

# WENPING CUI

+01 617-763-9639 ◇ wenpingcui@gmail.com

Jadwin Hall 344, Washington Road, Princeton, NJ 08544

## EMPLOYMENT

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| <b>Postdoctoral Associate</b> , Department of Physics, Princeton University            | June 2024            |
| <b>Postdoctoral Fellow</b> , Kavli Institute for Theoretical Physics, UC Santa Barbara | June 2021 - May 2024 |

## EDUCATION

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| <b>PhD in Biophysics</b> , Boston College, United States                         | Aug 2014 - April 2021                      |
| PhD Thesis: Statistical Mechanics of Microbiomes                                 | Advisor: <a href="#">Pankaj Mehta</a>      |
| <b>MS in Statistical Physics</b> , Universität Bonn, Germany                     | Aug 2011 - Feb 2014                        |
| Master Thesis: A variational study of two and three dimensional melting          | Advisor: <a href="#">Thomas Nattermann</a> |
| <b>BS in Astrophysics</b> , University of Science and Technology of China        | Aug 2007 - Jul 2011                        |
| Bachelor Thesis: Transient Accelerating Scalar Models with Exponential Potential | Advisor: <a href="#">Yang Zhang</a>        |

## AWARDS

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| KITP Postdoctoral Fellow, UC Santa Barbara  | 2021-2024  |
| Best poster award, The Future of Quantitative Biology Symposium, Harvard University | 2019       |
| Bonn and Cologne Graduate Scholarship, Universität Bonn                             | 2011- 2013 |
| Bonn International Graduate Scholarship, Universität Bonn                           | 2011       |
| National Astronomical Observatories Scholarship, Chinese Academy of Science         | 2010       |

## SKILLS

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**Programming:** Strong proficiency in Python, Pytorch, TensorFlow, Matlab, Linux, C, Git

**Machine Learning:** Deep Learning, Deep Reinforcement Learning, Belief Propagation, Convex Optimization.

**Theory:** Biophysics, Theoretical Ecology, Statistical Physics, Random Matrices, Spin Glass Theory, Information Theory.

## PUBLICATIONS

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**W Cui**, R Marsland III, P Mehta, *Les Houches Lectures on Community Ecology: From Niche Theory to Statistical Mechanics*, [arXiv:2403.05497](#)

**W Cui**, J Fendley, S Srikant, B Shraiman, *A model of pan-immunity maintenance by horizontal gene transfer in the ecological dynamics of bacteria and phages*, [arXiv:2402.19388](#) Under review by PNAS

**W Cui**, J. W Rocks, P Mehta, *An elementary mean-field approach to the spectral densities of random matrix ensembles*, [Physica A: Statistical Mechanics and its Applications: 129608 \(2024\)](#)

**W Cui**, R Marsland III, P Mehta, *Diverse communities behave like typical random ecosystems*, [Phys. Rev. E 104, 034416 \(2021\)](#)

R Marsland III, **W Cui**, P Mehta, *The Minimum Environmental Perturbation Principle: A New Perspective on Niche Theory*, [The American Naturalist 196.3 \(2020\): 291-305.](#)

- W Cui**, R Marsland III, P Mehta, *Effects of resource dynamics on species packing in diverse ecosystems*, [Phys. Rev. Lett. 125.4 \(2020\): 048101](#). Editor's Suggestion, See also the synopsis in Physics Magazine: [Resource Dynamics Dictate Diversity](#).
- O Howell, **W Cui**, R Marsland III, P Mehta, *Machine Learning as Ecology*, [J. Phys. A: Math. Theor. 53 \(2020\): 334001](#).
- R Marsland III, **W Cui**, P Mehta, J Goldford, *The Community Simulator: A Python package for microbial ecology*, [Plos one 15, no. 3 \(2020\): e0230430](#).
- R Marsland III, **W Cui**, P Mehta, *A minimal model for microbial biodiversity can reproduce experimentally observed ecological patterns*, [Sci Rep 10, 3308 \(2020\)](#)
- R Marsland III, **W Cui**, J Horowitz, *The Thermodynamic Uncertainty Relation in Biochemical Oscillations*, [Journal of the Royal Society Interface 16.154 \(2019\)](#). [Highlight](#) by Nature Physics.
- P Mehta, **W Cui**, CH Wang, R Marsland III, *Constrained optimization as ecological dynamics with applications to random quadratic programming in high dimensions*, [Phys. Rev. E 99.5 \(2019\): 052111](#).
- R Marsland III, **W Cui**, J Goldford, A Sanchez, K Korolev, P Mehta, *Available energy fluxes drive a phase transition in the diversity, stability, and functional structure of microbial communities*, [PLoS Comput Biol 15.2 \(2019\): e1006793](#).
- W Cui**, P Mehta, *Identifying feasible operating regimes for early T-cell recognition: The speed, energy, accuracy trade-off in kinetic proofreading and adaptive sorting*, [PloS one 13.8 \(2018\): e0202331](#).
- M Li, **W Cui**, MS Dresselhaus, G Chen, *Electron energy can oscillate near a crystal dislocation*, [New Journal of Physics. 19,1 \(2017\)](#)
- Li, Mingda, et al. , *Proximity-Driven Enhanced Magnetic Order at Ferromagnetic-Insulator-Magnetic-Topological-Insulator Interface*, [Phys. Rev. Lett. 115, 087201 \(2015\)](#)
- M Li, **W Cui**, J Yu, Z Dai, Z Wang, F Katmis, W Guo, J Moodera, *Magnetic Proximity Effect and Interlayer Exchange Coupling of Ferromagnetic/Topological Insulator/Ferromagnetic Trilayer*, [Phys. Rev. B. 91, 014427 \(2015\)](#)
- W Cui**, M Li, Z Dai, Q Meng, Y Zhu, *Near-Field Optical Effect of a Core-Shell Nanostructure In Proximity to a Flat Surface*, [J. Chem. Phys. 140, 044109 \(2014\)](#)
- M Li, Z Dai, **W Cui** Z Wang, F Katmis, P Le, J Wang, L Wu, Y Zhu, *Tunable THz Surface Plasmon Polariton based on Topological Insulator-Layered Superconductor Hybrid Structure*, [Phys. Rev. B. 89, 235432 \(2014\)](#)
- M Li, **W Cui**, L Wu, Q Meng, Y Zhu, Y Zhang, W Liu, Z Ren, *Topological Effect to Surface Plasmon Excitation in Topological Insulator Nanowires*, [Canadian Journal of Physics. 10, 1139 \(2014\)](#)
- W Cui**, Y Zhang, Z Fu, *Transient Accelerating Scalar Models with Exponential Potential*, [Res. Astron. Astrophys. 13, 629 \(2013\)](#)

## ACADEMIC SERVICE

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Reviewer for Proceedings of the National Academy of Sciences, Nature Communications, PLOS Computational Biology, Physical Review E.

## CONFERENCE / WORKSHOP PRESENTATIONS

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### Effects of horizontal gene transfer on phage-host coevolution

Flash Talk at Workshop hosted by Princeton Center for Theoretical Science, New Jersey

Feb, 2025

Talk at APS March Meeting, Minneapolis, Minnesota

March, 2024

Talk at Center for Quantitative Biology, Peking University, Beijing, China

Mar, 2023

### Effects of resource dynamics on species packing in diverse ecosystems

Poster at MIT Quantitative Ecology Meeting, Boston, United States

Jan, 2020

**Diverse communities behave like typical random ecosystems**

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| Talk at Institute of Theoretical Physics, Chinese Academy of Sciences, Beijing, China          | Mar, 2023 |
| Poster at Boulder School for Condensed Matter and Materials Physics                            | Jul, 2019 |
| Talk at APS March Meeting 2019, Boston, United States  | Mar, 2019 |
| Poster at Stochastic Physics in Biology, Gordon Research Conference, Ventura CA, United States | Jan, 2019 |
| Poster at Bridging Theory and Experiment in Microbial Communities, PCTS, Princeton University  | Dec, 2018 |

**Why it is difficult to engineer diverse, synthetic microbial communities?**

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| Talk and Poster at The Future of Quantitative Biology Symposium, Harvard University | May, 2019 |
| Talk at Biological Design Center Symposium, Boston University                       | May, 2019 |

**Invasion dynamics in generalized MacArthur's consumer resource models**

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| Talk at APS March Meeting 2018, Los Angeles, United States | Mar, 2018 |
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