



Conference Report

Report of The Professor M. R. Gupta Memorial 2nd National Seminar 2018

This seminar was held on Friday, the 3rd August, 2018 at the Seminar Room of the Department of Mathematics, Jadavpur University. It was organized by the Centre for Plasma Studies (Jadavpur University) in collaboration with the Department of Mathematics (Jadavpur University) and the Advanced Centre for Nonlinear and Complex Phenomena (ACNCP), Kolkata. The financial sponsorship was done by the family members of Late Professor M. R. Gupta.

At the Inaugural Session, a brief introductory remark was made by Prof. Shamik Ghosh, Head of the Department of Mathematics (Jadavpur University). At 10-45 A. M. , the “*M. R. Gupta Memorial Lecture*” for this year was delivered by Professor Sandip Kr. Chakrabarti of the *Satyendra Nath Bose National Centre for Basic Sciences, Kolkata*. The title of the talk was “*Non-linear waves in black hole accretion flows: Theory and Observational Evidences*”. The speaker gave a brief overview of the generalized Bondi accretion flow on black holes and specially mentioned the many interesting characteristics such as

- a) The flows are necessarily transonic,
- b) The flows have centrifugal pressure supported shock waves,
- c) Flows with super-critical viscosity parameter produce Keplerian disc with general black body radiations.

These shocks, according to Professor Chakrabarti, can be standing, oscillating or propagating depending on the flow parameters. He also discussed these solutions and showed that the spectral and timing properties of black holes clearly demonstrated the evidence of these shock

waves. He also showed that by fitting the data with a generalized flow model one can obtain the rate at which matter falls into the black holes and also estimated masses of the black holes.

The talk was of one hour's duration and held in a hall packed by interested audience.

A memento was handed over to Prof. Chakrabarti by Mrs. Bharati Gupta

There was a brief ‘*Tea Break*’ at 11-45 A. M.

The Technical Session I commenced at 12-00 noon and ended at 1-20 P. M. This Session was chaired by Professor Prasanta Kr. Mukherjee (Former Professor, Indian Association for the Cultivation of Science). In this session, four young researchers spoke on topics related to their research.

The first speaker was Sudipto Bhattacharjee of the Department of Mathematics (Jadavpur University). He spoke on “*Some General Prescription from Unified First Law in Inhomogeneous FLRW type and LTB spacetime models*”. In his presentation, the young speaker talked about his investigations on the interrelationship between the unified first law of thermodynamics and Friedmann equations for two anisotropic and inhomogeneous space-time metrics. He talked about two different models and concluded that in those models he found that Einstein field equations are obtainable by projecting the unified first law along and perpendicular to the Kodama vector and also along two linearly independent directions.

The second speaker was Sudip Misra from the Department of Mathematics (Jadavpur University). The title of his paper was

“Implication of Center Manifold Theory in Various Cosmological Models”. In his presentation, he said that the Einstein field equations were highly non-linear second order differential equations and it was very difficult to solve them analytically. He had in his work, considered a non-canonical scalar field model in the background of homogeneous and isotropic flat FLRW space-time and a Skyrme fluid with a constant radial profile in locally rotational Kantowski-Sachs space-time. Then an autonomous system was constructed from the cosmic evolution equations. Critical points and eigenvalues of Jacobian matrices at those points were evaluated by the researcher. He went on to determine the values of cosmological parameters and to analyze nature of non-hyperbolic critical points both geometrically and from the cosmological point of view. In this work, the researcher has applied Center Manifold Theory to characterize the behaviour of the non-hyperbolic critical points.

The third speaker was by Santu Mondal also from the Department of Mathematics (Jadavpur University). The researcher spoke on *“Lie and Noether Symmetry Analysis in Brans-Dicke Cosmology”*. He stated that his aim was to study the group invariant solutions of the evolution equations in Brans-Dicke cosmology. For the stated problem, he considered the flat homogeneous and isotropic FLRW cosmological model and used Lie and Noether symmetry on augmented system. From Lie symmetry he determined the unknown potential for two different values of the equation of state parameter w . Then he assumed that the Lagrangian admitted a Noether symmetry, and accordingly obtained an analytic solution of the system in both old and new coordinate system.

The fourth and the last speaker of the session was Dipanjana Das from the Department of Mathematics (Jadavpur University). The paper which she presented was titled *“Does fractal Universe describe a complete cosmic scenario?”* In her presentation, she described a model of constant – roll inflationary scenario with particle creation mechanism, in the frame work of non-equilibrium thermodynamics. In the context of homogeneous and isotropic spatially flat FLRW model of the Universe, she has considered the cosmic fluid as a dissipative fluid. She has considered dissipation

in the form of bulk viscous pressure due to particle creation mechanism. For constant and slow-roll phase of inflationary scenario, the particle creation rate has been derived and an analogous inflation field has been calculated. Finally she has shown an equivalence of the warm inflation with the present particle creation mechanism.

The session ended on time. There was a lunch break from 1-20 P. M. to 2-00 P. M.

The Technical Session II started at 2-00 P. M. and continued till 4-00 P. M. This Session was chaired by Professor Subinoy Chakrabarti of the Department of Mathematics (Jadavpur University). In this session 6 young research workers presented their papers.

The first speaker was Jayanta K. Saha of the Department of Physics (Aliah University). The title of his talk was *“Atomic structure under plasma environment”*. In his talk the scholar discussed the modelling of different plasma environments by suitable compact potential. Subsequently he also discussed many novel phenomena such as evolution of quasi bound states, incidental degeneracy and level crossing, ionization potential depression etc.

The second speaker was Debdutta Debnath of the Department of Mathematics (Jadavpur University). The topic of the talk was *“Ion acoustic solitary structures in a magnetized nonthermal dusty plasma.”* The speaker said that in the work concerned the Sagdeev potential technique has been used to investigate the arbitrary amplitude ion acoustic solitary structures in a collisionless magnetized dusty plasma consisting of negatively charged static dust grains, adiabatic warm ions and nonthermal electrons. In the presented paper, the mechanism of transition of a negative potential supersoliton to a conventional soliton after the formation of a double layer of same polarity has been discussed with the help of phase portraits.

The third speaker was Subha Samanta of the Saha Institute of Nuclear Physics, Kolkata. In her talk titled *“Study of stickiness phenomena in magnetic field lines governed by Beltrami magnetic fields”*, said that in the work under discussion, magnetic field lines of single and double curl Beltrami magnetic fields have been studied numerically in connection with their

stickiness property. She gave a detailed account of the study and said that finally recurrence time distribution of chaotic trajectories have been plotted to understand their global behaviour.

The fourth speaker was Mithun Karmakar also from the Saha Institute of Nuclear Physics, Kolkata. The title of his talk was "*Excitation and Breaking of Nonlinear Plasma Wave.*" The scholar said that in his work, he has performed an extensive analysis to investigate the wave breaking phenomena of particularly two different high frequency nonlinear plasma modes (Langmuir wave and upper hybrid wave) with the consideration of the effect of the nonlinearities associated with inhomogeneous ion background, relativistic electron mass variation effect, ion motion etc. In conclusion, he said that the onset of such wave breaking has been confirmed by the observed high density spikes in the electron fluid density obtained in investigating the space time evolution (Lagrangian fluid description) of the nonlinear relativistic plasma wave dynamics.

The fifth speaker in this session was Sayantan Dutta of the Department of Mathematics (Visva-Bharati University, Shantiniketan). The title of the talk was "*Large amplitude electromagnetic solitons in a relativistic electron-positron-pair plasma.*" According to the scholar, Electron-positron (EP) plasmas are ubiquitous and play important roles in exotic astrophysical environments like pulsars, neutron stars and active galactic nuclei. Because of their intrinsic and complete symmetry with equal charge-to-mass ratios, the dynamics of EP-pair plasmas become significantly different from that of electron-ion plasmas or from a purely electronic beam. In the presented paper, the team of researchers (Sayantan Dutta and A. P. Misra) have studied the nonlinear propagation of large amplitude electromagnetic (EM) solitons in

relativistic thermal EP-pair plasma. Previously established theories in this area have been advanced and modified by the relativistic and thermal effects of electrons and positrons.

The sixth and final speaker of this session was Pritikana Bhandari of the Department of Mathematics (Jadavpur University). The title of her talk was "*Thermal Stability in coupled Dark Energy.*" The scholar said that in the background of homogeneous and isotropic FLRW model, the thermodynamics of the interacting DE fluid has been investigated by her. By studying the thermodynamical parameters namely heat capacities and the compressibilities both thermal and mechanical stability have also been discussed and the restrictions on the equation of state parameter of the dark fluid have been analyzed by her.

The lectures delivered by the young researchers in both the sessions were open for discussions. Important questions were raised and suggestions were given by the experts present in the audience.

A panel of experts comprising Professor Rajkumar Roychoudhuri, Professor Samiran Ghosh, Prof.Sekhar Dutta Choudhury and Prof. Alaka Das deliberated and announced the names of three best papers presented. The scholars who received the prizes were

1. Subha Samanta of SINP, Kolkata
2. Debdutta Debnath of Math.Deptt. JU
3. Sudip Misra of Math Deptt. JU

Cash prizes and memento were handed over by Prof. Shamik Ghosh

The event ended with the customary vote of thanks delivered by Prof. Manorajan Khan of Jadavpur University.

[A few photographs of the event are in back inside cover]

Purabi Mukherji
Indian Science Cruiser
