

# Emily Lichko

## Curriculum Vitae

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### Education

- 2013–2020 **PhD**, *Physics*, University of Wisconsin - Madison.  
Graduation Date: February 2020
- 2009–2013 **B.S.**, *Physics (Highest Honors) and Mathematics*, University of Michigan.

### Research Interests

Space and Astrophysical Plasmas, Particle-In-Cell Simulations, Dissipative Processes in Kinetic Plasmas, Instabilities

### Publications

Lichko, E., Egedal, J. (2020) Magnetic pumping model for energizing superthermal particles applied to observations of the Earth's bow shock. *Nat Commun* **11**, 2942 <https://doi.org/10.1038/s41467-020-16660-4>

Egedal, J., H. K. Monkhorst, E. Lichko, and P. Montag (2018) *Theory of ion dynamics and heating by magnetic pumping in FRC plasma*. *Physics of Plasmas*, **25**, 072510

Lichko, E., J. Egedal, W. Daughton, and J. Kasper (2017) *Magnetic pumping as a source of heating and power-law distributions in the solar wind*. *The Astrophysical Journal Letters*, **850**, L28

Montag, P., J. Egedal, E. Lichko, and B. Wetheron (2017) *Impact of compressibility and a guide field on Fermi acceleration during magnetic island coalescence*. *Physics of Plasmas*, **24**, 062906

### Honors and Awards

- 2020 **NSF Atmospheric and Geospace Sciences Postdoctoral Research Fellowship (NSF AGS PRF) Recipient.**
- 2019 **NASA LWS Jack Eddy Postdoctoral Fellowship, Honorable Mention.**
- 2019 **Elizabeth Hirschfelder Award**, *This award is given to graduate women in the physics department at the University of Wisconsin - Madison.*
- 2018 **NASA Earth and Space Science Fellowship (NESSF).**
- 2017 **SHINE Outstanding Poster Award.**
- 2017 **AGU Outstanding Student Paper Award.**
- 2016 **Henry & Eleanor Firminhac Award**, *This award is given to undergraduate or graduate students in the physics department at the University of Wisconsin - Madison.*

- 2015 **National Defense Science and Engineering Graduate (NDSEG) Fellowship.**
- 2014 **National Science Foundation Graduate Research Fellowship Program (NSF GRFP), Honorable Mention.**
- 2013 **Phi Beta Kappa, National Honor Society.**
- 2012 **Phi Kappa Phi, National Honor Society.**
- 2012 **Sigma Pi Sigma, National Physics Honor Society.**
- 2012 **International Institute Individual Fellowship, These fellowships are given to students at the University of Michigan who wish to conduct research abroad.**
- 2011 **Otho Lyle Tiffany and Mary Lois Tiffany Fellowship, This prize is to encourage non-graduating physics students to continue their great academic effort at the University of Michigan.**
- 2009 **Society of Exploration Geophysics: Urban E. Neese Scholarship.**

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## Relevant Research Experience

- 2020 - **Postdoctoral Research Fellow, University of Arizona, Tucson, AZ.**  
Present Mentor: Kristopher Klein  
Project: The Effects of Nonlinearities on the Onset and Evolution of Microinstabilities in Solar Plasma
- 2014-2020 **Graduate Research Assistant, University of Wisconsin-Madison, Madison, WI.**  
Mentor: Jan Egedal  
Project: Magnetic pumping as a source of particle heating in the solar wind
  - Developed and tested a model for magnetic pumping, a heating mechanism for particles that naturally leads to power-law distributions, in the limit where the particle velocities at or slower than the wave speed (1D) and where they are far faster (2D)
  - Utilized VPIC, a particle-in-cell code developed at Los Alamos National Laboratory (LANL), as well as LANL high-performance computing resources, to test the 1D theoretical model
  - Used observations from the Magnetospheric MultiScale (MMS) mission to compare to the 2D model of magnetic pumping
- 2011-2013 **Undergraduate Research Assistant, University of Michigan, Ann Arbor, MI.**  
Mentor: Luming Duan  
Project: Preliminary investigations into the theoretical and experimental techniques for exploiting cold atom systems for the purposes of quantum computation
  - Investigated spin-orbit coupling in one- and two-dimensional optically trapped atomic systems for senior honors thesis
  - Traveled with the group to Tsinghua University (Beijing, China) to continue research over the summer, funded by the International Institute Individual Fellowship
- June-August 2011 **Research Experience for Undergraduates Participant, Santa Fe Institute (SFI), Santa Fe, NM.**  
Mentors: Anne Kandler, Laura Fortunato, Tanmoy Bhattacharya  
Project: How Micro- and Macro-evolutionary Processes Shape Cultural Diversity
  - Designed and programmed an agent-based model of population dynamics and trait transmission
  - Selected to represent the SFI REU Program at the 2011 REU Conference

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## Teaching and Service

- 2020 APS DPP Public Information Committee Member

- 2020 SHINE Virtual Postdoc Application Workshop, Panel Member
- 2019 Graduate Fellowship Opportunities Panel Member, APS Division of Plasma Physics Meeting, Fort Lauderdale, FL
- 2018 - 2019 SHINE Student Representative. *This involved organizing the programming for the Student Day preceding the main SHINE conference and running the Student Poster Contest for SHINE 2018 and SHINE 2019.*
- 2017 - 2018 Member of the Climate and Diversity Committee, Physics Department, UW - Madison
- 2015 - 2018 President and Founding Member of UW - Madison's Society of Women and Gender Minorities in Physics. *This included applying for and receiving a Women in Physics Group Grant from the American Physical Society in 2016.*
- Spring 2014 Teaching Assistant for Physics 308 - Intermediate Laboratory - Electromagnetic Fields and Optics
- Fall 2013 Teaching Assistant for Physics 307 - Intermediate Laboratory - Mechanics and Modern Physics
- 2012 - 2013 Member of the Undergraduate Concerns Committee, Physics Department, University of Michigan

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## Presentations

### Invited

- July 2020 **Magnetic pumping model for energizing superthermal particles applied to observations of the Earth's bow shock**, *Princeton Heliophysics Seminar, Princeton, NJ.*  
Colloquium
- October 2019 **New theory of magnetic pumping as applied to spacecraft observations of particle heating**, *APS Division of Plasma Physics Meeting, Fort Lauderdale, FL.*  
Invited Talk - Student Day
- February 2019 **Quantifying heating by magnetic pumping through in situ spacecraft observations**, *Plasma Seminar, Madison, WI.*  
Colloquium
- December 2018 **Magnetic pumping as a source of heating in the solar wind**, *AGU Fall Meeting, Washington, D.C.*  
eLightning Session
- November 2018 **Quantifying heating by magnetic pumping through in situ spacecraft observations**, *APS Division of Plasma Physics Meeting, Portland, OR.*  
Invited talk

### Contributed

- December 2019 **New theory of magnetic pumping as applied to spacecraft observations of particle heating**, *AGU Fall Meeting, San Francisco, CA.*  
Talk

- October 2019 **New theory of magnetic pumping as applied to spacecraft observations of particle heating**, *APS Division of Plasma Physics Meeting, Fort Lauderdale, FL.*  
Talk
- October 2019 **Extensions of the magnetic pumping model for particle heating**, *APS Division of Plasma Physics Meeting, Fort Lauderdale, FL.*  
Poster
- December 2018 **Quantifying heating by magnetic pumping through in situ spacecraft observations**, *AGU Fall Meeting, Washington, D.C.*  
Poster
- November 2018 **How local trapping amplifies the effects of heating from magnetic pumping**, *APS Division of Plasma Physics Meeting, Portland, OR.*  
Poster
- August 2018 **Quantifying heating by magnetic pumping through in situ spacecraft observations**, *SHINE Conference, Cocoa Beach, FL.*  
Poster
- December 2017 **Magnetic pumping as a source of heating in the solar wind**, *AGU Fall Meeting, New Orleans, LA.*  
Poster
- October 2017 **Magnetic pumping as a source of heating in the solar wind**, *APS Division of Plasma Physics Meeting, Milwaukee, WI.*  
Poster
- October 2017 **Observations of magnetic pumping in the solar wind using MMS data**, *APS Division of Plasma Physics Meeting, Milwaukee, WI.*  
Poster
- August 2017 **Magnetic pumping as a source of heating in the solar wind**, *SHINE Conference, Saint-Sauveur, QC, Canada.*  
Poster
- November 2016 **Magnetic pumping as a source of heating in the solar wind**, *APS Division of Plasma Physics Meeting, San Jose, CA.*  
Poster
- November 2015 **Breakdown of adiabatic electron behavior in expanding magnetic fields**, *APS Division of Plasma Physics Meeting, Savannah, GA.*  
Poster
- October 2014 **Magnetic pumping as a source of heating in the solar wind**, *APS Division of Plasma Physics Meeting, New Orleans, LA.*  
Poster
- November 2011 **How Micro- and Macro-evolutionary Processes Shape Cultural Diversity**, *Complex Systems Advanced Academic Workshop, Ann Arbor, MI.*  
Colloquium
- October 2011 **How Micro- and Macro-evolutionary Processes Shape Cultural Diversity**, *REU Conference, Arlington, VA.*  
Poster



# Programming Languages

Matlab, C++, Python, Fortran, Mathematica