

# ELIZABETH TOLMAN

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## EXPERIENCE

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### **Flatiron Institute Center for Computational Astrophysics**

*Flatiron Research Fellow*

2022 - Present

*New York, NY*

- Fellowship jointly offered by the Institute for Advanced Study (2 years) and the Flatiron Institute Center for Computational Astrophysics (3 years)

### **Institute for Advanced Study**

*Member*

2020 - 2022

*Princeton, NJ*

- Fellowship jointly offered by the Institute for Advanced Study (2 years) and the Flatiron Institute Center for Computational Astrophysics (3 years)

## EDUCATION

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### **Massachusetts Institute of Technology**

Ph.D. in Physics

GPA: 4.9/5.0

Advisor: Professor Nuno Loureiro

Thesis topic: H-mode access, H-mode pedestals, and alpha-driven Alfvén eigenmodes in high field tokamaks

Coursework includes: Quantum Field Theory II, General Relativity, Plasma Waves

*September 2020*

### **Princeton University**

A.B. in Physics with High Honors, Certificate in Latin American Studies

GPA: 3.9/4.0

Senior thesis advisor: Professor Herman Verlinde

Senior thesis topic: Force-free magnetohydrodynamics near Kerr black holes

Coursework includes: Quantum Field Theory I, Topological Matter

*June 2015*

## SELECTED HONORS AND AWARDS

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### **Rising Star in Physics (Program postponed to fall 2022 due to COVID-19)**

Invited to participate in a Heising-Simons Foundation program for the next generation of physics academic leaders.

*2020*

### **Plasma Science and Fusion Center (PSFC) Outreach Award**

Given to top leaders of PSFC tours, outreach talks, and exposition nights.

*2017, 2018, 2019*

### **First Place Student Presenter at the US/EU Transport Task Force**

*2017*

### **Kurt Forrest Fellowship**

“Prestigious award...initiated to attract the most promising physics graduate students” to MIT.

*2015*

### **Allen G. Shenstone Prize in Physics**

Given by Princeton Physics Department for “excellence in course work and promise in independent research.”

*2015*

### **Elected to Phi Beta Kappa**

*2015*

### **Elected to Society of 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**

Given by Princeton Physics Department for “excellence in course work and promise in independent research.”

*2014*

<b>Princeton Environmental Institute Grand Challenges Grant</b>	2013
Grant to support independently-arranged internship at Eindhoven University of Technology.	
<b>Shapiro Prize for Academic Excellence</b>	2012
Given by Princeton for “outstanding academic achievement.”	
<b>Pyka Memorial Prize in Physics</b>	2012
Given by Princeton Physics Department for “excellence in course work and promise in independent research.”	

## TEACHING EXPERIENCE

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<b>Lecturer, Simons Collaboration on Extreme Electrodynamics of Compact Sources Summer School</b>	2024
<b>Lecturer, NSF/APS DPP GPAP Summer School on Plasma Physics for Astrophysicists</b>	2021, 2023
<b>Lecturer, IAS Learning Seminars on Plasma Physics and Gravitational Waves</b>	2021, 2023
<b>Research Internship Advisor for Trystin McCann, Princeton Junior</b>	2021
<b>Grader, Fusion Energy (MIT Course 22.62)</b>	2019
<b>TA, Engineering Principles for Fusion Reactors (MIT Course 22.63)</b>	2018
<b>Undergraduate Research Advisor for Sean Parks, MIT Sophomore</b>	2017

## SELECTED TALKS AND SEMINARS

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<b>University of Wisconsin Department of Physics</b>	2024
Topic: Tearing-mediated reconnection in magnetohydrodynamic poorly ionized plasmas	
<b>“High Energy Plasma Phenomena in Astrophysics” Workshop, Munich Institute for Astro-, Particle and Bio-Physics</b>	2024
Topic: Tearing-mediated reconnection in magnetohydrodynamic poorly ionized plasmas I. Onset and linear evolution	
<b>Flatiron Institute Scientific Advisory Board</b>	2024
Topic: Tearing-mediated reconnection in magnetohydrodynamic poorly ionized plasmas I. Onset and linear evolution	
<b>Fifth Purdue Workshop on Relativistic Plasma Astrophysics</b>	2024
Topic: Tearing-mediated reconnection in magnetohydrodynamic poorly ionized plasmas I. Onset and linear evolution	
<b>Canadian Institute for Theoretical Astrophysics</b>	2024
Topic: Tearing-mediated reconnection in magnetohydrodynamic poorly ionized plasmas I. Onset and linear evolution	
<b>University of Michigan Nuclear Engineering and Radiological Sciences Department</b>	2024
Topic: Using tokamak physics to advance the understanding of light and energetic particle production in extreme plasmas	
<b>Princeton Astrophysics Department Astroplasmas Seminar</b>	2023
Topic: Tearing-mediated reconnection in magnetohydrodynamic poorly ionized plasmas I. Onset and linear evolution	
<b>APS Division of Plasma Physics Annual Meeting</b>	2023
Topic: Tearing-mediated reconnection in magnetohydrodynamic poorly ionized plasmas I. Onset and linear evolution	
<b>“Modeling Plasmas Around Black Holes” Workshop, Lorentz Center</b>	2023
Topic: Electric field screening by pair discharges in pulsar polar caps	
<b>CCA Observational Astrophysics Discussion Series</b>	2023
Topic: Pulsar radio emission variability	
<b>“Improving Black Hole Accretion Models with Plasma Theory” Workshop, Princeton Gravity Initiative/Princeton Center for Theoretical Science</b>	2023
Topic: Basic plasma theory for black-hole accretion physics	
<b>Princeton Plasma Physics Laboratory Theory Department</b>	2022
Topic: Electric field screening in pair discharges and generation of pulsar radio emission	
<b>West Virginia University Physics and Astronomy Department</b>	2022
Topic: Electric field screening in pair discharges and generation of pulsar radio emission	
<b>APS Division of Plasma Physics Annual Meeting</b>	2022
Topic: Onset of magnetic reconnection in poorly ionized plasmas	
<b>University of Maryland Astronomy Center for Theory and Computation</b>	2022

Topic: Electric field screening in pair discharges and generation of pulsar radio emission <b>“Coherent Structures in Astro-Geo-Turbulence” Workshop, Flatiron Institute</b>	2022
Topic: Turbulence in fusion plasmas <b>Fourth Purdue Workshop on Relativistic Plasma Astrophysics</b>	2022
Topic: Electric field screening in pair discharges and generation of pulsar radio emission <b>APS April Meeting</b>	2022
Topic: Electric field screening in pair discharges and generation of pulsar radio emission <b>Joint UCLA/UCSD/UCI Virtual Seminar</b>	2022
Topic: Electric field screening in pair discharges and generation of pulsar radio emission <b>Institute for Advanced Study Seminar</b>	2022
Topic: Electric field screening in pair discharges and generation of pulsar radio emission <b>Princeton Astrophysics Department Astroplasmas Seminar</b>	2021
Topic: Electric field screening in pair discharges and generation of pulsar radio emission <b>Journal of Plasma Physics Frontiers of Plasma Physics Colloquium</b>	2021
Topic: Drift kinetic theory of alpha particle transport by tokamak perturbations <b>APS Division of Plasma Physics Annual Meeting</b>	2020
Topic: Drift kinetic formulation of alpha particle transport by tokamak MHD perturbations <b>Plasma Physics Seminar at University of Maryland</b>	2020
Topic: Drift kinetic theory of tokamak alpha particle transport by MHD modes and ripple <b>18th European Fusion Theory Conference, Ghent, Belgium</b>	2019
Topic: Theory and modeling of fusion-alpha-driven TAEs in high magnetic field devices <b>12th Plasma Kinetics Working Meeting, Vienna, Austria</b>	2019
Topic: Implications of the high magnetic field path to fusion energy for Alfvén eigenmode stability <b>Aalto University, Espoo, Finland</b>	2019
Topic: MIT’s high magnetic field path to fusion energy and implications for Alfvén eigenmode stability <b>APS Division of Plasma Physics Annual Meeting</b>	2017
Topic: Tearing Instability of a Current Sheet Forming by Sheared Incompressible Flow <b>U.S. Transport Task Force Meeting</b>	2017
Topic: H-mode Access and Pedestal Characteristics at High Magnetic Field (7.8 T) in Alcator C-Mod Discharges	

## SELECTED SERVICE

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<b>Member, CCA Retreat Planning Committee</b>	2023
<b>Organizer, PGI/PCTS Workshop on Improving Black Hole Accretion Models with Plasma Theory</b>	2023
<b>Member-at-Large, APS Topical Group in Plasma Astrophysics Executive Committee</b> Position won with 76% of the vote	2022-2025
<b>Attendee, Aspen Center for Physics Workshop on Plasmas in Strong Gravity</b>	2022
<b>Attendee, 2022 Multi-Petawatt Physics Prioritization (MP3) Workshop</b>	2022
<b>Reviewer, Journal of Plasma Physics, Astrophysical Journal Letters, Nature Communications Physics, National Science Centre (Poland)</b>	2021-
<b>Advisory Board Member, Journal of Plasma Physics</b> Provided advice to Journal editorial board and participated in or led a variety of initiatives to improve the Journal, including the creation of the Journal Twitter feed and the selection of featured articles	2019-2023

<b>Plasma Science and Fusion Center Outreach Volunteer and Event Coordinator</b>	2016-2020
<b>Co-Captain and Co-Founder, PSFC FC (Intramural Soccer Team)</b>	2017
<b>Player, PSFC FC (Intramural Soccer Team)</b>	2017-2020
<b>Resident Assistant, The Warehouse Graduate Residence</b>	2016-2019
<b>Member, MIT Radiation Protection Committee</b>	2015-2019
<b>Co-Leader and Co-Founder of the MIT Plasma Physics Graduate Student Group</b> Group to advocate for the interests of plasma physics students to Physics Department leadership and Visiting Committee	2019-2023
<b>Delegate, U.S. Magnetic Fusion Research Strategic Directions Workshop</b>	2017
<b>Panelist, Fellowship Opportunities for Graduate Students in Plasma Physics (Panel at the Annual Meeting of the APS Division of Plasma Physics)</b>	2017

## FIRST AUTHOR JOURNAL PUBLICATIONS

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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 transport by neoclassical tearing modes*, accepted to Journal of Plasma Physics (arXiv:2406.13884).
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*, ApJ 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*, ApJL 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. Marmor, *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. Marmor, 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

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1. P.J. Catto, **E.A. Tolman**, and F.I. Parra, *Merging of the superbanana plateau and  $\sqrt{v}$  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*, ApJ 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. 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. Marmor, 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. Marmor, 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  $\rho_*$  scaling of intrinsic rotation in C-Mod plasmas with edge transport barriers*, Nuclear Fusion 57, 116004 (2017).

## CONFERENCE PROCEEDINGS AND WHITE PAPERS

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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. Gutfenfelder, 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 US Burning Plasma (2018).