

# ELIZABETH J. PAUL

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## PROFESSIONAL EXPERIENCE

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**Princeton University, Department of Astrophysical Sciences**  
Presidential Postdoctoral Research Fellow

*July 2020-2022*

## EDUCATION

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**University of Maryland, College Park**

*May 2020*

Ph.D., Physics

Thesis: “Adjoint methods for stellarator shape optimization and sensitivity analysis” ([link to preprint](#))

Advisor: William Dorland

Thesis committee: Thomas Antonsen, Adil Hassam, Matt Landreman, Ricardo Nochetto

**Princeton University**

*June 2015*

A.B., Astrophysical Sciences, Magna Cum Laude

Certificates: Applied and Computational Mathematics, Applications of Computing

Thesis: “Passive tracers in ATHENA: implementation and applications for turbulent star formation”

Advisor: Eve Ostriker

## AWARDS AND HONORS

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**DOE Office of Workforce Development Student Mentorship Award**

*December 2021*

**Marshall N. Rosenbluth Outstanding Doctoral Thesis Award**

*July 2021*

Awarded annually by the American Physical Society. This award recognizes exceptional early-career scientists who have performed original thesis work of outstanding scientific quality and achievement in the area of plasma physics.

**Monroe H. Martin Graduate Research Fellowship**

*May 2020*

Awarded by UMD Physics to a Ph.D. candidate in his or her last year of completing the dissertation whose research interests span both mathematics and physics

**ARCS Foundation Fellowship**

*March 2019*

Awarded \$15,000 for the 2019-2020 academic year by the Metro Washington Chapter of the ARCS Foundation

**Outstanding Research Assistant Award**

*December 2018*

Awarded by UMD Graduate School to top 2% of graduate assistants

**Graduate Student Poster Prize, Sherwood Fusion Theory Conference**

*April 2017*

**Graduate Student Seminar Speaker Award**

*December 2016 and December 2017*

Awarded by Institute for Research in Electronics and Applied Physics, UMD

**Elected to membership in Sigma Xi Research Honors Society**

*May 2015*

**University of Maryland Dean’s Fellowship in Physics**

*February 2015*

Award of \$10,000 by UMD Graduate School for outstanding incoming students

## PUBLICATIONS

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16. P. Helander, S. R. Hudson, and **E. J. Paul**, “Heat conduction in an irregular magnetic field: Part I. Heat conduction in irregular magnetic fields,” *Journal of Plasma Physics* 88, 905880122 (2022). ([DOI link](#))
15. E. Rodriguez, **E. J. Paul**, and A. Bhattacharjee, “Measures of quasisymmetry for stellarators,” *Journal of Plasma Physics* 88, 905880109 (2022). ([DOI link](#))
14. **E. J. Paul**, S. R. Hudson, and P. Helander, “Heat conduction in an irregular magnetic field: Part II. Heat transport as a measure of the effective non-integrable volume,” *Journal of Plasma Physics* 88, 905880107 (2022). ([DOI link](#))
13. R. Nies, **E. J. Paul**, S. R. Hudson, and A. Bhattacharjee, “Adjoint methods for quasisymmetry of vacuum fields on a surface,” *Journal of Plasma Physics* 88, 905880106 (2022). ([DOI link](#))
12. M. Landreman and **E. J. Paul**, “Magnetic fields with precise quasisymmetry,” *Physical Review Letters* 128, 035001 (2022). ([DOI link](#)) (**Featured Article**)
11. C. Hegna, D. Anderson, A. Bader, T. Bechtel, A. Bhattacharjee, M. Cole, M. Drevlak, J. Duff, B. Faber, S. Hudson, M. Kotschenreuther, T. Kruger, M. Landreman, I. McKinney, **E. J. Paul**, M. J. Pueschel, J. Schmitt, P. Terry, A. Ware, M. Zarnstorff, and C. Zhu, “Improving the stellarator through advances in plasma theory,” *Nuclear Fusion* 62, 042012 (2022). ([DOI link](#))
10. A. Geraldini, M. Landreman, and **E. J. Paul**, “An adjoint method for determining the sensitivity of island size to magnetic field variations,” *Journal of Plasma Physics* 87, 905870302 (2021). ([DOI link](#))
9. A. Carlton Jones, **E. J. Paul**, and W. Dorland, “Computing the shape gradient of stellarator coil complexity with respect to the plasma boundary,” *Journal of Plasma Physics* 87, 905870222 (2021). ([DOI link](#))
8. **E. J. Paul**, M. Landreman, and T. M. Antonsen, “Gradient-based optimization of 3D MHD equilibria,” *Journal of Plasma Physics* 87, 905870214 (2021). ([DOI link](#))
7. W. Sengupta, **E. J. Paul**, H. Weitzner, and A. Bhattacharjee, “Vacuum magnetic fields with exact quasisymmetry near a flux surface. Part 1: Solutions near an axisymmetric surface,” *Journal of Plasma Physics* 87, 905870205 (2021). ([DOI link](#))
6. **E. J. Paul**, T. Antonsen, Jr., M. Landreman, and W. A. Cooper, “Adjoint approach to calculating shape gradients for 3D magnetic confinement equilibria. Part 2. Applications,” *Journal of Plasma Physics* 86, 905860103 (2020). ([DOI link](#))
5. **E. J. Paul**, I. G. Abel, M. Landreman, and W. Dorland, “An adjoint method for neoclassical stellarator optimization,” *Journal of Plasma Physics* 85, 795850501 (2019). ([DOI link](#))
4. T. Antonsen, Jr., **E. J. Paul**, and M. Landreman, “Adjoint approach to calculating shape gradients for 3D magnetic confinement equilibria,” *Journal of Plasma Physics* 85, 905850207 (2019). ([DOI link](#)) (**Featured Article**)
3. M. Landreman and **E. J. Paul**, “Computing local sensitivity and tolerances for stellarator physics properties using shape gradients,” *Nuclear Fusion* 58, 076023 (2018). ([DOI link](#))
2. **E. J. Paul**, M. Landreman, A. Bader, and W. Dorland, “An adjoint method for gradient-based optimization of stellarator coil shapes,” *Nuclear Fusion* 58, 076015 (2018). ([DOI link](#))
1. **E. J. Paul**, M. Landreman, F. M. Poli, D. A. Spong, H. M. Smith, and W. Dorland, “Rotation and neoclassical ripple transport in ITER,” *Nuclear Fusion* 57, 116044 (2017). ([DOI link](#))

## MONOGRAPHS IN PREP

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L.-M. Imbert-Gerard, **E. J. Paul**, and A. M. Wright, “An Introduction to Stellarators: From Magnetic Fields to Symmetries and Optimization,” *under contract with SIAM* (2021). ([link to preprint](#))

## COLLOQUIA

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University of Iowa Physics Colloquium - Remote *October 2021*  
Columbia University Plasma Physics Colloquium - Remote *September 2021*  
JPP Frontiers of Plasma Physics Colloquium - Remote *August 2020*

## CONFERENCE ORAL PRESENTATIONS

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Simons Hidden Symmetries Collaboration Annual Meeting (**Invited**) *March 2022*  
International Toki Conference (**Invited**) - Remote *November 2021*  
APS Division of Plasma Physics Meeting (**Invited**) - Remote *November 2021*  
European Fusion Theory Conference - Remote *October 2021*  
Sherwood Fusion Theory Conference - Remote *August 2021*  
SIAM Conference on Computational Science and Engineering - Remote *March 2021*  
APS Division of Plasma Physics Meeting - Remote *November 2020*  
Max Planck Princeton Center Workshop (**Invited**) - Göttingen, Germany *January 2020*  
SIAM APDE Meeting - La Quinta, CA *December 2019*  
APS Division of Plasma Physics Meeting (**Invited**) - Fort Lauderdale, FL *October 2019*  
International Stellarator and Heliotron Workshop (**Invited**) - Madison, WI *September 2019*  
US/Japan Workshop on “Progress on Advanced Concept Optimization and Modeling in Stellarator-Heliotrons” - Madison, WI *June 2019*  
Sherwood Fusion Theory Conference (**Invited**) - Princeton, NJ *April 2019*  
Wolfgang Pauli Institute Plasma Kinetic Working Meeting - Vienna, Austria *July 2017*

## CONFERENCE POSTER PRESENTATIONS

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International Stellarator and Heliotron Workshop - Warsaw, Poland *June 2022*  
Sherwood Fusion Theory Conference - Santa Rosa, CA *April 2022*  
APS Division of Plasma Physics Meeting - Portland, OR *November 2018*  
Transport Task Force - San Diego, CA *May 2018*  
Sherwood Fusion Theory Conference - Auburn, AL *April 2018*  
APS Division of Plasma Physics Meeting - Milwaukee, WI *October 2017*  
Sherwood Fusion Theory Conference - Annapolis, MD *May 2017*  
APS Division of Plasma Physics Meeting - San Jose, CA *October 2016*

## SEMINAR PRESENTATIONS

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University of Wisconsin Plasma Physics Seminar - Madison, WI	<i>April 2022</i>
University of Texas Plasma Physics Seminar - Austin, TX	<i>April 2022</i>
Warwick CFSA Seminar - Remote	<i>December 2021</i>
Center for Computational Astrophysics Compact Objects Seminar - Remote	<i>May 2021</i>
University of Colorado Boulder CIPS Seminar - Remote	<i>April 2021</i>
PPPL Research & Review Seminar - Remote	<i>March 2021</i>
PPPL Stellarator Seminar - Remote	<i>March 2021</i>
PPPL Theory Seminar - Princeton, NJ	<i>November 2019</i>
Courant Magneto-fluid Dynamics Seminar - New York, NY	<i>November 2019</i>
Courant Magneto-fluid Dynamics Seminar - New York, NY	<i>July 2018</i>
Chalmers Physics Seminar - Gothenberg, Sweden	<i>June 2018</i>
Institute for Plasma Physics Greifswald Seminar - Greifswald, Germany	<i>June 2018</i>
PPPL Theory Seminar - Princeton, NJ	<i>March 2018</i>
MIT PSFC Theory Seminar - Cambridge, MA	<i>November 2017</i>
Graz University of Technology Plasma Physics Seminar - Graz, Austria	<i>July 2017</i>
Courant Magneto-Fluid Dynamics Seminar - New York, NY	<i>July 2016</i>

## COMPUTING TIME ALLOCATION

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XSEDE Educational Grant (Co-PI) *August 2020*

Awarded 60,000 SUs for Summer School on Stellarator Optimization

## RESEARCH SUPERVISION

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Alexander Ireland (undergrad)	<i>June 2022-present</i>
Daniel Alex (undergrad)	<i>December 2021-February 2022</i>
Brandon Lee (undergrad, now Fulbright Fellow)	<i>January 2021-present</i>
Richard Nies (grad)	<i>November 2020-present</i>
Arthur Carlton-Jones (undergrad, now UMD physics grad)	<i>Summer 2019-Spring 2021</i>
Ben Cha (undergrad, now U. Waterloo grad)	<i>Fall 2018</i>

## RESEARCH SERVICE

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Sherwood Fusion Theory Conference

- Program Committee member *Spring 2022*
- Executive Committee member *Fall 2022*

*Journal of Plasma Physics* advisory board member *September 2019-present*

Reviewer for *Plasma Physics and Controlled Fusion*, *Journal of Plasma Physics*, *Nuclear Fusion*, *Physics of Plasmas*, *Nature Scientific Reports*, *PRX Energy*, and *Engineering Optimization*

Reviewer for US Dept. of Energy Fusion Energy Sciences and NSF Plasma Physics Program grant proposals

## SERVICE, OUTREACH, AND COMMUNICATION

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### PPPL Graduate Summer School

- Lecturer and organizer for mini-course on “Stellarators” *August 2021*

### UMD TREND REU Program

- Judge for undergraduate poster session and presentations *August 2021*

### PPPL Introduction to Fusion Energy and Plasma Physics Course

- Lecturer on “Stellarators” *June 2021*

### APS DPP Women in Plasma Physics

- Panelist for webinar on postdoc positions *February 2021*

### Simons-PPPL Summer School

- Organizer of summer school and leader of optimization laboratory section *August 2020*
- Prepared materials for and co-led laboratory session *August 2019*

### University of Maryland Girls Talk Math

- Presented mini-lecture on “Number systems and scientific computing” for high school girls summer camp *June 2019*

### University of Maryland Women in Physics

- Mentor for undergraduate physics major *Fall 2017*
- Led physics GRE prep session *February 2017*

### Graduate Resources for Advancing Diversity with Maryland Astronomy and Physics (GRAD-MAP)

- Prepared lecture material for Python workshop *January 2018*
- Volunteer at Spring Symposium *April 2017*

### University of Maryland Physics Graduate Student Committee

- Mentor for first year physics graduate students *Fall 2016-Spring 2018*

## TEACHING EXPERIENCE

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### Department of Physics, University of Maryland

#### *Graduate Teaching Assistant*

- PHYS 761 - Plasma Physics I: Survey *Fall 2019*
- PHYS 275 - Experimental Physics I: Mechanics and Heat *Spring 2016*
- PHYS 121 - Fundamentals of Physics *Fall 2015*