Rishabh Sharma

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About

I'm a Simons Center Independent Postdoctoral Fellow at New York University. My current research focuses on world models and their emergent neural representations, mechanistic interpretability, and the physics of memorization and privacy in diffusion models.

Previously, I completed my Ph.D. in computational physics at the Tata Institute of Fundamental Research, Hyderabad, with publications in *Nature Physics* and *Physical Review Letters* on the physics of disordered systems. I was awarded the 2025 Ramakrishna Cowsik Medal — given for the best paper across the TIFR system by a researcher under 35 — for my *Nature Physics* publication.

Positions

Simons Center Independent Postdoctoral Fellow *Jul 2025 – present*
Simons Center for Computational Physical Chemistry, New York University, USA

Education

Integrated Ph.D. in Physics *2019 – 2025*
Tata Institute of Fundamental Research (TIFR), Hyderabad, India
Advisor: Prof. Smarajit Karmakar
Thesis: Annealing and Memory Effects in Active and Passive Amorphous Solids

B.E. in Mechanical Engineering *2014 – 2018*
Panjab University, Chandigarh, India

Awards & Fellowships

Ramakrishna Cowsik Medal, TIFR 2025
Best paper across the TIFR system by a researcher under 35.

Simons Center Independent Postdoctoral Fellowship, NYU 2025

Sarojini Damodaran International Student Travel Fellowship, TIFR 2023

Computing

Have worked on HPC clusters throughout my career — parallel molecular dynamics in C + MPI during my PhD, now training diffusion transformers and probing latent diffusion U-Nets on NYU's Torch and the Empire AI consortium's H100/H200 clusters via SLURM + Apptainer/Singularity.

Publications

[1] **R. Sharma**, G. Hogervorst, W. E. Mackey, D. J. Heeger, S. Martiniani. *Cross-View World Models.* **ICLR 2026 Workshop on World Models.** OpenReview | arXiv:2602.07277

[2] **R. Sharma**, S. Karmakar. *Activity-induced annealing leads to a ductile-to-brittle transition in amorphous solids.* **Nature Physics** (2025). doi:10.1038/s41567-024-02724-5
Featured in Nature Physics News & Views.

[3] M. Adhikari*, **R. Sharma***, S. Karmakar. *Encoding fast and fault-tolerant memories in bulk and nanoscale amorphous solids.* **Physical Review Letters** (2025). doi:10.1103/PhysRevLett.134.018202

[4] U. A. Dattani*, **R. Sharma***, S. Karmakar, P. Chaudhuri. *Cavitation instabilities in amorphous solids via secondary mechanical perturbations.* arXiv preprint (2023). arXiv:2303.04529

*Co-first author.

Work in Progress

[1] **R. Sharma** et al. *On memorization in diffusion models* (manuscript in preparation, 2026).

Research Visits

Roskilde University, Denmark — Nov – Dec 2023
Hosted by Prof. Jeppe Dyre

Heinrich Heine University Düsseldorf, Germany — Dec 2023 – Jan 2024
Hosted by Prof. Jürgen Horbach

Talks & Presentations

[1] Poster, ICLR 2026 Workshop on World Models, Rio de Janeiro, Brazil — Apr 2026

[2] Contributed talk, APS Global Physics Summit, Denver, USA — Mar 2026

[3] Seminar, Institut für Theoretische Physik, University of Göttingen, Germany — Jan 2024

[4] Computational Soft Matter Seminar, University of Amsterdam, Netherlands — Jan 2024

[5] Seminar, Soft Matter Group, Heinrich Heine University Düsseldorf, Germany — Jan 2024

[6] Seminar, "Glass and Time" Group, Roskilde University, Denmark — Nov 2023

Professional Service

Journal reviewer for PRX Intelligence (APS)

Selected Media Coverage

Nature Physics News & Views | EurekAlert | Phys.org