Oral Presentations

Defects and Optoelectrical Properties of ZnO Nanowire Films

Ajay Kushwaha

Metal oxide nanowires are exceptional due to their peculiar morphology and crystalline structure. The geometry provides a high surface to volume ratio rendering peculiar surface properties in these 1D nanostructures. The perfect crystalline nature along with a defect ridden surface controls the electrical and optical properties in a larger way. Soft chemical approach deposition can give rise to highly oriented nanowire films on glass substrates. Interestingly, thorough investigations, it has been observed that submicron sized zinc oxide (ZnO) nanorods contain intense defect band emissions. We also found that high number of defects (defects responsible for green emissions) result in higher order of UV light photosensitivity. We also explored the effect of surface defects on electrical transport properties in nanowire based ZnO films. The responsible defect state identification is still debatable however I would like to present some recent investigations which probably could hint which defect could be a source of n-type conductivity and responsible for high photosensitivity .

Optical and transport properties of GaN nanowall network grown by Molecular Beam Epitaxy

Hari Pratap Bhasker

Transport and optical properties of random networks of c-axis oriented wedge-shaped Gallium Nitride (GaN) nano walls grown spontaneously on c-plane sapphire substrates through molecular beam epitaxy are investigated. Our study suggests a one dimensional confinement of carriers at the top edges of these connected nano-walls, which results in a blue shift of the band edge luminescence, a reduction of the exciton-phonon coupling, and an enhancement of the exciton binding energy. Not only that, the yellow luminescence in these samples is found to be completely suppressed even at room temperature. All these changes are highly desirable for the enhancement of the luminescence efficiency of the material. More interestingly, the electron mobility through the network is found to be significantly higher than that is typically observed for GaN epitaxial films. This dramatic improvement is attributed to the transport of electrons through the edge states formed at the top edges of the nanowalls.

Modeling collective cell migration in response to wound healing

Dr. Tripti Bameta

The phenomenon of collective cell migration arises in biological pro- cesses of morphogenesis, wound healing, as well as cancer growth and is an active topic of current research interest. To understand the basic features in collective cell kinetics as a response to wound healing, two- dimensional patches of Madin–Darby canine kidney (MDCK) tissues on deformable substrates have been studied in different experiments. For a physical scientist, there are many interesting aspects that these experiments reveal. The swarming and swirling velocity patterns exhibited by the cells studied by particle image velocimetry are reminiscent of similar pattern formation in active nematics and driven granular matter. In order to mimic the self–driven, collective motility of epithelial cell collective, we have developed a simple model of a heterogeneous elastic membrane (representing the cell sheet) pulled over a viscous medium (representing the extra-cellular matrix) . Our model can qualitatively explain a few experimentally observed facts: (i) the growth of velocity ordering which spreads from the boundary of the cell sheet to the interior, (ii) the exponential tails of the distributions of the traction forces exerted by the cell sheet on the extra-cellular matrix, and (iii) the swirling pattern of velocities observed in the interior of the tissue.

Incomplete fusion reactions : A modified sum rule model

Bhushan Bhujang

The excitation functions of three reactions, viz, 11B+124Sn, 10B+124Sn and 11B+122Sn are obtained by activation techique followed by off-line gamma spectrometry. The projectile energy was in the range 5-8 MeV/A. Complete fusion cross-sections are fairly well reproduced by Projected Angular momentum Coupled Evaporation (PACE4) code. Sum rule of Wilczyski et al. [1]., in its original form was not able to account for the obtained cross-sections by incomplete fusion reactions. Many authors [2, 3] have tried to modify the sum rule model and our work is also one of its kind. Similar to the work of Glas and Mosel [4] we modified the concept of critical angular momentum by introducing energy dependent term in its definition. With this modification there is remarkable improvement in the

prediction of our modified sum rule model [5]

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Structural and magnetic properties probed using neutron diffraction technique in NiCoMnSb system

Roshnee Sahoo

Magnetization and neutron diffraction studies have been carried out in Ni50-xCoxMn38Sb12 (x = 0 and 5) to investigate the effect of Co on the structural and magnetic properties. A comparison of the neutron diffraction data of Ni45Co5Mn38Sb12 and Ni50Mn38Sb12 alloys shows that Co substitution leads to an increase in the Mn moments. Considerably sharp martensitic transition has also been observed after Co substitution. The neutron data has revealed that the martensitic transition is accompanied by a 70% decrease in the moment and a 0.3% decrease in the cell volume. The observed thermal hysteresis of the magnetization and the cell volume along with the enhancement of the Mn moment explain the strong magneto-structural coupling resulted from the Co doping. The variations in the individual site moments after Co substitution and their temperature dependencies seem to account for all the observed bulk magnetization data.

Photoelectron spectroscopic investigations of graphene oxide and reduced graphene oxide monolayers.

D.S. Sutar

In this presentation, I will talk about investigation of chemical and electronic structure of graphene oxide (GO) and reduced graphene oxide (RGO) monolayers

using x-ray photoelectron and ultraviolet photoelectron spectroscopy (XPS and UPS). GO monolayers were transferred to silicon substrates by Langmuir-Blodgett technique and were suitably treated to obtain RGO monolayers. Core-level C1s XPS measurements showed substantial decrease in oxidized carbon species upon reduction. Valence band measurements using UPS in case of RGO monolayers as compared to GO monolayers revealed increase in π electron density of states, steeper Fermi edge, decrease in work function; features attributable to increase in graphitic carbon network. In addition, X-ray induced Auger transitions and energy losses of C1s photoelectrons due to plasmon resonance have been analyzed to elucidate the valence band structure.

Light Front Dynamics

Sreeraj Nair

Light-cone coordinate system plays an essential role in simplifying the calculations involved in the study of hadron physics.
An elementary introduction to light-front dynamics and the essential role it plays in hadron physics is presented.

Graphene Oxide LB monolayers transferred on surface modified SiO2 and Si substrates

Venkatadivakar Botcha

Graphene oxide (GO) and reduced graphene oxide (RGO) have been explored for device applications as alternatives to graphene. Transfer of monolayers of graphene on SiO2 and graphene oxide on silicon by Langmuir Blodgett (LB) technique has been reported. The LB deposition of GO on SiO2 and its subsequent reduction to RGO is an alternative approach towards the fabrication of bottom gated RGO based FETs. In this work, we report the LB deposition of GO monolayer sheets on SiO2/Si substrate through appropriate surface treatment. The effect of similar surface treatments of Si substrate on LB deposition of GO sheets has also been studied for the purpose of comparison. GO sheets formed by oxidative exfoliation of graphite contain regions of basal plane that are hydrophobic and hydrophilic carboxylic acid groups at the periphery, making them effectively a large amphiphilic molecule, amenable for LB deposition. In the present work, silicon and thermally oxidized silicon (SiO2/Si) with ~100 nm oxide have been used as substrates, with and without

RCA-1 [NH4OH:H2O2:H2O (1:1:2) at 80oC] treatment, which is expected to form silanol groups on the surface, making it hydrophilic. The hydrophilicity of these surfaces has been evaluated by contact angle measurements with water at room temperature. With and without RCA-1 treatment, Si surface, exhibits contact angles of < 6o and 43o, respectively, while, SiO2/Si surface exhibits contact angles of < 6o and 28o, respectively. The concentration of GO sheets on the subphase was controlled by the volume of GO spreading solution (having an absorbance value of 0.1 at 230 nm) and the surface pressure was varied in the range of 1 – 10 mN/m. For initial depositions on both substrates, 20 ml of GO solution was spread on the subphase at pH ~5.6 and the transfer was carried out at 10 mN/m. AFM studies show that no GO sheets are transferred on untreated Si substrate, which is attributed to its high hydrophobicity as seen by the large contact angle (43o) of water with Si. In contrast, uniformly distributed and non-overlapping GO sheets are transferred on Si subjected to RCA-1 treatment. Height profiling of AFM images shows that the thickness of GO sheets is ~1 nm, confirming their monolayer character. However, on decrease of surface pressure to 1 mN/m, GO sheets are not transferred on the RCA -1 treated Si substrate. A completely different transfer behavior was observed on SiO2/Si substrates. AFM images show uniformly distributed, closely spaced but non-overlapping GO sheets on both RCA-1 treated as well as untreated SiO2/Si. It is however found that the GO sheets transferred on untreated SiO2/Si surface have curled up edges, exhibiting a tendency to peel off, implying poor adhesion, whereas, on RCA-1 treated SiO2/Si surfaces, the GO sheets exhibit no such features and the height profiles at the edges correspond to monolayer thickness ~ 1 nm. The relatively smaller (28o) contact angle of water with untreated SiO2 surface appears to be sufficiently hydrophilic, facilitating the transfer of GO, though with poor adhesion. However, in case of the RCA-1 treated SiO2/Si, transfer of GO monolayer sheets without any significant change in morphological features is observed, even at low surface pressures ~1 mN/m and suitable control of volume of spreading solution, has been found to result in transfer of GO monolayers with controlled spacing between the sheets.

Gravity Duals of Nontrivial Infrared Behaviour of Field Theories

Arpan Saha

Studying asymptotically AdS solutions with nontrivial near horizon behaviour can lead to interesting insights about condensed matter systems which undergo RG flow to nontrivial symmetries in the IR limit, via the AdS/CFT correspondence. We investigate the difficulties that arise when we try to extend the work done by Kachru et al (2012) to find solutions interpolating between AdS_5 and a Bianchi Type VII, to

other Bianchi Types and how these difficulties might be addressed.

ω → π+ π− π0 in p-p collisions with WASA-at-COSY detector

Siddhesh Sawant

The decay mechanism of omega into π+ π− π0 states can be investigated by comparing the experimentally obtained Dalitz plot with that of therotical predictions. In order to obtain a high density Dalitz plot omegas are produced in proton beam - proton target collision at Tp =2.063 GeV with WASA-at-COSY experimental setup. The reaction is well above (Q ≤ 60 GeV) the threshold of omega production. The oral presentation presents the current status of analysis in the data.

Exploring QCD phase diagram by net-Charge Higher Moments at RHIC and LHC

Nirbhay Kumar Behera

In materialistic world we see matters in form of many state having same fundamental constituent. Physicists describe the transformation of matter from one state to another state in terms of thermo-dynamical variables pressure (p) and temperature (T). The representation is known as phase diagram. Like water, CO2, magnetism all phases are governed by electro-magnetic force, similarly the interaction of all building blocks of matter; the nucleons(proton and neutron) are governed by Strong interaction. Quarks and gluons are most fundamental particles of nucleons. In Strong interaction, the phase diagram of quark-gluon is studied under Quantum Chromo- Dynamics (QCD). Hence it is called QCD phase diagram. QCD phase diagram is drawn temperature vs baryo-chemical potential. Lattice QCD predicts that like in water, in QCD phase diagram has also a critical point. In recent decade, there are many experimental efforts in higher energy physics have been taken in search of QCD critical point. At Relativistic Heavy Ion collison (RHIC) and Large Hadron Collider (LHC) experiments, heavy atomic nuclei are smashed at relativistic speed with different

center of mass energy to explore the QCD phase diagram from low temperature-high baryo chemical potential to high temperature-low baryo-chemical potential. Higher moments analysis of conserved quantity like net-charge, net-proton are potential candidature for critical point search. In this talk I will introduce about the QCD phase diagram and then I will go through the recent experimental findings in higher moments analysis at RHIC and LHC.

Magnetic Properties of Magnesium Ferrite Thin Films Deposited by Pulsed Laser Ablation at Different Substrate Temperatures

Himadri Roy Dakua

The magnesium ferrite thin films are studied to correlate the magnetic properties of the films with their microstructural properties. The films are deposited on quartz substrates, using pulse laser deposition method, at different substrate temperatures ranging from room temperature to 750C, keeping the oxygen pressure fixed at 6.5x10-2 mbar. The XRD of the films deposited at room temperature (RT) and 250C do not show any peaks whereas the films deposited at 500 and 750C show single phase of magnesium ferrite. The saturation magnetization ($4\pi Ms$) of the films obtained from vibrating Sample magnetometer (VSM) varies unconventionally with the substrate temperatures (Ts). The $4\pi Ms$ value of films deposited at Ts = RT and 750C give almost same values (nearly 65% of bulk the value 1660 Gauss), but the films deposited at TS = 2500C and 5000C give very less magnetization (less than 10% of the bulk value). This unconventional variation of $4\pi Ms$ values of the films may be due to the change in the lattice positions of the magnetic (Fe^{3+}) and non magnetic (Mg^{2+}) ions of the magnesium ferrite films.

Study of a low-dimensional geometrically frustrated magnetic system

Tanmoy Chakrabarty

The field of low-dimensional and geometrically frustrated magnetism is an active area of research in solid state physics. In the last few decades, special emphasis has been laid on low- dimensional spin systems such as chains, square lattices, ladders, especially after the discovery of high-temperature superconductivity incuprates. In

the case of one-dimensional (1D) antiferromagnetic (AF) chains, the scenario becomes even more interesting if in addition to a nearest-neighbor (nn) interaction, a frustrating next-nearest-neighbor (nnn) interaction is also present. Depending on the ratio of the nnn to nn coupling (Jnnn/Jnn) in these so called “Majumdar-Ghosh” (MG) chains, distinct magnetic phases are formed. For Jnnn/ Jnn¸ 0.24, the ground state is spontaneously dimerized with an energy gap in the excitation spectrum. In this work we prepared and studied the bulk (x-ray, magnetic properties and heat capacity) as well as local properties (NMR) of a low-dimensional geometrically frustrated spin. Both short and long range order have been observed in this system which are the characteristics of low dimensional and 3-d magnetic systems respectively. We have modeled the magnetic susceptibility of this system considering a coupled-Majumdar-Ghosh arrangement. These salient features are also observed in the hat capacity measurement .

High spin states of 126Te

Virendra Pasi

The nucleus 126Te was theoretically predicted to have K-isomerism [1]. The experimental study, however, was limited to only low spin states [2].
We performed an experiment using the Indian National Gamma Array (INGA) at the Inter University Accelerator Centre (IUAC). The set-up consisted of 15 Compton suppressed HPGe clover detectors. The reaction used was 124Sn(7Li, p4n)126Te at the beam energy of 50 MeV. The triple-gamma coincidence data were analyzed to obtain the projections of many coincident double-gamma gates. The known and the new gamma transitions belonging to 126Te were identified. For the Directional correlation analysis (DCO), an asymmetric matrix of size 4k×4k, with the 32 detectors or the 148 detectors on one axis and the 90 detectors on the other axis was prepared. A pair of -transitions, including the one decaying from the unknown spin state, was used to find the DCO ratios. This ratio was then compared with the theoretical results to find the value of the unknown spin and the mixing ratio. Two asymmetric matrices, with parallel or perpendicular scattering of the -ray on one axis and all the remaining clovers on the other axis, were prepared for the polarization analysis. The results are presented below:
(i) Thirty four new -transitions have been placed in the decay scheme (Fig. 1) and the preliminary results were presented in the DAE symposium [3]. The placement of the known transitions, 990, 209 keV, belonging to the yrast band has been interchanged. Only then it was possible to place consistently many new transitions in the decay scheme.
(ii)The quadrupole nature of the transitions belonging to the yrast band was confirmed by our DCO analysis. The new assignment of the spins was made to ten energy levels.
(iii) To find the parity of the states, the experimental asymmetry () for many

transitions were determined from the polarization analysis. The positive and negative values of correspond to the pure stretched electric and magnetic transition, respectively. Reverse is the case for the pure non-stretched transitions. The spin of the bandhead of the negative parity band (Band 1) was tentatively assigned to be 7 earlier which needed to be confirmed from our experimental data analysis. The 721 keV transition was found to be dipole from our DCO analysis and the value of was obtained as 0.09. The possibility that the state is 6+ cannot be ruled out. The theoretical analysis of the polarization is being currently carried out to remove the ambiguity and establish the bandhead spin.

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Higher moments of Net Kaon Fluctuation in the Beam Energy Scan of STAR

Amal Sarkar

The Relativistic Heavy-Ion Collider (RHIC), at BNL, has started its beam energy scan program to locate the QCD critical point which is also one of the main aims of the STAR experiment. Calculations on the lattice predict that the higher moments of the multiplicity distribution of the conserved quantities like the net-charge, net-baryon, net-strangeness are related to the corresponding susceptibilities and the correlation length of the system. These moments shows deviation from monotonic behavior at critical point. STAR experiment has already published the result for higher moments of the net-proton multiplicity distribution in Au+Au collisions at √sNN = 7.7, 11.5, 19.6, 27, 39, 62.4 and 200 GeV. Here we report the first measurements of the standard deviation, skewness and kurtosis of the net kaon fluctuation measured by the STAR detector at midrapidity for Au+Au collisions at various energies.The volume independent product of these moment will be shown and compared with various theoretical models.

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Coupling heterogeneous oscillators to a common dynamical environment and its applications

Tanu Singla

Synchronization of nonlinear oscillators from different origins is attempted. This involves coupling these heterogeneous oscillators to a common dynamical environment. Three different timeseries: a) y variable of the Lorenz oscillatorb) the X-component of Earth's magnetic field and c) EEG (Electro Encephalo Gram) signal are environmentally coupled, under the master slave scenario, with a Chua oscillator. Our results indicate that environmental coupling is strong enough to provoke complete synchronization of heterogeneous oscillators from distinct origins.

Effect of Metal deposition on Electrical performance of Carbon Nano Devices

Neha Kulshrestha