

Report of the Prof. M. R. Gupta Memorial National Seminar-2017

The Centre for Plasma Studies, Jadavpur University, the Department of Instrumentation Science, Jadavpur University and the Advanced Centre for Nonlinear & Complex Phenomena (ACNCP) commemorated the 85th Birth Anniversary of Late Professor M. R. Gupta by organizing a national seminar on Nonlinear and Complex Phenomena. The national seminar was held at the K. P. Basu Memorial Hall in the Jadavpur University premises on the 4th August, 2017.

The entire expenses for organizing the seminar, was contributed by the family members of Late Professor M. R. Gupta.

Professor M. R. Gupta was a renowned mathematician and a revered teacher of the Department of Applied Mathematics, University of Calcutta. After his retirement, he was associated with the Centre for Plasma Studies, Jadavpur University and conducted and guided research on different areas of Plasma Physics till his death in 2013.

The programme on Friday, the 4th August, 2017 started with a brief Inaugural Session at 11 A. M. The session was chaired by Professor Chiranjib Bhattacharya, Dean, Faculty of Engineering & Technology, Jadavpur University. Professor Abhijit Sen, Distinguished Professor, Institute of Plasma Research (IPR), Gandhinagar was the Chief Guest. The distinguished guests paid their floral tributes and homage to the portrait of late Professor Gupta. Flower bouquets were presented to the dignitaries on the stage by the lady students of the two participating departments. Dr. Sima Chakrabarti sang the opening song. Introductory remarks were made by Professor R. Bhar of Jadavpur University. Professor Nikhil Chakrabarti and some family members of late Professor M. R. Gupta reminisced about the late professor. They talked about the brilliant mathematician as well as the kind human being that was Professor M. R. Gupta. After brief address by the Dean, Faculty of Engineering and Technology of the Jadavpur University, Professor

Abhijit Sen of IPR delivered the M. R. Gupta Memorial Lecture entitled "Precursor Solitons in a Flowing Dusty Plasma". At the onset, Prof. Sen remembered his first interaction with Prof. Gupta about 45 years back with a rare photograph of Prof. Gupta with Prof. Sen when he was a young Researcher.

In his lecture, Professor Sen discussed the fore-wake excitations in the form of solitons or shocks ahead of a moving object in a fluid was a spectacular phenomena that had been observed in front of fast moving ships and had been widely studied in hydrodynamics. He wondered whether a similar phenomenon could occur in plasmas in front of a moving charged object. He discussed the recent researches carried by his team which established the existence of such excitations in laboratory experiments done using a dusty plasma flowing over an electrostatic potential hill. He explained how such precursor solitons could be modelled by a driven form of the KdV equation- the so called forced KdV equation – that had a rich variety of exact analytic solutions. He elaborated on the possibilities of new theoretical and experimental areas of research in plasmas in the context of the novel phenomenon as established by him and his co-workers. After the memorial lecture, a memento was presented to Professor Sen. Professor Manoranjan Khan proposed a vote of thanks and the session was over.

After a short tea break, the Technical Session I commenced at 11-45 A. M. The session was chaired by Professor Rajkumar Roychoudhury, formerly of the Indian Statistical Institute, Kolkata. There were two invited talks in this session. The first talk was delivered by Professor Satyavir Singh of the Indian Institute of Geomagnetism (IIGM), Mumbai. The topic of his talk was "Evolution of electrostatic solitary waves in the Lunar Wake". Professor Singh explained how electrostatic waves had been observed in the lunar wake during the first flyby of the ARTEMIS (Acceleration, Reconnection, Turbulence and Electrodynamics

of Moon’s Interaction with the Sun) mission on 13th February, 2010. He and his co-workers have proposed an alternative generation mechanism for the evolution of these electrostatic waves in terms of slow and fast ion-acoustic and electron-acoustic solitons. He mathematically explained the modelling process and elaborated on the results.

The second invited speaker of the session was Professor Amar Kakad also from IIGM, Mumbai. He delivered his talk on “Ponderomotive processes during breaking and evolution of coherent wave structures in plasmas”. The speaker observed that wave-breaking was a ubiquitous nonlinear phenomenon in plasmas that was followed by a sudden drop of wave amplitude after a wave steepening. He said that simulation studies which were recently carried out showed that the breaking of large amplitude long wavelength waves evolve into series of coherent wave structures, which were similar to that of observed in space and laboratory plasmas. Making observational studies of such a process with the help of spacecraft in the plasma environments of the Earth and other planets was a highly challenging task. So Professor Kakad and his group of researchers performed fluid and particle-in-cell (PIC) simulations to understand the evolution of ion acoustic type coherent wave structures through wave breaking. From detailed analysis of the simulation output they were able to accomplish the novel criteria for identifying steepening and breaking of the IASWs based on the ponderomotive potential and ponderomotive frequencies of electrons and ions. He went on to explain the advantages of the method employed by them.

After the first technical session, there was a one hour lunch break and the technical session II commenced at 1-45 P. M. This session was chaired by Professor Aswini Sinha from IIGM, Mumbai. This session continued till 4-25 P. M. There were 8 contributed papers, which were presented by the authors. Dr. Kaushik Ghosh, University Institute of Technology, University of Burdwan talked on “Investigation of Memory and Nonlinear Behaviour of Daily Mean Temperature at Different Weather Stations of India.” In his analysis seven different weather stations viz. Kolkata, Chennai, New Delhi, Mumbai, Bhopal, Agartala and

Ahmadabad representing different geographical zones in India have been considered. The Delay Vector Variance (DVV) method has been used to investigate the nonlinearity and he claimed that calculations confirmed a deterministic nonlinear profile for the considered daily mean temperature time series. The second paper was presented by Shri Pankaj Shaw of the Saha Institute of Nuclear Physics, Kolkata. His topic was “A localized cathode glow in the presence of bar magnet and its associated nonlinear dynamics”. In his talk the author explained how the plasma density in the localised glow region and the luminous intensity of the structure increased with the increase in the magnetic field strength. The author and his group of researchers have investigated the effect of such localised glow region on the plasma floating potential fluctuation dynamics. To understand the dynamical origin of such complex oscillations, they have carried out a numerical modelling for ion dynamics by considering trapping of ions inside the potential structure. Their numerical results show the existence of period doubling route to chaos. Tushar Kanti Das of Visva Bharati University delivered a talk on “Effect of dust ion collision on dust ion acoustic waves in the framework of damped Zakharov-Kuznetsov equation in presence of external periodic force”. In this paper the authors have derived the dZK equation by employing the standard reductive perturbation technique. They have also discussed the effect of dust ion collision on the quasiperiodic and chaotic motion of dust ion acoustic (DIA) waves. The next presentation was by Sourav Choudhury also from Visva Bharati University. In his paper titled “Study of non linear waves in quantum semiconductor plasma in presence of time dependent exchange potential and electron-hole and hole-phonon collision frequency”. In this paper he has studied the effects of exchange-correlation potential, quantum diffraction parameter and statistical pressure on the nature of solitary waves in a quantum semiconductor plasma. A deformed Korteweg-de Vries has been obtained by using the Reduction Perturbation Technique (RPT) for propagation of nonlinear waves in a quantum semiconductor plasma, and the effects of different plasma parameters on the two soliton solution of the equation have also been presented.

Animesh Roy of Visva Bharati University presented his paper titled "Chaos synchronization and cryptography for network security". As mentioned by the speaker, the main objective of the work is to study the synchronization and chaotic properties of different nonlinear dynamical systems such as semiconductor lasers, vertical cavity surface emitting lasers which exhibit chaos. These systems, according to the author, are then used for data transmission by means of cryptosystem. Supriya Chaudhuri of Ramkrishna Mission Vivekananda University presented his paper titled "Effect of quantum plasma on the structural properties on Ne". In the paper they have stressed that correlated results for the free systems compare well with the existing experimental values. The author also feels that the results under plasma environment are completely new and are likely to be useful for plasma diagnostic determination. Hiya Mandal of Jadavpur University presented her paper titled "A Non-linear Model for Magnetoconvection". In her paper she has developed a non-linear low dimensional model for low-Prandtl-number fluids with rigid boundaries. She has discussed the advantages of the model. The last paper of the

session was by Satyajit Chowdhury of Saha Institute of Nuclear Physics, Kolkata. The title of his paper was "First experimental observation of Electron Acoustic Wave Propagation in Laboratory Plasma". The author has elaborated the experimental methodologies and stated that the observed phase velocity agrees well with the theoretical estimate. He also hopes that experimental realization of the mode may open up a new avenue in the Electron Acoustic Wave research.

After the technical sessions were over, the AGM of the 'Advanced Centre for Nonlinear and Complex Phenomena' (ACNCP) was held followed by a formal tea break. That completed the national seminar, which was well attended and was nicely organized.

(Some glimpses of the event are in back inside cover)

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News Review

Geopolymer as a substitute for concrete

Raw materials: Geopolymer as mineral binding medium is environment protector and resistant against chemicals and heat. Concrete is valid as climate-killer and definitely because of cement whose manufacture through pulverization and burning of stone causes huge consumption of energy. To that climate damaging carbon dioxide (CO_2) out of which existing limestone is separated. More than 5% of worldwide emissions of CO_2 is generated as consequence of the cement manufacture.

Therefore Eddie Koenders, civil engineer and manager of the Institute for Raw Materials in Civil Engineering of TU Darmstadt – searcher

for climate-friendly alternative and discovered geopolymer. That is two component system of a reactive stable material which contains silicon and aluminium oxide as also a basic activating solution out of alkali hydroxide or silicates in water. Like cement the rigid material consists of natural stone. The mixture of pulverized stable material with the activating solutions then becomes a stone like inorganic polymer.

Although since 1970's research was done on geopolymers but it has not made breakthrough in the wholesale market. This situation could change since its potential as climate-friendly binding
