

GREGORY J. PARKER

EMPLOYMENT	University of California, Berkeley NSF Postdoctoral Fellow	2025 –
	Stanford University Szegő Assistant Professor of Mathematics, NSF Postdoctoral Fellow (on leave at Simons–Laufer MSI Fall 2022)	2023 –2025
EDUCATION	Massachusetts Institute of Technology Ph.D. in Mathematics Advisors: Prof. C.H. Taubes and Prof. T. Mrowka. Thesis: <i>Gluing $\mathbb{Z}_2$-Harmonic Spinors</i>	2017 – 2022
	Harvard University Bachelor of Science, <i>Summa cum Laude</i> . Sc.B. - Mathematics with honors, Sc.B. - Physics Honors Thesis: <i>Lefschetz Fibrations on 4-Manifolds</i>	2013 – 2017
RESERACH INTERESTS	My research focuses on singular nonlinear elliptic PDEs and their applications in geometric analysis, particularly gauge theory and minimal submanifolds. I also work in numerical analysis of PDEs with a focus on high-dimensional and multi-scale kinetic equations with applications in plasma physics and nuclear fusion.	
PREPRINTS & PUBLICATIONS (MATHEMATICS)	Non-product Minimal Surfaces with Cylindrical Tangent Cones Rafe Mazzeo and Gregory J. Parker, expected Oct 2026. In preparation.	
	9. The Universal Moduli Space of Non-Degenerate $\mathbb{Z}/2\mathbb{Z}$-Harmonic Spinors Siqi He, Gregory J. Parker, and Thomas Walpuski, September 2024. arXiv:2609.02848 (71 pages) In review.	
	8. $\mathbb{Z}_2$-Harmonic Spinors and 1-forms on Connect Sums and Torus Sums of 3-manifolds Siqi He and Gregory J. Parker. To appear in Geometry & Topology, arXiv:2407.10922 (40 pages) July 2024.	
	7. Gluing $\mathbb{Z}_2$-Harmonic Spinors and Seiberg–Witten Monopoles on 3-manifolds Gregory J. Parker, February 2024. arXiv:2402.03682 (103 pages) In review.	
	6. Concentrating Dirac Operators and Generalized Seiberg–Witten Equations Gregory J. Parker. Mathematical Research Letters, 33 (2026) Number 1, 1-55, arXiv:2307.00694 (55 pages) July 2023.	
	5. Deformations of $\mathbb{Z}_2$-Harmonic Spinors on 3-Manifolds Gregory J. Parker. Geometric and Functional Analysis, 36 (2026) Number 1, 201-300, arXiv:2301.06245 (100 pages) Jan. 2023.	
	4. Concentrating Local Solutions of the Two-Spinor Seiberg–Witten Equations on 3-Manifolds Gregory J. Parker. Asian Journal of Mathematics, 30 (2026), Number 2, 147–260, arXiv:2210.08148 (113 pages) October 2022.	

3. A Propagator-based multi-level Monte-Carlo scheme for kinetic neutral species in edge plasmas

Gregory J. Parker, Maxim V. Umansky, Benjamin D. Dudson.

Accepted in Journal of Computational Physics,

arXiv:2512.09334 | Dec. 2025.

2. Machine Learning approach to modeling of neutral particles transport in plasma

Maxim V. Umansky, Gregory J. Parker, R.D. Smirnov.

Contributions to Plasma Physics (e70085),

arXiv:2510.23088 | Sep. 2025.

1. Coupling Fluid Plasma and Kinetic Neutral Models using Correlated Monte-Carlo Methods

Gregory J. Parker, Maxim V. Umansky, Benjamin D. Dudson.

Nuclear Materials and Energy **42**: 101889,

arXiv:2407.10936 | July 2024.

0. LIBS and ablation threshold analysis using a megahertz Yb fiber laser oscillator.

Gregory J. Parker, Daniel E. Parker, Bai Nie, Vadim Lozovoy, Marcos Dantus.

Spectrochimica Acta Part B: Atomic Spectroscopy.,

arXiv:n/a | May 2015.

9. Chapman Reserach Fellowship 2026 (Imperial College of London, declined)
8. NSF Mathematical Sciences Postdoctoral Research Fellowship, (2023–2027)
7. NSF Graduate Research Fellowship (2017–2022).
6. Norman Levinson Fellowship (MIT, 2018-19).
5. Captain Jonathan Fay Prize for Top Senior Thesis, Harvard University (2017).
4. Hoopes Prize for Outstanding Senior Thesis, Harvard University (2017).
3. Hertz Foundation Fellowship Finalist (2017).
2. John Harvard Scholar (2016).
1. Certificate of Distinction in Teaching (2015).

29. *Non-product minimal submanifolds with Cylindrical Tangent Cones*, UCL Geometry Seminar, London, Sep 2026.
28. *The Choice of Infinite-Dimensional Gauge in Deformations of Submanifolds*, Clay Workshop: Multivalued Harmonicity. Clay Mathematics Institute, Oxford UK, Sep. 2026.
27. *Non-product minimal submanifolds with Cylindrical Tangent Cones*, Rutgers Geometric Analysis Conference, New Brunswick, New Jersey, July 2026.
26. *Deformations of Calibrated Submanifolds via Generalized $\mathbb{Z}/2$ -harmonic Spinors*, University of Wisconsin, Madison. Geometry Seminar, September 2025.
25. *Non-product minimal submanifolds with Cylindrical Tangent Cones*, University of Oregon Geometry & Analysis Seminar, May 2025.
24. *Non-product minimal submanifolds with Cylindrical Tangent Cones*, UCSD Geometry & Analysis Seminar, May 2025.
23. *Non-product minimal submanifolds with Cylindrical Tangent Cones*, Cornell Analysis Seminar, May 2025.

22. *Non-product minimal submanifolds with Cylindrical Tangent Cones*, Lehigh Geometry Seminar (virtual), 21 January, 2025.
21. *Non-product minimal submanifolds with Cylindrical Tangent Cones*, New Frontiers in Curvature: Flows, General Relativity, Minimal Submanifolds, and Symmetry Program Seminar, MSRI / SLMath, 23 November 2024.
20. *The role of flat $SL(2, \mathbb{C})$ connections in counting special Lagrangians*, Geometry and analysis of special structures on manifolds conference, MSRI / SLMath conference, 21 November 2024.
19. *Non-product minimal submanifolds with Cylindrical Tangent Cones*, Stanford Geometry Seminar, 12 Nov 2024.
18. *$\mathbb{Z}_2$ -Harmonic Spinors and 1-forms II: Gluing* (joint with Siqi He), Qingtian Geometry and Topology Conference, Qingtian, China, 5 June 2024.
17. *$\mathbb{Z}_2$ -Harmonic 1-forms and Flat $SL(2, \mathbb{C})$ Connections on 3-Manifolds*, Rutgers Geometric Analysis Conference, Rutgers University (virtual), 15 May 2024.
16. *A Fredholm Framework for Singular Deformation Problems*, Simons Collaboration on Special Holonomy, Duke University, 14 May 2024.
15. *$\mathbb{Z}_2$ -harmonic spinors as limiting objects in geometry and topology*, Representation Theory and Mathematical Physics Seminar, Louisiana State University, 22 April 2024.
14. *Gluing, Excision, and the Alternating Method*, Rutgers Geometric Analysis and Gauge Theory Learning Seminar, Jan 2024.
13. *Compactness and Wall-Crossing Formulas in Gauge Theory*, Stanford Topology Seminar. Sep. 2023.
12. *Deformations of $\mathbb{Z}_2$ -Harmonic Spinors*, Summer School in Geometric Analysis at ULB. Aug. 2023.
11. *Deformations of $\mathbb{Z}_2$ -Harmonic Spinors*, Stanford University Geometry Seminar. Jan. 2023.
10. *Concentrating Local Solutions of the Two-Spinor Seiberg–Witten Equations*, New Four-Dimensional Gauge Theories Conference, MSRI. Oct. 2022.
9. *Gluing $\mathbb{Z}_2$ -Harmonic Spinors*. Weekly Colloquium Talk, Simons Center for Geometry and Physics, Simons Collaboration on Special Holonomy. Sep. 2022.
8. *Variations of the $\mathbb{Z}_2$ -Dirac Operator*. Geometric Analysis Seminar, Rutgers University. May 2022.
7. *Gluing $\mathbb{Z}_2$ -harmonic spinors*. Low-Dimensional Topology, Gauge Theory, and Symplectic Topology Seminar, Simons Center for Geometry and Physics. April 2022.
6. *Gluing $\mathbb{Z}_2$ -harmonic spinors*. AMS Special Session on Gauge Theory, Geometric Analysis, and Low-Dimensional Topology. Tufts University. March 2022.
5. *Existence of $\mathbb{Z}_2$ -harmonic spinors* (expository talk on work of A. Doan and T. Walpuski). Harvard graduate student gauge theory seminar. Nov 2019.
4. *Chern-Weil Theory and Equivariant Cohomology*. MIT Juvitop Seminar on Differential Cohomology, Sep. 2019.
3. *Seiberg-Witten Monopoles, Fueter Sections, and G_2 -instantons*. British Isles Graduate Workshop III: gauge theory with a view towards higher-dimensions. June 2019.
2. *Generalized Seiberg-Witten Equations*. British Isles Graduate Workshop III: gauge theory with a view towards higher-dimensions. June 2019.
1. *The Maslov Index*. Kylerec Workshop for Graduate Students in Symplectic Topology. May 2018.

INVITED TALKS
(NUMERICAL
ANALYSIS &
COMPUTATIONAL
PHYSICS)

6. *A Propagator-based Multi-level Monte-Carlo for Kinetic Neutrals in Edge Plasmas*, UKAEA Exhaust Code Workshop, Culham Campus, Abingdon UK, Oct. 4, 2026.
5. *A Propagator-based Multi-level Monte-Carlo for Kinetic Neutrals in Edge Plasmas*, CASC and WCI Joint Seminar, Lawrence Livermore National Laboratory, Livermore, CA, Dec. 11, 2025.
4. *A Propagator-based Multi-level Monte-Carlo for Kinetic Neutrals in Edge Plasmas*, Invited talk, Plasma Edge Theory 20, KU Leuven, Sep. 26, 2025.
3. *A Propagator-based Multi-level Monte-Carlo for Kinetic Neutrals in Edge Plasmas*, EMU Seminar, Lawrence Livermore National Laboratory, Sep. 18, 2025.
2. *Differentiable Monte-Carlo and Implicit Coupling Methods*, Princeton Plasma Physics Lab, Computation Seminar, Aug. 1, 2024.
1. *Coupling Fluid-Plasma and Kinetic-Neutral Models using Differentiable Monte-Carlo Methods*, UEDGE and Magnetic Fusion Theory Seminar, Lawrence Livermore National Lab, Nov. 29, 2023.

STUDENTS
MENTORED

3. Jakob Buehler (UC Berkeley UGRA, SURF Program 2026). Topic: *Tensor Network Approximations for Kinetic Neutral Dynamics*.
2. Spencer Lamoureux (UC Berkeley UGRA, Spring/Summer 2026). Topic: *Dynamical Low-Rank Methods for Kinetic Equations*.
1. Denise Dengi (UC Berkeley, Senior Honors Thesis, 2026). Topic: *Predictive Mathematical Modeling of Combination Immunotherapy for Cancer*.

TEACHING

(all course notes available in pdf format on my personal webpage)

Math 126: Partial Differential Equations

Berkeley, Spring 2026

Undergraduate PDE theory and applications for physics, engineering, and math majors.

Math 126: Partial Differential Equations

Berkeley, Fall 2025

Math 53: Ordinary Differential Equations with Modern Applications

Stanford Winter 2025

Undergraduate ODE theory for physics, engineering, and math majors. Standard ODE methods, Fourier series, numerical methods.

Math 171: Measure Theory and Fourier Analysis

Stanford Fall 2024

Measure theory and Fourier analysis course for advanced math majors and graduate students.

Math 116: Complex Analysis

Stanford Fall 2024

Undergraduate Complex Analysis course for mathematics majors.

Math 20: Calculus II

Stanford Spring 2023

Course head. Second quarter of Stanford's main undergraduate calculus sequence.

ORGANIZING

New developments of analytic and geometry aspects of gauge theory

Banff International Research Station (Hangzhou 2027), co-organizer

Stanford Geometry seminar

Department seminar, co-organizer 2023–2025

Literature Review Seminar

MSRI Program “Analytic and Geometric Aspects of Gauge Theory” (Fall 2022) seminar, organizer.

OUTREACH

Seminar XL Facilitator, MIT Office of Minority Education. Instructor for Math 18.02 (Multivariable calculus), and Math 18.03 (Differential Equations).

Petey Greene Program / MIT Prison Initiative

2019–2022

Teaching assistant and instructor, Massachusetts Correctional Institutions at Concord and Souza Baranowski. Instructor for courses for incarcerated students through Emerson Prison Initiative, Concord Prison Outreach, and other organizations. Designed and taught courses on business mathematics, creative writing, and other topics.