

Mihir R. Khadilkar

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EDUCATION

- **Cornell University** 2009-2015
Ph.D. (Physics) Ithaca, NY, USA
- **Cornell University** 2009-2013
M.S. (Physics) Ithaca, NY, USA
- **Indian Institute of Technology Bombay (IIT Bombay)** 2005-2009
B.Tech. (Engineering Physics) Mumbai, India

RESEARCH EXPERIENCE

- **Postdoctoral researcher, Materials Research Laboratory, U. C. Santa Barbara** 2015 - present
Inverse methods for material design in polymers with Dow Chemical Company Santa Barbara, CA, USA
Advisor: Prof. Glenn Fredrickson
 - Developed a novel optimization method for targeted design of block-copolymer morphologies for industrial applications that worked up to **10 times faster** than existing methods.
 - Worked in a team of academic and industrial researchers, communicating progress in monthly meetings and planning long-term research outline with quarterly reports.
- **Graduate research assistant, Cornell University** 2011 - 2015
Novel phases in polyhedral nanoparticles: mixtures and spatial confinement Ithaca, NY, USA
Advisor: Prof. Fernando Escobedo
 - Led the research project on probing structural behavior of polyhedral nanoparticles (generally used in chemical and electronics industries) using computer simulations.
 - Discovered **previously unknown guiding rules** on nanoparticle mixture self-assembly. Systems studied bear crucial importance in novel *material design applications*.
 - Analyzed the effect of spatial confinement on the **self-assembly** of hard polyhedral nanoparticles, including novel structural ordering brought about by confinement.
 - Presented the work in international conferences, invited talks as well as weekly group meetings. Helped research group members adapt to the developed coding platform.
- **Graduate research assistant, Cornell University** 2009 - 2010
FCIQMC - Full CI Quantum Monte Carlo: a method development Ithaca, NY, USA
Advisor: Prof. Cyrus Umrigar
 - Worked within a team of researchers, implementing a numerical method for fast and accurate calculation of electronic structure and properties in materials.
 - The method consisted of a hybrid stochastic-deterministic technique to overcome fermion sign problem.
- **Research intern, University of Lille** May - July 2008
Topological analysis of funnel chaos in Rossler system Lille, France
 - Designed numerical methods to analyze ‘chaotic’ dynamical systems (such as typically found in weather forecasting and lasers) using topology.
 - Developed and implemented computational tools, with important implications to **chaos synchronization**.
- **Research intern, Trinity College Dublin** May - July 2007
Embedding methods in quantum transport Dublin, Ireland
 - Worked on developing a faster, ‘embedding’ technique for calculating electronic transport through a nanowire. The new method, scaled **linearly** with system size as against **cubic scaling** of the conventional method.

PUBLICATIONS

- Inverse design of bulk morphologies in multiblock polymers using particle swarm optimization: **Mihir R. Khadilkar**, Sean Paradiso, Kris T. Delaney and Glenn H. Fredrickson (*in preparation*).
- Phase behavior of polyhedral nanoparticles in parallel plate confinement: **Mihir R. Khadilkar**, Fernando A. Escobedo, *Soft Matter* **12**, 1506 (2016).
- Heuristic rule for binary superlattice coassembly: Mixed plastic mesophases of hard polyhedral nanoparticles: **Mihir R. Khadilkar**, Fernando A. Escobedo, (*Phys. Rev. Lett.*) **113**, 165504 (2014). [Arxiv preprint](#)
- Phase behavior of binary mixtures of hard convex polyhedra: **Mihir R. Khadilkar**, Umang Agarwal, Fernando A. Escobedo, *Soft Matter* **9**, 11557 (2013). [Arxiv preprint](#)
- Self-assembly of binary space-tessellating compounds: **Mihir R. Khadilkar** and Fernando A. Escobedo, *J. Chem. Phys.* **137**, 194907 (2012).

SELECTED AWARDS, GRANTS AND HONORS

- Dow Material Institute (DowMI) and Materials Research Laboratory (MRL) Travel grant, at U. C. Santa Barbara. (2017)
- Materials Computation Center, University of Illinois at Urbana-Champaign's Travel Award, towards attending conferences abroad. (2011, 2014)
- *V. R. Rao Summer Fellowship* at Cornell University, given only to a *single* student every year in the Physics department at Cornell. (2011)
- *Cornell Graduate Fellowship*, given to only a select students in the incoming graduate class every year in the Physics Department at Cornell. (2009)
- *Summer Research Fellowship*, from Indian Academy of Sciences, given annually to only 20 students from all across India. (2008)
- Qualified for *Indian National Mathematics Olympiad*, being among less than 500 students selected all across India. (2003)
- Certificate of Silver Merit, in the 2nd *National Cyber Olympiad (India)*. (2003)
- *National Talent Search Scholarship*, awarded by the Government of India, given only around top 0.2% students annually from more than 500,000 applicants. (2002)

SELECTED TALKS AND PRESENTATIONS

- **APS March Meeting 2017, New Orleans, LA:** Inverse design of bulk morphologies in block copolymers using particle swarm optimization. *March 2017*
- **TIFR Centre for Interdisciplinary Sciences, Hyderabad (India):** Self-assembly at nanoscale: polyhedral colloids and block-copolymers. *November 2016*
- **Computational Fluid Design Consortium Meeting 2016, Santa Barbara (CA):** Using particle swarm optimization for bulk phase discovery in block copolymer formulations. *February 2016*
- **APS March Meeting 2015, San Antonio, TX:** Designing entropy-driven binary ordered superlattices from polyhedral nanoparticles. *March 2015*
- **Chemistry seminar, University of Utah, Salt Lake City, UT:** Engineering ordered multicomponent structures with nanoparticles: story of polyhedral 'Lego-blocks'. *January 2015*
- **CECAM workshop on patchy colloidal particles, Vienna, (Austria):** Using entropic and enthalpic patches for targeted binary superlattice assembly (Poster Presentation). *September 2014*
- **APS March Meeting 2014, Denver, CO:** Binary Mixtures of Polyhedra: from phase-separation to super-structures. *March 2014*
- **APS March Meeting 2013, Baltimore, MD:** Self-assembly of binary tessellating compounds. *March 2013*

TECHNICAL SKILLS

- **Simulation techniques:** Monte Carlo methods, polymer SCFT, Molecular Dynamics, Thermodynamic integration, Swarm optimization
- **Computer Languages:** C, C++, Fortran, Python, Bash, HTML, CSS
- **Tools:** GIT, Emacs, L^AT_EX, Matplotlib, Povray, VMD, OpenGL

TEACHING EXPERIENCE

- **Phys 1101/1102:** (Fall 2009, Summer 2013, Spring 2014): General Physics I/II: Guided more than 200 students in this lab based course on mechanics and electromagnetism.
- **Private tutoring:** (2012-13): Conducted private tutoring for undergraduates on physics courses.
- **Phys 2208:** (Spring 2012): Fundamentals of Physics II: Guided around 60 students in this course on electromagnetism and modern physics through recitation sessions, office hours and by grading exams.
- **Phys 1112:** (Fall 2009): Classical Mechanics: Assisted the professor in instructing approximately 80 students in theory and experiments. Graded exams and conducted office hours.

ORGANIZATIONAL EXPERIENCE

- **High school science outreach** *Santa Barbara, CA (USA), 2015-present*
 - Participated in science outreach events in local high school science nights in Santa Barbara area, including hands-on demos on topics related to materials science as a way to promote scientific curiosity.
- **General Secretary, Department of Physics, IIT Bombay** *Mumbai (India), 2008-09*
 - Acted as a liaison between students and the academic body regarding many academic issues including a major curriculum overhaul and the department mentorship program.
- **Institute student mentor, IIT Bombay** *Mumbai (India), 2008-09*
 - Selected as a student mentor based on peer recommendation, balanced academics and mentoring skills. Counseled around 14 freshmen, guiding them on academic as well as personal matters.