

James Juno

100 Stellarator Road
Princeton, NJ, 08540 U.S.A.

email: jjuno@pppl.gov

Education

- 2020 PhD in Physics, University of Maryland, College Park.
Thesis: “A Deep Dive into the Distribution Function: Understanding Phase Space Dynamics using Continuum Vlasov–Maxwell simulations.”
Advisers: William Dorland and Jason TenBarge.
- 2014 BS in Computational Physics, Rice University.

Work Experience

- Jan. 2022–present **Staff Research Physicist**, Princeton Plasma Physics Laboratory.
- Sept. 2020–January 2022 **NSF AGS Postdoctoral Fellow**, University of Iowa.
- Jun. 2020–Sept. 2020 **Assistant Research Scientist**, Princeton Plasma Physics Laboratory.

Awards, fellowships & grants

- 2020 National Science Foundation Atmospheric and Geospace Sciences Postdoctoral Research Fellow (\$190,000), titled *A continuum kinetic study of heliospheric collisionless shocks*.
- 2018 Outstanding Tutorial Talk—Parker Solar Probe, 19th Solar Heliospheric and INterplanetary Environment (SHINE) Student Day.
- 2017 NASA Earth and Space Science Fellowship—Heliophysics (\$135,000), titled *Novel kinetic methods for the study of turbulence in the near Sun environment*.
- 2017 Outstanding Poster Award, Sherwood Fusion Theory Conference.
- 2015 Outstanding Tutorial Talk—Turbulence, 16th Solar Heliospheric and INterplanetary Environment (SHINE) Student Day.
- 2014 Rice University Distinguishment in Research.
- 2013 Department of Energy National Undergraduate Fellowship in Plasma Physics.
- 2012 Rice University Physics and Astronomy Summer Research Fellowship.

Publications

- 2022 L. Wang, A. Hakim, B. Srinivasan, **J. Juno**. “Electron cyclotron drift instability and anomalous transport: two-fluid moment theory and modeling.” Submitted to *Plasma Sources Science and Technology*. arXiv:2107.09874.
- 2022 T. N. Bernard, F. D. Halpern, M. Francisquez, N. R. Mandell, **J. Juno**, G. W. Hammett, A. Hakim, G. J. Wilkie, and J. Guterl. “Kinetic modeling of neutral transport for a continuum gyrokinetic code.” *Physics of Plasmas*, **29**, 052501.

- 2022 M. Francisquez, **J. Juno**, A. Hakim, G. W. Hammett, D. R. Ernst. “Improved multispecies Dougherty collisions.” *Journal of Plasma Physics*, **88**, (3), 905880303.
- 2021 B. Ripperda, J. F. Mahlmann, A. Chernoglazov, J. M. TenBarge, E. R. Most, **J. Juno**, Y. Yuan, A. A. Philippov, A. Bhattacharjee. “Weak Alfvénic turbulence in relativistic plasmas Part 2: Current sheets and dissipation.” *Journal of Plasma Physics*, **87**, (5), 905870512.
- 2021 J. M. TenBarge, B. Ripperda, A. Chernoglazov, A. Bhattacharjee, J. F. Mahlmann, E. R. Most, **J. Juno**, Y. Yuan, A. A. Philippov. “Weak Alfvénic turbulence in relativistic plasmas Part 1: Dynamical equations and basic dynamics of interacting resonant triads.” *Journal of Plasma Physics*, **87**, (6), 905870614.
- 2021 S. M. Jenab, G. Brodin, **J. Juno**, I. Kourakis. “Ultrafast Electron Holes in Plasma Phase Space Dynamics.” *Scientific Reports* **11**, 16358.
- 2021 **J. Juno**, G. G. Howes, J. M. TenBarge, L. B. Wilson III, A. Spitkovsky, D. Caprioli, K. G. Klein, A. Hakim. “A field–particle correlation analysis of a perpendicular magnetized collisionless shock.” *Journal of Plasma Physics*, **87**, (3), 905870316.
- 2021 O. Pezzi, H. Liang, **J. L. Juno**, P. A. Cassak, C. L. Vásconez, L. Sorriso-Valvo, D. Perrone, S. Servidio, V. Roytershteyn, J. M. TenBarge, W. H. Matthaeus. “Dissipation measures in weakly collisional plasmas.” *Monthly Notices of the Royal Astronomical Society*, **505**, (4), Pages 4857–4873.
- 2020 A. Hakim and **J. Juno**. “Alias-Free, Matrix-Free, and Quadrature-Free Discontinuous Galerkin Algorithms for (Plasma) Kinetic Equations.” *SC20: Proceedings of the International Conference for High Performance Computing, Networking, Storage and Analysis*, IEEE Press.
- 2020 **J. Juno**, M. Swisdak, J. M. TenBarge, V. Skoutnev, A. Hakim. “Noise-induced magnetic field saturation in kinetic simulations.” *Journal of Plasma Physics*, **86**, (4).
- 2020 A. Hakim, M. Francisquez, **J. Juno**, G. Hammett. “Conservative discontinuous Galerkin schemes for nonlinear Dougherty–Fokker–Planck collision operators.” *Journal of Plasma Physics*, **86**, (4).
- 2020 I. Pusztai, **J. Juno**, A. Brandenburg, J. M. TenBarge, A. Hakim, M. Francisquez, A. Sundström. “Dynamo in Weakly Collisional Nonmagnetized Plasmas Impeded by Landau Damping of Magnetic Fields.” *Physical Review Letters*, **124**, 255102.
- 2019 J. M. TenBarge, J. Ng, **J. Juno**, L. Wang, A. Hakim, A. Bhattacharjee. “An extended MHD study of the 16 October 2015 MMS diffusion region crossing.” *Journal of Geophysical Research: Space Physics*, **124**, 8474–8487.
- 2019 J. Ng, A. Hakim, **J. Juno**, A. Bhattacharjee. “Drift Instabilities in Thin Current Sheets Using a Two-Fluid Model With Pressure Tensor Effects.” *Journal of Geophysical Research: Space Physics*, **124**, 3331–3346.
- 2019 V. Skoutnev, A. Hakim, **J. Juno**, J. M. TenBarge. “Temperature-dependent Saturation of Weibel-type Instabilities in Counter-streaming Plasmas.” *Astrophysical Journal Letters*, **872**, 2.
- 2019 A. Sundström, **J. Juno**, J. M. TenBarge, I. Pusztai. “Effect of a weak ion collisionality on the dynamics of electrostatic shocks.” *Journal of Plasma Physics*, **85**(1). 905850108.
- 2018 **J. Juno**, A. Hakim, J. M. TenBarge, E. Shi, W. Dorland (2018). Discontinuous Galerkin algorithms for fully kinetic plasmas. *Journal of Computational Physics*, **353**, 110–147.
- 2018 I. Pusztai, J. M. TenBarge, A. N. Csapó, **J. Juno**, A. Hakim, L. Yi, T. Fülöp (2018). Low Mach-number collisionless electrostatic shocks and associated ion acceleration. *Plasma Physics and Controlled Fusion*, **60**, 3, 035004.
- 2017 P. Cagas, A. Hakim, **J. Juno**, B. Srinivasan (2017). Continuum kinetic and multi-fluid simulations of classical sheaths. *Physics of Plasmas*, **24**, 2, 022118.

Invited Presentations

- 2020 “A Deep Dive into the Distribution Function: Understanding Phase Space Dynamics using Continuum Vlasov–Maxwell simulations.” *62nd Meeting of the American Physical Society’s Division of Plasma Physics Conference*. **Remote due to COVID-19**

- 2019 “A Modal, Alias-Free, Discontinuous Galerkin Algorithm for Plasma Kinetic Equations.” *Society for Industrial and Applied Mathematics (SIAM) Analysis of PDEs*. La Quinta, CA, USA.
- 2019 “A Deep Dive into the Distribution Function: Understanding Phase Space Dynamics using Continuum Vlasov–Maxwell simulations.” *Princeton Plasma Physics Theory Seminar*. Princeton, NJ, USA.
- 2019 “A Deep Dive into the Distribution Function: Understanding Phase Space Dynamics using Continuum Vlasov–Maxwell simulations.” *Chalmer’s University Plasma Seminar*. Gothenburg, Sweden.
- 2019 “A Deep Dive into the Distribution Function: Understanding Phase Space Dynamics using Continuum Vlasov–Maxwell simulations.” *Massachusetts Institute of Technology Plasma Theory Seminar*. Cambridge, MA, USA.
- 2019 “A Deep Dive into the Distribution Function: Understanding Phase Space Dynamics using Continuum Vlasov–Maxwell simulations.” *Dartmouth Space Physics Seminar*. Hanover, NH, USA.
- 2018 “A Quadrature and Matrix-Free Discontinuous Galerkin Algorithm for (Plasma) Kinetic Equations.” *ASTRONUM: Numerical Methods for Astrophysics Conference*. Panama City, FL, USA.
- 2017 “An Eulerian Discontinuous Galerkin Scheme for the Fully Kinetic Vlasov–Maxwell System.” *New York University MagnetoFluids Seminar*. New York City, NY, USA.
- 2015 “Toward a continuum Vlasov–Maxwell model: algorithm developments and basic benchmarks.” *American Geophysical Union Fall Meeting*. San Francisco, CA, USA.
- 2014 “Benchmarking a discontinuous Galerkin Vlasov-Poisson Solver in Gkeyll.” *University of Maryland-College Park Plasma Physics Seminar*. College Park, MD, USA.
- 2013 “Benchmarking a discontinuous Galerkin Vlasov-Poisson Solver in Gkeyll.” *Rice University Space Physics Seminar*. Houston, TX, USA.

Contributed Presentations

- 2022 “Novel parallel-kinetic perpendicular-fluid model for highly magnetized (relativistic) plasmas.” **Poster** presented at *64th Meeting of the American Physical Society’s Division of Plasma Physics*. Spokane, WA, USA.
- 2021 “Phase Space Energization in Quasi-Perpendicular and Oblique Collisionless Shocks.” **Talk** presented at *63rd Meeting of the American Physical Society’s Division of Plasma Physics*. Pittsburgh, PA, USA.
- 2020 “Cross-Shock Electric Fields and Electron Energization in Collisionless Shocks.” **Talk** presented at *American Geophysical Union Fall Meeting*. **Remote due to COVID-19**.
- 2020 “A Deep Dive into the Distribution Function: Understanding Phase Space Dynamics of Plasma Instabilities in the Early Universe.” **Dissertation Talk** presented at *235th American Astronomical Society Winter Meeting*. Honolulu, HI, USA.
- 2019 “A Deep Dive into the Distribution Function: Understanding Phase Space Dynamics using Continuum Vlasov–Maxwell simulations.” **Dissertation Talk** presented at *61st Meeting of the American Physical Society’s Division of Plasma Physics Conference*. Ft. Lauderdale, FL, USA.
- 2019 “Comparing Kinetic Methods for Phase Space Dynamics of Weibel-Type Instabilities.” **Talk** presented at *Kavli Institute for Theoretical Physics Multiscale Astrophysics Workshop*. Santa Barbara, CA, USA.
- 2019 “The Effect of Particle Noise on Small-Scale Kinetic Instabilities.” **Poster** presented at *19th Solar, Heliospheric, and INterplanetary Environment (SHINE) Conference*. Boulder, CO, USA.
- 2019 “A Quadrature and Matrix-Free Discontinuous Galerkin Algorithm for (Plasma) Kinetic Equations.” **Talk** presented at *6th Vlasovia Conference*. Strasbourg, France.
- 2019 “Turbulent Dissipation in Simple Vlasov Systems.” **Poster** presented at *Sherwood Fusion Theory Conference*. Princeton, NJ, USA.
- 2019 “Discretizing the Vlasov–Maxwell system on a grid.. and applications!” **Talk** presented at the *Max Planck–Princeton Center Workshop*. Tokyo, Japan.

- 2018 “Diagnosing dissipation in non-relativistic collisionless shocks.” **Talk** presented at *American Geophysical Union Fall Meeting*. Washington D.C., USA.
- 2018 “Eulerian Algorithms for the Discretization of (Plasma) Kinetic Equations.” **Poster**¹ presented at *Association for Computing Machinery (ACM) Supercomputing Conference*. Dallas, TX, USA.
- 2018 “Turbulent Dissipation in Simple Vlasov Systems.” **Talk** presented at *60th Meeting of the American Physical Society’s Division of Plasma Physics*. Portland, OR, USA.
- 2018 “A Quadrature and Matrix-Free Discontinuous Galerkin Algorithm for (Plasma) Kinetic Equations.” **Poster** presented at *19th Solar, Heliospheric, and INterplanetary Environment (SHINE) Conference*. Orlando, FL, USA.
- 2017 “Phase mixing in transverse electromagnetic shocks.” **Poster** presented at *American Geophysical Union Fall Meeting*. New Orleans, LA, USA.
- 2017 “Quantifying dissipation in Eulerian Vlasov simulations of collisionless shocks.” **Poster** presented at *59th Meeting of the American Physical Society’s Division of Plasma Physics*. Milwaukee, WI, USA.
- 2017 “Quantifying dissipation in Eulerian Vlasov simulations of collisionless shocks.” **Poster** presented at *18th Solar, Heliospheric, and INterplanetary Environment (SHINE) Conference*. Saint-Sauveur, Quebec, Canada.
- 2017 “Continuum Vlasov Simulations of Riemann Problems and Magnetized Shocks.” **Poster** presented at *Sherwood Fusion Theory Conference*. Annapolis, MD, USA.
- 2017 “Eulerian Algorithms for the Discretization of Plasma Kinetic Equations.” **Poster** presented at *Society for Industrial and Applied Mathematics (SIAM) Computational Science and Engineering Conference*. Atlanta, GA, USA.
- 2016 “Exploring electron-ion instability couplings in two-fluid extended MHD in high beta plasmas and looking ahead to analogous kinetic simulations.” **Poster** presented at *58th Meeting of the American Physical Society’s Division of Plasma Physics*. San Diego, CA, USA.
- 2016 “Toward a continuum Vlasov–Maxwell model: novel time-stepping and including inter-particle collisions.” **Poster** presented at *17th Solar, Heliospheric, and INterplanetary Environment (SHINE) Conference*. Santa Fe, NM, USA.
- 2016 “Scaling and performance of an Eulerian discretization of the plasma kinetic equation.” **Talk** presented at *International High Performance Computing Summer School*. Ljubljana, Slovenia.
- 2015 “Turbulence Dissipation Challenge: AstroGK Results.” **Talk** presented at *16th Solar, Heliospheric, and INterplanetary Environment (SHINE) Conference*. Stowe, VT, USA.
- 2015 “A new Vlasov–Maxwell solver for studying distribution function dynamics in solar physics.” **Poster** presented at *16th Solar, Heliospheric, and INterplanetary Environment (SHINE) Conference*. Stowe, VT, USA.
- 2014 “A new method of driving turbulence in particle-in-cell simulations.” **Poster** presented at *56th Meeting of the American Physical Society’s Division of Plasma Physics*. New Orleans, LA, USA.
- 2013 “Benchmarking a discontinuous Galerkin Vlasov-Poisson Solver in Gkeyll.” **Poster** presented at *55th Meeting of the American Physical Society’s Division of Plasma Physics*. Denver, CO, USA.

Teaching Experience

- 2015, 2016 TA for HONR 268N/L: Cracking the Secrets of the Universe Using Computers.
Duties: Grading and providing assistance inside and outside of class with coding projects. Since the class was experimental, I also helped in the design of the course work and notes. In the second semester, I supervised a small team of undergraduate students on a plasma physics project benchmarking the Vlasov–Maxwell solver in Gkeyll applied to electron-scale kinetic instabilities.
- 2015 Grader for PHYS 761: Plasma Physics I.
- 2014 TA for PHYS 270: Electrodynamics, Light, Relativity and Modern Physics.

¹Poster presented as part of the Association for Computing Machinery’s Student Research Contest

Duties: Weekly discussion sessions and grading of exams.
2012 Grader for PHYS 144: Physics of Music.
2012 Grader for MATH 354: Honors Linear Algebra.

Leadership & Outreach Experience

2016–2017 Solar, Heliospheric, and INterplanetary Environment (SHINE) Student Representative.
Duties: A 2 year term organizing the annual Student Day associated with the SHINE conference, which occurs the day before the SHINE conference begins. Student Day is principally for graduate and undergraduate students—scientists with PhDs are forbidden from attending—as a way to learn about the field of solar astrophysics and provide opportunities for students to practice presentation skills. During my tenure we re-organized the talks that occur during the day to emphasize a combination of tutorial topics as well as the student’s research. In addition, we organized a poster contest for the students for the first time, which has continued after my tenure ended.

2015–2017 Committee Member — University of Maryland Physics Graduate Student Committee.
Duties: Discussion of issues and solutions within the graduate program at the University Maryland. Also help with the organization of the prospective graduate student weekend and the maintenance of a mentorship program where older graduate students help first year students become acclimated to graduate life.

2014–2016 Member — Graduate Resources Advancing Diversity with Maryland Astronomy and Physics (GRADMAP).
Duties: Given tutorials over the Python programming language at their Winter Workshop, a two week program for physics majors who are members of underrepresented groups to teach them skills which are useful in research, and provide a jumping off point to apply for summer research experiences for undergraduates. Volunteered for their Collaborative Seminar Series, where professors and graduate students travel to local community and historically black colleges to talk about their research and graduate school. Designed a small project in astrophysical plasma physics visualizing plasma turbulence which two students completed at the Winter Workshop in 2016.

Professional affiliations

- American Physical Society
- American Geophysical Union
- American Astronomical Society
- Society of Industrial and Applied Mathematicians
- Association for Computing Machinery