

Dr. Awadhesh Kumar Dubey

Assistant Professor,
Department of Physics under School of Engineering and Technology,
Central University of Haryana, Jant-Pali, Mahendergarh, Haryana.

Email: awadhesh1234@gmail.com

Contact No. : +917380553791



Education :

Ph. D. : School of Physical Sciences (SPS), Jawaharlal Nehru University (JNU), New Delhi, 2013.

Thesis Title : Clustering and Aggregation in Far-from-Equilibrium Systems

Supervisor : Prof. Sanjay Puri

MSc : School of Physical Sciences (SPS), Jawaharlal Nehru University (JNU), New Delhi, 2004.

BSc : VBS Purvanchal University, Jaunpur, UP, 2002.

Research Interests :

My research interest focuses to study various fascinating problems in condensed matter physics :

1. Mechanical properties of amorphous solids such as glasses.
2. Homogeneous and inhomogeneous cooling states of cooling granular gases
3. Phase-ordering phenomena : martensite-austenite phase transformation and phase separation in binary fluids.
4. Front propagation and interfaces, Barkhausen Noise.

Research Experience :

1. Postdoctoral Fellow, Department of Chemical Physics, Weizmann Institute of Science, Rehovot, Israel (2014-2016).
2. Postdoctoral Fellow, Laboratory FAST, CNRS, University of Paris-SUD(11), Orsay, France(2013-2014).
3. Research Associate, SPS, JNU, New Delhi (November 2016-January 2017).

Academic Awards :

1. Qualified NET+JRF, CSIR, India (2008).
2. Qualified GATE conducted by IITs, India (2006).

Teaching Assistantship :

1. Phase Transitions and Critical Phenomena (Pre-PhD)
Course Teacher : Prof. Sanjay Puri School of Physical Sciences, JNU, (Winter Semester, 2008).
2. Classical Mechanics (M. Sc.) Course Teacher :
Prof. Debashish Ghoshal School of Physical Sciences, JNU, (Monsoon Semester, 2009).
3. Statistical Mechanics II (M. Sc.) Course Teacher :
Prof. Sanjay Puri School of Physical Sciences, JNU, (Monsoon Semester, 2010).
4. Statistical Mechanics II (M. Sc.) Course Teacher :
Prof. Sanjay Puri School of Physical Sciences, JNU, (Monsoon Semester, 2012).

Presentations :

1. Oral at "Statistical Physics Out of Equilibrium", Paris, France (2007).
Title :Kinetics of Phase Separation (Binary Mixtures).
2. Oral at "SERC School", IIT, Guwahati (2008).
Title :Lattice Boltzmann Simulations of Binary Fluid Mixtures.
3. Oral at "Fifth Dynamics Day", SPS, JNU, New Delhi (2009).
Title :Free Cooling of a Granular Gas.
4. Poster at "Fundamental Problems in Statistical Physics", (FPSP) XII, Leuven, Belgium (2009).
Title :Free Cooling of Granular Gases of Viscoelastic Particles. Awadhesh Kumar Dubey, Anna Bodrova, Sanjay Puri and Nikolai Brilliantov
5. Poster at "SPS March Meeting on Soft Matter Physics", SPS, JNU, New Delhi, India (2010).
Title :Cooling and Brownian Motion in Viscoelastic Granular Gases. Awadhesh Kumar Dubey, Anna Bodrova, Sanjay Puri and Nikolai Brilliantov
6. Poster at "Dynamics of Phase Transformations", JNCASR, Bangalore, India (2011). Title :Growth and Coarsening Dynamics of a Triple Well Landau Free Energy.
Awadhesh Kumar Dubey, Sanjay Puri and Subodh R. Shenoy

Computational Skills :

1. Operating Systems : Unix, GNU/Linux, MS DOS, Windows.
2. Programming :
 - C, C++, Fortran, UNIX Shells.
 - MPI and OpenMP.
 - Matlab and Mathematica.

3. Advanced Simulation Techniques :

- Molecular Dynamics (MD) Simulations

- (a) Time-driven MD Applied on :

- Binary mixtures : Particles interact via Lennard Jones (LJ) potential.

- (b) Event-driven MD Applied on :

- Study of a force-free and a heated granular gas :

- 1. Low-density viscoelastic granular gases.
 2. A granular gas of rough particles.

- Monte-Carlo Simulations Applied on :

- 1. Binary-Mixtures (Kawasaki Dynamics).
 2. Ferromagnets (Glauber Dynamics).

- Lattice-Boltzmann Simulations Applied on :

- 1. Phase-separation kinetics of binary-fluid mixtures.
 2. To analyze the different regimes of propagation of an autocatalytic reaction front in heterogeneous porous media

- Langevin Simulations Applied on :

- Kinetics of phase separation :

- 1. Binary mixtures and binary-fluid mixtures.
 2. Thin-films.
 3. Austenite-martensite phase transformations.

Other Activities :

- "System Administrator", Ph.D. Computational Lab, School of Physical Sciences, JNU (2008-2009).
- "System Administrator", Gibbs cluster, School of Physical Sciences, JNU (2010-2012).

Research Experience :

During year 2014-2016, I have worked in department of chemical physics, Weizmann institute of science, Rehovot, Israel. Here, in our attempt to study mechanical and magnetic properties of amorphous solids or glasses, we analyzed serrated signals, e.g., Barkhausen noise and stress-strain curve. Further, we found piece-wise linear response rather than nonlinear in the context of elasticity in amorphous solids. We use molecular dynamics (MD) simulations and athermal quasistatic simulation (AQS) (at $T = 0$) for our study. Further, we generalize AQS protocol at some finite but low temperature.

During the year 2013-2014, as a postdoc fellow in Laboratoire FAST, University of Paris-SUD, Orsay, France; I, along with my colleagues, have been interested to study the propagation of fronts in the presence of an adverse flow. These fronts exist in many processes such as population dynamics in biology, chemotaxis, flame propagation in combustion and plasma physics. We performed an analysis of the different regimes of propagation of an autocatalytic reaction front in heterogeneous porous media. Here, we use lattice-Boltzmann simulation to solve an advection-reaction-diffusion equation. We compute the roughness exponent and the growth exponent of the moving front and compare our results with the existing theory. Further, we study the complex spatiotemporal dynamics of the avalanches and calculate various exponents to understand the avalanche behavior. We numerically solve the corresponding quenched KPZ (qKPZ) equation and perform the analogous study.

Finally, my PhD thesis comprises following subjects of great research interest : (1) granular materials and (2) phase ordering kinetics. A brief summary of the problems that we have undertaken is given below. (a) Brownian motion in a granular gas in a homogeneous cooling state is studied theoretically and by means of event-driven molecular dynamics. We consider a granular gas of viscoelastic spheres and reveal that for a wide range of initial conditions the ratio of granular temperatures of Brownian and bath particles demonstrates complicated non-monotonous behavior, which results in transition between different regimes of Brownian dynamics. (b) We study large-scale Molecular Dynamics simulation results for granular gases of viscoelastic particles. We analyze both cases of force-free gases and homogeneously heated gases. We develop a theory for the velocity distribution for heated gases. We explored evolution of temperature and the Sonine coefficient, which characterize the form of the velocity distribution function. (c) We investigate the impact of particles' roughness on the self diffusion coefficient D in granular gases. We perform a large-scale molecular dynamics simulation for a gas in a homogeneous cooling state and also for a heated gas.

Selected Publications :

1. Dynamical scaling for underdamped strain order parameter quenched below first-order phase transitions
N. Shankaraiah, **Awadhesh K. Dubey**, Sanjay Puri and Subodh Shenoy
Phys. Rev. B **94**, 224101 (2016).
2. Statistics of Plastic Events in Post-Yield Strain Controlled Amorphous Solids
Awadhesh K. Dubey, H. George E. Hentschel, Itamar Procaccia and Murari Singh
Phys. Rev. B **93**, 224204(2016).
3. Elasticity in Amorphous Solids : Nonlinear or Piece-Wise Linear?
Awadhesh K. Dubey, Itamar Procaccia, CABZ Shor and Murari Singh
Phy. Rev. Lett. **116**, 085502(2016).
4. Modeling Barkhausen Noise in Magnetic Glasses with Dipole-Dipole Interactions
Awadhesh K. Dubey, H. George E. Hentschel, Prabhat K. Jaiswal, Itamar Procaccia, Candana Mondal and Bhaskar Sen Gupta

- Europhys. Lett. **112**, 17011(2015).
5. Experimental Evidence for Three Universality Classes for Reaction Fronts in Disordered Flows
S. Atis, Awadhesh K. Dubey, D. Salin, L. Talon, P. le Doussal and K. J. Wiese
Phys. Rev. Lett. **114**, 234502(2015).
 6. Strong Pinning of Propagation Fronts in Adverse Flow
T. Gueudre, Awadhesh K. Dubey, Laurent Talon and Alberto Rosso
Phys. Rev. E **89**, 041004(R), 2014.
 7. Velocity distribution function and effective restitution coefficient for a granular gas of viscoelastic particles
Awadhesh K. Dubey, A. Bodrova, Sanjay Puri and N. Brilliantov
Phys. Rev. E **87**, 062202(2013).
 8. Intermediate Regimes in Granular Brownian Motion: Superdiffusion and Subdiffusion
Anna Bodrova, Awadhesh K. Dubey, Sanjay Puri and N. Brilliantov
Phys. Rev. Lett. **109**, 178001(2012).

Collaborators :

1. Sanjay Puri, SPS, JNU, New Delhi.
2. Itamar Procaccia, Chemical Physics, Weizmann Institute of Science, Rehovot, Israel.
3. Laurent Talon, Lab. FAST, CNRS, University of Paris-SUD(11), Orsay, France.
4. N. Brilliantov, University of Leicester, UK.
5. Subodh R. Shenoy, TIFR, Hyderabad, India.