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PROFESSIONAL EXPERIENCE

Assistant Professor Jan 7^{th}, 2008 - Present.
Department of Physics, Jamia Millia Islamia, New Delhi.

Junior Research fellow, CSIR Jan 2003 - Dec 2004.
Senior Research fellow, CSIR Jan 2005 - Dec 2007.

EDUCATIONAL QUALIFICATIONS

Doctor of Philosophy (Physics) 2008.
School of Physical Sciences, Jawaharlal Nehru University, NEW DELHI.
Thesis Title : *Dynamical Properties of Granular Materials*

Master of Science (Physics) 1998.
Department of Physics, Patna University, PATNA.

Bachelor of Science (Physics) 1996.
Department of Physics, Patna Science College, Patna Universty.
Subjects : Physics(Hons.), Chemistry, Mathematics.

PUBLICATIONS

1. S. Puri and **S.R. Ahmad**, *Velocity Distributions in a Cooling Granular Gas*, in *Proc. of International Conference on Statistical Mechanics of Plasticity and Related Instabilities*, edited by S. Dattagupta, A. El-Azab, S.B. Krupanidhi, S. Noronha, S.A. Shivashankar and M. Zaiser, PoS (SMPRI2005) 049(2006).

2. S.R. Ahmad and S. Puri, *Velocity Distributions in a Freely Evolving Granular Gas*, Europhys. Lett, **75**(1), pp. 56-62(2006).

3. S.R. Ahmad and S. Puri, *Velocity Distributions and Aging in a Cooling Granular Gas* (PRE, 2007).

4. S.R. Ahmad and S. Puri, *Aging of Autocorrelation Function in Granular Gases* (yet to be published).

5. S.R. Ahmad and S. Puri, *Interplay of Dissipation and Gravity Driven Clustering in Self Gravitating Systems* (yet to be published).

OTHER ACADEMIC ACHIEVEMENTS

1. Qualified NET-JRF conducted by CSIR in June 2002.

2. Qualified GATE in 2002.

CONFERENCES AND SCHOOLS

1. Attended Department of Science and Technology sponsored SERC School on Statistical Physics held at Tata Institute of Fundamental Research, Mumbai in February, 2004.

2. Attended STATPHYS 22, the 22nd IUPAP International Conference on Statistical Physics, held at Indian Institute of Science, Bangalore between July 4-9, 2004.

3. Attended "Unifying Concepts in Glass Physics III", a satellite meeting to STATPHYS22 at Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore, between 28 June - 1 July 2004.

4. Attended "Pattern Formation in Nonequilibrium Systems", a satellite meeting to STATPHYS22 at S N Bose National Centre for Basic Sciences, Kolkata, between 11-13 July 2004.

5. Attended DST sponsored SERC School on Nonlinear Dynamics held at Delhi University in December, 2009.

TECHNICAL EXPERTISE

1. Programming Languages : Fortarn 77, Fortran 90, C, Unix Shell Programming.

2. Operating Systems : Red Hat Linux 9, Red Hat Enterprise Linux 4, Other linux Versions, Unix, Solaris, Windows 9x, Windows XP.

CONTRIBUTION TO CORPORATE LIFE

1. Advisor, Jamia Physics Association : 2010 - till date.

2. Assistant Superintendent of (Compartment) Examinations : December 2010 - January 2011.

COURSES TAKEN

UG COURSES
1. : Mechanics (BSc I)
2. : Electromagnetic Theory (BSc III)
3. : Mathematical Physics (BSc III)

PG COURSES
1. : Mathematical Physics (MSc I)
2. : Numerical Analysis & Computer Programming (MSc I)
3. : Condensed Matter II (MSc II)

PHYSICS LABS
(MSc I & BSc I, II, III)

OUTLINE OF RESEARCH WORK

At the moment I am employed as an Assistant Professor at the Department of Physics, Jamia Millia Islamia, New Delhi. Before joining my current position, I did my doctoral research at Jawaharlal Nehru University under the supervision of Prof. Sanjay Puri. My research was primarily concentrated on studying the dynamical Properties of Granular Materials which are nothing but powders or grains. They are ubiquitous in nature and used abundantly in industries. Advanced Computational techniques like Event Driven Molecular Dynamics (EDMD) and Hierarchical Linked Cell (HLC) Simulation methods were applied to study the statistical properties of such systems. For the numerical study, I developed codes in Fortran and C Programming languages. The programs were primarily run on Linux based HP Xeon and HP Opteron dual processor machines.

The study of the static and dynamical properties of Granular Materials has seen a surge in interest lately. This is partly due to their immense technological importance and physical applications. Granular materials are comprised of mesoscopic grains, whose typical size ranges from 1 micron to 1cm. The grains in general are polydisperse and arbitrary in shape. They are inelastic and dissipate energy on collision. The interest in the study of granular media is also due to the fact that they exhibit properties intermediate to those of solids and liquids. Thus, a sand pile resists strain but can also flow like a fluid.

In our study of these systems we are interested in the various dynamical properties. If we allow an assembly of granular particles to evolve freely, the entire system dissipates energy or starts cooling owing to the inelastic nature of the collisions. At the initial stages of evolution the density field remains homogeneous and the system is said to be in the Homogeneous Cooling State (HCS). At later times, instability sets in and the density field becomes inhomogeneous. The system evolves into a bi-continuous morphology consisting of high and low density regions, which is usually referred to as Inhomogeneous Cooling State (ICS). With our numerical and analytical studies we have studied the velocity distribution of both the HCS and ICS. Using the Sonine polynomial expansion and using the event-driven molecular dynamics simulation method, we have been able to show that the distribution of velocity shows a marked departure from the Maxwell Boltzmann distribution. We also observed in our studies that the velocity autocorrelation function displays the aging property.

To study the distribution of velocities, a system of a million particles were simulated and the departure in the inelastic gas was quantified by determining the coefficients of the Sonine polynomial expansion. For the classical case, i.e., the Maxwell-Boltzmann distribution, the expansion coefficients vanish (except for the leading term). However, for the inelastic case, the expansion coefficients assume non-zero values. For each of the four parameter values, $e = 0.95,\ 0.9,\ 0.8$ and 0.7, results were obtained by taking the average over 50 independent realizations. This exercise was done for both the dimensions $d = 2, 3$.

For systems away from equilibrium like the granular gas, there are quantities that depend on the thermal history of the system. This means that these quantities depend not only on the time interval of measurement, as is the case in equilibrium systems, but also on the reference time or *waiting time* t_w, when the measurement is started. The t_w dependence of quantities is referred to as the *aging* property and has been studied in the context of a wide range of nonequillibrium systems like structural and spin glasses, polymers, domain growth etc. In the context of granular gases, the velocity autocorrelation function exhibits explicit dependence on waiting time.

The freely-evolving granular gas was originally proposed as a model for the formation of galaxies and planets from a homogeneous cloud of interstellar dust. Clearly, the presence of gravity between the particles plays an important role in this aggregation process, i.e., it enhances the tendency amongst particles to collide, thereby accelerating the clustering process. Using the Hierarchical Linked Cell (HLC) method, we simulated a system of 100000 inelastic particles evolving under the long-range gravitational interaction and studied its statistical properties. The length scales of the clusters are found to exhibit a power-law growth. The structure factor is found to exhibit dynamic scaling and the tail of the structure factor shows Porod's law dependence $S(k,t) \sim k^{-4}$, which is typical of scattering of sharp interfaces.