

# NAN CHENG

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## EMPLOYMENT

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**Georgia Institute of Technology**

Atlanta, GA, USA

Postdoctoral Fellow

Advisor: Zeb D. Rocklin

Sept. 2025 – Present

## EDUCATION

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**University of Michigan, Ann Arbor**

Ann Arbor, MI, USA

Ph.D in Physics

Advisors: Xiaoming Mao and Kai Sun

Aug. 2025

M.S. in Mathematics

Aug. 2025

M.S. in Physics

May 2021

**Fudan University**

Shanghai, China

B.S. with Honors in Physics

June 2019

GPA 3.72/4.00, Ranking 4/103

## RESEARCH INTERESTS

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Condensed Matter Physics, Statistical Mechanics

## PUBLICATIONS

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- Band theory and boundary modes of high-dimensional representations of infinite hyperbolic lattices,***  
Nan Cheng, Francesco Serafin, James McInerney, Zeb Rocklin, Kai Sun, and Xiaoming Mao  
*Physical Review Letters* **129**, 088002, (2022)
- Universal spectral moment theorem and its applications in non-Hermitian systems,***  
Nan Cheng, Chang Shu, Kai Zhang, Xiaoming Mao, and Kai Sun  
*Physical Review Letters* **133**, 216401, (2024)
- Frustrated self assembly of hyperbolic crystal from icosahedron shaped nanoparticles,***  
Nan Cheng, Kai Sun, and Xiaoming Mao  
*Physical Review E* **110**, 054132, (2024)
- Backscattering-free edge states below all bands in two-dimensional auxetic media,***  
Wenting Cheng\*, Kai Qian\*, Nan Cheng\*, Nicholas Boechler, Xiaoming Mao, and Kai Sun  
*Nature Communications* **16**, 2373 (2025) (\* Equal contribution)
- Regeneration leads to global tissue rejuvenation in aging sexual planarians,***  
Xiaoting Dai, Xinghua Li, Alexander Tyshkovskiy, Cassandra Zuckerman, Nan Cheng, Peter Lin, David Paris, Saad Qureshi, Xiaoming Mao, Jayakrishnan Nandakumar, Vadim Gladyshev, Scott Pletcher, Leonid Kruglyak, Jacob Sobota, and Longhua Guo  
*Nature Aging* **5**, 780-789 (2025)
- Rethinking fine-tuning when scaling test-time compute: limiting confidence improves mathematical reasoning,***  
Feng Chen, Allan Raventós, Nan Cheng, Surya Ganguli, and Shaul Druckmann  
*Advances in Neural Information Processing Systems* (2025)
- Observation of mechanical kink control and generation via acoustic waves,***  
Kai Qian, Nan Cheng, Francesco Serafin, Kai Sun, Georgios Theocharis, Xiaoming Mao, and Nicholas Boechler  
*Nature Communications* **17**, 2428 (2026)

## UNDER REVIEW

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1. *Lyapunov exponents explain disorder-induced polarization and soliton teleportation in a mechanical Markov system*,  
Will Stephenson, **Nan Cheng**, Kai Sun, and Xiaoming Mao  
Second round review at Nature Communications.  
arXiv: 2511.08738 (2025)
2. *Failure of the goldstone theorem for vector fields and boundary-mode proliferation in hyperbolic lattices*,  
Daniel Sela\*, **Nan Cheng\***, and Kai Sun  
Second round review at Physical Review Letters.  
arXiv:2511.16328 (2025) (\* Equal contribution)
3. *Broad band wave isolation in viscoelastic topological mechanical metamaterials*,  
Fan Liu, **Nan Cheng**, James McInerney, Ellen Arruda, and Xiaoming Mao  
First round review at Journal of the Mechanics and Physics of Solids.
4. *Self-limiting frustrated self-assembly of nanoscale right bipyramids into complex superstructures*,  
Daniel García-Lojo, **Nan Cheng**, Tim Moore, Rafael Contreras-Cáceres, Eva Bladt, Benito Rodríguez-Gonzalez, Jorge Pérez-Juste, Kai Sun, Sara Bals, Sharon Glotzer, Luis M. Liz-Marzán, Xiaoming Mao, Nick A. Kotov, Isabel Pastoriza-Santos  
Second round review at ACS Nano.

## MANUSCRIPTS IN PREPARATION

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1. *Validation of non-Hermitian spectral momentum theorem in active acoustic crystals*,  
Jiaxin Zhong, Chang Shu, **Nan Cheng**, Kai Zhang, Kai Sun, Yun Jing.  
Manuscript in preparation.

## EXPERTISE

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Computational Expertise: Python.

Theoretical Expertise: Representation Theory, Riemannian Geometry.

## AWARDS

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American Physical Society Division of Soft Matter: Emerging Soft Matter Excellence Award Finalist *Mar. 2025*  
Honors Student Award in Physics in National Top Undergraduate Training Program (Top 5%) *June 2019*  
Excellent Graduate of Fudan University (Top 5%) *June 2019*

## INVITED TALKS

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- **Seminar at Department of Physics, Fudan University, Shanghai, China (2024)**  
Universal spectral moment theorem and its applications in non-Hermitian systems
- **Microstructured Quantum Matter Seminar at Max Planck Institute for the Structure and Dynamics of Matter, Hamburg, Germany (2024)**  
Real space curvature effect on wave propagation
- **Talk at the Society for Industrial and Applied Mathematics Conference on Material Science, Pittsburgh, PA, USA (2024)**  
Band theory and boundary modes of high-dimensional representations of infinite hyperbolic lattices

## CONTRIBUTED TALKS

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- **Talk at the ICAM Workshop on Frustrated Assemblies, Ann Arbor, MI (2025)**  
Geometrically frustrated self-assembly of hyperbolic crystals from icosahedral nanoparticles
- **Talk at the APS March Meeting, Anaheim, CA (2025)**  
Backscattering-free edge states below all bands in two-dimensional auxetic media
- **Talk at the APS March Meeting, Minneapolis, MN (2024)**  
Universal spectral moment theorem and its applications in non-Hermitian systems
- **Talk at Complex Mechanical Metamaterials Workshop, Ann Arbor, MI (2023)**  
Band theory and boundary modes of high-dimensional representations of infinite hyperbolic lattices
- **Talk at the APS March Meeting, Las Vegas, NV (2023)**  
Frustrated self assembly of hyperbolic crystal from icosahedron shaped nanoparticles

- **CM-AMO Double Feature Seminar, Ann Arbor, MI (2022)**

Band theory and boundary modes of high-dimensional representations of infinite hyperbolic lattices

- **Talk at the APS March Meeting, Chicago, IL (2022)**

Band theory and boundary modes of high-dimensional representations of infinite hyperbolic lattices

## **TEACHING EXPERIENCE**

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Elementary physics experiment

Fall 2019, Spring 2020, Fall 2020, Spring 2021

Summer short course on topological mechanics

Summer 2023

Summer short course on linear elasticity

Summer 2024