

Sudip Garai

Curriculum Vitae

Diamond Harbour Women's University
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Education

- 2010
2016 **PhD in Science (Physics)**, University of Calcutta, Senate House, 87/1, College Street, Kolkata, Westbengal 700 073, India.
Velocity Shear Driven Phenomena In Strongly Coupled Dusty Plasma.
- 2008
2010 **MSc in Physics**, Visva Bharati University, Santiniketan, Bolpur, Birbhum, Westbengal 731 204, India, **69.5%**.
Astrophysics & Cosmology and Field theory as special papers.
- 2005
2008 **BSc in Physics**, Visva Bharati University, Santiniketan, Bolpur, Birbhum, Westbengal 731 204, India, **80.5%**.
Mathematics (85.7%) and Chemistry (70.7%) as pass subjects with Environmental Studies.
- 2005 **Higher Secondary**, West Bengal Council of Higher Secondary Education, **86.7%**.
Science Stream.
- 2003 **Secondary**, West Bengal Board of Secondary Education, **88.1%**.

Experience

- 2016 **Assistant Professor**, Diamond Harbour Women's University, Diamond Harbour Road, Sarisha, South 24 Parganas, 743368, India
Physics.
- 2016 **Research Associate**, Saha Institute of Nuclear Physics, 1/AF Bidhannagar, Salt Lake, Kolkata 700 064, India
Theoretical Plasma Physics.
- 2012
2016 **Senior Research Fellow**, Saha Institute of Nuclear Physics, 1/AF Bidhannagar, Salt Lake, Kolkata 700 064, India
Theoretical Plasma Physics.

2011
2012

Junior Research Fellow, *Saha Institute of Nuclear Physics*, 1/AF Bidhannagar, Salt Lake, Kolkata 700 064, India
Theoretical Plasma Physics.

2010
2011

Post MSc in Physics, *Saha Institute of Nuclear Physics*, 1/AF Bidhannagar, Salt Lake, Kolkata 700 064, India
Did a six month project on “*High Energy Gamma Ray Astronomy*”.

PhD Thesis

- Title “*Velocity Shear Driven Phenomena In Strongly Coupled Dusty Plasma*”
(**Awarded** with provisional PhD degree, 27th of July, 2016)
- Supervisors **M. S. Janaki**
Professor and Head, Plasma Physics Division, Saha Institute of Nuclear Physics, 1/AF Bidhannagar, Kolkata 700 064
&
Nikhil Chakrabarti
Professor, Plasma Physics Division, Saha Institute of Nuclear Physics, 1/AF Bidhannagar, Kolkata 700 064
- Description My PhD work has been gone through mainly in the direction of investigating stability characteristics of a inhomogeneous strongly correlated dust fluid in presence of sheared flow. The investigations of the dusty plasma viz. collective waves/oscillations and their stability properties have grown tremendously since the discovery of the said field and with subsequent developments in this direction both theoretically and experimentally. In a weakly coupled dusty plasma, the particles are more mobile and weakly correlated with each other; whereas in strongly coupled dusty plasma, the average potential energy per particle dominates over the average kinetic energy and can lead to form arranged structures. These areas are presently offering a great interest to the plasma physics community due to their various potential applications to the interplanetary space plasmas, comet tails, atmospheric lightnings, white dwarf interiors, fusion reactions in laboratories etc. There are various free energy sources; such as density gradient, pressure gradient, shear velocity etc. and dissipation mechanisms such as collisional damping, viscous dragging etc.; present in such complex systems, which greatly affect the stability of the system. My thesis work is oriented along with the stability properties of these complex systems with various free energy sources and as well as dissipative agents both in Newtonian and non-Newtonian limits.

Areas of Specialization

- Dusty Plasma** The presence of dust particles in various realistic case, generated major interest in various physical applications; starting from dry powder coatings, ionospheric research, micro electronics, semiconductor and nanoparticle physics and so on. Dusty plasmas are mainly ionized gases with some macroscopic charged dust particles (either positive or negative depending upon the dust surrounding and charging mechanisms). Inclusion of micron sized dust grains, in a normal electron-ion plasma, completely changes and tangles the system properties due to various charging mechanisms and correlation effects between the constituents (hence often labeled with the term 'complex system'); which explores a fascinating research field in understanding various physical phenomena.
- Strongly Coupled Dusty Plasma** The electromagnetic Coulomb force couples the various constituents present in dusty plasma and due to the large amount of charge on a single dust grain, the effect of correlations become very significant. These kinds of systems, commonly labeled as strongly coupled plasma, can even exhibit viscoelastic nature showing both the solid and fluid like signatures. In recent times, strongly coupled dusty plasma has been considered as a major interdisciplinary research field to explore the fundamental physics of the strongly coupled Coulomb and Yukawa systems.
- Velocity shear driven phenomena** Shear velocity, also known as friction velocity, is a form with which shear stress can be re-written in the units of velocity. It is a very useful tool in fluid mechanics to understand the velocity of a flow in a stream where different shear layers possess different velocities with respect to each other. Shear velocity is utilized in description of diffusion and dispersion of the suspended particles, tracers, and contaminants in a fluid. Shear driven phenomena has been getting a serious attention for studying dusty plasma dynamics both theoretically and experimentally in the recent past. The generation of shear flow in complex systems (dusty plasma) enables to measure shear viscosity of those systems. The interplay between vorticity and shear flow in plasma can excite or stabilize many instabilities and the majority work of my thesis works revolved around this.
- Non-Newtonian Fluids** The non-Newtonian properties of plasmas in presence of velocity shear are emerging as an interesting field of study in plasma physics to obtain the information about the structure and properties of such complex systems under consideration. The viscosity, in general, always shows non-Newtonian characteristics in most of the fluids and complex systems such as dusty plasmas.
- Linear and Nonlinear Phenomena** Plasma is a highly non-linear system, where various physical phenomena occurs and interacts with each other simultaneously. The nonlinear study of this complex system explores the physical characteristics and stability properties of the system. Soliton type, shock type structures can propagate through the system due to the nonlinearity and dispersive effects present in the system.

Publications

- 2016 **Sudip Garai**;
“Stability characteristics of Rayleigh-Taylor instability in a strongly coupled incompressible dust fluid with finite shear flow”,
Phys. Plasmas **23**, 113706 (2016)
- 2016 **S. Garai**, M. S. Janaki, and N. Chakrabarti;
“Nonlinear coupling of acoustic and shear mode in a strongly coupled dusty plasma with a density dependent viscosity”,
Astrophys. Space Sci. Online First DOI: 10.1007/s10509-016-2890-1 (2016)
- 2016 **S. Garai**, S. Jana, M. S. Janaki, and N. Chakrabarti;
“Stability of collective modes in a strongly coupled non-Newtonian dusty plasma with finite velocity shear”,
Europhys. Lett. **114**, 65003 (2016)
- 2016 **S. Garai**, D. Banerjee, M. S. Janaki, and N. Chakrabarti;
“Shear flow driven instability in an incompressible dusty plasma with a density dependent viscosity”,
Indian Journal of Physics **90**, 717 (2016)
- 2015 **S. Garai**, M. S. Janaki, and N. Chakrabarti;
“Coupling of dust acoustic and shear mode through velocity shear in a strongly coupled dusty plasma”,
Phys. Plasmas **22**, 073706 (2015)
- 2015 **S. Garai**, D. Banerjee, M. S. Janaki and N. Chakrabarti;
“Stabilization of Rayleigh-Taylor instability in a non-Newtonian incompressible complex plasma”,
Phys. Plasmas **22**, 033702 (2015)
- 2014 **S. Garai**, D. Banerjee, , M. S. Janaki, and N. Chakrabarti;
“Velocity shear effect on the longitudinal wave in a strongly coupled dusty plasma”,
Astrophys. Space Sci., **349**, 789 (2014)
- 2014 **S. Garai**, D. Banerjee, , M. S. Janaki, and N. Chakrabarti;
“Dynamics of the longitudinal and transverse modes in presence of equilibrium shear flow in a strongly coupled dusty plasma”,
AIP Conference Proceedings, **1582**, 93 (2014)
- 2013 D. Banerjee, **S. Garai**, M. S. Janaki, and N. Chakrabarti;
“Kelvin-Helmholtz instability in non-Newtonian complex plasma”,
Phys. Plasmas **20**, 073702 (2013)

Grants, Achievements and Awards

Membership I am a life member of the Plasma Science Society of India (PSSI), Regn. No. F-828, Ahmedabad with the ID No. LM-1150

- CSIR-UGC NET Cleared the CSIR-UGC National Eligibility Test on December 2010, and selected under the UGC fellowship scheme with 0150/0216 rank.
- UGC Scholarship Got the prestigious “**Post graduate merit scholarship for university rank holders (2008-2010)**” from the University Grants Commission in the year 2008-2010 after securing **First class first** position in the undergraduate examination at Visva-Bharati University in Physics.
- National Scholarship Scheme Got short-listed in the list of meritorious candidates in the Madhyamik Exam, 2003
- Computer Software Course Had successfully completed the course on linux, C, C++, Access, Visual Basic during September 2005-2006 at Brainware Computer Academy, Bolpur, Birbhum, Westbengal 731204, India.

Conferences, Symposiums, Seminars

- August, 2016 Attended and actively participated in “Prof. M. R. Gupta Memorial Seminar”, jointly organized by Centre for Plasma Studies, Jadavpur University and Advanced Centre for Nonlinear and Complex Phenomena, Jadavpur University, Kolkata, August 4, 2016.
- July, 2016 Successfully defended my “Thesis work” at Department of Instrumentation Science, Jadavpur University, July 21, 2016.
- January, 2016 Attended one day Seminar on “Nonlinear & Complex Phenomena on Plasmas and Fluids” organized by Centre for Plasma Studies, Jadavpur University in collaboration with Advanced Centre for Nonlinear and Complex Phenomena, Jadavpur University, Kolkata, January 21, 2016.
- December, 2015 Attended and presented a poster entitled “Stability characteristics of Rayleigh-Taylor instability in a strongly coupled incompressible dust fluid with finite shear flow” in the “30th National Symposium on Plasma Science and Technology (Plasma-2015)” at Saha Institute of Nuclear Physics (SINP), Kolkata (Westbengal) in association with the Plasma Science Society of India (PSSI), December 1-4, 2015.
- August, 2015 Successfully delivered the Pre-Phd Seminar at Science College, Calcutta University, August 28, 2015.
- March, 2015 Attended and presented a poster entitled “Stabilization of Rayleigh-Taylor Instability in a non-Newtonian Incompressible Dusty Plasma” in the 2nd National Symposium on Nonlinear and Complex Phenomena (NSNCP-2015) organized at IASST, Guwahati in association with CPP-IPR, Sonapur and Advanced Centre for Nonlinear and Complex Phenomena (ACNCP), Kolkata, March 26-28, 2015.

- March, 2014 Attended one day Seminar on “Nonlinear Aspects of Plasmas and Fluids” jointly organized by Centre for Plasma Studies, Jadavpur University and Advanced Centre for Nonlinear and Complex Phenomena, Jadavpur University, Kolkata, March 26, 2014.
- January, 2014 Attended and presented a poster entitled with “Velocity shear driven instabilities in a dusty plasma” in the National Symposium on Nonlinear and Complex Phenomena; jointly organized by the Advanced Centre for Nonlinear and Complex Phenomena (ACNCP) and Centre for Plasma Studies, Jadavpur University, Kolkata, January 7-9, 2014.
- December, 2013 Attended and presented a poster entitled with Velocity Shear Driven Instabilities in a Dusty Plasma in the “28th National Symposium on Plasma Science and Technology (Plasma-2013)” at Kalinga Institute of Industrial Technology (KIIT), Bhubaneswar (Odisha) in association with the Plasma Science Society of India (PSSI), December 3-6, 2013.
- December, 2012 Attended a one day workshop on “Plasma and its application” organized by the Department of Physics, Kharagpur College, Kharagpur, December 18, 2012.
- September, 2011 Attended a “Micro-seminar on Nonlinear Phenomena” organized by the Department of Mathematics, Bethun College, Kolkata - 700 006, September 23, 2011.

Languages

Bengali	Fluent	<i>Mother Tongue, Daily practice</i>
English	Standard	<i>All professional communicative work performed in English</i>
Hindi	Average	<i>Rarely used</i>

Interests and Hobbies

Sport	Badminton, Carrom
Hobbies	Photo editing in Photoshop, listening songs, reading story books

Skills

Development

Languages	C, C++, Fortran	Softwares	MATLAB, MATHEMATICA, Various Windows Softwares
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