Alan A. Kaptanoglu

Curriculum Vitae

University of Washington
William E. Boeing Department of
Aeronautics & Astronautics
AERB, Room 434
Seattle, WA 98195

Phone: 206-616-3590
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Profiles: Google Scholar | ORCID
More: GitHub | YouTube

Current appointment: Assistant Professor of Aeronautics and Astronautics and Inaugural William D. Larsen Faculty Fellow, University of Washington; Affiliate Assistant Professor of Mechanical Engineering, University of Washington.

Educational History

Ph.D., Physics 2021
University of Washington, Seattle, Washington
Dissertation: *An Exploration of Data-Driven System Identification and Machine Learning for Plasma Physics*. Advisor: Steven L. Brunton.

B.S., Physics, Theoretical Concentration 2016
Stanford University, Stanford, California

Employment History

Assistant Professor of Aeronautics and Astronautics Sep. 2026–present
University of Washington
Inaugural William D. Larsen Faculty Fellow. Research in plasma physics, stellarator optimization, scientific machine learning, and numerical methods.

Assistant Professor of Mathematics Sep. 2023–Aug. 2026
Courant Institute of Mathematical Sciences, New York University
Research and teaching in plasma physics, stellarator optimization, nonlinear dynamics, numerical analysis, and scientific machine learning.

Postdoctoral Researcher Mar. 2022–July 2023
Institute for Research in Electronics and Applied Physics, University of Maryland
Advisor: Matt Landreman. Research in constrained optimization, greedy algorithms, and stellarator design; supervision of graduate research in physics-informed neural networks.

Postdoctoral Researcher Jan. 2022–Mar. 2022
University of Washington
Advisors: Steven L. Brunton and Christopher J. Hansen. Research in sparse system identification and nonlinear stability theory.

Awards and Honors

Next-Generation Follow-on Grant Awardee, Physicists Coalition for Nuclear Threat Reduction	2021–2022
Next-Generation Fellowship, Physicists Coalition for Nuclear Threat Reduction	2020–2021
APS Five Sigma Physicist Award	2021
Best Student Presentation, Sherwood Fusion Theory Conference	2021
Outstanding Graduate Student Teaching Assistant, with Distinction, University of Washington	2019
NSF Graduate Research Fellowship Program, Honorable Mention	2018

Affiliations and Other Appointments

Affiliate Assistant Professor, Mechanical Engineering Mar. 2022–present
University of Washington
Research in sparse system identification, nonlinear stability theory, and supervision of undergraduate and master's research.

Publications

Google Scholar metrics: 1,253 total citations; h-index 16; i10-index 21. Symbols identify supervised researchers: graduate student†, postdoctoral researcher‡, and undergraduate or high-school researcher§.

Refereed Archival Journal Publications (29)

1. Pedro F. Gil‡, Weiping Li§, Julianne Stratton†, **Alan A. Kaptanoglu**, and Eve V. Stenson, "Stellarator Coils for Future Fusion Reactors via an Augmented Lagrangian Approach," *Physical Review Letters* **137**, 065101 (2026). DOI.
2. Pedro F. Gil‡, Weiping Li§, Julianne Stratton†, **Alan A. Kaptanoglu**, and Eve V. Stenson, "Efficient Computation of Stellarator Coils with an Augmented Lagrangian Optimization Method," *Physical Review E* **114**, 025202 (2026). DOI.
3. Armin Ulrich§, Mason Haberle†, and **Alan A. Kaptanoglu**, "Permanent Magnet Optimization of Stellarators with Coupling from Finite Permeability and Demagnetization Effects," *Physics of Plasmas* **33**, 072502 (2026). DOI.
4. Lanke Fu‡, Dario Panici, Elizabeth J. Paul, **Alan A. Kaptanoglu**, and Amitava Bhattacharjee, "A Flexible and Differentiable Coil Proxy for Stellarator Equilibrium Optimization," *Physics of Plasmas* **33**, 062506 (2026). DOI.
5. Mai Peng†, **Alan A. Kaptanoglu**, Christopher J. Hansen, Jacob Stevens-Haas, Krithika Manohar, and Steven L. Brunton, "Extending the Trapping Theorem to Provide Local Stability Guarantees for Quadratically Nonlinear Models," *Physics of Fluids* **37**, 107115 (2025). DOI.
6. W. Sengupta, R. Madan, S. Buller, N. Nikulsin, E. J. Paul, R. Nies, **Alan A. Kaptanoglu**, S. R. Hudson, and A. Bhattacharjee, "Periodic Korteweg–de Vries Soliton Potentials Generate Quasisymmetric Magnetic Field Strength in a Finite Plasma-β Equilibrium," *Physics of Plasmas* **32**, 102509 (2025). DOI.
7. **Alan A. Kaptanoglu**, Matt Landreman, and Michael C. Zarnstorff, "Optimization of Passive Superconductors for Shaping Stellarator Magnetic Fields," *Physical Review E* **111**, 065202 (2025). DOI.
8. **Alan A. Kaptanoglu**, Alexander Wiedman, Jacob Halpern, Siena Hurwitz, Elizabeth J. Paul, and Matt Landreman, "Reactor-Scale Stellarators with Force and Torque Minimized Dipole Coils," *Nuclear Fusion* **65**, 046029 (2025). DOI. Corrigendum: **65**, 079501 (2025), DOI.
9. Siena Hurwitz, Matt Landreman, Paul Huslage, and **Alan A. Kaptanoglu**, "Electromagnetic Coil Optimization for Reduced Lorentz Forces," *Nuclear Fusion* **65**, 056044 (2025). DOI.
10. Lanke Fu‡, Elizabeth J. Paul, **Alan A. Kaptanoglu**, and Amitava Bhattacharjee, "Global Stellarator Coil Optimization with Quadratic Constraints and Objectives," *Nuclear Fusion* **65**, 026045 (2025). DOI.
11. C. T. Holcomb and the DIII-D Team (including **Alan A. Kaptanoglu**), "DIII-D Research to Provide Solutions for ITER and Fusion Energy," *Nuclear Fusion* **64**, 112003 (2024). DOI.
12. C. M. Oishi, **Alan A. Kaptanoglu**, J. Nathan Kutz, and Steven L. Brunton, "Nonlinear Parametric Models of Viscoelastic Fluid Flows," *Royal Society Open Science* **11**, 240995 (2024). DOI.
13. K. C. Hammond and **Alan A. Kaptanoglu**, "Improved Stellarator Permanent Magnet Designs through Combined Discrete and Continuous Optimizations," *Computer Physics Communications* **299**, 109127 (2024). DOI.

14. Byoungchan Jang[†], **Alan A. Kaptanoglu**, Rahul Gaur, Shaowu Pan, Matt Landreman, and William Dorland, "Grad–Shafranov Equilibria via Data-Free Physics-Informed Neural Networks," *Physics of Plasmas* **31**, 032510 (2024). DOI. Erratum: **31**, 059901 (2024), DOI.
15. **Alan A. Kaptanoglu**, Gabriel P. Langlois[‡], and Matt Landreman, "Topology Optimization for Inverse Magnetostatics as Sparse Regression: Application to Electromagnetic Coils for Stellarators," *Computer Methods in Applied Mechanics and Engineering* **418**, 116504 (2024). DOI.
16. **Alan A. Kaptanoglu**, Lanyue Zhang[§], Zachary G. Nicolaou, Urban Fasel, and Steven L. Brunton, "Benchmarking Sparse System Identification with Low-Dimensional Chaos," *Nonlinear Dynamics* **111**, 13143–13164 (2023). DOI.
17. J. W. Brooks, **Alan A. Kaptanoglu**, and M. S. McDonald, "A Comparison of Fourier and POD Mode Decomposition Methods for High-Speed Hall Thruster Video," *Frontiers in Space Technologies* **4**, 1220011 (2023). DOI.
18. J. D. Lore, S. De Pascuale, P. Laiu, B. Russo, J.-S. Park, J. M. Park, Steven L. Brunton, J. Nathan Kutz, and **Alan A. Kaptanoglu**, "Time-Dependent SOLPS-ITER Simulations of the Tokamak Plasma Boundary for Model Predictive Control Using SINDy," *Nuclear Fusion* **63**, 046015 (2023). DOI.
19. **Alan A. Kaptanoglu**, Christopher J. Hansen, Jeremy D. Lore, Matt Landreman, and Steven L. Brunton, "Sparse Regression for Plasma Physics," *Physics of Plasmas* **30**, 033906 (2023). DOI.
20. **Alan A. Kaptanoglu**, Rory Conlin, and Matt Landreman, "Greedy Permanent Magnet Optimization," *Nuclear Fusion* **63**, 036016 (2023). DOI.
21. **Alan A. Kaptanoglu**, Azarakhsh Jalalvand, Alvin V. Garcia, Max E. Austin, Geert Verdoolaege, Jeff Schneider, Christopher J. Hansen, Steven L. Brunton, William W. Heidbrink, and Egemen Kolemen, "Exploring Data-Driven Models for Spatiotemporally Local Classification of Alfvén Eigenmodes," *Nuclear Fusion* **62**, 106014 (2022). DOI.
22. **Alan A. Kaptanoglu**, Tony Qian, Florian Wechsung, and Matt Landreman, "Permanent-Magnet Optimization for Stellarators as Sparse Regression," *Physical Review Applied* **18**, 044006 (2022). DOI.
23. M. E. Fenstermacher and the DIII-D Team (including **Alan A. Kaptanoglu**), "DIII-D Research Advancing the Physics Basis for Optimizing the Tokamak Approach to Fusion Energy," *Nuclear Fusion* **62**, 042024 (2022). DOI.
24. Azarakhsh Jalalvand, **Alan A. Kaptanoglu**, Alvin V. Garcia, Andrew O. Nelson, Joseph Abbate, Max E. Austin, Geert Verdoolaege, Steven L. Brunton, William W. Heidbrink, and Egemen Kolemen, "Alfvén Eigenmode Classification Based on ECE Diagnostics at DIII-D Using Deep Recurrent Neural Networks," *Nuclear Fusion* **62**, 026007 (2022). DOI.
25. **Alan A. Kaptanoglu**, Brian M. de Silva, Urban Fasel, Kadierdan Kaheman, Andy J. Goldschmidt, Jared L. Callaham, Charles B. Delahunt, Zachary G. Nicolaou, Kathleen Champion, Jean-Christophe Loiseau, J. Nathan Kutz, and Steven L. Brunton, "PySINDy: A Comprehensive Python Package for Robust Sparse System Identification," *Journal of Open Source Software* **7**, 3994 (2022). DOI.
26. **Alan A. Kaptanoglu**, Jared L. Callaham, Aleksandr Aravkin, Christopher J. Hansen, and Steven L. Brunton, "Promoting Global Stability in Data-Driven Models of Quadratic Nonlinear Dynamics," *Physical Review Fluids* **6**, 094401 (2021). DOI.
27. **Alan A. Kaptanoglu**, Kyle D. Morgan, Christopher J. Hansen, and Steven L. Brunton, "Physics-Constrained, Low-Dimensional Models for Magnetohydrodynamics: First-Principles and Data-Driven Approaches," *Physical Review E* **104**, 015206 (2021). DOI.
28. **Alan A. Kaptanoglu**, Thomas E. Benedett, Kyle D. Morgan, Christopher J. Hansen, and Thomas R. Jarboe, "Two-Temperature Effects in Hall-MHD Simulations of the HIT-SI Experiment," *Physics of Plasmas* **27**, 072505 (2020). DOI. Erratum: **27**, 119901 (2020), DOI.
29. **Alan A. Kaptanoglu**, Kyle D. Morgan, Christopher J. Hansen, and Steven L. Brunton, "Characterizing Magnetized Plasmas with Dynamic Mode Decomposition," *Physics of Plasmas* **27**, 032108 (2020). DOI.

Submitted Manuscripts and Preprints

P1. Zachary L. Daniel[§], **Alan A. Kaptanoglu**, Christopher J. Hansen, Kyle D. Morgan, Steven L. Brunton, and J. Nathan Kutz, "Data-Driven Methods to Discover Stable Linear Models of the Inductive Helicity Injectors" (2026). arXiv:2501.05405.

P2. Lanke Fu[‡] and **Alan A. Kaptanoglu**, "Towards Joint Optimization of Stellarator Coils and Support Structures" (2026). arXiv:2607.05749.

P3. **Alan A. Kaptanoglu** and Tobias Blickhan[‡], "Computational Boundary Specification in 3D Fixed-Boundary Magnetohydrodynamic Equilibrium Modeling" (2026). arXiv:2605.01652.

P4. **Alan A. Kaptanoglu** and Pedro F. Gil[‡], "A Proof-of-Concept for Automated AI-Driven Stellarator Coil Optimization with In-the-Loop Finite-Element Calculations" (2026). arXiv:2603.15240.

P5. Tobias Blickhan[‡], Julianne Stratton[†], and **Alan A. Kaptanoglu**, "MRX: A Differentiable 3D MHD Equilibrium Solver without Nested Flux Surfaces" (2025). arXiv:2510.26986.

P6. **Alan A. Kaptanoglu**, Kyle D. Morgan, Christopher J. Hansen, and Steven L. Brunton, "The Structure of Global Conservation Laws in Galerkin Plasma Models" (2021). arXiv:2101.03436.

Other Significant Research Dissemination

- PySINDy, a widely used package for sparse system identification. Core developer with Brian de Silva, Kathleen Champion, and others. Approximate annual repository traffic: 500 unique clones, 65,000 views, and 13,000 unique visitors.
- SIMSOPT, open-source software for stellarator optimization led by Matt Landreman. Substantial contributor. Approximate annual repository traffic: 1,040 unique clones, 39,000 views, and 1,300 unique visitors.
- MRX, a differentiable 3D MHD equilibrium solver that permits magnetic islands and chaotic fields. Developed with Tobias Blickhan[‡] and Julianne Stratton[†].
- coil-fem, an open-source differentiable finite-element tool for joint optimization of stellarator coils and support structures. Developed with Lanke Fu[‡].
- Educational YouTube channel: more than 1,400 subscribers, 72,000 views, and 4,100 hours watched, with tutorials on stellarator optimization, PySINDy, and data-driven plasma modeling.

Outside Professional Work for Compensation

Scientific Consultant Mar. 1, 2026–present
Stellarex, Inc.
Scientific consulting on stellarator design, coil optimization, and computational workflows for fusion-energy development.

Other Scholarly Activity

Invited Talks and Seminars

1. Invited seminar, Auburn University, Auburn, Alabama, October 30, 2026.
2. Invited seminar, The University of Texas at Austin, Austin, Texas, October 27, 2026.
3. "Recent Work on Stage-1 and Stage-2 Stellarator Optimization," invited presentation, UCLA Institute for Pure and Applied Mathematics Workshop III: Fusion Device Design and Engineering, Los Angeles, California, May 5, 2026.
4. "Some Recent Progress on Modeling and Designing Stellarators," Journal of Plasma Physics Journal Colloquium, October 23, 2025. Recording.
5. "Recent Advances in Stellarator Coil Optimization," plenary lecture, Simons Collaboration on Hidden Symmetries and Fusion Energy Annual Meeting, March 21, 2025.

6. "Opportunities for Sparse Regression and PINNs in Plasma Physics," plenary lecture, International AI Plasma Physics Conference, October 29, 2024.
7. "Coil and Magnet Optimization for Fusion Devices as Sparse Regression," Fifth International Conference on Data-Driven Plasma Science, August 16, 2024.
8. "Sparse Regression in Inverse Magnetostatics," University of Washington AI Institute Data-Driven Seminar, July 18, 2024.
9. "Sparse Regression and Local Basis Functions in Stellarator Optimization Problems," Columbia University Plasma Physics Colloquium, January 26, 2024.
10. "Promoting Global Stability in Data-Driven Models of Quadratic Nonlinear Dynamics," Physical Review Fluids Journal Club, October 27, 2021.

Conference Presentations and Abstracts

1. **A. A. Kaptanoglu**, "Overview of plasma physics research in the Kaptanoglu lab," poster, 68th Annual Meeting of the APS Division of Plasma Physics and 79th Annual Gaseous Electronics Conference, Chicago, Illinois, November 2–6, 2026.
2. **A. A. Kaptanoglu**, "Augmented Lagrangian Methods Produce Cutting-Edge Magnetic Coils for Stellarator Fusion Reactors," poster, APS Division of Plasma Physics Meeting, November 17, 2025.
3. L. Fu, **A. A. Kaptanoglu**, E. J. Paul, and A. Bhattacharjee, "Gradient-Based Single-Stage Dipole Optimization," oral presentation, APS Division of Plasma Physics Meeting, November 20, 2025.
4. J. Stratton, T. Blickhan, and **A. A. Kaptanoglu**, "Testing a New Differentiable MHD Equilibrium Solver," poster, APS Division of Plasma Physics Meeting, November 17, 2025.
5. W. Sengupta, R. Jorge, N. Nikulsin, S. Buller, R. Madan, A. Brown, R. Nies, **A. A. Kaptanoglu**, J. Kappel, D. Seidita, and A. Bhattacharjee, "Theory of Ridges in Compact Quasi-Axisymmetric Devices," poster, APS Division of Plasma Physics Meeting, November 17, 2025.
6. W. Sengupta, N. Nikulsin, S. Buller, R. Madan, E. J. Paul, R. Nies, **A. A. Kaptanoglu**, S. R. Hudson, and A. Bhattacharjee, "Periodic Korteweg–de Vries Soliton Potentials Generate Magnetic Field Strength with Exact Quasisymmetry," invited oral presentation, APS Division of Plasma Physics Meeting, October 10, 2024.
7. **A. A. Kaptanoglu** and M. Landreman, "Optimization of Passive Superconducting Coil Arrays," poster, APS Division of Plasma Physics Meeting, October 8, 2024.
8. J. Stratton and **A. A. Kaptanoglu**, "3D MHD Equilibria Using Local Spline Basis Functions," poster, APS Division of Plasma Physics Meeting, October 8, 2024.
9. L. Fu, E. J. Paul, **A. A. Kaptanoglu**, and A. Bhattacharjee, "Fast Coil Complexity and Force Proxy Based on Global Coil Optimization," poster, APS Division of Plasma Physics Meeting, October 8, 2024.
10. M. Landreman, I. G. Abel, G. Abreu, R. Conlin, W. D. Dorland, G. W. Hammett, S. Hurwitz, B. Jang, R. Jorge, and **A. A. Kaptanoglu**, "How Does Magnetic Geometry Affect Plasma Turbulence? A Machine Learning Approach," poster, APS Division of Plasma Physics Meeting, October 8, 2024.
11. **A. A. Kaptanoglu**, G. P. Langlois, and M. Landreman, "Coil Topology Optimization for Stellarators," poster, APS Division of Plasma Physics Meeting, October 31, 2023.
12. T. M. Elder, A. H. Boozer, E. J. Paul, and **A. A. Kaptanoglu**, "Mixed-Type Stellarator Coil Sets for Decreased Complexity," poster, APS Division of Plasma Physics Meeting, October 31, 2023.
13. K. C. Hammond and **A. A. Kaptanoglu**, "Improved Stellarator Permanent Magnet Designs through Combined Discrete and Continuous Optimizations," poster, APS Division of Plasma Physics Meeting, October 31, 2023.
14. B. Jang, **A. A. Kaptanoglu**, R. Gaur, S. Pan, M. Landreman, and W. Dorland, "Grad–Shafranov Equilibria via Data-Free Physics-Informed Neural Networks," poster, APS Division of Plasma Physics Meeting, November 2, 2023.

15. Z. L. Daniel, **A. A. Kaptanoglu**, C. J. Hansen, J. N. Kutz, and S. L. Brunton, "Data-Driven Methods to Discover Stable Linear Models of the Helicity Injectors on HIT-SIU from Experimental Data," poster, APS Division of Plasma Physics Meeting, October 30, 2023.
16. **A. A. Kaptanoglu**, C. J. Hansen, S. L. Brunton, and M. Landreman, "Bringing Advanced Sparse System Identification to Plasma Physics," invited oral presentation, APS Division of Plasma Physics Meeting, October 20, 2022.
17. **A. A. Kaptanoglu**, J. L. Callaham, C. J. Hansen, and S. L. Brunton, "Machine Learning to Discover Interpretable Models in Fluids and Plasmas," oral presentation, APS March Meeting, March 17, 2022.
18. **A. A. Kaptanoglu**, J. L. Callaham, K. D. Morgan, C. J. Hansen, A. Aravkin, and S. L. Brunton, "Data-Driven, Interpretable Plasma Models," oral presentation, Sherwood Fusion Theory Conference, August 16–18, 2021. Best Student Presentation Award.
19. **A. A. Kaptanoglu**, A. Jalalvand, A. V. Garcia, A. O. Nelson, J. Abbate, G. Verdoolaege, S. L. Brunton, W. W. Heidbrink, and E. Kolemen, "Spatially Localized Alfvén Eigenmode Classification Using Convolutional Neural Networks," poster, APS Division of Plasma Physics Meeting, November 8, 2021.
20. **A. A. Kaptanoglu**, K. D. Morgan, C. J. Hansen, and S. L. Brunton, "Physics-Constrained Data-Driven Methods in MHD," poster, APS Division of Fluid Dynamics Meeting, November 23, 2020; also presented at the APS Division of Plasma Physics Meeting, November 9–13, 2020.
21. **A. A. Kaptanoglu**, T. E. Benedett, C. J. Hansen, K. D. Morgan, and T. R. Jarboe, "Two-Temperature Effects in the HIT-SI Experiment," poster, APS Division of Plasma Physics Meeting, October 21–25, 2019.

Professional Society Memberships

- American Physical Society, member, 2020–present.

Refereeing and Reviewing

- Referee for journals in plasma physics, nonlinear dynamics, scientific computing, and machine learning; verified activity is listed on ORCID.

Graduate Students and Post-Doctoral Researchers

Postdoctoral Researchers

Opal Issan, University of Washington Feb. 2027–
Postdoctoral researcher supported by a U.S. Department of Energy ORISE fellowship.

Pedro F. Gil, University of Washington Oct. 2026–
Postdoctoral researcher.

Lanke (Frank) Fu, New York University Sep. 2025–present
Postdoctoral researcher in stellarator optimization and differentiable scientific computing.

Tobias Blickhan, New York University Sep. 2024–Dec. 2026
Research in 3D MHD equilibria and differentiable simulation. Appointed Lecturer/Reader in Theoretical Plasma Physics at the University of Edinburgh, beginning Jan. 2027.

Gabriel Langlois, New York University Sep. 2023–Sep. 2024
Research in inverse magnetostatics and stellarator coil topology optimization. Current position: Visiting Assistant Professor of Mathematics, University of Illinois Urbana-Champaign.

Current Doctoral Students

Andrea Gonzalez Galvan, University of Washington 2026–present
Ph.D. student in Aeronautics & Astronautics.

Daisy Nguyen, University of Washington 2026–present
Ph.D. student in Aeronautics & Astronautics.

Mason Haberle, New York University 2023–present
Research in global methods for stellarator optimization.

Julianne Stratton, New York University 2023–present
Research in 3D MHD equilibria and differentiable numerical methods.

Other Doctoral Supervision

Mai Peng, University of Washington 2023–present
Co-advised Ph.D. student; research in stability guarantees for data-driven nonlinear models.

Byoungchan Jang, University of Maryland 2022–2024
Co-advised doctoral research on physics-informed neural networks for Grad–Shafranov equilibria.

Current Master's Students

Baixuan (Mellow) Chen, New York University 2025–present
Research on differentiable multi-time-step SINDy. Coauthor with Alan A. Kaptanoglu of *Machine-learned spectral PDE solvers for fluids and plasmas*, manuscript in preparation for *Nonlinear Dynamics*.

Completed Master's Degrees and Projects

Davii Zarshenas, New York University 2024–2026
M.S. thesis: *Incorporating Pressure-Profile Degrees of Freedom into Stellarator Optimization with DESC*. Current position: Ph.D. student in Physics, The University of Texas at Austin.

Julianne Stratton, New York University 2023–2024
M.S. thesis: *3D MHD Equilibria Using Local Spline Basis Functions*. Current position: Ph.D. student, New York University.

Elias Pratschke, EPFL 2023–2024
M.S. thesis: *Resistive Tearing: Numerical Exploration of Nonmodal Effects*. Current position: Ph.D. student, University of California San Diego.

Mai Peng, University of Washington 2022–2024
M.S. thesis: *Local Stability Guarantees for Data-Driven Quadratically Nonlinear Models*. Current position: Ph.D. student in Mechanical Engineering, University of Washington.

Undergraduate Research Supervision

Armin Ulrich 2025–present
Finite-permeability coupling in permanent-magnet optimization; supported by the Courant SURE research program; coauthor of a 2026 *Physics of Plasmas* article.

Vincenzo (Vinnie) Gallegos 2025–present
Analysis of stochastic coil optimization for stellarators. Coauthor of *An In-depth Study of Stochastic Stellarator Coil Optimization: Manufacturing and Assembly Errors*, with Evan Laljit, Julianne Stratton, Gabe Perez-Giz, and Alan A. Kaptanoglu; manuscript in preparation for *Nuclear Fusion*.

Logan Tsai 2025–present
Filamentary coil optimization using QUADCOIL.

Evan Laljit 2025–2026
Analysis of stochastic coil optimization for stellarators. Coauthor of *An In-depth Study of Stochastic Stellarator Coil Optimization: Manufacturing and Assembly Errors*, with Vincenzo Gallegos, Julianne Stratton, Gabe Perez-Giz, and Alan A. Kaptanoglu; manuscript in preparation for *Nuclear Fusion*. Current position: M.S. student in Applied Physics and Applied Mathematics, Columbia University.

Hamza Hussain 2025–2026
Single-stage stellarator optimization using augmented Lagrangian methods. Current position: DPhil student in Mathematics, University of Oxford.

Yuxiang (Zoe) Xue 2025–2026
Tokamak shape optimization using physics-informed neural networks. Current position: M.S. student in the Master of Computational Data Science program, Carnegie Mellon University.

Manav Patel 2024–2026
Minimization of forces in permanent-magnet arrays. Current position: plasma research at Thea Energy.

William Hoffman 2023–2026
Optimization of rectangular permanent magnets with near-field effects. Current position: Ph.D. student in plasma physics, Department of Applied Physics and Applied Mathematics, Columbia University.

Lanyue Zhang 2022–2023
Benchmarking sparse regression on a large database of chaotic polynomial dynamical systems; resulting 2023 *Nonlinear Dynamics* article.

Zachary L. Daniel 2022–2024
Analytic and data-driven circuit models for the HIT-SIU plasma experiments; coauthor of a 2026 arXiv preprint. Current position: Ph.D. student, Department of Applied Physics and Applied Mathematics, Columbia University.

High-School Research Supervision

All high-school researchers were supported by the NYU Courant GSTEM program.

Weiping (Jessica) Li Summer 2025
Fourier-series-order effects in stellarator coil optimization; coauthor of two 2026 journal articles. Current position: undergraduate student, Columbia University.

Jaahnvi Toolsidas Summer 2024
Fast calculation of the magnetic field from a rectangular coil. Current position: undergraduate student in Computer Science, Georgia Institute of Technology.

Sophie (Eve) Liberman Summer 2024
Calculation of the magnetic field from a circular coil with a rectangular cross-sectional area. Subsequently coauthored a 2025 peer-reviewed article on gastric dilatation and volvulus in rabbits.

Research Activities

Funded External Research

Agency	Project title	Role and investigators	Amount	Dates
Google	*Google Impact Challenge: AI for Science: High-Beta, Non-Nested Stellarator Equilibrium and Transport Modeling*	Co-PI; Joshua Burby (UT Austin), lead PI; team includes David Hatch, Tan Bui, and Tobias Blickhan; partners Type One Energy, ExoFusion, and the Dutch Institute for Fundamental Energy Research	$2.5 million total; $534,998 UW portion	Sep. 2026–Aug. 2029
Google TPU Award	*Differentiable Equilibria for Fusion Reactor Design*	PI	$100,000 plus $25,000 in Google Cloud credits	Sep. 2026–Aug. 2027
National Science Foundation	*Collaborative Research: Wave-Particle Interactions in 3D Magnetic Fields*	Co-PI; PI Elizabeth Paul; Co-PI Weichao Tu	$242,547 NYU portion	Sep. 2025–Aug. 2028
Simons Foundation	*Collaboration on Hidden Symmetries in Fusion Energy*	NYU Co-PI with Georg Stadler and Mike O'Neil; multi-institutional collaboration	$8 million collaboration-wide	Sep. 2023–Sep. 2027

Pending Research Support

Agency	Proposal title	Role	Amount	Proposed dates
U.S. Army Research Office	*Theory and Prediction of Transient Instabilities in Magnetized Fluids*	PI	$360,000	Jan. 2027–Dec. 2029
National Science Foundation	*Collaborative Research: Sparse Identification of Nonlinear Geometric Ocean Dynamics (SINGOD)*	Co-PI	$551,410	Sep. 2026–Aug. 2029
U.S. Department of Energy	*The Stellarex Plan for Rapid Realization of Economical Fusion Based on the Stellarator Approach*	Co-PI	$215,176	Mar. 2026–Sep. 2027

Documentation of Teaching Effectiveness

Planned University of Washington Teaching

Course	Course title	Term	Credits
ENGR 510	Foundations of Machine Learning for Engineering	Fall 2026	5
AA 565	Fusion Reactor Fundamentals	Winter 2027	3
ENGR 510	Foundations of Machine Learning for Engineering	Fall 2027	5
AA 545	Computational Methods for Plasmas	Spring 2028	3

No teaching assignment for Spring 2027 or Winter 2028.

Courses Taught

Evaluation scores are averages across student-response questions concerning instructor performance and class quality, using a 5-point scale. A dash indicates that a score is not available; N/A indicates that no standard evaluation was administered.

Course	Institution	Term	Enrollment	Evaluation
Undergraduate Honors Numerical Analysis	NYU	Fall 2023	30–35	4.77
Undergraduate Honors Numerical Analysis	NYU	Spring 2024	30–35	4.82
Advanced Topics in Applied Mathematics (A Crash Course in Magnetohydrodynamics)	NYU	Spring 2024	11	N/A
Graduate Linear Algebra	NYU	Fall 2024	17	4.67
Undergraduate Honors Numerical Analysis	NYU	Spring 2025	30–35	–
Graduate Linear Algebra	NYU	Fall 2025	30	4.52

SERVICE

Departmental and University Service

- New York University Mathematics Ph.D. comprehensive examination committee, 2023–2026.
- New York University Ph.D. examination committees, 2023–2026.
- New York University Mathematics Ph.D. Survey Analysis Committee, 2024.
- New York University Ph.D. comprehensive examination writer, 2024 and 2025.
- President, Research Computing Club, University of Washington, 2020–2021.
- Training Coordinator, Research Computing Club, University of Washington, 2019–2020.

Professional Service

- Committee member, Women+ in Plasma Physics (W+IPP), 2024–present.
- APS Division of Plasma Physics Ally training and annual-meeting service, 2021–present.
- XSEDE EMPOWER Program application reviewer, 2019–2021.
- XSEDE EMPOWER Program mentor, 2019–2020.

Community and Public Service

- Volunteer, 350 Seattle, 2019–2021.
- Volunteer, Washington Against Nuclear Weapons, 2019–2021.
- Volunteer, Physicists for Diversity and Inclusion, 2018–2019.