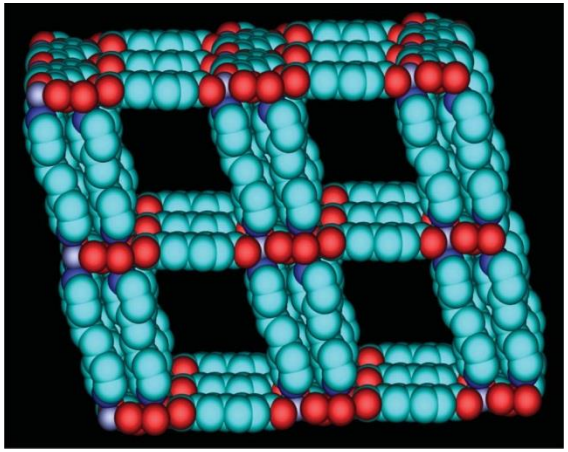
J. Appl. Phys. 114 (2013) 093901
Mater. Chem. Phys. 138 (2013) 833
J. Appl. Phys. 108 (2010) 034307



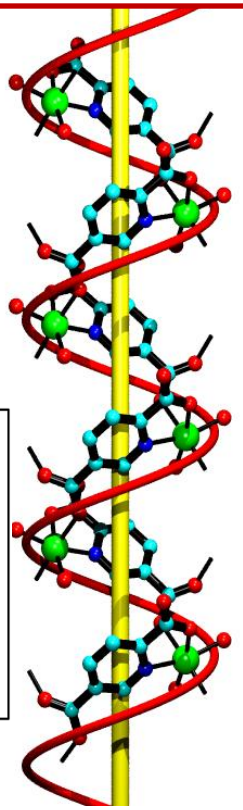




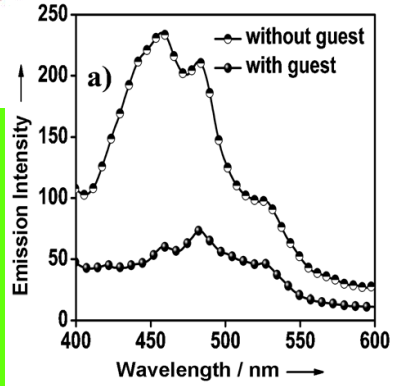


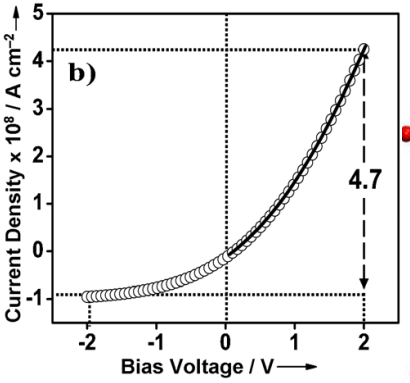


2D coordination sheet



1D coordination chain





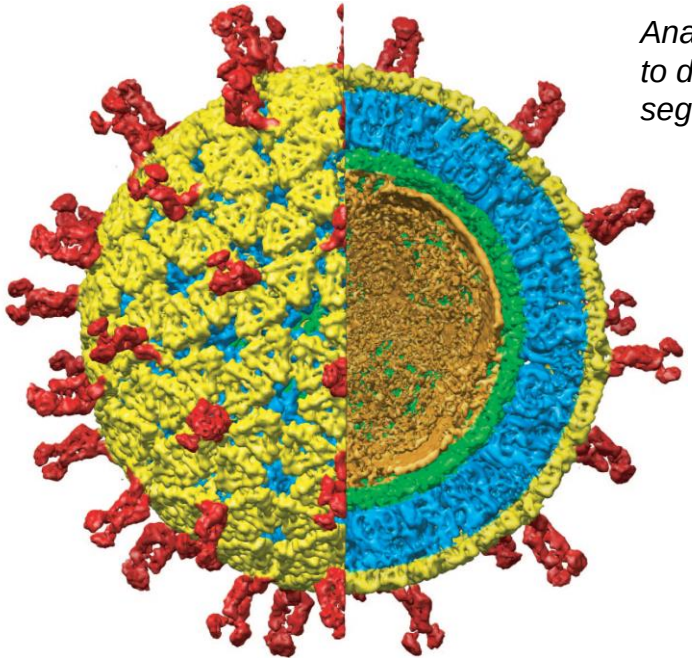
CrystEngComm, 14 (2012) 4980
Cryst. Growth Des., 13 (2013) 2135
Angew.Chem.Int.Ed., 51 (2012) 12534
Polyhedron, 53 (2013) 258
Chem. A Euro. J., 2013, Just Accepted.

Molecular Biology Group - a JU-CIRE collaboration

Principal field of research: Novel ways of viewing and analyzing DNA sequences

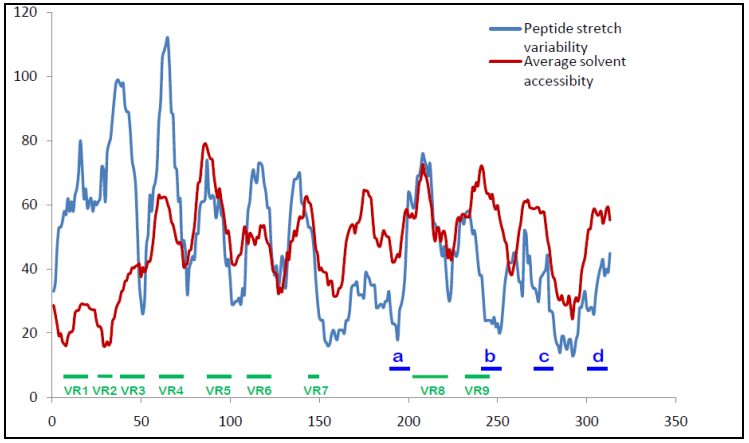
Current Application area – Drug targeting for virus particles

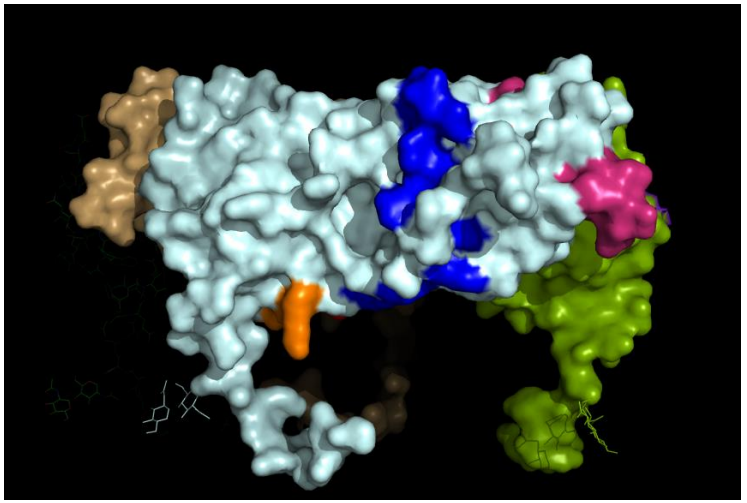
Example: Rotavirus – a gastro-intestinal disease



The rotavirus virion. The VP7 surface protein are shown in yellow

Analysis from our model to determine conserved segments





VP7 protein and conserved segments

Molecular Biology Group - a JU-CIRE collaboration (contd.)

Research Project 1: Interrelationship between surface proteins of the influenza virus.

Main query – Why only certain types of HA and NA combine in the influenza virion – e.g. H5N1, H3N2?
Have worked already on recent China flu – H7N9, paper communicated
Student – Tapati Sarkar, PI – Dr Sukhen Das, Funded by CSIR. Time: 2012-14

.

Research Project 2: Characterisation of the Dengue virus genomes circulating in India and determination of possible vaccine targets

Objective – Determine special attributes of the dengue virus genomes and examine the possibility of identifying drug/vaccine targets on the surface proteins. There are no effective vaccines against dengue yet.

Student – Sumanta De, PI – Dr Ashesh Nandy , Funding - None

an: 08 October 2013

MATERIAL SCIENCE & BIOPHYSICS LABORATORY

Physics Department, Jadavpur University, Kolkata
Centre for Interdisciplinary Research and Education, Kolkata
Condensed Matter Physics Centre, Jadavpur University, Kolkata

- **PI** : Dr. Sukhen Das, Physics Department, Jadavpur University
-
- **Members** : 20 (including 4 from other Institutes)
-
- **Number of Projects Running** : 7
-
- **Number of Papers published (2012- 13)** : 26
-
- **Number of Papers Communicated:** 7

Research Topics

1. Characterisation of transition metal incorporated ceramic material
2. Role of interdependence between hemaglutinin and neurominidase in propagation of viral infection
3. Development of supercapacitors using various metal oxide electrode materials
4. Ecofriendly high density nanocrystalline mulite rich ceramic pigment
5. Broad spectrum hybrid solar cell using dyes and nanoparticles
6. Preparation of soft magnetic nano composite materials
7. Homeopathic nano medicine – potency and size
8. Lipid bilayer membrane as rapid biosensor detector of pathogens and bioterrorism agents
9. Synthesis of metal/rare earth doped nanocrystalline mixed spinel ferrites .
10. Development of nano-mullite based biocers and their applications

A NOVEL PROTEIN – BIOREMEDIASE ISOLATED FROM A NOVEL BACTERIUM BKH1 HAVING POTENTIAL BIOTECHNOLOGICAL APPLICATION IN CONCRETE TECHNOLOGY

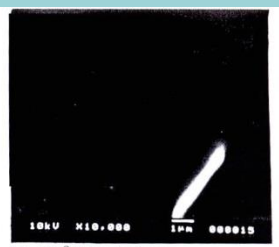
Trinath Chowdhury (1), Sudipta Majumdar (1), Manas Sarkar, **Brajadulal Chattopadhyay** (1) and Saroj Mondal (2).

Characterization of the silica leaching Bioremediase Protein

- The molecular weight of the protein is 28 kDa approximately.
- The protein shows maximum activity at pH 8.
- The protein is thermostable and at 65°C, the protein exhibited optimum activity.
- The enzyme specific activity is determined as 2.4 unit (1U = ng of silica released / µg of enzyme / min).
- In the presence of 10 mM $CaCl_2$, the specific activity of the protein was increased 2 folds implying that the protein has a calcium binding site.
- The protein shows similar strength improving property as shown by bacteria.
- The protein remains active in very high pH (12.5).
- The protein does not have hydrolase activity as seen in Silicatein of Marine sponge.
- The protease activity also absent in the protein.

1a. 42 °C bacterium

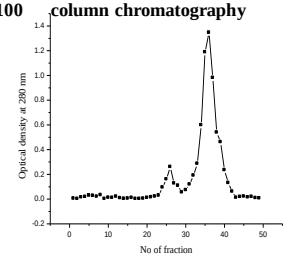
1b. 65 °C bacterium

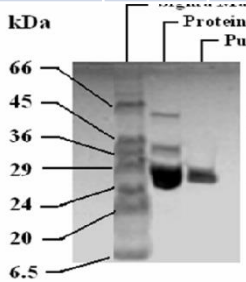


1c. 72 °C bacterium

Source temp.	Morphology	Gram Stain	Optimum pH for growth	Optimum temp. for growth	Compressive Strength Increment Property	Silica Releasing Activity
42°C	Coccoid	-ve	7.5	42°C	Absent	Absent
65°C	Long rod	-ve	8.0	65°C	Present	Present
72°C	Small rod	-ve	7.5	72°C	Absent	Absent

Graphical representation of protein fraction separated through Sephadex G-100 column chromatography



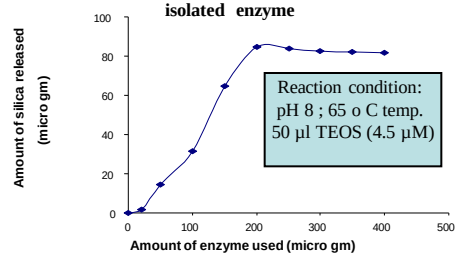


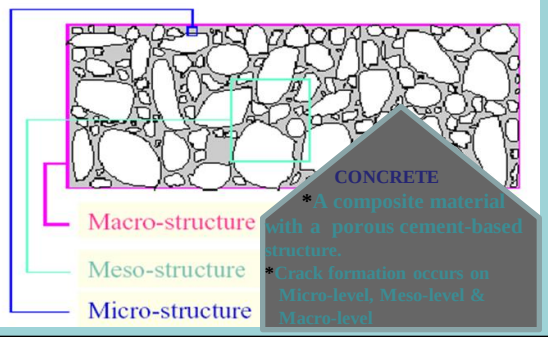
Lane 1 – Sigma Marker
Lane 2 – Supernatant Protein of the growth medium
Lane 3 – Sephadex G-100 column purified protein

Bacterial study

- Three novel bacterial strains in pure cultures are isolated.
- One of the strains (BKH1) shows property of bioremediation in Concrete.
- SEM view shows the bacterium was long rod shape.
- Gram staining suggests the bacterium is gram negative.
- The optimum growth is seen at pH 8 and 65°C temperature.

Biochemical assay of Silicification showing the activity of the isolated enzyme

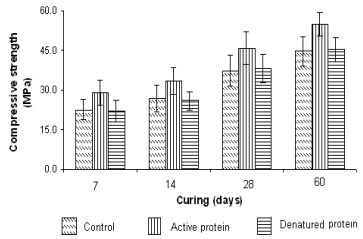




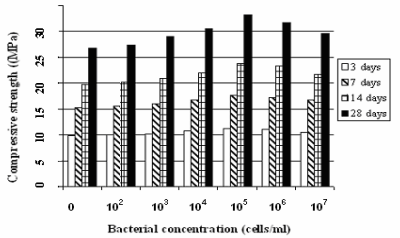
BACTERIAL CONCRETE

CEMENT
+
SAND + AGGREGATE
+ WATER
+
MICROORGANISMS

SEM view of Concrete pores with 10^5/ml bacteria showing crystalline deposition



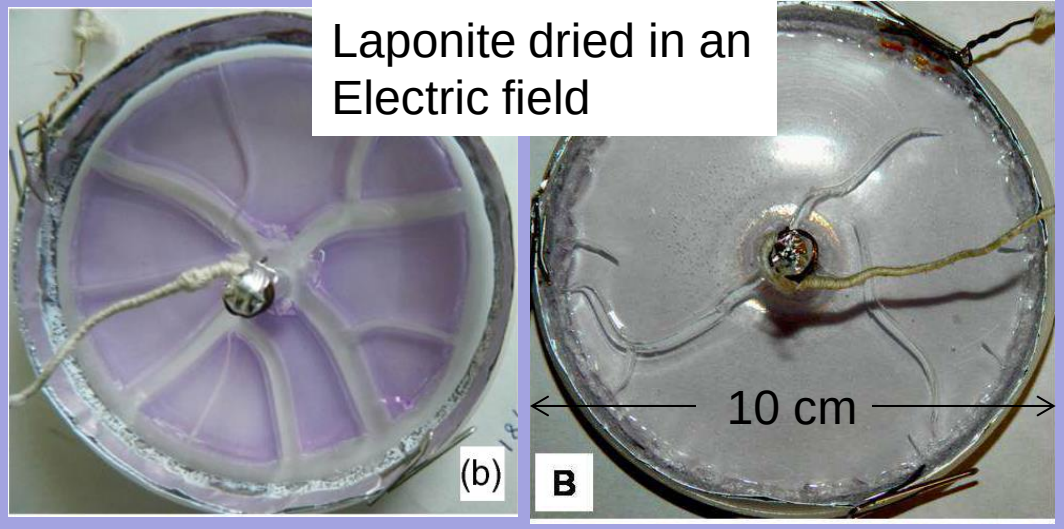
Compressive Strength of Mortar samples at different curing days with different active Bioremediase protein and denatured protein



Compressive Strength of Mortar samples at different curing days with different BKH1 cell concentration

Sujata Tarafdar : Desiccation of Complex fluids: Pattern Formation In aggregates and development of cracks.

Collaborators:
Dr.Tapati Dutta
(St. Xavier's)



Laponite dried in an Electric field

sujata_tarafdar@hotmail.com

Left : Radial cracks in DC 120 V. - (centre +ve), **Tajkera Khatun et al. PRE 2012**

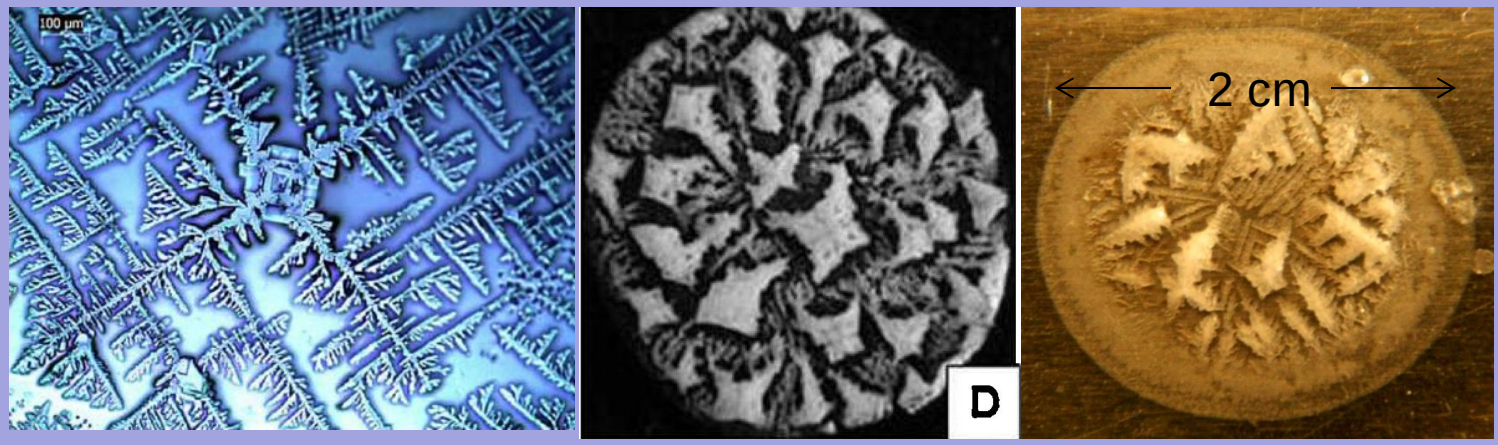
Right: Curved cracks in AC 40 V. 50 Hz

Appl. Clay Sci. (accepted)

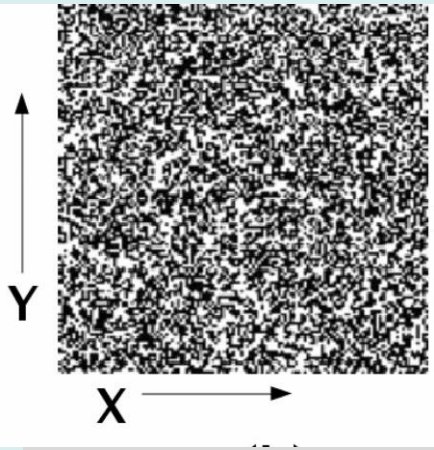
- **Book (Wiley VCH, under prep)**

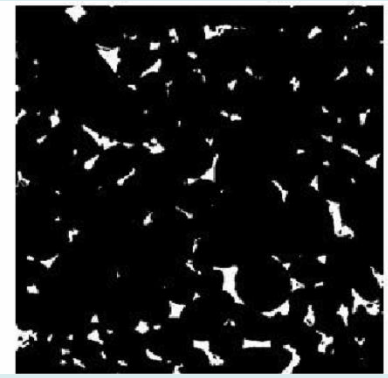
A. Giri et al.. Cryst Growth & Design (2012), M. D. Choudhuri et al Col. Surf A, 2013.

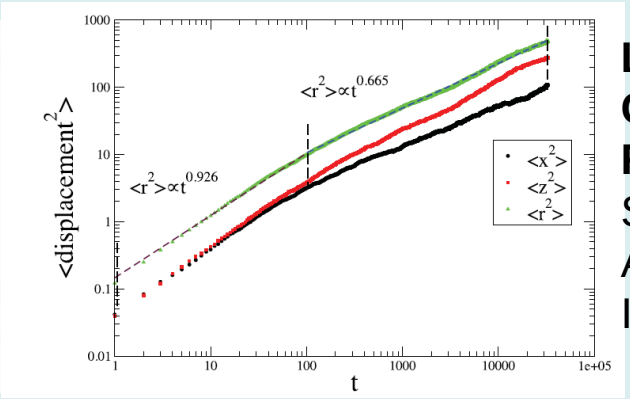
Mutifractal and Fractal Aggregates in Dried Starch gel + NaCl droplets, Expt.+simulation



- **Fractal modelling of Porous rocks** : Reaction and transport during fluid flow **Indo-French project** (**PI – Tapati Dutta**, CI – S. Tarafdar, French collaborator – Philippe Gouze, Montpellier Univ.) A. Giri et al. Geophys. J. Int. (2012)



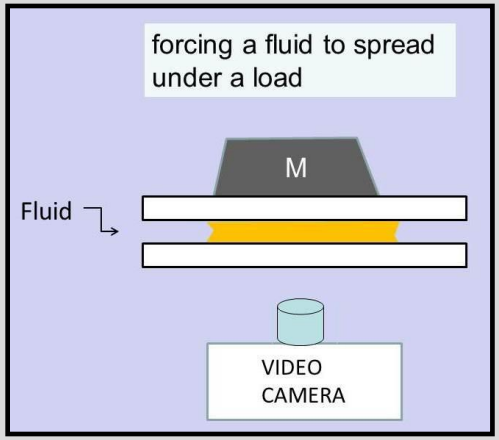


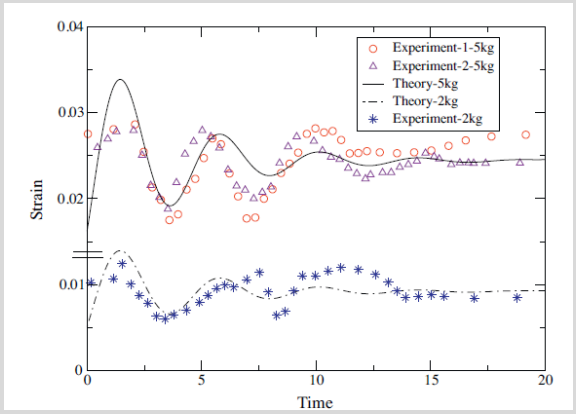


L: Simulated rock
C. Real rock
R. Av. R^2 vs t plot
Showing
Anomalous diffusion
In real rock.

Applying Generalized calculus to model complex systems

❖ **Visco-elasticity in spreading (collaborator – Shantanu Das, BARC)**

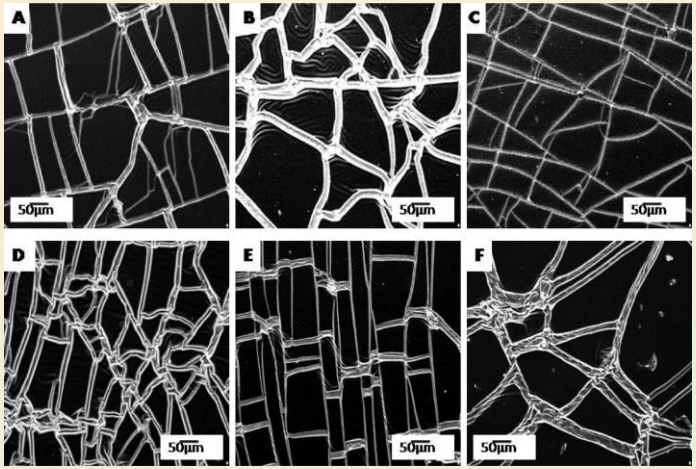




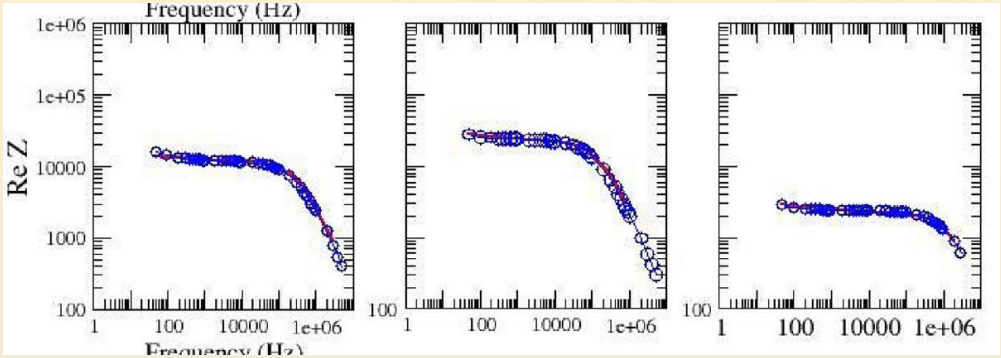
Modeling oscillatory spreading in squeeze flow (M. Dutta Choudhury et al. Col. Surf. A 2012)

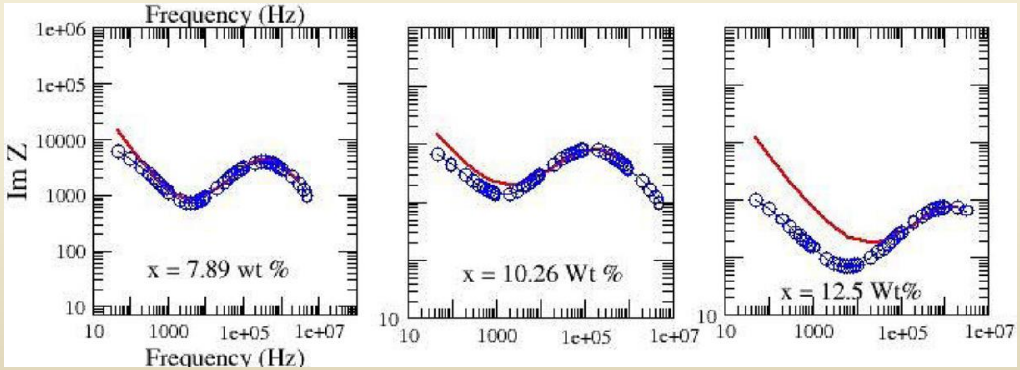
❖ Impedance spectroscopy of gelatin based polymer electrolyte (collaborator – **T. R. Middya**)

SEM images of films of gelatin $LiClO_4$



Tania Basu et al J. Phys. Chem B, (2012)





Fractional order derivative of order γ models anomalous Diffusion in the eq. of continuity

$$-\infty \mathcal{D}_t^{\gamma} \delta n_{\pm}(z,t) = D_{\gamma} \frac{\partial^2}{\partial z^2} \delta n_{\pm}(z,t) \pm \frac{NqD_{\gamma}}{k_B T} \frac{\partial^2}{\partial z^2} V(z,t)$$

Calculated (blue) and expt (red) results For real and imaginary parts of Z as Function of frequency

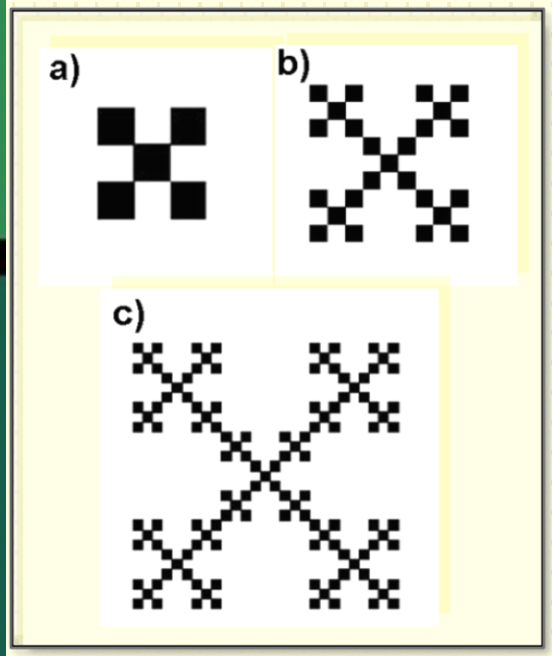
Influence of High Energy Gamma Irradiation on Polymer Electrolytes: Structure – Property Correlation & Validation through Simulation and Modelling

➢ ***Dr. Tapas Kumar Ballabh***

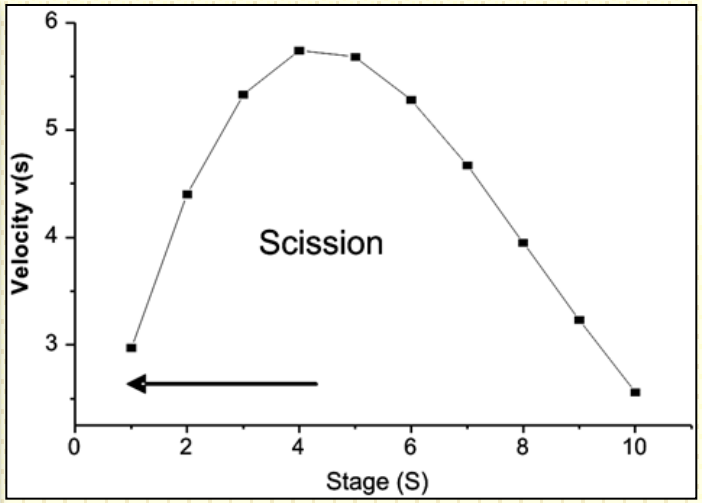
Group Members →

- *Dr. Ruma Ray [Gurudas College]*
- *Dr. Madhumita Mukhopadhyay*
- *Subhashis Ghosal*
- *Mou Saha*
- *Prof. Sujata Tarafdar*

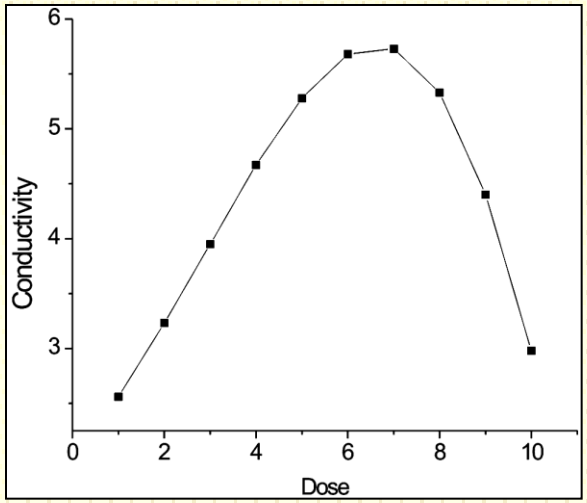
Diffusion and Conduction of Gamma Irradiated Polymer Electrolytes through Fractal Model:



➢ ***a) First, b) second and c) third stages of Vicsek fractal***



➢ ***Variation in velocity with fractal stage (arbitrary unit)***



➢ ***Conductivity vs. radiation dose (arbitrary unit)***

- The mentioned study is based on the application of fractal model considering only scission reactions
- The conductivity curve shows a peak for a particular time step [equivalent to radiation dose] and validates well with the experimental finding

S. Ghosal, R. Ray, T. K. Ballabh, S. Tarafdar, Indian J. Pure Appl. Phys. 51 (2013) 324-332.

- **Ongoing Research Work and Newer Outlook:**

  - Application of **fractal model** to elucidate the competitive scission and cross-linking in polymer electrolyte subjected to irradiation
  - Study of the intrinsic **kinetic phenomena** for polymeric phase change viz. melting, crystallization etc. derived from differential scanning calorimetry.
  - Influence of **gamma irradiation** on the formation of films and intrinsic properties of solid polymer electrolyte: Computer simulation and corresponding validation
  - Distribution pattern of microscopic **molecular weight distribution** and macroscopic **particle size distribution** of SPE: As an influence of gamma irradiation
  - Study of **reaction mechanism** on effect of irradiation onto polymer matrix : an insight into simulation and respective experimental validation

Prof. Alok K. Mukherjee, akm_ju@rediffmail.com

X-ray Crystallography

Structure of human kidney stone
From IR, SEM, TGA, XRD

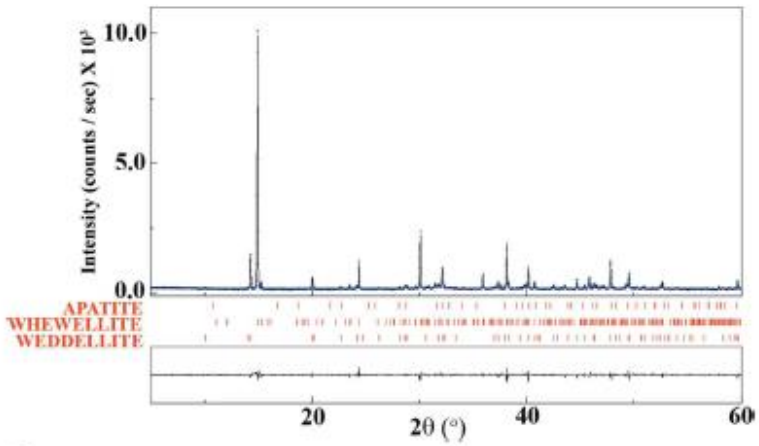


Figure 5
Final observed (blue crosses), calculated (black) and difference (black) profiles for kidney stone sample KS8.

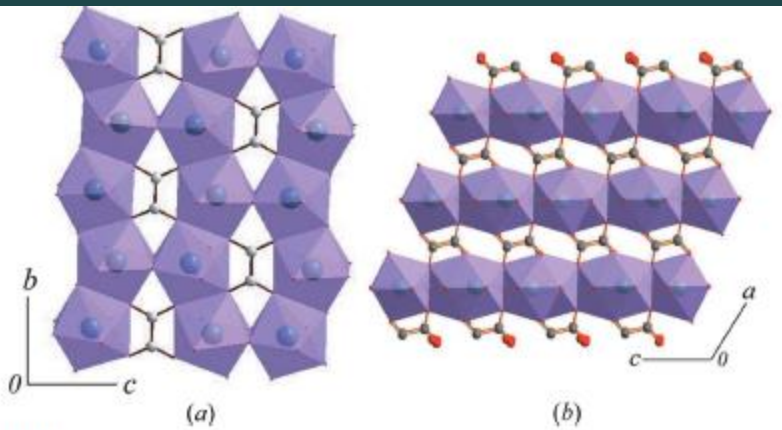


Figure 6
View of the COM structure, projected onto (*a*) the (100) plane and (*b*) the (010) plane.

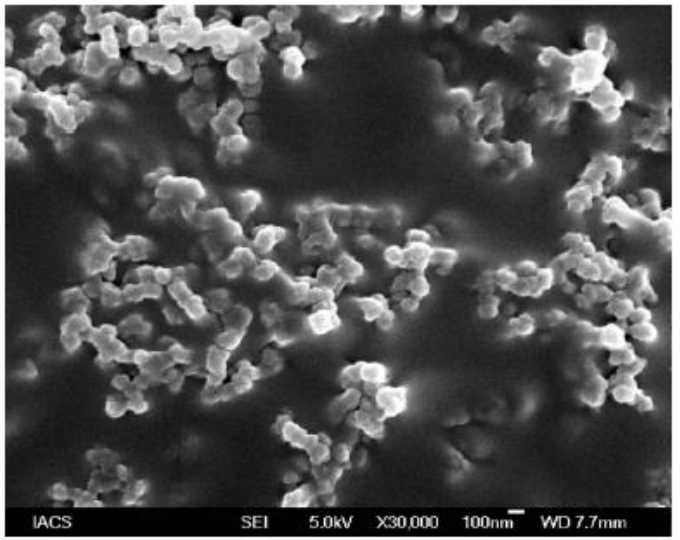


Figure 8
SEM micrograph of kidney stone sample KS1.

Ghosh et al.
J. Appl. Cryst.(2009) **42**, 629

Dr. Ajay Ghosh is working on superconductors

akg@phys.jdvu.ac.in

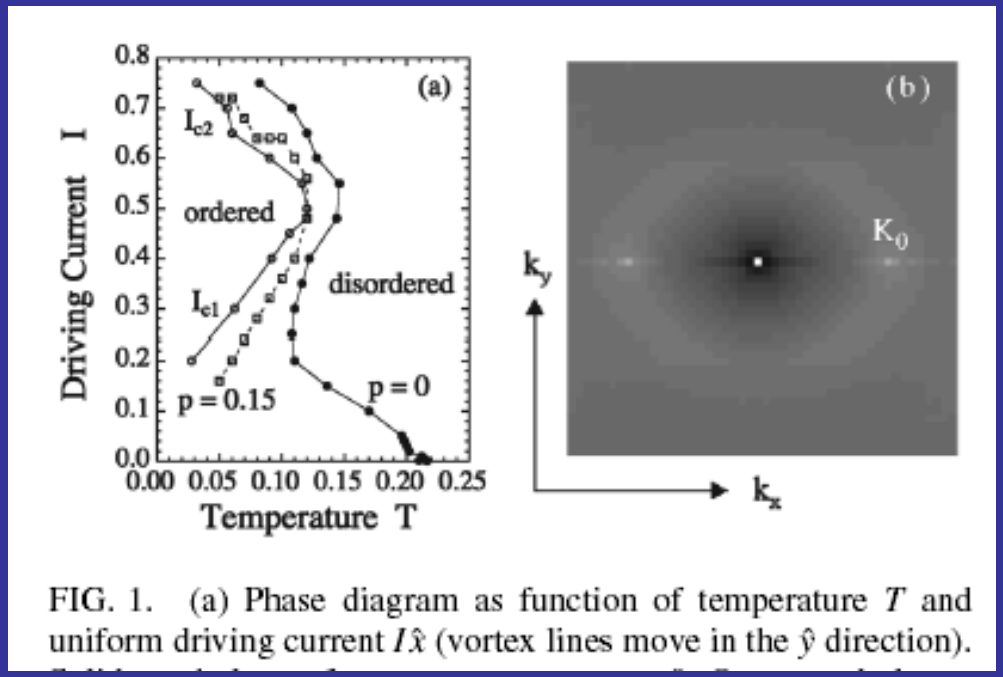


FIG. 1. (a) Phase diagram as function of temperature T and uniform driving current $I\hat{x}$ (vortex lines move in the $\hat{y}$ direction).

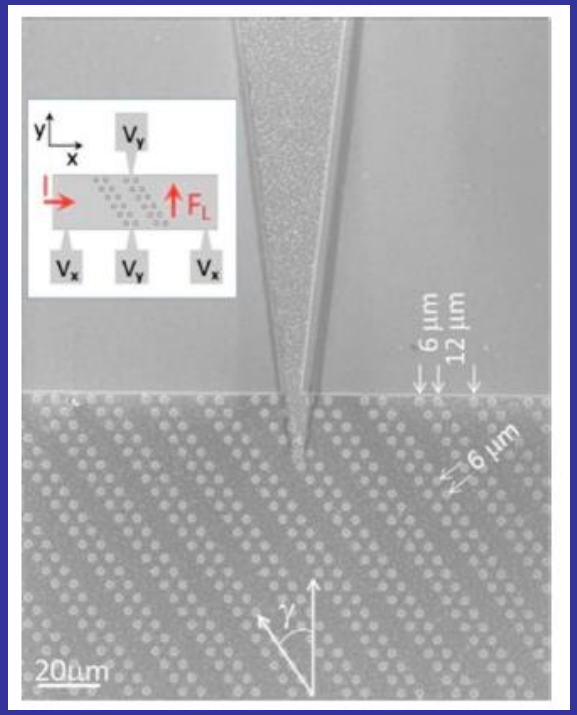
Applied Superconductivity Conf., August,2010, Washington DC, USA (invited)

Vortex line ordering in 3-D vortex glass

Ghosh et al. PRL 97, 267002, 2006

Appl. Phys. Lett. **94**, 202501 (2009)

Vortex motion in patterned YBCO film



Dr. Debashish Biswas

Atomic and Molecular Physics, Spectroscopy

Molecular Physics
Vol. 108, No. 15, 10 August 2010, 1957–1964

Taylor & Francis
Taylor & Francis Group

RESEARCH ARTICLE

Diode laser spectroscopy of He, N_2 and air broadened water vapour transitions belonging to the $(2\nu_1 + \nu_2 + \nu_3)$ overtone band

Priyanka Poddar[a], Soma Mitra[a], Md. Mabud Hossain[a], Debasish Biswas[b], Pradip N. Ghosh[b] and Biswajit Ray[a]*

[a]*Department of Physics, University of Calcutta, 92, A.P.C. Road, Kolkata –700009, India;* [b]*Jadavpur University, Jadavpur, Kolkata-700032, India*

(*Received 12 February 2010; final version received 2 June 2010*)

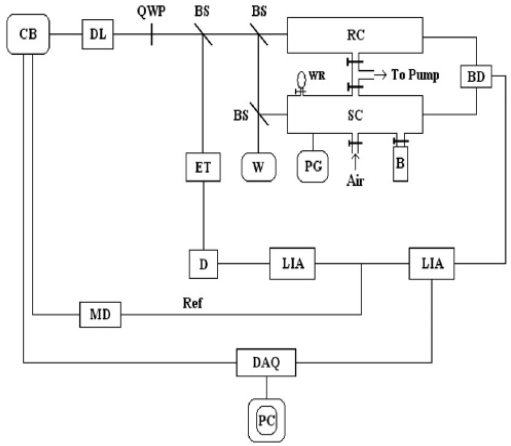


Figure 1. Block diagram of the NIR diode laser spectrometer: CB – Control box, DL – Diode laser, QWP – Quarter wave plate, BS – Beamsplitter, ET – Etalon, W – Wavemeter, SC – Sample cell, RC – Reference cell, PG – Pirani Gauge, D – Detector, BD – Balanced detector, LIA – Lock-in amplifier, DAQ – Data acquisition system, MD – Modulation, PC – Personal computer, WR – Water reservoir, B – Buffer gas cylinder.

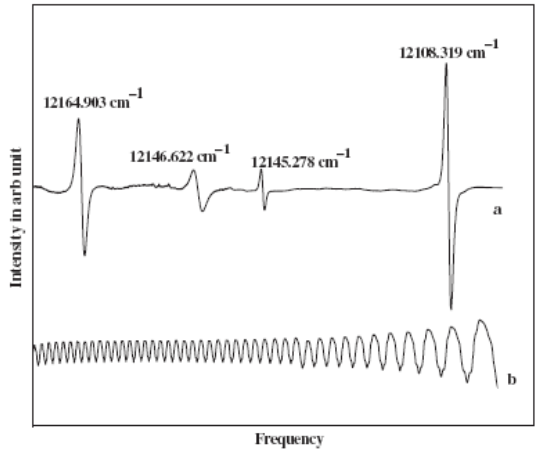


Figure 2. Thermal scan of the diode laser HL8331E (823 nm) from 40°C to 15°C (a) 1*f* spectra of water vapour transitions and (b) etalon signal. Lock-in time constant is 300 ms.

DEVELOPMENT OF LARGE AREA SINGLE JUNCTION AMORPHOUS SILICON SOLAR CELL

Dr. Partha Pratim Ray
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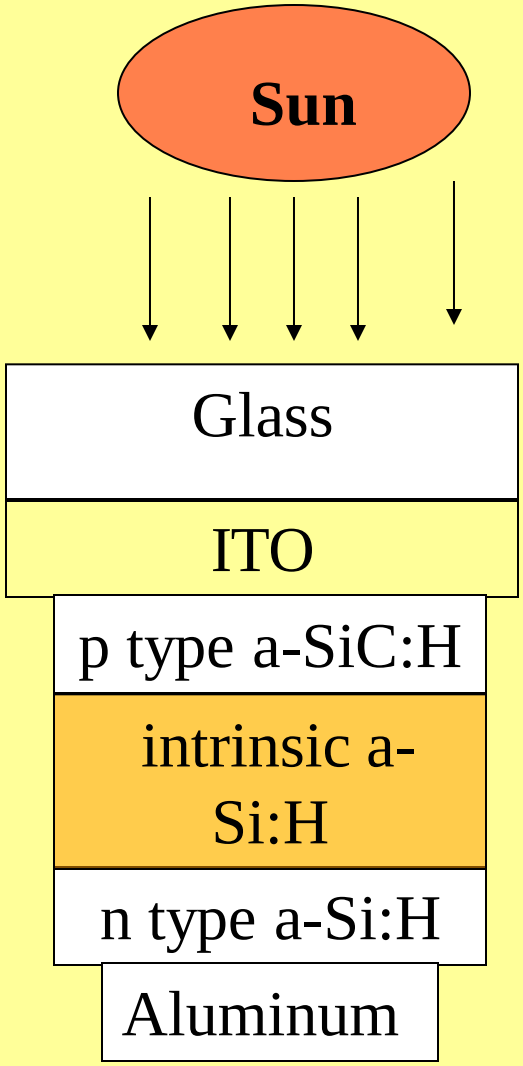
p-i-n Solar cell structure



Intrinsic a-Si layer is prepared by Argon dilution method.

P P Ray, C Longeaud, D Daineka, P R Cabarrocas, A Bhaduri, P Chaudhuri – **Proc. 18th Photovolt. Sci. and Engg Conf. (PVSEC-18)** (Kolkata, Jan 2009)

Theory and Simulation

Dr. Asim K. Ghosh – Condensed matter theory

PHYSICAL REVIEW B **80**, 214418 (2009)

Spin dynamics of the Ising-like fully anisotropic spin-$\frac{1}{2}$ antiferromagnet in presence of a staggered magnetic field

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Department of Physics, Jadavpur University, 188 Raja S. C. Mallik Road, Kolkata 700 032, India
(Received 25 June 2009; revised manuscript received 16 October 2009; published 21 December 2009)

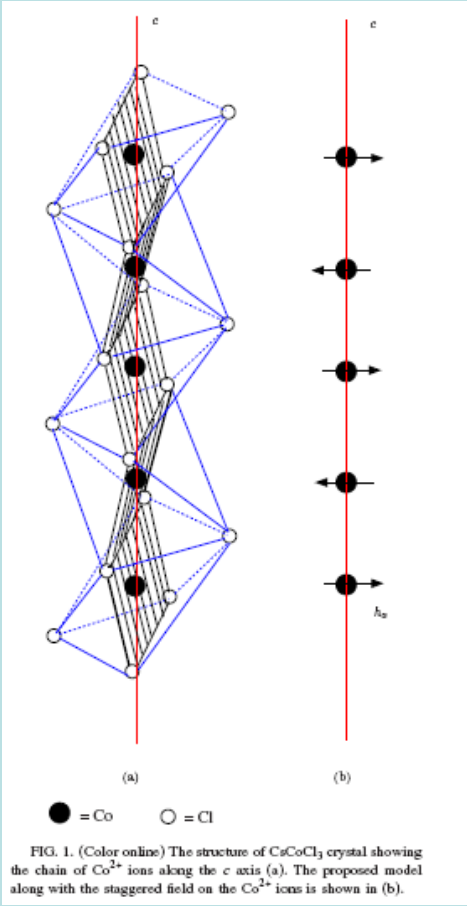


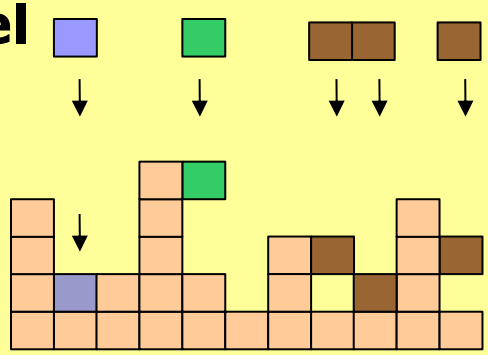
FIG. 1. (Color online) The structure of $CsCoCl_3$ crystal showing the chain of Co^{2+} ions along the c axis (a). The proposed model along with the staggered field on the Co^{2+} ions is shown in (b).

Recent publication

Domain wall dynamics of the spin-1/2 Ising-like antiferromagnetic chain in presence of Dzyaloshinskii-Moriya interactions;
Asim Kumar Ghosh, Eur. Phys. J. B **82**, (2011) 19–27.

Surface Growth Models:Computational & Analytical

- **Random-Ballistic Deposition Model**
- **Random Deposition Model with Surface Diffusion:**

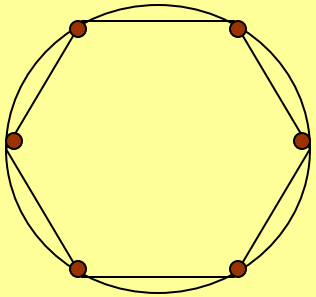


- Perfectly sticky particle
- Particle with variable stickiness
- Perfectly non-sticky particle
- Deposited Particle

http://arxiv.org/abs/0805.0647

Bethe Ansatz Study: Analytical

- **Calogero - Sutherland Model (CSM):**

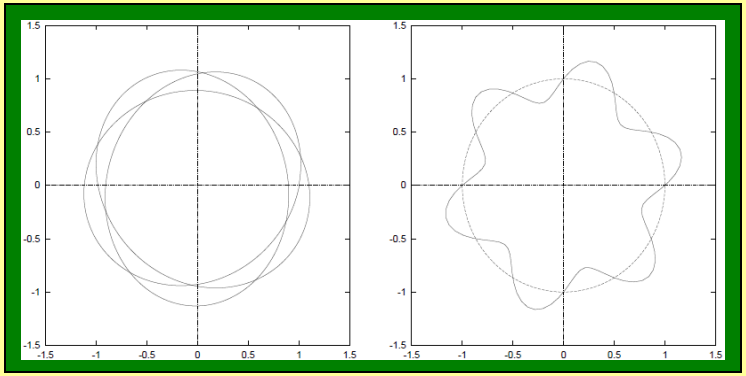


- Cyclic Chain in magnetic field, Elliptic and Hyperbolic extension

http://arxiv.org/abs/hep-th/0701137

Other Relevant Research:

- **Classical Orbits in General Power Law Potentials**
- **Phase Transition in Nuclear Matter:** Bethe – Peierls and Bragg – Williams Approximation in nuclear lattice gas



Central Field

Allowed **orbit** Not Allowed orbit

Work done by Subhankar Ray, Arindam Chakraborty, Baisakhi Mal (JU) in collaboration with J. Shamanna (Cal Univ) and T. T. S. Kuo (Stonybrook, NY) *sray@phys.jdvu.ac.in*

Dr. Sulava Bhattacharyya
Collaborators:
Shantanu Roy
Somnath Bhattacharya

Magnetic, Optical, Thermal and Nuclear Hyperfine Properties of Some Rare-Earth Compounds:

Crystal field theory has been used to calculate energy levels of ground and excited states, magnetic susceptibilities (along and perpendicular to symmetry axis) for TmF_3(Proc. 2nd Nat. Seminar on New materials Research and Nanotechnology, 2013). Work on NdF_3 is in progress.

sulava@phys.jdvu.ac.in

Prof. S K Roy: Statistical Physics
Monte Carlo Simulation of
Liquid Crystals

skroy@phys.jdvu.ac.in

PHYSICAL REVIEW E **81**, 041120 (2010)

Role of topological defects in the phase transition of a modified *XY* model: A Monte Carlo study

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(Received 21 January 2010; published 19 April 2010)

Monte Carlo simulation has been performed on a classical two-dimensional *XY* model with a modified form of interaction potential to investigate the role of topological defects on the phase transition exhibited by the model. In simulations in a restricted ensemble without defects, the system appears to remain ordered at all temperatures. Suppression of topological defects on the square plaquettes in the modified *XY* model leads to complete elimination of the phase transition observed in this model.

Thank you