Dr. Mihir Khadilkar

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Postdoctoral Researcher
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Professional summary

- Computational scientist with interdisciplinary research experience in **statistical physics and material design**, working on **polymers, colloids** and **nanoparticles**.
- Expertise in **molecular modeling** and **data-driven** computational methods with excellent communication skills acquired through several invited talks, conferences and **industrial collaborations**.
- Broad work exposure with several **international research experiences** and internships.

Work experience

- **Postdoctoral researcher, Institute of Physics, University of Mainz, Germany** 2017 - present
  Semiflexible polymers, interatomic potentials and machine learning *Mainz, Germany*
  Advisor: Dr. Arash Nikoubashman
  - Investigated ordering and defects of **bipolymers** under spatial and curved confinement (similar to cells or chromosomes) using computational methods, as a way to **control their structure and function**.
  - Worked on **inverse design** of interatomic potentials using **machine learning techniques** (neural networks and kernel regression methods)
- **Postdoctoral researcher, Materials Research Laboratory, U. C. Santa Barbara** 2015 - 2017
  *Inverse methods for material discovery in polymers with **Dow Chemical Company*** *Santa Barbara, CA, USA*
  Advisor: Prof. Glenn Fredrickson
  - Developed a novel optimization method for **targeted inverse design** of block-copolymer morphologies for industrial applications that worked up to **10 times faster** than existing methods.
  - Proposed method involved combining computer simulations with **data-driven global optimization** in parameter space to reduce experimental effort.
  - 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
  - Explored structure and ordering of **polyhedral nanoparticles** (generally used in chemical, biotechnolgy, and electronics industries) using molecular modeling (Monte Carlo simulations).
  - Discovered **previously unknown guiding rules** on nanoparticle mixture self-assembly in 2-D and 3-D, for novel **material discovery** applications.
  - Used **computational and data analysis tools** to understand colloidal self-assembly.
- **Research intern, Trinity College Dublin** May - July 2007
  Embedding methods in quantum transport *Dublin, Ireland*
  - Developed a faster, 'embedding' numerical method for electronic transport through a nanowire.

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*

Technical skills and languages

- **Simulation techniques:** Monte Carlo, Molecular dynamics, Self-consistent field theory, Optimization methods
- **Programming:** Fortran, Python, C++, matplotlib, bash, LaTeX, HTML, Jekyll.
- **Techniques:** Data preparation, processing, analysis, and visualization (using python, numPy, sciPy, Mayavi)
- **Languages:** English (fluent), Hindi (fluent), Marathi (native), German (Level A2)

Publications

- Phase behavior of semiflexible polymers confined to thin spherical shells: **Mihir R. Khadilkar** and Arash Nikoubashman, *Soft Matter* **14**, 33, 6903-6911 (2018).
- Inverse design of bulk morphologies in multiblock polymers using particle swarm optimization: **Mihir R. Khadilkar**, Sean Paradiso, Kris T. Delaney and Glenn H. Fredrickson, *Macromolecules* **50**, 17, 6702-6709 (2017).
- 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 talks and presentations

- Conference on Multiscale Materials Modeling, Osaka (Japan): *October 2018*
- Dow Chemical Company, Midland, MI (USA): *October 2016*
- DPG Annual Spring Meeting, Berlin (Germany): *March 2018*
- APS March Meeting 2017, New Orleans, LA (USA): *March 2017*
- TIFR Centre for Interdisciplinary Sciences, Hyderabad (India): *November 2016*
- CECAM workshop on patchy colloidal particles, Vienna, (Austria): *September 2014*
- Chemistry seminar, University of Utah, Salt Lake City, UT (USA): *January 2015*

Selected awards, grants and honors

- *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)*
- *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)*

Professional and organizational duties

- **Reviewer: Applied Physics Letters (APL)** 2017-present
  - Journal referee for multiple article submissions on APL, a journal from American Institute of Physics
- **Science outreach for high school students** *Santa Barbara, CA (USA)*, 2015-2017
  - Participated in science outreach events in local high school science nights, including hands-on demos on topics related to materials science as a way to promote scientific curiosity.
- **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.