
# SYMPHY 2011

## Physics Department In-House Symposium

15 Janurary, 2011

Venue: F C Kohli Auditorium, KReSIT


Organizer: Research Scholars' Association, Physics(RSAP)

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# Schedule

**Session 1**

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| 09:20 | Standard Model of particle physics with four chiral generations | Debasish Borah |
| | | |
| 09:40 | Study of laser action in functionalized opal Photonic crystal | Sunita Kedia |
| | | |
| 10:00 | Ab initio real space approach to electronic structure calculations in solids | Ravindra Shinde |
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10:20 **TEA BREAK**

**Session 2**

| Time | Title | Speaker |
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| 10:40 | Probing Lorentz invariance at EeV energy | Reetanjali Moharana |
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| 11:00 | Activities in the low temperature physics group | Anil Kumar Yadav |
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| 11:20 | Resonances in heavy ion collision experiments at Relativistic Heavy Ion Collider at Brookhaven National Laboratory | Prabhat Pujahari |
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| 11:40 | Spectroscopic studies of large sheets of grapheme oxide and reduced grapheme oxide monolayers prepared by Langmuir-Blodgett technique | D S Sutar |
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12:00 **Invited Talk:** Prof. Deepak Dhar (TIFR, Mumbai): Pattern formation in growing sandpiles

13:00 **Lunch (Gulmohar Lawns)**

**Session 3**

| Time | Title | Speaker |
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| 14:30 | The physics potential of a 2540 km superbeam long baseline experiment | Suprabh Prakash |
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| 14:50 | Magneto-plasmonic Fe3O4@Ag core-shell nanoparticles for multimodal contrast agent | Jeotikanta Mohapatra |
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| 15:10 | Generalized Parton Distributions in longitudinal and transverse position space | Ravi Manohar |
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| 15:50 | Coarsening in polycrystalline material using Quaternions | Santidan Biswas |
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| 16:10 | NMR research at Physics department, IIT Bombay | Tushar K Dey |
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16:30 **Invited talk:** Prof. Sandip Trivedi (TIFR, Mumbai): Accelerating universes in String theory, and Einstein's dream

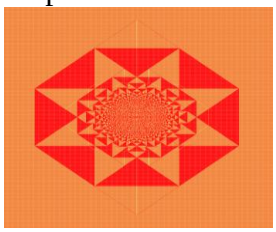
17:30 **Poster session + High Tea (KReSIT Foyer)**

# Invited Talks

## Pattern Formation in Growing Sandpiles

**Deepak Dhar**
Department of Theoretical Physics
Tata Institute of Fundamental Research

An important feature of biological growth in animals is proportionate growth: as a baby animal grows into an adult, the body mass may increase by around two orders of magnitude, but different parts of the body grow roughly at same rate. Most models of growth studied in physics literature do not have this feature. In this talk, I will discuss patterns formed in some sandpile models, which show proportionate growth. The patterns are beautiful, and rather intricate, formed by very simple evolution rules. An example is shown in the attached file. I will indicate how, in this special case, the limit pattern can be characterized exactly analytically.



## Accelerating Universes in String Theory and Einstein's Dream

**Sandip Trivedi**
Department of Theoretical Physics
Tata Institute of Fundamental Research

Dramatic advances in observational cosmology have taught us that the universe is accelerating. This discovery has far reaching consequences. Quite recently we have understood that such an accelerating universe can arise in string theory - a framework that attempts to provide an understanding of gravity based on quantum mechanics. The picture which emerges is that of a complicated landscape with many different possibilities for the acceleration and the others constants of nature. What do these developments mean for our quest for unification? And for the fulfillment of Einstein's dream? These are some of the questions we will discuss in the talk.

# Abstracts for Oral Presentation

**ZNO NANOWIRES: FABRICATION AND UTILIZATION IN ELECTRONIC DEVICES**

**Ajay Kushwaha**

Wide band gap (3.34 eV) and large excitonic binding energy (60 meV) of ZnO makes it a very potential material for electronic and optoelectronic device applications. In terms of nanomaterial fabrication ZnO shows its simpler and easier ways to get different morphologies. Herein low temperature and simple beaker chemistry approach is utilized to get highly ordered and well aligned array of ZnO nanowires. The control over the morphology and density of the nanowires is achieved successfully. Various characterization tools (SEM, TEM, HRTEM, AFM, and XRD) were performed to do structural and morphological investigation of the nanowires array. It was observed that the nanowires diameter ranges from 150 nm to 450 nm and length from 2 - 4 µm. PL measurement shows that nanowires array have defect band transition at 550nm and a intense UV emission, excitonic band transition at 386nm. All I-V measurements were performed using Agilent 4155C semiconductor parameter analyzer, at room temperature and Kelvin probe connection based probe station was utilized in this study. I-V measurement of the nanorod array was optimized for different contact combinations. A voltage controlled resistor device has been fabricated and tested.

**$U(1)_X$ extension of Standard Model with Four Chiral Generations**

**Debasish Borah**

We propose a viable way to generate neutrino masses in Standard model with four chiral families of leptons and quarks (SM4). To arrive at seesaw we include four singlet heavy neutrinos in the SM4. We show that the three light $(\sim \text{eV} )$ neutrinos of the standard model can be obtained from usual type I seesaw and a heavy fourth generation Dirac neutrino $m_{\nu 4} > 45 \text{GeV} $ can be obtained by extending the Standard Model gauge group by an additional $U(1)_X$. We assume non-universal coupling of this extra force which prevent the fourth generation right handed neutrino from acquiring Majorana mass resulting in a heavy Dirac neutrino. We also discuss different phenomenological aspects of this model.

**"Study of laser action in functionalized opal photonic crystal"**

**Sunita Kedia**

Three-dimensional opaline photonic crystals (PhC) are grown within 3 hrs by inward growing self-assembly technique using mono-dispersed Rhodamine-B dye-doped polystyrene (PS-RhB) spherical colloids of mean diameter 302nm. PS-RhB PhC with nearly 70% reflectance along ΓL direction shows the expected shift of the reflection spectrum towards lower wavelengths when the angle of incidence is increased, indicating the pseudo band gap nature of the crystal. Second harmonic of Nd: YAG laser at 532nm (with pulse duration of 6ns and pulse repetition rate of 10Hz) is used to pump the active PhC normal to its surface. An angle dependent modification in the spontaneous emission spectrum of the embedded dye is observed. The full width at half maximum of PS-RhB PhC is decreased from 65nm to 9nm when the pump power is increased. The PhC shows a directional spectral narrowing at a central wavelength of 587nm with the lasing threshold at 74mW.

**ab initio Real Space Approach to Electronic Structure Calculations in Solids**

**Ravindra Shinde**

Highly Localized and orthogonal orbitals for solids such as LiH, LiF, NaH, NaF, NaCl and KH are obtained using ab initio real space approach. A closed shell restricted Hartree Fock system is considered with an extra localizing potential term in Hartree Fock equations. Inter particle interactions are evaluated using Ewald summation – all interactions are taken into account. No approximations are made other than the Hartree Fock itself. Ground state total energy per unit cell is calculated for each of the above system. Geometry optimization has been done to get equilibrium lattice constant. The localized orbitals obtained are then plotted. The importance of this localization is discussed in context of CI calculations.

**Probing Lorentz Invariance at EeV energy.**

**Reetanjali Moharana**

Pierre Auger experiment has detected at least a couple of ray events above energy 60 EeV from the direction of the radio-galaxy Centaurus A. Assuming those events are from Centaurus A, we have calculated the number of neutral cosmic ray events from this source for small values of the degree of violation in Lorentz invariance. Our results show that a comparison of our calculated numbers of events with the observed number of events at EeV energy from the direction of the source can probe extremely low value of the degree of this violation.

**Activities in the low temperature physics group**

**Anil Kumar Yadav**

Our group focuses on various aspects of superconductivity and magnetism in condensed matter systems. In this in-house symposium we will talk about some of the recent work carried out by our lab-members in recent past. These include : (i) Iron (Fe) based superconductors, (ii) Exchange bias systems, (iii) Multiferroic materials, (iv) Mesoscopic systems, and (v) Thin film activity

**Resonances in heavy ion collisions experiments at Relativistic Heavy Ion Collider at Brookheven National Laboratory.**

**Prabhat Pujahari**

Study the resonances in heavy ion collisions is a very important tool to understand the dynamics of the system evolved in such collisions. In this talk we will discuss the transverse momentum spectra and the elliptic flow for various resonances those have been studied in STAR experiment at RHIC.

**Spectroscopic studies of large sheets of graphene oxide and reduced graphene oxide monolayers prepared by Langmuir-Blodgett technique**

**D. S. Sutar**

Graphene oxide (GO) sheets prepared by chemical exfoliation were spread at the air-water interface and transferred to silicon substrates by Langmuir-Blodgett technique as monolayers. Chemical reduction results in the formation of reduced graphene oxide (RGO) monolayers, without significantly affecting the overall morphology of the sheets as ascertained by AFM. XPS revealed that the reduction process results in a significant decrease in oxygen functionalities, accompanied by a substantial decrease in the ratio of non-graphitic to graphitic (sp2 bonded) carbon in the monolayers from 1.2 to 0.42. UPS revealed increase in density of states near the Fermi level due to reduction. Raman spectra have shown that during the reduction process, the G-band shifts by 8-12 cm-1 and the ratio of the intensities of D-band to G-band, I(D)/I(G) decreases. The significant decrease in I(D)/I(G) is attributed to the inherent order present in precursor GO and possibly the mechanism of solid state reduction.

**The Physics Potential of 2540 Km Superbeam LBL Experiment.**

**Suprabh Prakash**

The Long Baseline corresponding to the BNL-Homestake 2540 km shows some very interesting features as far as the determination of the Mass Hierarchy(sequence of the neutrino mass eigenstates) and CP-violation in the leptonic sector is concerned. We consider the physics potential of such a set-up for the discovery of these unknowns

**Magneto-Plasmonic Fe3O4@Ag core-shell Nanoparticles for multimodal contrast agent**

**J. Mohapatra**

A novel low-temperature thermal decomposition (< 200°C) approach was optimized for the fabrication of assembled multifunctional nanoparticles with a plasmonic shell of silver (Ag) and a magnetic core of Fe3O4 nanoparticles. Fe3O4 nanoparticles are used as seed materials and coated with Ag shells by stimulated reduction of the Ag precursor. The XRD spectrum and HR-TEM images confirm the as synthesized samples of Ag have an fcc structure with a = 4.076 Å, while Fe3O4 has a inverse spinel cubic structure with a = 8.374 Å. The optical studies for Fe3O4@Ag nanoparticles reveal strong plasmonic peak at around 400 nm due to Ag core and found to be red-shifted form that of the pure Ag nanoparticles. This could be due to the charge variation of the Ag particles within the core-shell structure. Samples of different sizes (10-22 nm) show almost negligible coercivity and remanence, suggesting that these NPs are superparamagnetic at room temperature. However saturation manetization increases gradually due to increase of size. Furthermore, the zero field cooled (ZFC) and field cooled (FC) curves measured under an applied field of 200 Oe showed a broad maximum on ZFC at around 75–125 K; the peak position (blocking temperature TB) follows the same trend as the saturation magnetization. This novel approach could be very useful to engineer the magnetic and optical properties of composite nanostructure over wide range by manipulating Ag to Fe molar ratio. A colloid suspension would make a promising multimodal contrast agent and the future studies are directed accordingly.

**Generalized Parton Distribution in Longitudinal and Transverse Position Space**

**R. Manohar**

If we take a Fourier transform of the Generalized parton distributions (GPDs) $H(x, \xi, t)$ and $E(x, \xi, t)$ at zero skewness ($\xi=0$) with respect to the momentum transfer in the transverse direction $\Delta^{\perp}$, we get the impact parameter dependent parton distributions (ipdpdfs). We present a study of these ipdpdfs using a recent parameterization of u and d quark GPDs $H(x, t)$ and $E(x, t)$ at zero skewness and discuss the region of validity of the positivity condition which seems to be violated in certain range of x and impact parameter $b^{\perp}$.

We also present the GPDs $H(x, \xi, t)$ and $E(x, \xi, t)$ in longitudinal position space using the same parameterization but extended to non-zero $\xi$ case in the kinematical region $x > \xi$. In particular, a study in longitudinal position space is interesting to understand the origin of the observed diffraction pattern in the DVCS amplitude in a simple QED model.

**Research Aspects of Carbon Nanotubes**

**Neha Kulshrestha**

Nanoscience and nanotechnology, in its meridian, is a field of researchers belonging from basic sciences to engineering. Carbon nanotubes are the most studied nanostructures in this fields. Their structural, mechanical and electrical properties are fascinating. Wide variety of their applications promises the interests in innovations varying from biomedical to computer science. This presentation is based on the various research prospectives in the related field.

**Coarsening in polycrystalline material using Quaternions**

**Santidan Biswas**

We develop a phase field model to study the phenomenon of recrystallization and grain coarsening in polycrystalline material. A unique feature of our model is that it can time evolve the actual orientation field of a material, expressed in terms of quaternions, a four-dimensional non-conserved vector field. The quaternions evolve in time following a Langevin dynamics. The free energy that drives the evolution contains bulk energy for various preferred grain types and anisotropic grain boundary energy. As a proof of principle for the new formalism we show that the average grain size (L) follows the usual L ~ t^1/2 scaling law when the grain boundary energy is independent of the misorientation angle between neighboring grains, where as the scaling exponent is lesser ( ~ 0.42) when grain boundary energy follows the misorientation dependent, phenomenological Read-Shockley formula.

**NMR research at Physics Dept, IIT Bombay**

**Tushar K Dey**

The NMR facility is recently established in Physics Dept, IIT Bombay. NMR is a very powerful technique to probe the magnetism of the sample at local level. I would like to talk about the technique, experimental setup and our findings using this setup in brief.

# Abstracts for Poster Presentation

**Lattice models for ballistic aggregation in one-dimension**

**Supravat Dey**

We propose two lattice models in one dimension, with stochastically hopping particles which aggregate on contact. The hops are guided by ``velocity rates" which themselves evolve according to the rules of ballistic aggregation as in a sticky gas in continuum. Our lattice models have both velocity and density fields and an appropriate real time evolution, such that they can be compared directly with event driven molecular dynamics (MD) results for the sticky gas. We demonstrate numerically that the long time and large distance behavior of the lattice models are identical to that of the MD, and some exact results known for the sticky gas. In particular, the exactly predicted form of the non-Gaussian tail of the velocity distribution function is clearly exhibited. This correspondence of the lattice models and the sticky gas in continuum is nontrivial, as the latter has a deterministic dynamics with local kinematic constraint, in contrast with the former; yet the spatial velocity profiles (with shocks) of the lattice models and the MD have striking match.

**Spectroscopic properties of nuclei in the mass region~130**

**Virendra Kumar B. Pasi**

Spectroscopic properties of nuclei in the mass region~130 like energy level, spin and angular moment of rotational states, special property like K-isomerism, chirality etc will be presented.

**Physical Property Measurement System**
**Sub Title: To Familiarize the Vibrating-Sample Magnetometer.**

**Himanshu Sharma**

PPMS(VSM): A vibrating sample magnetometer or VSM is a scientific instrument that measures magnetic properties invented in 1955 by Simon Foner at Lincoln Laboratory MIT. The paper about his work was published shortly afterward in 1959. A sample is placed inside a uniform magnetic field to magnetize the sample. The sample is then physically vibrated sinusoidally, typically through the use of a piezoelectric material. Commercial systems use linear actuators of some form and historically the development of these systems was done using modified audio speakers, though this approached was dropped due to the interference through the in-phase magnetic noise produced, as the magnetic flux through a nearby pickup coil varies sinusoidally. The induced voltage in the pickup coil is proportional to the sample's magnetic moment, but does not depend on the strength of the applied magnetic field. In a typical setup, the induced voltage is measured through the use of a lock-in amplifier using the piezoelectric signal as its reference signal. By measuring in the field of an external electromagnet, it is possible to obtain the hysteresis curve of a material.

**Low Dimensional and Geometrically Frustrated Magnetism**

**Ramender Kumar Sharma**

Magnetism has been an active area of research since it was discovered. In 3D magnetism we encounter with ordered state of moments like Ferromagnetism and Antiferromagnetism below a certain temperature called transition temperature. But when we tune the dimensionality of the lattice we see some astonishing effects, and these effects lead to various ground states like, gapped behavior, spin glass behavior and spin ice behavior which are never seen before in 3D systems. This is the combined effect of spin dimensionality, magnetic dimensionality as well as the types of interaction between the localized magnetic moments.

## FABRICATION AND OPTICAL CHARACTERIZATION OF SU-8 WAVEGUIDE AND DISTRIBUTED BRAGG STRUCTURES

**Diksha Makwani**

SU-8 ridge waveguides and distributed Bragg reflector (DBR) structures have been fabricated on silicon substrates. The good quality of the fabricated structures in SU-8 is ascertained by optical microscope (OM) and scanning electron microscope (SEM) images of ridge waveguide and DBR structures. In optical characterization studies, a significant amount of light from a fiber coupled laser at 633nm is guided by these structures which qualify the design parameters.

## DENSITY FUNCTIONAL STUDY OF FREQUENCY DEPENDENT POLARIZABILITY OF GOLD CLUSTERS

**Diksha Makwani**

The electronic structure of stable gold (Aun, n=2-10) clusters have been obtained using density functional theory (DFT) with generalized gradient approximation (GGA). The energy gap between the highest occupied molecular orbital (HOMO) and the lowest unoccupied molecular orbital (LUMO) for each stable structure shows odd-even oscillations. The even-numbered clusters have larger HOMO-LUMO gap and are relatively more chemically stable than the odd-numbered neighbors. The frequency dependent polarizability of Aun clusters is calculated. resonance peak occurs at energies of 3.0, 2.8, 2.5 and 2.3 eV respectively, for Au4, Au6, Au8 and Au10 cluster. It is observed that the first resonance peak shifts to lower energies consistently and polarizability per atom decreases as cluster size increases.

**Effect of Si and Ga substitutions on the magnetocaloric properties of NiCoMnSb quaternary Heusler alloys**

**Roshnee Sahoo**

The effect of Si and Ga substitutions on the magnetic and the magnetocaloric properties in Heusler based system Ni46Co4Mn38Sb12-xZx (Z=Si and Ga) has been studied. From the M(T) plots it is found that Si substitution stabilizes the austenite phase, whereas, Ga substitution stabilizes the martensite phase. Strong metamagnetic behaviour is observed in the M(H) isotherms for Si=0.75 and 1, whereas, such a behaviour is absent in the Ga substituted alloys. Associated with magneto-structural transition, large MCE of 58 J/kg K and 70 J/kg K is observed for x=0.75 and 1, respectively in the case of Si. Though the MCE observed in x=0.5 and 1 in the case of Ga is much lower, the MCE peak is found to be quite broad.

**Observation of spin-orbital compensation in Sm1-xGdxNi2**

**Bibekananda Maji**

We report the observation of a compensation point in the temperature dependence of magnetization data of polycrystalline Sm0.97Gd0.03Ni2 alloy. Magnetization measurements show that this compound magnetically orders at about 25 K. Below this temperature, the magnetization data shows a compensation point. When the cooling field is below 5 kOe, the alloy exhibits a large negative magnetization below the compensation temperature (T~18 K). However, for the higher cooling fields, a spin flip takes place which aligns the total magnetic moment along the field direction leaving a dip in the M(T) curve at the compensation point. Field cooled hysteresis loops obtained below the compensation temperature show that the compound possesses exchange anisotropy. Both the exchange anisotropy field and the coercive field are found to be quite large and a peak at the compensation temperature for temperature dependence of exchange bias field is detected. These results are similar to those of the well known and classical spin-orbit compensated ferromagnet (Sm,Gd)Al2 [1,2,3]. Resistivity data indicates that the material remains in the ferromagnetic phase even at the compensation temperature and below it. This peculiar magnetic property is attributed to the different temperature dependencies of the spin and orbital magnetic moments due to the complex thermal admixture of nearly degenerate J multiplets of Sm+3 ions[1]. A detailed discussion on the nature of the compensation in this alloy will be presented.

**Experimental Study of the Dynamics of Fiber Ring Laser under Cavity Loss Modulation**

**Aditi Ghosh**

The continuous-wave output of a single-mode erbium-doped fiber ring laser when subjected to cavity loss modulation is found to exhibit harmonic as well as subharmonic resonances. These features have been studied experimentally under variation of modulation frequency in a regime near the relaxation oscillation frequency.

**Emerging routes to Multiferroics**

**Dinesh K. Dixit**

Recent years have seen a considerable worldwide effort to discover a new class of materials known as multiferroics. These materials are so interesting because of their potential in making of many multifunctional devices. Multiferroics are the materials in which more than one ferroic order parameters are coupled to each other simultaneously in a single phase. The ferroic order parameters come in several forms, referred to as ferroic properties, all of which manifest themselves around some critical temperature. The primery order parameters are ferromagnetism, ferroelectricity (spontaneous electric polarization that can be reversed by an electric field) and ferroelasticity (spontaneous strain). But mant other flavours also exist, including antiferromagnetim and antiferroelasticity. Any material that combines more than one of these properties is described as multiferroic. If the order parameters are coupled to each other, then each can be manipulated by the application of the conjugate field by the other. For example in a magnetoelectric material, the magnetic moment can be manipulated by an electric field or the electric moment with the magnetic field. These materials are of great fundamental scientific interest, and are also highly desireable for several applications. Unfortunately, it is becoming clear that the electronic structure of the molecules that are required for ferromagnetism and ferroelectricity tend to be mutually exclusive. Ferromagnetism typically requires unpaired electrons that interact through a quantum-mechanical process known as exchange coupling. But typical ferroelectric materials (such as barium titanate, BaTiO_{\text{3}}, and other structurally related 'perovskites' compoundes that contain transition metals) require the transition-metal ion to have empty outer shell of electrons. This fundamental contrast is the main reason why few materials are both ferroelectric and ferromagnetic, In the materials that do have both of these order parameters, one is usually much weaker and appears at much lower temperatures than the other.

**Enhancement in superconducting properties on Cr substitution at Fe site in FeSe.**

**Anil K Yadav**

Iron based superconductor is interesting material for researcher in low temperature physics group due to formation of cooper pair in presence of Iron. Iron based superconductor can be categorized in four type according to structure. Among these Fe1+xSe is the simplest structure and has Tc = 8.5 K . We report enhancement of Tc = 11.2 K with substitution of Cr (x = 0.02) in place of excess iron. The crystals are prepared by conventional solid state reaction method. Phase purity and structural characterization were done in powder XRD. Magnetization and Resistance measurement were performed for Tc conformation in Physical Property Measurement System. Heat capacity measurement were performed to check the bulk property of superconductor.

**Fabrication of Fe1212 thin films and study of their magnetic properties.**

**Santosh Kumar**

Thin films of Fe1212 have been prepared by pulsed laser deposition. The films were synthesized at different partial pressure of Oxygen at a constant temperature of 715 C. The structural characterization have been done by using x ray diffraction. The aim of varying the partial pressure of Oxygen is to obtain different Critical temperature.

**Facile synthesis and tuned magnetization of Al xFe3-xO4 naoparticles depending on doping concentration**

**Arijit Mitra**

Here we report a novel one step approach to synthesize AlxFe3-xO4 naoparticles by a mild thermal-decomposition method at a moderate temperature 180◦C using ferrous chloride, aluminum chloride as the precursors and oleylamine as reducing and surface functionalizing agent. The X-ray diffraction (XRD) revealed that the synthesized nanoaprticles are single phase with spinel structure. TEM images show the size of the nanoparticles is below 10 nm. The magnetic measurements of the nanoparticles was done by using Quantum Design Physical Properties Measurement System (PPMS) which revealed that the synthesized nanoparticles are superparamagnetic in nature and their saturation magnetization could easily be tuned by varying the doping concentration of Al. The nanoparticles was also characterized by Fourier transform infrared spectrometry (FTIR), thermogravimetric analysis (TGA), inductively coupled plasma atomic emission spectrometry (ICPAES).

**Synthesis of single layer Graphene by chemical Method.**

**Hemen Kr. Kalita**

Graphene is a one atom-thick planar sheet of sp2- bonded carbon atoms. The carbon-carbon bond length in graphene is about 0.142 nm. The 3D material graphite is a layer structured material and is composed of several layers of graphene that are held together by van der Walls forces. It was first discovered by Professor Andre Geim's research group at the University of Manchester. Graphene was first obtained by top-down approach by using the technique of micromechanical cleavage. But now-a-days bottom up approach is used such as Chemical method, CVD method etc. It is so interesting because Graphene based transistors are supposed to be more efficient than silicon transistors. Graphene based Gas sensors are supposed to measure the effect of single molecule associating with a graphene. Also Graphene is supposed to be resistant to attack by many powerful acids and alkalis so it can used as atomically thin protective coating. Here we've tried to synthesize significant size Graphene films by the liquid Phase exfoliation method of Graphite and doing various characterizations such as HR-TEM, HR-SEM, Raman Spectroscopy, AFM etc to get signatures of single layer Graphene. HR-TEM images and Raman Spectrum shows the exfoliation of multilayer Graphene. My Research objective is to produce significant size Graphene films and look at the optoelectronic properties of the same so that we can use it to design some kind of sensor.

**Properties of Vanadium-based spin1/2 triangular systems**

**Tanmoy Chakroborty**

The field of strongly correlated systems is presently one of the most active areas of research in condensed matter physics. Among them low-dimensional systems have attracted a lot of attention due to the presence of strong quantum fluctuations in them and the geometrically frustrated systems have gained a lot of imoprtance because of the existence of wide variety of ground states in them. In this domain S=1/2 systems are more fascinating because in these systems quantum effects will be more dominant due to their low value of spins. In this paper, we have prepared one V4+(S=1/2) based system and studied its bulk magnetic properties. In this presentation we'll show two geometrically frustrated S=1/2 Vanadium based (V4+) systems[BaV3O8 and BaV4O9].In this system I'll briefly discuss about their crystal structure, preparation and their importance in the field of magnetism. Among these two the first one(BaV3O8 is mixed-valenced-2 Vanadium ions are in 5+ state(non-magnetic) and one is 4+ state(magnetic).In both these systems the V4+ ions are in edge-shared triangular network.