

XINGYANG YU

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Postdoctoral Associate, Department of Physics, Virginia Tech

Scientific Consultant (part-time), Anthropic

SUMMARY

Theoretical physicist (19 published papers) working at the interface of AI and fundamental physics, building tools that check and improve how AI systems reason about fundamental physics. Scientific Consultant at Anthropic.

APPOINTMENTS

Virginia Tech Postdoctoral Associate	Aug 2023 – Present
Anthropic Scientific Consultant (part-time): evaluating and improving frontier model reasoning on fundamental physics	Apr 2026 – Present
University of Pennsylvania Visiting Scholar	Jul 2021 – Jul 2023

EDUCATION

New York University Ph.D. in Physics <i>Dissertation:</i> Dualities and Symmetries of Quantum Field Theories from Brane Engineering <i>Advisors:</i> Massimo Porrati and Sebastián Franco	Sep 2017 – May 2023
University of Science and Technology of China B.S. in Physics	Sep 2011 – Jun 2015

AI FOR PHYSICS: RESEARCH AND TOOLS

- **QFTCert** (research prototype, in active development): an automated *fact-checker for AI-generated physics*. Instead of taking an AI’s claim about a deep physics result on faith, it breaks the claim into precise consistency checks, runs them, and issues an auditable report of exactly what holds up and what does not. Designed to sit in the loop: AI proposes, the tool verifies, the claim is repaired or rejected. Public version: github.com/xingyang-yu/QFTCert.
- **“Grading the Unspoken”** ([arXiv:2604.14188](https://arxiv.org/abs/2604.14188); under review, COLM 2026): measures how well today’s leading AI models handle the implicit reasoning steps that physics experts leave unsaid.
- **Cyber-Witten**: a public question-answering system grounded *only* in the papers of Edward Witten (289 papers, 1976–2026; ~13,000 passages). It answers strictly from retrieved source passages with inline citations and is built to *fail honestly* when the evidence is not there, an AI that “knows when it is allowed to speak.” The thesis: in expert domains, more text is not better text; the quality of an AI’s knowledge source and its epistemic restraint may matter as much as raw model size. github.com/xingyang-yu/cyber-witten.

PUBLICATIONS

Published Articles

1. E. Torres and X. Yu, *SymTFT Entanglement and Holographic (Non)-Factorization*, *Phys. Rev. D* **113** (2026) 106028. [[arXiv:2510.06319](https://arxiv.org/abs/2510.06319)].

2. A. Perez-Lona, E. Sharpe, **X. Yu**, and H. Zhang, *Total instanton restriction via multiverse interference: Noncompact gauge theories and (-1) -form symmetries*, *JHEP* 05 (2026) 214. [[arXiv:2508.00050](#)].
3. A. Perez-Lona, D. Robbins, S. Roy, E. Sharpe, T. Vandermeulen, and **X. Yu**, *Anomaly resolution by non-invertible symmetries*, *Int. J. Mod. Phys. A* Vol. 36, No. 29. [[arXiv:2504.06333](#)].
4. **X. Yu** and H. Y. Zhang, *von Neumann Subfactors and Non-invertible Symmetries*, *SciPost Phys.* 19, 154 (2025). [[arXiv:2504.05374](#)].
5. A. Caldararu, T. Pantev, E. Sharpe, B. Sung, and **X. Yu**, *Noninvertible symmetries in the B model TFT*, *J. Geom. Phys.* 218 (2025) 105653. [[arXiv:2504.02023](#)].
6. **X. Yu**, *Gauging in Parameter Space: A Top-Down Perspective*, *Phys. Rev. D* 112 (2025) 025020. [**Editor's Suggestion**] [[arXiv:2411.14997](#)].
7. A. Perez-Lona, D. Robbins, E. Sharpe, T. Vandermeulen, and **X. Yu**, *Notes on gauging noninvertible symmetries, part 2: higher multiplicity cases*, *JHEP* 05 (2025) 066. [[arXiv:2408.16811](#)].
8. T. Pantev, E. Sharpe, and **X. Yu**, *Chern-Simons theory, decomposition, and the A model*, *JHEP* 10 (2024) 112. [[arXiv:2406.18633](#)].
9. S. Franco and **X. Yu**, *Generalized Symmetries in 2D from String Theory: SymTFTs, Intrinsic Relativeness, and Anomalies of Non-invertible Symmetries*, *JHEP* 11 (2024) 004. [[arXiv:2404.19761](#)].
10. A. Perez-Lona, D. Robbins, E. Sharpe, T. Vandermeulen, and **X. Yu**, *Notes on gauging noninvertible symmetries, part 1: Multiplicity-free cases*, *JHEP* 02 (2024) 154. [[arXiv:2311.16230](#)].
11. **X. Yu**, *Non-invertible Symmetries in 2D from Type IIB String Theory*, *Phys. Rev. D* 110 (2024) 065008. [[arXiv:2310.15339](#)].
12. F. Baume, J. J. Heckman, M. Hubner, E. Torres, A. P. Turner, and **X. Yu**, *SymTrees and Multi-Sector QFTs*, *Phys. Rev. D* 109 (2024) 106013. [[arXiv:2310.12980](#)].
13. C. Lawrie, **X. Yu**, and H. Y. Zhang, *Intermediate Defect Groups, Polarization Pairs, and Non-invertible Duality Defects*, *Phys. Rev. D* 109 (2024) 026005. [[arXiv:2306.11783](#)].
14. J. J. Heckman, M. Hubner, E. Torres, **X. Yu**, and H. Y. Zhang, *Top Down Approach to Topological Duality Defects*, *Phys. Rev. D* 108 (2023) 046015. [[arXiv:2212.09743](#)].
15. S. Franco, A. Mininno, Á. Uranga, and **X. Yu**, *Spin(7) Orientifolds and 2d $\mathcal{N} = (0, 1)$ triality*, *JHEP* 01 (2022) 058. [[arXiv:2112.03929](#)].
16. J. J. Heckman, A. P. Turner, and **X. Yu**, *Disorder Averaging and its UV (Dis)Contents*, *Phys. Rev. D* 105 (2022) 086021. [[arXiv:2111.06404](#)].
17. S. Franco, A. Mininno, Á. Uranga, and **X. Yu**, *2d $\mathcal{N} = (0, 1)$ Gauge Theories and Spin(7) Orientifolds*, *JHEP* 03 (2022) 150. [[arXiv:2110.03696](#)].
18. S. Franco and **X. Yu**, *BFT₂: a General Class of 2d $\mathcal{N} = (0, 2)$ Theories, 3-Manifolds and Toric Geometry*, *JHEP* 08 (2022) 277. [[arXiv:2107.00667](#)].
19. S. Franco, A. Hasan, and **X. Yu**, *On the Classification of Duality Webs for Graded Quivers*, *JHEP* 06 (2020) 130. [[arXiv:2001.08776](#)].

Preprints and Submitted Papers

20. Yinghuan Zhang, **X. Yu**, Yufei Zhang, and Zijun Cui, *Uncertainty Quantification for Open-Ended LLM Physics Reasoning via Physics Semantics*. Under review, NeurIPS 2026.
21. **X. Yu**, *From Baby Universes to Narain Moduli: Topological Boundary Averaging in SymTFTs*, [[arXiv:2605.06653](#)].

22. **X. Yu**, Yinghuan Zhang, Yufei Zhang, and Zijun Cui, *Grading the Unspoken: Evaluating Tacit Reasoning in Quantum Field Theory and String Theory with LLMs*, [arXiv:2604.14188]. Under review, COLM 2026.
23. O. Bergman, J. J. Heckman, M. Hubner, D. Migliorati, **X. Yu**, and H. Y. Zhang, *On the SymTFTs of Finite Non-Abelian Symmetries*, [arXiv:2603.12323]. Under review, Adv. Theor. Math. Phys.
24. A. Perez-Lona, E. Sharpe, and **X. Yu**, *Categorified structures over moduli spaces: Anomalies, non-invertible symmetries, and exceptional holonomy*, [arXiv:2506.19909].
25. W. Gu, D. Pei, and **X. Yu**, *On mixed 't Hooft anomalies of emergent symmetries*, [arXiv:2506.06432]. Under review, JHEP.

INVITED SEMINARS AND COLLOQUIA

- “SymTFT Entanglement and Holographic Factorization Puzzle”, Dec 2025, Amherst Center for Fundamental Interactions Seminar, UMass Amherst
- “Global Aspects of Dimensional Deconstruction”, Nov 2025, Special HEP Seminar, The Center for Cosmology and Particle Physics, New York University
- “Symmetries and Moduli Spaces: Baby Steps beyond Calabi–Yau”, Oct 2025, Differential Geometry and Physics Seminar, Center for Mathematical Sciences and Applications (CMSA), Harvard University
- “Non-invertible Symmetries in (3+1) Dimensions”, Jun 2025, Math–Physics Seminar of the Sino-French Mathematics Excellence Program
- “Non-invertible Symmetries via Subfactors: Conformal and Topological Applications”, Jun 2025, Quantum Theories of Fields, Matter, and Strings (QTFMS) Online Seminar Series
- “Dimensional Deconstruction with Generalized Symmetries”, Jun 2025, Mathematics–String Theory (MS) Seminar, Kavli Institute for the Physics and Mathematics of the Universe (IPMU), University of Tokyo
- “Top-down Approach to Generalized Global Symmetries”, Nov 2024, ADS Seminar, Yau Mathematical Sciences Center, Qiuzhen College, Tsinghua University
- “Aspects of Generalized Global Symmetries in 2D: SymTFTs, Anomalies and Gauging”, Nov 2024, Physical Math Seminar, Shanghai Institute for Mathematics and Interdisciplinary Sciences
- “Top-down Approach to Generalized Global Symmetries”, Nov 2024, High Energy Theory Seminar, Department of Physics, Fudan University, China
- “Generalized Global Symmetries and Branes”, Jun 2024, String Phenomenology in the LHC Era Journal Club, Institute of Theoretical Physics–IFT
- “2D Non-invertible Symmetries and Anomalies from String Theory”, May 2024, “Symmetry Seminar”, Online Weekly Seminar on Generalized Symmetries in QFT, String Theory, and Related Topics
- “Stringy Approach to Categorical Symmetries”, Mar 2024, Colloquium Series of the “Simons Collaboration on Global Categorical Symmetries”
- “Stringy Approach to SymTFTs and Categorical Symmetries”, Mar 2024, Informal HEP Talk, The Center for Cosmology and Particle Physics, New York University
- “SymTrees and Multi-Sector QFTs”, Nov 2023, Anomalology Seminar Series
- “Absolute QFTs, Polarization Pairs, and Non-invertible Symmetries”, Sep 2023, String Theory Seminar, Department of Physics, Virginia Tech
- “Top Down Approach to Ensemble Averaging”, Mar 2022, Informal High Energy Theory Seminar, The Center for Cosmology and Particle Physics, New York University

- “ $2d \mathcal{N} = (0, 1)$ Gauge Theories, Spin(7) Orientifolds and Triality”, Dec 2021, Algebraic Geometry in String Theory Seminar, Center for Mathematical Sciences and Applications, Harvard University
- “ $2d \mathcal{N} = (0, 1)$ Gauge Theories, Spin(7) Orientifolds and Triality”, Nov 2021, Seminar Series on String Phenomenology
- “ $2d \mathcal{N} = (0, 1)$ Gauge Theories, Spin(7) Orientifolds and Triality”, Oct 2021, High Energy Theory Seminar, NHETC and Department of Physics and Astronomy, Rutgers University
- “ $2d \mathcal{N} = (0, 1)$ Gauge Theories, Spin(7) Orientifolds and Triality”, Oct 2021, High Energy Theory Seminar, Walter Burke Institute for Theoretical Physics, California Institute of Technology
- “ $2d \mathcal{N} = (0, 1)$ Gauge Theories, Triality and Spin(7) Orientifolds”, Sep 2021, High Energy Theory Seminar, Department of Physics and Astronomy, University of Pennsylvania
- “Dualities of Supersymmetric Field Theories in Various Dimensions and Their Engineering with D-branes”, Jan 2020, String Theory Seminar, Yau Mathematical Sciences Center, Tsinghua University, China
- “Dualities of Supersymmetric Field Theories in Various Dimensions and Their Engineering with D-branes”, Jan 2020, Mathematical Physics Seminar, Wu Wen-Tsun Key Laboratory of Mathematics, University of Science and Technology of China

CONFERENCE AND WORKSHOP TALKS

- “Non-invertible Symmetries for Exceptional Holonomy”, Jul 2025, String Phenomenology 2025, Northeastern University
- “Non-invertible Symmetries in 2D from String Theory”, Jun 2024, “IHES Summer School—Symmetries and Anomalies: A Modern Take”, Institut des Hautes Études Scientifiques
- “String Theory Approach to Categorical Symmetries”, Mar 2024, “Southeastern Regional Mathematical String Theory Meeting”, Department of Physics and Astronomy, University of North Carolina at Chapel Hill
- “Non-invertible Symmetries of 2D Gauge Theories from IIB String Theory”, Mar 2023, “Strings and Geometry 2023”, University of Pennsylvania
- “ $2d (0, 2)$ Gauge Theories, D-branes and Toric Calabi–Yau 4-Folds”, May 2019, “East Coast High Energy Theory Student Meeting”, CCPP, New York University

AWARDS AND FELLOWSHIPS

- James Arthur Graduate Associate Fellowship, New York University, Fall 2022 and Spring 2023
- Carl Feinberg Fellowship in Theoretical Physics and Cosmology, New York University, Spring 2022
- Tianjuan Fellowship in Mathematics and Physics, Wuhan Institute of Physics and Mathematics, Chinese Academy of Sciences, Summer 2014

ACADEMIC SERVICE

- Organizer, String Theory Seminar, Virginia Tech Aug 2023 – Present
- Co-organizer, “Strings and Geometry 2023,” University of Pennsylvania Mar 5–9, 2023
- Co-organizer, HEP Journal Club, CCPP, New York University Sep 2019 – Dec 2020