

CURRICULUM VITAE

Arindam Kundagrami

ADDRESS

Department of Polymer Science and Engineering, University of Massachusetts
120 Governor's Drive, Amherst, MA 01003 USA

Email : arindam@theory.pse.umass.edu

URL : <http://theory.pse.umass.edu/members.html#Arindam>

Phone : 1-413-577-2242 (Work); 1-267-972-1406 (Personal)

Fax : 1-413-545-0082

EDUCATION AND PROFESSIONAL EXPERIENCE

UNIVERSITY OF MASSACHUSETTS, Amherst, MA, USA

Postdoctoral Fellow (*Concentration: Theoretical Polymer Physics*) 2004-Present

Research Advisor: Murugappan Muthukumar

- Calculated numerically and analytically using equilibrium statistical mechanics the counterion distribution and chain configuration of flexible polyelectrolytes in presence of monovalent and divalent salts. Demonstrated charge reversal and first-order chain collapse due to multivalent ion-bridging. Studied further application of the theory to volume collapse transition in synthetic or biopolymer gels.
- Proposed a continuum kinetic model involving an entropic barrier that recovers rate-limiting characteristics of both nucleation and diffusion control for polymer crystal growth in both melts and solutions.
- Studied the diffusion of solvent during polymer swelling and dissolution, and the nature of time-dependence of the reaction-diffusion fronts in model photoresists.
- Studied the constitutive equation of stress relaxation to calculate the kinetics of polyelectrolyte gel swelling in polar solvents.
- Developed numerical programs involving moving boundary conditions in non-trivial geometries to calculate temperature diffusion and related volume changes in polymeric materials.

UNIVERSITY OF PENNSYLVANIA, Philadelphia, PA, USA

Ph.D in Physics (*Concentration: Theoretical Soft-matter Physics*) 1997-2003

Ph.D Advisor: Tom Lubensky

THESIS: Structure of TGB_C phases near the upper critical twist k_{c2}

- Calculated using generalized Abrikosov vortex lattice theory the detailed nature of smectic and director ordering in twist-grain-boundary-C (TGB_C) phases in liquid crystals, and the nature of transitions to them from the cholesteric phase.

INDIAN INSTITUTE OF SCIENCE, Bangalore, India

M.S in Physics (*Concentration: Non-equilibrium Statistical Physics*)

1994-1997

M.S Advisor: Chandan Dasgupta

THESIS: Generic Scale Invariance and Multiscaling

- Demonstrated using computer simulations the presence of extended self-similarity (ESS) and multi-exponent scaling ("multiscaling") in height fluctuations in atomistic surface growth models.

PRESIDENCY COLLEGE (CALCUTTA UNIVERSITY), Kolkata (Calcutta), India

B.Sc in Physics

1991-1994

PUBLICATIONS

- **Arindam Kundagrami** and M. Muthukumar. "Super-diffusion in a model of polymer photoresist swelling", *in preparation*.
- **Arindam Kundagrami** and M. Muthukumar. "Polyelectrolyte gel collapse by divalent counterions", *in preparation*.
- **Arindam Kundagrami** and M. Muthukumar. "First order coil-globule transition of polyelectrolytes in poor solvents : the counterion adsorption effect", *in preparation*.
- Rajeev Kumar, **Arindam Kundagrami**, and M. Muthukumar. "Counterion adsorption on flexible polyelectrolytes : a comparison of theories", *submitted to Macromolecules*.
- Peter Loh, Roshan Deen, Doris Vollmer, Karl Fischer, Manfred Schmidt, **Arindam Kundagrami**, and Murugappan Muthukumar. "The collapse of linear polyelectrolyte chains in a poor solvent: When does a collapsing polyelectrolyte collect its counter ions?", *submitted to Macromolecules*.
- **Arindam Kundagrami** and M. Muthukumar. "Theory of competitive counterion adsorption on flexible polyelectrolytes : Divalent salts", *The Journal of Chemical Physics*, **128**, 244901 (2008).
- **Arindam Kundagrami** and M. Muthukumar. "Continuum theory of polymer crystallization", *The Journal of Chemical Physics* **126**, 144901 (2007).
- **Arindam Kundagrami** and Tom Lubensky. "The Structure of twist-grain-boundary-*C* Phases", *Physical Review E (Rapid Communications)* **68**, 060703 (2003).
- **Arindam Kundagrami** and Chandan Dasgupta. "Multiscaling in discrete models of epitaxial growth", *Physica A* **270**, 135 (1999).
- **Arindam Kundagrami**, Chandan Dasgupta, P. Punyindu, and S. Das Sarma. "Extended self-similarity in kinetic surface roughening", *Physical Review E (Rapid Communications)* **57**, R3703 (1998).

CONFERENCES AND SCHOOLS

- **7th International Symposium on Polyelectrolytes - Polyelectrolytes 2008**, University of Coimbra, Coimbra, PORTUGAL, June 16-19, 2008. *The collapse of linear polyelectrolyte chains in a poor solvent: When does a collapsing polyelectrolyte collect its counter ions?* (poster presented by co-author)
- **American Physical Society - March meeting 2008**, New Orleans, LA, USA, March 10-14, 2008. *Theory of competitive counterion adsorption on flexible polyelectrolytes : Divalent salts* (oral presentation)
- **University of Massachusetts Amherst/University of Heidelberg Workshop, 'Modeling and Computation in Physics, Mathematics, and Biology'**, Amherst, MA, USA, May 21-23, 2007. *Competitive counterion adsorption and charge reversal on a single flexible polyelectrolyte : Divalent salts* (poster presentation)
- **American Physical Society - March meeting 2006**, Baltimore, MD, USA, March 13-17, 2006. *The swelling and dissolution kinetics of polymer thin films* (oral presentation)
- **6-th National Graduate Research Conference**, University of Massachusetts, Amherst, MA, USA, June 15-17, 2005. *Theory of Lamellar Growth in Polymer Crystallization* (oral presentation)
- **American Physical Society - March meeting 2005**, Los Angeles, CA, USA, March 21-25, 2005. *Theory of Lamellar Growth in Polymer Solutions* (oral presentation)
- **American Physical Society - March meeting 2004**, Montreal, QC, CANADA, March 22-26, 2004. Attended.
- **American Physical Society - March meeting 2003**, Austin TX, USA, March 3-7, 2003. *Renn-Lubensky and Bordeaux TGB_C phases near the upper critical field h_{c2}* (oral presentation)
- **Boulder School for Condensed Matter and Materials Physics - 2002**, 'The Physics of Soft Condensed Matter', Boulder CO, USA, July 1-26, 2002. *The Structure of TGB_C phases near the upper critical field h_{c2}* (poster presentation)
- **American Physical Society - March meeting 2002**, Indianapolis IN, USA, March 18-22, 2002. *The dislocation lattice structure in the TGB_C phases near h_{c2}* (oral presentation)
- **International Conference on Statistical Physics, 'STATPHYS - KOLKATA-IV-2002'**, S. N. Bose National Centre for Basic Sciences, Kolkata (Calcutta), INDIA, January 14-19, 2002. *The dislocation lattice structure in the TGB_C phases near h_{c2}* (poster presentation)
- **Gordon Research Conferences, 'Liquid Crystals - 2001'**, Colby-Sawyer College, New London NH, USA, June 24-29, 2001. *TGB_C phases near h_{c2}* (poster presentation)
- **American Physical Society - March meeting 2001**, Seattle WA, USA, March 12-16, 2001. *TGB_C phases near h_{c2}* (oral presentation)
- **International Conference on Statistical Physics, 'STATPHYS - KOLKATA-III-1999'**, S. N. Bose National Centre for the Basic Sciences, Kolkata (Calcutta), INDIA, January 4-9, 1999. Attended.
- **83d Statistical Mechanics Conference**, Rutgers University NJ, USA, May 2000. Attended.

- **Annual symposia on the Physics of Soft Materials**, Laboratory of Research for the Structure of Matter, University of Pennsylvania, Philadelphia, PA, USA 1998 - 2002. Attended.
- **10 Years of TGB Phase : A workshop**, University of Pennsylvania, Philadelphia PA, USA, April 22-24, 1998. Attended.

AWARDS AND HONORS

- **Research Fellowship**: Graduate Program, University of Pennsylvania (1998-2003)
- **Junior Fellowship**: Integrated Doctoral Programme, Indian Institute of Science, Dept. of Science and Technology (Govt. of India) (1994-1997)

RESEARCH INTERESTS (SUMMARY)

Current:

- Equilibrium statistical mechanics of counterion distribution and conformation of polyelectrolytes in presence of multivalent salts (role of ion-bridging) - isolated chains, gels, brushes - application to complexation problems (e. g., adsorption of protein on a flexible polyelectrolyte), semi-flexible polymers (DNA compaction), and drug delivery (volume transition in gels). Further, kinetics of above-mentioned systems starting from single-molecule level.
- The nature of the coil-globule transition in neutral and charged polymers, especially the role of polymer charge and salt concentration in affecting the order and degree of the transition and locations of the phase boundaries.
- Kinetics of swelling and solvent diffusion in polyelectrolyte gels for two different scenarios - one in which physical stress relaxation (e. g., in polar solvents) and the other in which chemical interaction (e. g., for model photoresists in aqueous-base developers) is important.
- Kinetics and equilibrium of polymer crystallization in solutions and melts, and application of the concept of entropic barrier to protein crystallization.
- Analytical and numerical solutions to moving boundary problems in a diffusive system, and its application to polymeric, soft-matter, and biological systems.
- Equilibrium and Non-equilibrium physics of soft condensed matter systems.
- Application of statistical mechanics in biological systems.

Previous:

- Phase transitions, topological defects and chiral segregation in liquid crystals.
- Application of Monte Carlo and Molecular Dynamics simulations in soft-matter systems.
- Nonequilibrium dynamics of surface growth models.

COMPUTATION

- Simulation: a) Large scale simulation on non-equilibrium dynamics of growth models.

- b) Simulated annealing of liquid crystal systems (e. g., 2-d droplet of nematic molecules) using Monte Carlo and Molecular Dynamics methods.
- Numerical: a) Solution of diffusion equations in multiple dimensions with time dependent boundary conditions.
b) Solution of nonlinear problems using numerical techniques (for example, multi-dimensional minimization).

TEACHING EXPERIENCE

- **Teaching Assistant:** Dept. of Physics and Astronomy, Univ. of Pennsylvania (1997-1998)
- **Lab Instructor:** Phy101 (Mechanics) - Fall 1997, Phy151 (Electricity and Magnetism) - Spring 1998, Dept. of Physics and Astronomy, Univ. of Pennsylvania

Reviewer

- Journal of Chemical Physics

Professional Memberships

- American Physical Society (APS) - since 1998

REFERENCES

Murugappan Muthukumar

Department of Polymer Science and Engineering, University of Massachusetts
Amherst, MA 01003, USA

email: muthu@polysci.umass.edu

phone: 413-577-1212, fax: 413-545-0082

Tom Lubensky

Department of Physics and Astronomy, University of Pennsylvania
Philadelphia, PA 19104-6396, USA

email: tom@physics.upenn.edu

phone: 215-898-8152, fax: 215-898-2010

Vivek M. Prabhu

Polymers Division, National Institute of Standards and Technology
100 Bureau Drive, Building 224, Room B316, MS8541

Gaithersburg, MD 20899-8541

email: vprabhu@nist.gov

phone: 301-975-3657, fax: 301-975-3928

Chandan Dasgupta

Department of Physics, Indian Institute of Science
Bangalore 560012, INDIA

email: cdgupta@physics.iisc.ernet.in

phone: 91-80-293-3278, fax: 91-80-360-2602