SATYENDRA NATH BOSE NATIONAL CENTRE FOR BASIC SCIENCES

Newsletter

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Editorial

We start this issue of the Newsletter reporting a mega scientific event that took place in our city, namely, the Centenary Celebrations of the Indian Science Congress. Our Centre has been a part of the celebration. We could not hold on to report the mega event even though this took place beyond the scheduled time period of coverage in this issue.

However, this does not mean all other activities in the Centre came to halt. We have tried to give a glimpse of the untiring activities all around in the Centre, despite the mega activity taking up a good amount of time in making its organisation.

Contents

Centenary Celebrations of Indian Science Congress (ISC), Kolkata, 3-7 January, 2013

Ambalika Biswas

Indian Science Congress Association is a premier scientific organization of India, started in the year 1914, with Headquarters at Kolkata, West Bengal, India. It meets annually in the first week of January every year. This year it had its centenary celebration jointly organized by the University of Calcutta and the Bose Institute, Kolkata from January 3 to January 7, 2013. The S. N. Bose Centre was one of the venues for the celebration.

His Excellency Sri M. K. Narayanan, Hon'ble Governor of West Bengal, on behalf of Calcutta University and committee of hosts welcomed the delegates to the historic 100th session of Indian Science Congress. On 3rd January 2013, Sri Pranab Mukherjee, Hon'ble President of India inaugurated the congress at Salt Lake Stadium. Dr. Manmohan Singh, Hon'ble Prime Minister of India delivered the presidential address of ISCA. Dr. Singh also chaired a panel discussion on "Science for shaping the future of India", which was the theme for this year's ISC. Ms. Mamata Banerjee, Hon'ble Chief Minister of West Bengal and Shri S. Jaipal Reddy, Hon'ble Minister of Science and Technology and Earth Sciences, Government of India delivered felicitation addresses and released publications. Shri Kapil Sibal, Hon'ble Minister for Communication and Information Technology, Government of India released commemorative postage stamp on 100th anniversary of Science Congress.

As an integral part of ISC, the Children's Science Congress (CSC) was organized to provide a unique opportunity for children to use their scientific temperament and knowledge and quench their thirst for creativity by undertaking scientific projects. Dr. A. P. J. Abdul Kalam, Hon'ble ex-President of India inaugurated the session on 4th January 2013 at the S. N. Bose National Centre for Basic Sciences. It comprised a

three-day exhibition that housed stalls with Science Models created by children from all over the country. The event stimulated young innovative minds and spurred them to be the budding scientists of the future. It gave them a prestigious platform to showcase their talents in science. The day turned memorable as everyone's very own "Kalam Sir" acceded to have a private interactive session dedicated exclusively to the S. N. Bose Community. The session grew highly enlightening as various general as well as technical issues were brought forth by the audience to be addressed by Dr. Kalam. During later half of the day, Shri S. Jaipal Reddy inaugurated the Women's Science Congress.

Lectures by several renowned scientists of eminence including Nobel Laureates such as Dr. Venkatraman Ramakrishnan, Dr. Ei-Ichi Negishi, Dr. James A. Mirrlees, Dr. R. K. Pachauri, Dr. Samuel C. Ting, were organised at different locations. Plenary sessions, Theme Symposiums, Sectional Committee meetings, Session of Women's Science Congress, Sessions of Vigyan Sancharak Sammelan were held.

'Pride of India' exhibition was organized at Yuva Bharati Krirangan, Salt Lake, as a part of the centenary edition in Kolkata. Stalls were put up by various research institutes from all over India. The stalls were grouped under various sub divisions viz: DST, DRDO, CSIR, ISRO, DAE, DSIR etc. and housed posters depicting ongoing research works.

As a whole, with persistent support from the Government of India, the organizers, host institutes and the untiring contribution of the volunteers, the centenary celebration of ISC was a huge success, where the scientific community could outreach the society and spur in the youth the spirit of invention and innovation.

The mood of festivity that was prevailing this isolated corner of the city was remarkable. The Director thanked the members of the Centre in a high tea. The S. N. Bose Centre published a special issue of newsletter on this occasion.

ACADEMIC REPORT

Development of a Broadband Ferro-magnetic Resonance Spectrometer for Measurement of Collective Spin Dynamics of Magnetic Thin Films and Nanostructures

Anjan Barman

Ferromagnetic resonance (FMR) experiments measure the collective spin excitations in a magnetic material. In conventional FMR the sample is subjected to a microwave field of fixed frequency in a resonant cavity with high Q-factor, and a bias magnetic field, the magnitude of which is varied. At each field value the reflected or absorbed power is measured, which may yield one or more peaks corresponding to the resonant modes of the system. The resonant fields depend on magnetic parameters including the gyromagnetic ratio, saturation magnetization, magnetic dipolar, exchange and anisotropy energies and interlayer coupling energies in case of magnetic multilayers. Further, the line-width of the resonance field gives information about the Gilbert damping coefficient of the material. In case of ordered arrays of ferromagnetic nanostructures a large frequency band may exist covering the MHz to high GHz regimes and usage of resonant cavity based FMR system is less efficient. In addition, conventional FMR does not offer broadband operation particularly below 1GHz, it is difficult to apply magnetic field along various orientations, which are all essential conditions for investigating and tailoring the magnonic band structures in magnonic crystals. Hence, a broad-band FMR spectrometer has been set up in our laboratory with all the above capabilities.

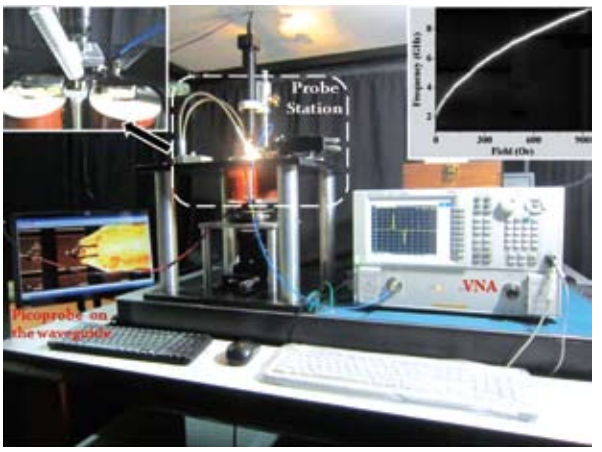


Fig. 1. A photograph of the broadband (10 MHz to 20 GHz) ferromagnetic resonance spectrometer with a vector network analyzer and a custom built high frequency (40 GHz) probe station. The shorted coplanar waveguide structure with the picoprobe is shown on the monitor of the PC. The inset at the right top corner of the picture shows the FMR frequency of a permalloy microstructure as a function of the bias magnetic field, which is constructed by measuring the FMR spectra at 100 different values of the bias magnetic field.

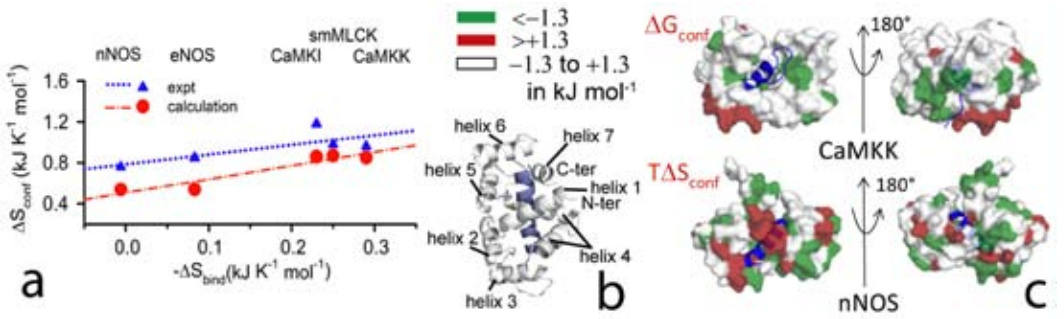
The setup is based upon a vector network analyzer with 10 MHz to 20 GHz frequency bandwidth and a homemade high frequency probe station with an in-built electromagnet as shown in Fig. 1. The FMR spectrometer has been customized to study magnetic thin films and nanostructures fabricated on co-planar stripline or waveguide structures made of Au on Si or GaAs.

The microwave devices are fabricated by a combination of optical and e-beam lithography. An electrically insulating layer (Al_2O_3 or SiO_2) is deposited on top of the stripline structure and the patterned samples are fabricated on top of the microwave devices by using e-beam or focused ion beam lithography. In the simplest configuration a microwave signal is sent to the co-planar stripline or the waveguide and the S-parameters are measured in the transmission (S_{21}) or reflection (S_{11}) geometry. For the reflection geometry the waveguide/stripline is shorted at one end (Fig. 1) and the absorbed signal is doubled in the measured S_{11} parameter. However, in both cases impedance matching of the stripline or the waveguide structure is crucial to avoid spurious reflections. To avoid spurious reflections at the contacts and for measurements of a series of devices made on a single wafer, high frequency probes with micromanipulators and a probe station with high resolution stages and imaging system has been developed. In addition, phase sensitive detection using modulation of the microwave signal with a lower frequency rf signal and measurement by using lock-in amplifiers are used for increasing the sensitivity of measurement. An electromagnet fixed on a goniometer is used to apply bias magnetic fields at various directions *with respect to* the artificial magnonic lattices. We also plan to perform local excitations of the magnons by using a microwave antenna and the propagation of the spin wave excitation along different directions of the artificial lattice. The wavevector and the frequency of the excitation may be selected by varying the width of the stripline structure. Using this method, we would be able to extract selective part of the magnonic band structures and investigate propagating and localized magnons.

Conformational contribution to thermodynamics of binding in protein-peptide complexes through microscopic simulation

Amit Das

Thermodynamic stability of biomacromolecular complexes is pivotal in biological processes. When biomacromolecules, like proteins, participate in complex formation, they experience conformational modifications over a huge number of binding regions (BR). The existing experimental techniques cannot provide microscopic information down to each BR, while the available computational methods seek heavy resources. Here we show, through an analysis[1] based on the one-dimensional histograms of different dihedral angles of the proteins, that both conformational entropy (ΔS_{conf}) and free energy (ΔG_{conf}) costs of such complexation, at the level of individual BR, can be obtained simultaneously. For each dihedral, ΔG_{conf} is obtained from the ratio of histogram maxima (i.e. populations) in free and bound states and ΔS_{conf} using the Gibbs formula. We apply the method for five Calmodulin-peptide complexes for which the experimental binding entropy (ΔS_{bind}) and ΔS_{conf} are known. According to Fig. 1a, our estimated ΔS_{conf} (circles), apart from matching quite well with the experimental ΔS_{conf} (triangles), recover (dash-dot line) the observed linear correlation (dotted line) between experimental ΔS_{conf} and ΔS_{bind}. We also provide a microscopic justification of the linear scaling proposed earlier between ΔS_{conf} and methyl order parameters measured from NMR relaxation experiments. Our calculations on ΔG_{conf} show that the unfavourable changes in helix 4 (Fig.1b) that wrap around the peptides (Fig.1b) are outweighed by the favourable changes at different BRs, illustrated for two complexes using surface diagrams for the protein in Fig.1c. Ours is a first ever microscopically detail picture of different binding regions of macromolecules that will be useful in various areas like drug designing, drug delivery and so forth.



References : (1) Amit Das, J. Chakrabarti and Mahua Ghosh, *Biophys. J,2013, (* **In Press**).

THESIS REPORT

Numerical Simulation of Viscous Accretion Flows Around Black Holes Which Include Shocks

Kinsuk Giri

Supervisor : Prof. Sandip Kumar Chakrabarti, Dept. of Astrophysics & Cosmology

In this thesis, we study time dependent solutions of one dimensional (spherically symmetric) and two dimensional (axially symmetric) accretion flows around compact objects in particular, for black holes, after examining the steady state solutions. A FORTRAN code for two dimensional numerical hydrodynamics has been developed to model viscous accretion disks. We employed a grid based finite difference method called the total variation diminishing method (TVD). The effective shear viscosity present in the core is evaluated. The simulations were carried out for flows in the Schwarzschild geometry. By numerical simulation, we show that the theoretical solutions (with or without shocks) which are claimed to be stationary are indeed so. When the shocks are absent, they show steady oscillations. Our survey was carried out using the entire inflow parameter space spanned by the specific energy, angular momentum, shear viscosity and a power-law cooling. It is believed that high viscosity flows reside on the equatorial plane, and supply low energy X-rays, while the low-viscosity and low angular momentum flows fall rapidly on to the black holes away from the equatorial plane and have little time to radiate X-rays. However, they can energize low energy photons and produce hard X-rays and contribute to the spectrum from black holes candidates. In the thesis work, numerically we have discovered the existence and stability of two component advective flow (TCAF). Thus the explanation of spectral and timing properties of galactic and extra-galactic black holes based on TCAF models appear to have firm foundation.

Spectroscopic Studies of Molten Electrolyte Mixtures, Binary Polar Solvent Mixtures and Solvents under Confinement

Biswajit Guchhait

Supervisor : Dr. Ranjit Biswas, Dept. of Chemical, Biological & Macromolecular Sciences

The present Thesis deals with fluorescence spectroscopic investigations of rotational and solvation response of a dissolved dipolar dye in supercooled molten mixtures, binary solvent mixtures and solvents under confinement. The molten mixtures composed of amide and electrolytes are the deep eutectic systems and a possible alternative to ionic liquids for industrial applications. Time-resolved fluorescence spectroscopy has been extensively used in tandem with steady state measurements to reveal not only the natural dynamics of these complex systems but also to unravel the interactions that dictates the timescales of the system response. A dye molecule which fluoresces and undergoes large change in dipole moment upon photo-excitation has been used. Our measurements with deep eutectics (supercooled melts) reveal viscosity decoupling of transport properties and a subsequent fractional viscosity dependence at a temperature range ~100-150 K above the glass transition temperature of these individual

melts. This is very similar to what has been found for deeply supercooled neat liquids. The investigations done in the binary mixtures have been aimed at generating a microscopic level understanding of the structure and dynamics of aqueous mixtures where phase-segregation at molecular level is expected to take place. The clustering of species and modification of hydrogen bonded network of water in such aqueous mixtures have been investigated by monitoring reactive and non-reactive dynamics. The origin of the slow dynamics reported by fluorescence measurements of reverse micelles have been explored by combining controlled time-resolved fluorescence measurements and simulation studies using realistic molecules.

Stochastic Approaches to Heterogeneous and Complex Reaction Kinetics

Biswajit Das

Supervisor : Dr. Gautam Gangopadhyay, Dept. of Chemical, Biological & Macromolecular Sciences

With the advent of single molecule spectroscopy and single molecule imagining techniques, now it is possible to study the heterogeneous reactions at the single molecule level, where the reactions become stochastic and nonequilibrium in nature. The heterogeneity and complexity arise due to the various diffusion mechanisms of a reactant in different phases, different binding affinity of ligands to a receptor, movement of ions under the applied external fields through the protein channels or monitoring the single molecule reaction by applying an external force. To describe the reaction kinetics at single or few molecular level, consideration of statistical fluctuations around the average become more important, as the fluctuations carry the information about the structure and non-equilibrium behavior of the system. Usually the dynamics of chemical reactions at single or few molecular level are described by the stochastic master equation approach where the time evolution of the number of reactants or conformations is considered as a kind of random-walk process in the population or the conformational state space.

In this thesis, we have described several heterogeneous and complex reaction kinetics by stochastic master equation approach. We have described how an external mechanical force affects the kinetics as well as thermodynamics of an oligomeric enzyme at chemiostatic condition. Then to describe the interfacial enzyme kinetics of lipid metabolism, we have considered the mechanical motion of the enzyme on the fluid and product phases as well as the chemical reaction steps are involved. Here we have developed a kinetic Monte Carlo simulation technique on the basis of the Gillespie's stochastic simulation algorithm and have shown the macroscopic kinetics by considering ensemble of trajectories. Next we have studied the non-equilibrium cooperativity phenomena developed in the oligomeric enzyme at the chemiostatic condition on the basis of different substrate binding mechanisms. Finally we have described the dynamics of a voltage-gated potassium ion channel in presence of the constant and oscillating voltage. We have also studied the non-equilibrium thermodynamic response function with the variation of external oscillating voltage.

Study of Nanostructured Iron Oxides

Arka Chaudhuri

Supervisor : Professor Kalyan Mandal, Dept. of Condensed Matter Physics & Material Sciences

Iron oxide nanoparticles have gained a tremendous impetus nowadays because of their manifold applications. Among the various Iron oxides, Ferrites form a very important class of material. The spinel ferrites is a class of material having general formulae MFe_2O_4 where M is a divalent cation such as Zn^{2+}, Mn^{2+}, Fe^{2+}, Ni^{2+}, Co^{2+}. M and Fe^{2+} occupying some or all of the octahedral and tetrahedral sites in the lattice. They are unique since they have the advantage of high resistivity and high magnetic permeability as well as low production cost. Some of the iron oxides show two or more ferroic properties such as ferroelectricity, ferromagnetism and ferroelasticity. They are called Multiferroics which are of two types- single phase and composite. By tuning one property we can change another which can be utilized for information storage like spintronic devices and sensors.

We have synthesized Nickel Ferrite nanoparticles and coated them with silica to reduce the agglomeration and also make them biologically compatible. Its magnetic properties were studied in details.We have also synthesized micelle coated Cobalt Ferrite nanoparticles of 16 nm in size which show a very high coercivity of 4.4 kOe. These nanoparticles can be very useful for memory storage devices. We have synthesized various nanostructures of Bismuth Ferrite and have observed that the magnetization is enhanced for the tile shaped structure. Bismuth Ferrite at room temperature does not show the multiferroic property. To overcome this problem we have doped Bismuth Ferrite with Lanthanum and Barium separately in the A site and enhanced the dielectric and ferromagnetic properties to manifest its multiferroic properties.We have also synthesized core shell nanostructures of piezomagnetic and piezoelectric composites of Cobalt Ferrite and Barium Titanate and have shown that the magnetoelectric coefficient of the core shell structure is much more than the mixture of the two phases.

Electronic, Magnetic and Structural Properties of Transition Metal Oxides

Kapil Gupta

Supervisor : Dr. Priya Mahadevan, Dept. of Condensed Matter Physics & Material Sciences

This thesis discusses how reducing the dimensionality in constrained geometry as is possible in thin-films and superlattices, influences the electronic, magnetic and structural properties of transition metal oxides. This gives us a handle to tune between the various competing energy scales such as crystal field splitting, Hund's exchange energy and band width resulting in the obsevation of phenomena not seen in the bulk counterparts. The substrate can allow crystal structures very different from those favored in the bulk form to be stabilized for the epitaxially grown overlayers. Further the substrate induced strain provides us with a handle of tuning electronic interaction strengths. In this thesis we have examined the tuning of the properties of some transition metal oxides.

Considering the case of a nonmagnetic oxide, $LaCoO_3$, one finds that substrate induced strain in thin films of $LaCoO_3$ leads to an appearance of magnetism. We discuss the electronic structure of thin films of $LaCoO_3$, origin of the magnetism in thin film regime, and the spin-state favored in the ground state[1,2]. Whether $LaCoO_3$ undergoes a transition from low to high or low to an intermediate spin-state is still a topic that is debated. We conclude that it is the strain-induced pseudotetragonal structure which is responsible for the spin state transition to an intermediate spin state. In contrast to earlier speculations made in experiments that the substrate induced strain could lead to large changes in the Co-O-Co angles and therefore drive the system ferromagnetic, we show that the angle changes are small and it is the transition into the intermediate spin state which drives the ferromagnetism.

Multiferroics with large values of electric polarization are rare as the systems which have large polarization usually have an empty d-shell, while magnetism requires a finite d electron count. The electric polarization in most multiferroics has noncollinear order, exchange striction or charge ordering, as its origin and has a very small displacive component. This results in small values for the electric polarization in these systems. In thin films geometry of transition metal oxides we explore a possible alternate route to realize multiferroics by having d0-type displacive ferroelectricity in a dn system by considering examples of thin films of $SrCrO_3$ grown on $SrTiO_3$[3]. We discuss how in the ultrathin film limit, $SrCrO_3$ which is metallic in the bulk form turns out to be band insulator at the surface due to the modified crystal field effects and favours a polar offcentring, leading to displacive ferroelectricity. The calculated polarization value is comparable to those found in typical d0 ferroelectrics such as $BaTiO_3$. To contrast with the case of $SrCrO_3$ we also examine the electronic structure of thin films of $SrVO_3$ grown on $SrTiO_3$. These films are found to favor Jahn-Teller distortions.

Recently we found that with the dilute doping of V into a well known ferroelctric $BaTiO_3$, ferroelectric distortions are found to survive with magnitudes for the VO_6 octahedra larger than found for the TiO_6 octahedra[4]. The value of polarization is also found to be large, comparable with d0 ferroelectrics. This provided us with a route to generating multiferroics considering superlattices of $BaTiO_3$ and $BaVO_3$ as well as $BaTiO_3$ and $BaCrO_3$. Interestingly this artificial heterostructure is found to favor FE distortions with calculated polarizations comparable to that in $BaTiO_3$. We also discuss how the system gains energy by stabilizing Jahn-Teller distortions in the xy-plane and the resulting orbital ordering leads to ferromagnetism and ferroelectricity in $BaVO_3/BaTiO_3$ while it lead to antiferromagnetism and ferroelecticity in $BaCrO_3/BaTiO_3$[5].

Taking the example of a bulk metallic system, we examined if the metallic ground state was favored down to the few monolayers limit. Our results found that the ultrathin film limit was found to be a rich playground for unusual atomic physics. Taking the example of $SrRuO_3$, which is ferromagnetic and metallic at the bulk limit, one finds that it becomes antiferromagnetic and insulating at the two-three monolayers limit. Examining the three monolayer limit we find a regime where anisotropic intra-atomic exchange interactions drives the insulating state [6,7]. Using strain as a parameter, we can move away from this regime into one where strong two dimensional metallicity is found, hence manipulating interaction strengths at the atomic level.

[1] K. Gupta and P. Mahadevan, Phys. Rev. B 79, 020406 (Rapid Comm.) (2009).

[2] Kapil Gupta and Priya Mahadevan, in "Simulation and characterization of Advanced Materials", (Research signpost) ed. Sudhir Kumar (2011)

[3] K. Gupta, P. Mahadevan and M. Ležiaæ, Submitted to Phys. Rev. Lett.

[4] H. K. Chandra, K. Gupta, A. Nandy and P. Mahadevan, Submitted to Phys. Rev. Lett.

[5] K. Gupta and P. Mahadevan, in preparation.

[6] Priya Mahadevan and Kapil Gupta, in "Functional Metal Oxide Nanostructures", (Springer-Verlag) ed. J.Wu, W. Han, H. Kim, A. Janotti and J. Cao: ISBN No : 978144199306 (2010).

[7] K. Gupta and P. Mahadevan, in preparation.

NEWS & VIEWS

Arghya Dutta, a student of the Centre received the best poster prize at the 57th DAE Solid State Physics Symposium, which was held at IIT Mumbai, during 3-7 December, 2012. Title of the poster was 'Dynamical structure factor of Fulde-Ferrell-Larkin-Ovchinnikov superconductors'. He is working with Prof. J. K. Bhattacharjee.

EVENTS

राजभाषा हिन्दी महीना (सितम्बर 2012) प्रतिवेदन

सुष्मिता दासगुप्ता

जैसा कि हम सभी को विदित है कि हिन्दी भाषा को राष्ट्रभाषा के सम्मान के साथ ही साथ राजाभाषा का भी सम्मान मिला हुआ है। अतः हिन्दी भाषा कि प्रगति के उद्देश्य से सरकार ने भी ठोस कदम उठाते हुए सभी केन्द्र सरकारी कार्यालयों में हिन्दी में कामकाज करने पर बल दिया है। इसी दृष्टिकोण से राजभाषा के कार्यान्वयन हेतु हमारे केन्द्र में भी हिन्दी में कार्य किए जाते हैं तथा पिछले कई वर्षों सें सितम्बर के महीने को राजभाषा हिन्दी महीना के रुप में मनाते आ रहे हैं।

अतः प्रतिवर्ष की तरह इस वर्ष भी हमारे केन्द्र में सितम्बर का महीना राजभाषा हिन्दी महीना के रुप में मनाया गया। इस कार्यक्रम का शुभारंभ सितम्बर के महीने के प्रथम दिन से लेकर पुरे महीने तक प्रतिदिन उपस्थिति रजिस्टर पर कर्मचारियों के हिन्दी में हस्ताक्षर के द्वारा हुआ। तत्पश्चात स्वागत कक्ष पर रखे श्वेत पट्ट

पर प्रतिदिन हिन्दी में एक शब्द लिखा गया जिसका अंग्रेजी रुप भी लिखा गया ताकि अधिक से अधिक राजभाषा में कार्य हो सके। दिनांक 7 सितम्बर 2012 को शाम को सात बजे विद्यार्थियों को हिन्दी चलचित्र दिखाया गया। दिनांक 14 सितम्बर 2012 को हन्दी दिवस के दिन इस कार्यक्रम का औपचारिक उद्घाटन समारोह सम्पन्न हुआ। कार्यक्रम का आरंभ केन्द्र के विद्यार्थी द्वारा संस्कृत के श्लोको के मधुर गायन के माध्यम से हुआ। निदेशक महोदय ने अपने भाषण द्वारा कार्यक्रम का उद्घाटन किया। इसके बाद प्रो. अमरनाथ शर्मा, कलकाता विश्वविद्यालय, श्री रामनारायण सरोज तथा श्री विपती ने राजभाषा की प्रगति से संबंधित कुछ सुझाव दिए तथा अपने विचार प्रस्तुत किए। दिनांक 18.09.2012 को केन्द्र के सिलवर जुबली भवन में सांस्कृतिक कार्यक्रम का आयोजन किया गया। केन्द्र के तीन विद्यार्थियों ने हिन्दी में भजन तथा गीत प्रस्तुत किए तत्पश्चात श्रीमती डॉली बसु जी ने सुविख्यात हिन्दी लेखिका मन्नू भण्डारी जी की तीन प्रसिद्ध कहानियों को बड़े ही रोचक ढंग से प्रस्तुत किया। दिनांक 24.09.2012 को शाम को साढ़े चार बजे केन्द्र में एक हिंदी प्रश्नोत्तरी प्रतियोगिता का आयोजन किया गया। प्रतियोगिता में जीतने वाले 30 जनो को कलम पुरस्कार स्वरुप प्रदान किया गया।

राजभाषा हिंदी महीना के अवसर पर आयोजित विविध कार्यक्रमों में केन्द्र के निदेशक तथा कुलसचिव सहित सभी शैक्षिक तथा प्रशासनिक सदस्यों तथा विद्यार्थियों ने बड़े ही उत्साह के साथ हिस्सा लिया तथा सम्पूर्ण कार्यक्रम को सफलता प्रदान करने में अपनी महत्वपूर्ण भूमिका निभाई।

Blood Donation Camp

Ashutosh Kumar Singh

The students body at the S. N. Bose Centre, BOSSAR in association with the Association of Voluntary Blood Donors, West Bengal organised a Blood Donation Camp on 12 Oct, 2012 from 10a.m. to 3p.m. Students, Academic and Non-academic staff of the Centre turned up in large numbers to donate blood. Total 84 units of blood were donated by donors. The donors went through a series of medical checkups before donating blood and were given refreshments, a memento and a certificate of appreciation. A confidential blood test report and a DONOR's card, provided to the BOSSAR by Association of Voluntary Blood Donors, West Bengal, were given to the blood donors. The event was a huge success with a large number of Students, Academic and Non-academic staff turning up for the cause.

STUDENTS' PAGE

When Puppets come alive

Rajashree Das

The culture of using puppets to tell stories from history or mythology has travelled down the ages in India. This art, Puppetry, has been very popular form of entertainment in our society, dazzling its audience with colourful, delicate and lively effect on their heart. Archaeological collection, dating back to the time of Indus valley civilization, includes a terracotta bull with detachable head that can be manipulated by a string. And the trend continues with the mention of puppets in "Mahabharata", "Gita", "Ashtadhyayi Mahabhashya", "Natya Shastra" and many more.

In Sanskrit, puppets are termed as Putraka, Putrika or Puttalika, all of which are derived from the root Putta equivalent to Putra (son). Puppetry also comes in different flavours depending on the animation techniques used, string, shadow, rod and glove are to name a few.

Puppetry in its contemporary form, is mostly story telling. However, like any other art form, it is also used as an effective medium to address social issues like illiteracy, status of women, bride burning, dowry system, family planning, and so forth, which need urgent attention.

Though it influence the human mind of all cross-section, it is fading away from modern Indian society. As always only a handful of masters are continuing to keep the charm alive. Late Raghunath Goswami was one of the pioneers of contemporary puppetry in India. To pay a tribute to him, the grand Indian museum organized an exhibition during 6th to 12th January, 2012 at Asutosh Mukherjee Birth Centenary Hall, Kolkata. Among the exhibits featuring his own hand made and used puppets and equipment were the shadow puppets portraying Sukumar Roy's Abol Tabol, string and glove puppets of bed time fairy tales or the drama of the city lives. Alongside, in the lawn of the museum main building, there were excellent string puppet performances by troops from all over India.The mastery of Late Goswami made all the dead puppets came alive over the eyes of thousands visitors in those early days of 2012.

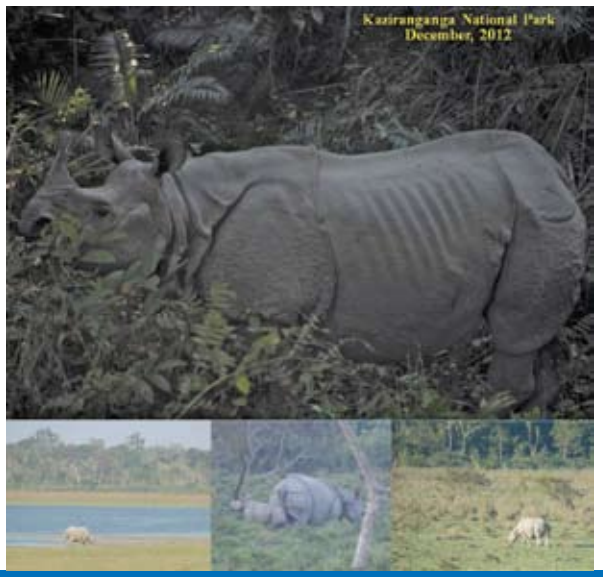
IN NATURE

The Great Indian Rhino

Mahua Ghosh

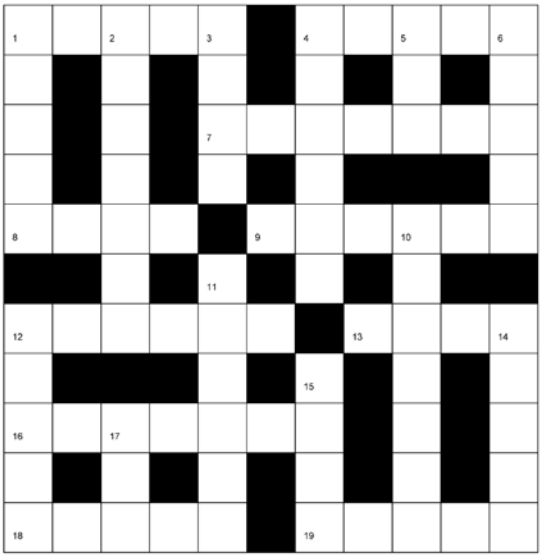
The end December 2012 trip to Kaziranga National Park was a grand success owing to the sight of the Great One Horned Indian Rhinoceros (Indian Rhino). The Indian government has taken major step towards the preservation and conservation of the Great One Horned Indian Rhinoceros with the help of the World Wildlife Fund (WWF). The Kaziranga National Park in Assam, a "world heritage site" since 1985, is home for this endangered animal. The natural habitat of Indian Rhino is the tall grasslands and forests in the foothills of the Himalayas, the Kaziranga National Park being an ideal habitat having the highest populated site of the Rhinos in India. The park site reports that the population of Rhino in Kaziranga is more than two thousand.

The Indian Rhino are gray in color. They have very thick skin that appears to be armor-plated. The Rhino skin is folded around the shoulder. The skin on the hind part of each thigh is shaped like shields separated by deep folds. They have a single horn which sits on top of their snout. Their horn can grow up to 45 cm and is made of hair. They weigh approximately 1600-2200 kg and range in height from 170-186 cm and are 368-380 cm long. The Rhino can run at speeds of up to 40 km/h for short periods of time and is also an excellent swimmer. It has good senses of hearing and smell, but relatively poor eyesight. The pictures were taken in a close up view.



CROSSWORD

Mahua Mitra & Mitali Bose

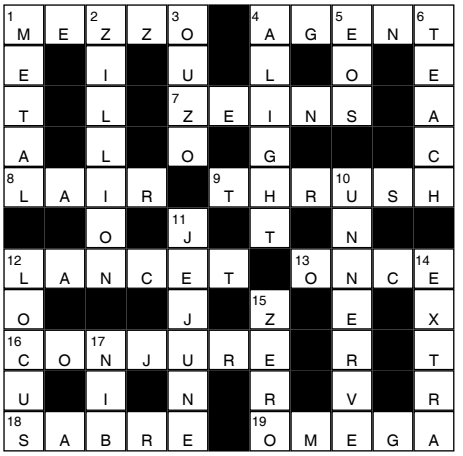


Down

1. unit of length
2. duplicate
3. tilt
4. performer
5. *Aralia cordata,* taken as vegetables
6. absence of difficulties
10. place of study
11. dawn
12. factory
14. gradually disappeared
15. substances used to color materials
17. ____port

Across

1. wall painting
4. cerulean
7. process of doing something
8. a long story, film etc telling of great deeds especially historic
9. inhabitants of Asia
12. groundnut
13. The British Armed Forces Federation
16. resemblance
18. soil
19. mister in Arabic



Solution of Vol.5, Issue 1 Crossword

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