Yuanzhao Zhang

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APPOINTMENTS

Department of Physics and Astronomy, University of Rochester 2026 –
Simons Empire Assistant Professor

Santa Fe Institute 2022 – 2026
Omidyar Fellow

Center for Applied Mathematics, Cornell University & Santa Fe Institute 2020 – 2022
Schmidt Science Fellow · Advisor: Steven Strogatz

IBM Thomas J. Watson Research Center 2015
Research Intern · Advisor: Ruhong Zhou

EDUCATION

Northwestern University 2020
Ph.D. Physics · Advisor: Adilson Motter

Northwestern University 2015
M.Sc. Applied Mathematics

Zhejiang University 2014
B.Sc. Mathematics, Chu Kochen Honors College

RESEARCH INTERESTS

Nonlinear Dynamics, Complex Systems, Networks, Physics of AI, AI for Science

AWARDS AND FELLOWSHIPS

Simons Empire Faculty Fellowship 2026
Awarded by the Simons Foundation and Simons Foundation International to support early-career tenure-track faculty in mathematics and the basic sciences across New York State

APS Dissertation Award in Statistical and Nonlinear Physics 2021
Awarded by American Physical Society

CSS Emerging Researcher Award 2021
Awarded by Complex Systems Society

SIAM Student Paper Prize 2021
Awarded by Society for Industrial and Applied Mathematics

Schmidt Science Fellowship 2020
Postdoctoral fellowship supporting interdisciplinary scientists pivoting to a different field

Omidyar Fellowship 2020
Independent postdoctoral fellowship awarded by the Santa Fe Institute

GRANTS

Closing the generalization gap of digital twins 2025 – 2028
DMS-2436231 · Funded by National Science Foundation · PI · $ 269,979

How do transcription factors control cell fate? 2022 – 2023
Schmidt Science Fellows Catalyst Grant · Funded by Schmidt Sciences · Co-PI · $ 10,000

Characterizing basins in high-dimensional landscapes 2022 – 2023
Lou Schuyler Research Grant · Funded by Santa Fe Institute · PI · $ 15,000

PREPRINTS AND PUBLICATIONS

- I. Léon, R. Muolo, **Y. Zhang**, and M. Lucas, *Symmetry-based selection rules for higher-order interactions in coupled oscillators*, *arXiv*:2606.04904

- X. Cheng, W. Yuan, Z. Mu, **Y. Zhang**, Y. Yang, H. Wang, Z. Sun, and C. Liu, *Scaling world-model reinforcement learning through diffusion policy optimization*, *arXiv*:2605.26282
- H. Hartle, P. L. Krapivsky, S. Redner, and **Y. Zhang**, *Anomalous scaling in redirection networks*, *arXiv*:2604.01540
- R. Delabays, **Y. Zhang**, F. Dörfler, and G. De Pasquale, *Data-driven control of hypergraphs: Leveraging THIS to damp noise in diffusive hypergraphs*, *arXiv*:2511.08647
- **Y. Zhang**, K. M. Rock, and S. P. Cornelius, *Tempological control of network dynamics*, *arXiv*:2510.10926
- P. S. Skardal, F. Battiston, M. Lucas, M. S. Mizuhara, G. Petri, and **Y. Zhang**, *Mixed higher-order coupling stabilizes new states*, *arXiv*:2510.09387
- F. M. Brady*, **Y. Zhang***, and A. E. Motter, *Cluster synchronization in directed networks generate hierarchies*, *arXiv*:2106.13220

1. Z. G. Nicolaou, H. Cho, **Y. Zhang**, J. N. Kutz and S. L. Brunton, *Signature of glassy dynamics in dynamic modes decompositions*, *Phys. Rev. E* **113** L053301 (2026)
2. B. H. Schlomann, W. S. DeWitt, **Y. Zhang**, and K. Shah, *Ignition criteria for trigger waves in cell signaling*, *PRX Life* **4** 023003 (2026)
3. F. Battiston, C. Bick, M. Lucas, A. P. Millán, P. S. Skardal, and **Y. Zhang**†, *Collective dynamics on higher-order networks*, *Nat. Rev. Phys.* **8** 146–159 (2026)
4. **Y. Zhang**† and W. Gilpin, *Context parroting: A simple but tough-to-beat baseline for foundation models in scientific machine learning*, *ICLR* 2026
5. X. Cheng, W. Yuan, Y. Yang, **Y. Zhang**, S. Cheng, Y. He, and Z. Sun, *Information shapes Koopman representation*, *ICLR* 2026
6. P. Groisman, C. De Vita, J. F. Bonder, and **Y. Zhang**†, *Size of the sync basin resolved*, *Phys. Rev. E* **112** L052201 (2025)
7. D. A. Norton, **Y. Zhang**, and M. Girvan, *Learning beyond experience: Generalizing to unseen state space with reservoir computing*, *Chaos* **35** 103146 (2025)
8. **Y. Zhang**†, E. R. dos Santos, H. Zhang, and S. P. Cornelius, *How more data can hurt: Instability and regularization in next-generation reservoir computing*, *Chaos* **35** 073102 (2025)
9. R. Delabays, G. De Pasquale, F. Dörfler, and **Y. Zhang**†, *Hypergraph reconstruction from dynamics*, *Nat. Commun.* **16** 2691 (2025)
10. **Y. Zhang** and W. Gilpin, *Zero-shot forecasting of chaotic systems*, *ICLR* 2025
11. **Y. Zhang**†, P. S. Skardal, F. Battiston, G. Petri, and M. Lucas, *Deeper but smaller: Higher-order interactions increase linear stability but shrink basins*, *Sci. Adv.* **10** ado8049 (2024)
12. **Y. Zhang** and S. P. Cornelius, *Catch-22s of reservoir computing*, *Phys. Rev. Research* **5** 033213 (2023)
13. Y. Huang, **Y. Zhang**, and R. Braun, *A minimal model of peripheral clocks reveals differential circadian re-entrainment in aging*, *Chaos* **33** 093104 (2023) · Washington Post · BBC Science Focus
14. **Y. Zhang***†, M. Lucas*, and F. Battiston, *Higher-order interactions shape collective dynamics differently in hypergraphs and simplicial complexes*, *Nat. Commun.* **14** 1605 (2023)
15. Z. Chen, T. Anglea, **Y. Zhang**, and Y. Wang, *Optimal synchronization in pulse-coupled oscillator networks using reinforcement learning*, *PNAS Nexus* **2** pgad102 (2023)
16. **Y. Zhang** and S. H. Strogatz, *Basins with tentacles*, *Phys. Rev. Lett.* **127** 194101 (2021) · Cornell Chronicle
17. **Y. Zhang**†, V. Latora, and A. E. Motter, *Unified treatment of synchronization patterns in generalized networks with higher-order, multilayer, and temporal interactions*, *Commun. Phys.* **4** 195 (2021)
18. **Y. Zhang**† and S. H. Strogatz, *Designing temporal networks that synchronize under resource constraints*, *Nat. Commun.* **12** 3273 (2021)
19. **Y. Zhang**, J. L. Ocampo-Espindola, I. Z. Kiss, and A. E. Motter, *Random heterogeneity outperforms design in network synchronization*, *Proc. Natl. Acad. Sci. U.S.A.* **118** e2024299118 (2021)
20. Y. Sugitani*, **Y. Zhang***, and A. E. Motter, *Synchronizing chaos with imperfections*, *Phys. Rev. Lett.* **126** 164101 (2021)
21. **Y. Zhang**, and A. E. Motter, *Mechanism for strong chimeras*, *Phys. Rev. Lett.* **126** 094101 (2021)
22. M. Feng, Y. Song, S. H. Chen, **Y. Zhang**, and R. Zhou, *Molecular mechanism of secreted Amyloid-β precursor protein in binding and modulating $GABA_BR1a$*, *Chem. Sci.* **12** 6107-6116 (2021)

23. **Y. Zhang**† and A. E. Motter, *Symmetry-independent stability analysis of synchronization patterns*, *SIAM Rev.* **62** 817–836 (2020) · Winner of the SIAM Student Paper Prize
24. **Y. Zhang**, Z. G. Nicolaou, J. D. Hart, R. Roy, and A. E. Motter, *Critical switching in globally attractive chimeras*, *Phys. Rev. X* **10** 011044 (2020)
25. B. Li, **Y. Zhang**, X. Meng, and R. Zhou, *Zipper-like unfolding of dsDNA caused by graphene wrinkles*, *J. Phys. Chem. C* **124** 3332-3340 (2020)
26. J. D. Hart*, **Y. Zhang***, R. Roy, and A. E. Motter, *Topological control of synchronization patterns: Trading symmetry for stability*, *Phys. Rev. Lett.* **122** 058301 (2019) · Quanta Magazine
27. **Y. Zhang** and A. E. Motter, *Identical synchronization of nonidentical oscillators: When only birds of different feathers flock together*, *Nonlinearity* **31** R1-R23 (2018)
28. **Y. Zhang**, T. Nishikawa, and A. E. Motter, *Asymmetry-induced synchronization in oscillator networks*, *Phys. Rev. E* **95** 062215 (2017)
29. G. Duan*, **Y. Zhang***, B. Luan, J. K. Weber, R. W. Zhou, Z. Yang, L. Zhao, J. Xu, J. Luo and R. Zhou, *Graphene-induced pore formation on cell membranes*, *Sci. Rep.* **7** 42767 (2017)
30. **Y. Zhang**, J. K. Weber, and R. Zhou, *Folding and stabilization of native-sequence-reversed proteins*, *Sci. Rep.* **6** 25138 (2016)
31. Z. Lin and **Y. Zhang**, *Stirring by multiple cylinders in potential flow*, *J. Fluid Mech.* **794** 552 (2016)
32. Z. Gu*, **Y. Zhang***, B. Luan, and R. Zhou, *DNA translocation through single-layer boron nitride nanopores*, *Soft Matter* **12** 817 (2016)
33. **Y. Zhang***, C. A. Jimenez-Cruz*, J. Wang, Z. Yang, B. Zhou and R. Zhou, *Bio-mimicking of proline-rich motif applied to carbon nanotube reveals unexpected subtleties underlying nanoparticle functionalization*, *Sci. Rep.* **4** 7229 (2014)
34. Y. Tu, H. Lu, **Y. Zhang**, T. Huynh, and R. Zhou, *Capability of charge signal conversion and transmission by water chains confined inside Y-shaped carbon nanotubes*, *J. Chem. Phys.* **138** 015104 (2013)

* equal contributions †corresponding author

INVITED TALKS

Mechanical Engineering Seminar @ Johns Hopkins University	Baltimore 2026
Physics Colloquium @ University of Rochester	Rochester 2026
Physics Seminar @ UC Berkeley	Berkeley 2026
Computational & Applied Mathematics Colloquium @ University of Chicago	Chicago 2026
Center for Computational Biology @ Flatiron Institute	New York 2025
Physics Colloquium @ National University of Singapore	Singapore 2025
SPMS Seminar @ Nanyang Technological University	Singapore 2025
Dynamics Days Europe	Thessaloniki 2025
BeyondTheEdge Seminar	Online 2025
Seminar @ University of Applied Sciences and Arts of Western Switzerland	Sion 2025
Seminar @ Complexity Science Hub	Vienna 2025
SIAM Conference on Applications of Dynamical Systems	Denver 2025
Center for Interdisciplinary Studies Seminar @ Westlake University	Hangzhou 2025
WTI Symposium on Cognition and Computation @ Yale University	New Haven 2025
PSU-Purdue-UMD Joint Seminar on Mathematical Data Science	Online 2025
EEB Seminar @ Princeton University	Princeton 2025
Oden & Neuroscience Seminar @ UT Austin	Austin 2025
Data Science & Math Seminar @ UNC Chapel Hill	Chapel Hill 2025
KIAS-KU workshop on Theoretical Challenges in Network Science	Seoul 2024
Seminar @ Fudan University	Shanghai 2024
Seminar @ Zhejiang University	Hangzhou 2024
TopoNets @ NetSci	Quebec City 2024
Applied Dynamics Seminar @ University of Maryland	College Park 2024
Workshop on Modelling and Mining Complex Networks as Hypergraphs	Toronto 2024

Machine Learning and Dynamical Systems Seminar @ Alan Turing Institute Online 2024
Physics Seminar @ University of Maryland College Park 2024
Complex Systems Seminar @ University of Michigan Ann Arbor 2024
Mathematics Seminar @ UCSD San Diego 2023
CNLD Seminar @ UT Austin Austin 2023
NetPLACE Seminar Online 2023
Collective Behavior Gordon Research Conference Newry 2023
CNLS Seminar @ Los Alamos National Laboratory Los Alamos 2023
Complexity Conclave Santa Fe 2023
SIAM Conference on Applications of Dynamical Systems Portland 2023
Mathematics Seminar @ UIUC Champaign 2022
Statistical Physics Seminar @ Chinese Academy of Sciences Online 2022
Prize Talk @ APS March Meeting Chicago 2022
Physics Seminar @ UC Berkeley Berkeley 2022
Applied Interdisciplinary Math Seminar @ University of Michigan Online 2022
Complex Systems & Statistical Mechanics Seminar @ ICTP-SAIFR Online 2021
Systems Neuroscience and Complexity Seminar @ University of Sydney Online 2021
Prize Talk @ SIAM Annual Meeting Online 2021
Oberseminar Dynamics @ Technische Universität München Online 2021
Applied & Computational Mathematics Seminar @ Dartmouth Online 2020

TEACHING

Higher-Order Networks NetSci School · 2022
Nonlinear Dynamics and Chaos Southwest Jiaotong University · 2022
Basins in Dynamical Systems Complex Systems Summer School · 2022
General Physics Northwestern University · 2017 – 2019
Physics of Magic Northwestern University · 2016

SERVICE

Vice President, Northwestern University Student Chapter of SIAM 2017 – 2018
President, Northwestern University Student Chapter of SIAM 2018 – 2020
Co-organizer, Bridging the Gap Seminar 2017 – 2020
Co-organizer, Chicago Area SIAM Student Conferences 2017 – 2020
Council member, Complex Systems Society 2021 – 2024
Ad hoc reviewer, Army Research Office 2023
Co-organizer, SFI Working Group "Dynamical systems and graph theory approaches for digital twins" 2025
Panelist, National Science Foundation 2025

MENTORING

Katherine Li 2022 – 2025
Undergraduate student at Minerva University (now a graduate student in physics at Johns Hopkins) · Project: basins of loss landscape in artificial neural networks

Fiona M. Brady 2018 – 2023
Undergraduate student at Northwestern (now a graduate student in mathematics at Princeton) · Project: cluster synchronization on directed networks · Fiona's senior thesis at Northwestern based on this project was awarded Outstanding Thesis Research in Physics and Astronomy

Ofer Neufeld 2021 – 2022
Postdoctoral fellow at Max Planck Institute for the Structure and Dynamics of Matter · Part of the peer mentoring scheme organized by Schmidt Science Fellows

Shriya Nagpal 2020 – 2021
Graduate student at Cornell · Project: stabilizing power grids through topological control

REFERENCES

Steven H. Strogatz (Postdoc advisor) strogatz@cornell.edu
Winokur Distinguished Professor for the Public Understanding of Science and Mathematics, Cornell University

Adilson E. Motter *(PhD advisor)* motter@northwestern.edu
Charles E. and Emma H. Morrison Professor of Physics and Astronomy, Northwestern University

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Assistant Professor of Physics, UT Austin

Michelle Girvan girvan@umd.edu
Professor of Physics, University of Maryland

Federico Battiston battistonf@ceu.edu
Associate Professor in Network Science, Central European University