Michael Winer

Curriculum Vitae

Email: mike@alignment.org
arXiv: arxiv.org/a/winer_m_1

> **Current Position:** Researcher at the Alignment Research Center, Berkeley, CA
> Using ideas from physics, computer science, and mathematics to understand and align powerful AI systems.

Research Interests

- AI alignment and safety
- Applications of statistical physics to machine learning
- Glassy physics and disordered systems
- Quantum chaos and spectral statistics

Education

2019 − 2024   University of Maryland, College Park, USA
PhD in Physics

2015 − 2019   Massachusetts Institute of Technology
BS in Physics

Publications

[1] **2025**   Michael Winer, Boris Hanin
Deep Neural Nets as Hamiltonians, Phys. Rev. E (2025)
[arXiv:2503.23982](https://arxiv.org/abs/2503.23982)

[2] **2025**   Michael Winer, Aidan Herderschee
A Jammed Parisi Ansatz, Phys. Rev. E 112, 064120 (2025)
[arXiv:2503.11761](https://arxiv.org/abs/2503.11761)

[3] **2025**   Ronen M. Kroeze, Brendan P. Marsh, D. A. Schuller, H. S. Hunt, A. N. Bourzutschky, Michael Winer, S. Gopalakrishnan, J. Keeling, B. L. Lev
Directly Observing Replica Symmetry Breaking in a Vector Quantum-Optical Spin Glass, Science 389, 1122–1126 (2025)
[DOI: 10.1126/science.adu7710](https://doi.org/10.1126/science.adu7710)

[4] **2025**   Aidan Herderschee, Michael Winer
Failure of the Large-N Expansion in a Bosonic Tensor Model, JHEP 05 (2025), 141
[arXiv:2410.06896](https://arxiv.org/abs/2410.06896)

[5] **2024**   Tiangang Zhou, Michael Winer, Brian Swingle
The Magnetic Maze: A System With Tunable Scale Invariance, JHEP 11 (2024), 132
[arXiv:2409.02176](https://arxiv.org/abs/2409.02176)

[6] **2024** Richard Barney, Michael Winer, Victor Galitski
Neural Networks as Spin Models: From Glass to Hidden Order Through Training
arXiv:2408.06421

[7] **2024** Michael Winer
Spectral Statistics, Hydrodynamics and Quantum Chaos (Dissertation)
arXiv:2407.07692

[8] **2024** Michael Winer, Christopher L. Baldwin, Richard Dean Barney, Victor Galitski, Brian Swingle
The Glass Transition of Quantum Hard Spheres in High Dimensions, Phys. Rev. E 109, 044112 (2024)
arXiv:2311.04968

[9] **2024** Brian Swingle, Michael Winer
A Bosonic Model of Quantum Holography, Phys. Rev. B 109, 094206 (2024)
arXiv:2311.01516

[10] **2023** Michael Winer, Brian Swingle
Reappearance of Thermalization Dynamics in the Late Time Spectral Form Factor
arXiv:2307.14415

[11] **2023** Richard Dean Barney, Michael Winer, Christopher L. Baldwin, Victor Galitski, Brian Swingle
Spectral Statistics of a Minimal Quantum Glass Model, SciPost Phys. 15, 084 (2023)
arXiv:2302.00703

[12] **2023** Michael Winer, Brian Swingle
Emergent Spectral Form Factors in Sonic Systems, Phys. Rev. B 108, 054523 (2023)
arXiv:2211.09134

[13] **2022** Michael Winer, Brian Swingle
The Loschmidt Spectral Form Factor, JHEP 10 (2022), 137
arXiv:2206.00677

[14] **2022** Michael Winer, Richard Dean Barney, Christopher L. Baldwin, Victor Galitski, Brian Swingle
Spectral Form Factor of a Quantum Spin Glass, JHEP 09 (2022), 032
arXiv:2203.12753

[15] **2022** Michael Winer, Brian Swingle
Spontaneous Symmetry Breaking, Spectral Statistics, and the Ramp, Phys. Rev. B 105, 104509 (2022)
arXiv:2106.07674

[16] **2022** Michael Winer, Brian Swingle
Hydrodynamic Theory of the Connected Spectral Form Factor, Phys. Rev. X 12, 021009 (2022)
arXiv:2012.01436

[17] **2020** Michael Winer, Shao-Kai Jian, Brian Swingle
An Exponential Ramp in the Quadratic Sachdev-Ye-Kitaev Model, Phys. Rev. Lett. 125, 250602 (2020)
arXiv:2006.15152

[18] **2018**   Duncan C. Wheeler, Emma Bingham, Michael Winer, Janet M Conrad, Sean P Robinson
Observation of Relativistic Corrections of Moseley's Law at High Atomic Number
arXiv:1809.10480

Invited Talks

2025

"Heuristic Estimation of Neural Network Outputs"
FDS Colloquium, Yale Institute for Foundations of Data Science, New Haven, CT

"Heuristic Estimation of Neural Network Outputs"
AI + Physics Workshop, CUNY Graduate Center, New York, NY

2024

"A Catastrophic Failure of Large-N Perturbation Theory"
Tensor Journal Club, Online

"A Bosonic Model of Quantum Holography"
CUNY Graduate Center, New York, NY

2023

"The Spectral Form Factor: From Hydrodynamics to the Riemann Zeta Function"
High Energy Theory Seminar, Rutgers University, New Brunswick, NJ

"The Riemann Zeta Function, Poincaré Recurrence, and Spectral Form Factor"
It From Qubit Collaboration Meeting, Perimeter Institute, Waterloo, Canada

"The Spectral Form Factor: From Hydrodynamics to the Riemann Zeta Function"
Quantum Aspects of Black Holes Group Meeting, Institute for Advanced Study, Princeton, NJ

2021

"The Connected Spectral Form Factor from Hydrodynamics"
Quantum Theory Seminar Series, Cornell University, Ithaca, NY

Research Experience

Present   Researcher
Alignment Research Center, Berkeley, CA
Research on AI alignment using ideas from physics, computer science, and mathematics to understand powerful artificial intelligences and make them safer.

2024 − 2025   Postdoctoral Researcher
Institute for Advanced Study, Princeton, NJ
Research on disordered systems, spin glasses, and applications of statistical physics to neural networks.

2019 – 2024   PhD Candidate in Physics
University of Maryland, College Park, MD
Advisors: Prof. Brian Swingle, Prof. Victor Galitski
Research on spectral statistics for integrable and chaotic systems, including analytic mean-field theory, numerical calculations, and perturbative hydrodynamic analyses. Additional research on spin glasses in mean field theory and beyond.

2017 – 2019   Undergraduate Research
Massachusetts Institute of Technology, Cambridge, MA
Advisor: Prof. Hong Liu
Studied the CTP formalism of hydrodynamics and performed perturbative calculations in the Rayleigh-Bénard setting.

Teaching Experience

Spring 2023   Teaching Assistant, University of Maryland
PHYS 611 and 613 — Conducted daily problem-solving sessions for students

Awards and Honors

2019   JQI Graduate Fellow
"JQI Graduate Fellowships are awarded to exceptional applicants."

2015   Intel Science Talent Search First Prize Winner, $150,000 Prize
"The nation's oldest and most prestigious science research competition for high school students."

2014   Silver Medal, International Physics Olympiad (representing USA)

Academic Service and Leadership

2021 – 2023   Co-coordinator, Friday Quantum Seminar
2022 – 2023   Quantum Science Activity Committee
2020 – Present   Research Mentor for undergraduate and high school students
          One mentee was a semifinalist in the Regeneron Science Talent Search

Outreach

2021 – Present   Physics Tutoring
Teaching high school students concepts from mechanics to special relativity to the Liénard-Wiechert potential

2022 – Present   Momentum Learning — Teacher
Designing and teaching an intense series of lectures for high school physics students

2017 – 2022   Coach for US Physics Olympiad Team
Writing and proofreading exams, lecturing students, preparing students for International Olympiad

References

Prof. Brian Swingle
Associate Professor, Brandeis University, MA

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Prof. Victor Galitski
Professor and Chesapeake Chair, University of Maryland, MD
galitski@umd.edu

Prof. Christopher Baldwin
Assistant Professor, Michigan State University
baldw292@msu.edu