ELIZABETH A. TOLMAN

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PROFESSIONAL APPOINTMENTS

University of Iowa, Department of Physics and Astronomy 2026 – Present
Assistant Professor *Iowa City, IA*

Flatiron Institute, Center for Computational Astrophysics 2022 – 2025
Flatiron Research Fellow *New York, NY*

- Fellowship jointly offered by the Institute for Advanced Study and the Flatiron Institute Center for Computational Astrophysics.

Institute for Advanced Study 2020 – 2022
Member *Princeton, NJ*

- Postdoctoral fellowship in theoretical plasma astrophysics.

RESEARCH INTERESTS

Theoretical and computational plasma physics; plasma astrophysics; magnetic reconnection; compact-object emission; pulsars; fundamental physics with astrophysical plasmas.

EDUCATION

Massachusetts Institute of Technology *Ph.D. in Physics, September 2020*
GPA: 4.9/5.0
Advisor: Professor Nuno Loureiro
Thesis: H-mode access, H-mode pedestals, and alpha-driven Alfvén eigenmodes in high-field tokamaks
Selected coursework: Quantum Field Theory II, General Relativity, Plasma Waves

Princeton University *A.B. in Physics with High Honors, June 2015*
Certificate in Latin American Studies
GPA: 3.9/4.0
Senior thesis advisor: Professor Herman Verlinde
Senior thesis: Force-free magnetohydrodynamics near Kerr black holes
Selected coursework: Quantum Field Theory I, Topological Matter

SELECTED HONORS AND AWARDS

Rising Star in Physics, Heising-Simons Foundation *2020*
Invited to participate in a program for the next generation of physics academic leaders; program postponed to Fall 2022 due to COVID-19.

Plasma Science and Fusion Center Outreach Award *2017, 2018, 2019*
Awarded for leadership in PSFC tours, outreach talks, and exposition nights.

First Place Student Presenter, U.S./E.U. Transport Task Force *2017*

Kurt Forrest Fellowship, MIT Physics *2015*
Awarded to outstanding incoming MIT physics graduate students.

Allen G. Shenstone Prize in Physics, Princeton University *2015*
Awarded by the Princeton Physics Department for excellence in coursework and promise in independent research.

Elected to Phi Beta Kappa *2015*

Elected to Sigma Xi *2015*

National Defense Science and Engineering Graduate Fellowship, declined *2015*

National Science Foundation Graduate Research Fellowship *2015*

Rhodes Scholarship Finalist *2014*

National Undergraduate Fellowship, Princeton Plasma Physics Laboratory *2014*

Kusaka Memorial Prize in Physics, Princeton University *2014*
Awarded by the Princeton Physics Department for excellence in coursework and promise in independent research.

Princeton Environmental Institute Grand Challenges Grant *2013*
Grant supporting an independently arranged internship at Eindhoven University of Technology.

Shapiro Prize for Academic Excellence, Princeton University *2012*
Given by Princeton for "outstanding academic achievement."

Pyka Memorial Prize in Physics, Princeton University *2012*
Awarded by the Princeton Physics Department for excellence in coursework and promise in independent research.

TEACHING AND MENTORING

Instructor, Electricity and Magnetism II, University of Iowa *2026*

Lecturer, Simons Collaboration on Extreme Electrodynamics of Compact Sources Summer School *2024*

Lecturer, NSF/APS DPP GPAP Summer School on Plasma Physics for Astrophysicists *2021, 2023*

Lecturer, IAS Learning Seminars on Plasma Physics and Gravitational Waves *2021, 2023*

Research Internship Advisor, Trystin McCann, Princeton University *2021*

Grader, Fusion Energy, MIT Course 22.62 *2019*

Teaching Assistant, Engineering Principles for Fusion Reactors, MIT Course 22.63 *2018*

Undergraduate Research Advisor, Sean Parks, MIT *2017*

SELECTED TALKS AND SEMINARS

University of California, Los Angeles *April 2025*
Searching for dark matter with plasma astrophysics

"Particles vs. New Probes (P vs. NP)" Workshop, Flatiron Institute Center for Computational Astrophysics
March 2025
Plasma physics and its connection to axion searches

Plasma Science and Fusion Center, Massachusetts Institute of Technology *March 2025*
Tearing-mediated reconnection in magnetohydrodynamic poorly ionized plasmas

University of Iowa *February 2025*
Searching for dark matter with plasma astrophysics

West Virginia University *February 2025*
Searching for dark matter with plasma astrophysics

Plasma Physics, Space Physics, and Astrophysics Seminar, University of Iowa *February 2025*
Tearing-mediated reconnection in magnetohydrodynamic poorly ionized plasmas

Blackboard Talk, "Relativistic Plasma Physics: From the Lab to the Cosmos" Program, Kavli Institute for Theoretical Physics *2025*
Electric field screening in pair discharges and generation of pulsar radio emission

Plasma Physics (Physics/ECE/NE 922) Seminar, University of Wisconsin–Madison *December 2024*
Tearing-mediated reconnection in magnetohydrodynamic poorly ionized plasmas

APS Division of Plasma Physics Annual Meeting *October 2024*
Tearing-mediated reconnection in magnetohydrodynamic poorly ionized plasmas: II. Nonlinear evolution

"High-Energy Plasma Phenomena in Astrophysics" Workshop, Max Planck Institute for Plasma Physics
September 2024
Tearing-mediated reconnection in magnetohydrodynamic poorly ionized plasmas

Flatiron Institute Scientific Advisory Board *2024*
Tearing-mediated reconnection in magnetohydrodynamic poorly ionized plasmas: I. Onset and linear evolution

Fifth Purdue Workshop on Relativistic Plasma Astrophysics *2024*
Tearing-mediated reconnection in magnetohydrodynamic poorly ionized plasmas: I. Onset and linear evolution

Canadian Institute for Theoretical Astrophysics *2024*
Tearing-mediated reconnection in magnetohydrodynamic poorly ionized plasmas: I. Onset and linear evolution

University of Michigan, Nuclear Engineering and Radiological Sciences Department *2024*
Using tokamak physics to advance the understanding of light and energetic-particle production in extreme plasmas

Princeton Astrophysics Department Astroplasmas Seminar *2023*
Tearing-mediated reconnection in magnetohydrodynamic poorly ionized plasmas: I. Onset and linear evolution

APS Division of Plasma Physics Annual Meeting *2023*
Tearing-mediated reconnection in magnetohydrodynamic poorly ionized plasmas: I. Onset and linear evolution

"Modeling Plasmas Around Black Holes" Workshop, Lorentz Center *2023*
Electric field screening by pair discharges in pulsar polar caps

CCA Observational Astrophysics Discussion Series *2023*
Pulsar radio emission variability

"Improving Black Hole Accretion Models with Plasma Theory" Workshop, Princeton Gravity Initiative/Princeton Center for Theoretical Science *2023*
Basic plasma theory for black-hole accretion physics

Princeton Plasma Physics Laboratory Theory Department *2022*
Electric field screening in pair discharges and generation of pulsar radio emission

West Virginia University Physics and Astronomy Department *2022*
Electric field screening in pair discharges and generation of pulsar radio emission

APS Division of Plasma Physics Annual Meeting *2022*
Onset of magnetic reconnection in poorly ionized plasmas

University of Maryland Astronomy Center for Theory and Computation *2022*
Electric field screening in pair discharges and generation of pulsar radio emission

"Coherent Structures in Astro-Geo-Turbulence" Workshop, Flatiron Institute *2022*
Turbulence in fusion plasmas

Fourth Purdue Workshop on Relativistic Plasma Astrophysics *2022*
Electric field screening in pair discharges and generation of pulsar radio emission

APS April Meeting *2022*
Electric field screening in pair discharges and generation of pulsar radio emission

Joint UCLA/UCSD/UCI Virtual Seminar *2022*
Electric field screening in pair discharges and generation of pulsar radio emission

Institute for Advanced Study Seminar *2022*
Electric field screening in pair discharges and generation of pulsar radio emission

Princeton Astrophysics Department Astroplasmas Seminar *2021*
Electric field screening in pair discharges and generation of pulsar radio emission

Journal of Plasma Physics Frontiers of Plasma Physics Colloquium *2021*
Drift-kinetic theory of alpha-particle transport by tokamak perturbations

APS Division of Plasma Physics Annual Meeting *2020*
Drift-kinetic formulation of alpha-particle transport by tokamak MHD perturbations

Plasma Physics Seminar, University of Maryland *2020*
Drift-kinetic theory of tokamak alpha-particle transport by MHD modes and ripple

18th European Fusion Theory Conference, Ghent, Belgium *2019*
Theory and modeling of fusion-alpha-driven TAEs in high magnetic-field devices

12th Plasma Kinetics Working Meeting, Vienna, Austria *2019*
Implications of the high magnetic-field path to fusion energy for Alfvén eigenmode stability

Aalto University, Espoo, Finland *2019*
MIT's high magnetic-field path to fusion energy and implications for Alfvén eigenmode stability

APS Division of Plasma Physics Annual Meeting *2017*
Tearing instability of a current sheet forming by sheared incompressible flow

U.S. Transport Task Force Meeting *2017*
H-mode access and pedestal characteristics at high magnetic field in Alcator C-Mod discharges

SELECTED SERVICE AND OUTREACH

Member, CCA Retreat Planning Committee *2023*

Organizer, PGI/PCTS Workshop on Improving Black Hole Accretion Models with Plasma Theory *2023*

Member-at-Large, APS Topical Group in Plasma Astrophysics Executive Committee *2022 – 2025*
Elected with 76% of the vote.

Reviewer, Journal of Plasma Physics, Astrophysical Journal Letters, Nature Communications Physics, National Science Centre, Poland, and National Science Foundation *2021 – Present*

Advisory Board Member, Journal of Plasma Physics *2019 – 2023*
Advised the editorial board and contributed to initiatives including the creation of the journal Twitter feed and the selection of featured articles.

Plasma Science and Fusion Center Outreach Volunteer and Event Coordinator *2016 – 2020*

Co-Leader and Co-Founder, MIT Plasma Physics Graduate Student Group *2019 – 2023*
Co-founded a group advocating for the interests of plasma physics graduate students to Physics Department leadership and the Visiting Committee.

Member, MIT Radiation Protection Committee *2015 – 2019*

Delegate, U.S. Magnetic Fusion Research Strategic Directions Workshop *2017*

Panelist, Fellowship Opportunities for Graduate Students in Plasma Physics, APS Division of Plasma Physics Annual Meeting *2017*

FIRST-AUTHOR JOURNAL PUBLICATIONS

1. **E.A. Tolman**, M.W. Kunz, J.M. Stone, and L. Arzamasskiy, *Tearing-mediated reconnection in magnetohydrodynamic poorly ionized plasmas: II. Nonlinear evolution*, in preparation.
2. **E.A. Tolman** and P.J. Catto, *Quasilinear drift kinetic theory of alpha particle transport by neoclassical tearing modes*, *Journal of Plasma Physics* 91(1), E4 (2025).
3. **E.A. Tolman**, M.W. Kunz, J.M. Stone, and L. Arzamasskiy, *Tearing-mediated reconnection in magnetohydrodynamic poorly ionized plasmas: I. Onset and linear evolution*, *Astrophysical Journal* 967(2), 136 (2024).
4. **E.A. Tolman**, A.A. Philippov, and A.N. Timokhin, *Electric field screening in pair discharges and generation of pulsar radio emission*, *Astrophysical Journal Letters* 933, L37 (2022).
5. **E.A. Tolman** and P.J. Catto, *Drift kinetic theory of alpha transport by tokamak perturbations*, *Journal of Plasma Physics* 87(2), 855870201 (2021).
6. A.J. Creely,* L.M. Milanese,* **E.A. Tolman**,* J.H. Irby, S.B. Ballinger, S. Frank, A.Q. Kuang, B.L. Linehan, W. McCarthy, K.J. Montes, T. Mouratidis, J.F. Picard, P. Rodriguez-Fernandez, A.M. Rosenthal, A.J. Sandberg, F. Sciortino, R.A. Simpson, R.A. Tinguely, M. Zhou, and A.E. White, *Design study of a combined interferometer and polarimeter for a high-field, compact tokamak*, *Physics of Plasmas* 27, 042516 (2020). **Shared first authorship.*
7. **E.A. Tolman**, N.F. Loureiro, P. Rodrigues, J.W. Hughes, and E.S. Marmar, *Dependence of alpha-particle-driven Alfvén eigenmode linear stability on device magnetic field strength and consequences for next-generation tokamaks*, *Nuclear Fusion* 59, 046020 (2019).
8. **E.A. Tolman**, N.F. Loureiro, and D.A. Uzdensky, *Development of tearing instability in a current sheet forming by sheared incompressible flow*, *Journal of Plasma Physics* 84, 905840115 (2018).
9. **E.A. Tolman**, J.W. Hughes, S.M. Wolfe, S.J. Wukitch, B. LaBombard, A.E. Hubbard, E.S. Marmar, P.B. Snyder, and M. Schmidtmayr, *Influence of high magnetic field on access to stationary H-modes and pedestal characteristics in Alcator C-Mod*, *Nuclear Fusion* 58, 046004 (2018).

CO-AUTHORED JOURNAL PUBLICATIONS

1. P.J. Catto, **E.A. Tolman**, and F.I. Parra, *Merging of the superbanana plateau and $\sqrt{\nu}$ transport regimes in nearly quasisymmetric stellarators*, *Journal of Plasma Physics* 89(1), 905890106 (2023).
2. C. Hamilton, **E.A. Tolman**, L. Arzamasskiy, and V.N. Duarte, *Galactic bar resonances with diffusion: an analytic model with implications for bar–dark matter halo dynamical friction*, *Astrophysical Journal* 954 (2022).
3. P.J. Catto and **E.A. Tolman**, *Collisional broadening of nonlinear resonant wave–particle interactions*, *Journal of Plasma Physics* 87(6), 905890106 (2021).
4. P.J. Catto and **E.A. Tolman**, *Reimagining full-wave RF quasilinear theory in a tokamak*, *Journal of Plasma Physics* 87(2), 905870215 (2021).

5. A.J. Creely et al. (45 authors), *Overview of the SPARC tokamak*, *Journal of Plasma Physics* 86(5), 865860502 (2020).
6. S.D. Scott, G. Kramer, **E.A. Tolman**, A. Snicker, J. Varje, K. Särkimäki, J. Wright, and P. Rodriguez-Fernandez, *Fast-ion physics in SPARC*, *Journal of Plasma Physics* 86(5), 865860508 (2020).
7. R.A. Tinguely, A. Rosenthal, R. Simpson, S.B. Ballinger, A.J. Creely, S. Frank, A.Q. Kuang, B.L. Linehan, W. McCarthy, L.M. Milanese, K.J. Montes, T. Mouratidis, J.F. Picard, P. Rodriguez-Fernandez, A.J. Sandberg, F. Sciortino, **E.A. Tolman**, M. Zhou, B.N. Sorbom, Z.S. Hartwig, and A.E. White, *Neutron diagnostics for the physics of a high-field, compact, $Q \geq 1$ tokamak*, *Fusion Engineering and Design* 143, 212–225 (2019).
8. A.Q. Kuang, N.M. Cao, A.J. Creely, C.A. Dennett, J. Hecla, B. LaBombard, R.A. Tinguely, **E.A. Tolman**, H. Hoffman, M. Major, J. Ruiz Ruiz, D. Brunner, P. Grover, C. Laughman, B.N. Sorbom, and D.G. Whyte, *Conceptual design study for heat exhaust management in the ARC fusion pilot plant*, *Fusion Engineering and Design* 137, 221 (2018).
9. J.W. Hughes, P.B. Snyder, M.L. Reinke, B. LaBombard, S. Mordijck, S. Scott, **E.A. Tolman**, S.G. Baek, T. Golfinopoulos, R.S. Granetz, M. Greenwald, A.E. Hubbard, E. Marmar, J.E. Rice, A.E. White, D.G. Whyte, T. Wilks, and S. Wolfe, *Access to pedestal pressure relevant to burning plasmas on the high magnetic field tokamak Alcator C-Mod*, *Nuclear Fusion* 58, 112003 (2018).
10. M. Schmidtmayr, J.W. Hughes, F. Ryter, E. Wolfrum, N.M. Cao, A.J. Creely, N.T. Howard, A.E. Hubbard, Y. Lin, M.L. Reinke, J.E. Rice, **E.A. Tolman**, S.J. Wukitch, and Y. Ma, *Investigation of the critical edge ion heat flux for L–H transitions in Alcator C-Mod and its dependence on* B_T, *Nuclear Fusion* 58, 056003 (2018).
11. A.E. Hubbard, S.-G. Baek, D. Brunner, A.J. Creely, I. Cziegler, E. Edlund, J.W. Hughes, B. LaBombard, Y. Lin, Z. Liu, E.S. Marmar, M.L. Reinke, J.E. Rice, B. Sorbom, C. Sung, J. Terry, C. Theiler, **E.A. Tolman**, J.R. Walk, A.E. White, D. Whyte, S.M. Wolfe, S. Wukitch, X.Q. Xu, and the Alcator C-Mod team, *Physics and performance of the I-mode regime over an expanded operating space on Alcator C-Mod*, *Nuclear Fusion* 57, 126039 (2017).
12. J.E. Rice, J.W. Hughes, P.H. Diamond, N. Cao, M.A. Chilenski, A.E. Hubbard, J.H. Irby, Y. Kosuga, Y. Lin, I.W. Metcalf, M.L. Reinke, **E.A. Tolman**, M.M. Victora, S.M. Wolfe, and S.J. Wukitch, *On the $\rho_\star$ scaling of intrinsic rotation in C-Mod plasmas with edge transport barriers*, *Nuclear Fusion* 57, 116004 (2017).

CONFERENCE PROCEEDINGS AND WHITE PAPERS

1. T. Tala et al., *Core density peaking experiments in JET, DIII-D and C-Mod in various operational scenarios—driven by fueling or transport?* Preprint for IAEA Fusion Energy Conference, Oct. 22–27, 2018, IAEA-CN-123/45.
2. **E.A. Tolman** et al., *Conceptual design study for heat exhaust management in the ARC fusion pilot plant*. Preprint for IAEA Fusion Energy Conference, Oct. 22–27, 2018, IAEA-FIP-P1-22.
3. J. Boguski, M. Brown, R. Buttery, R. Churchill, W. Guttenfelder, G. Hammett, J. Hanson, D. Hatch, C. Hegna, M. Knolker, X. Liu, L. Lodestro, R. Majeski, R. Pinsker, M. Shafer, D. Sutherland, R.A. Tinguely, **E. Tolman**, and D. Weisberg, *Discussion Group 5 Summary of USMFRSD Workshop in Austin, TX*. Submitted to the National Academy of Sciences regarding *A Strategic Plan for U.S. Burning Plasma* (2018).