THOMAS ARCHER MARKS

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EDUCATION

Doctor of Philosophy in Aerospace Engineering and Scientific Computing — September 2023

University of Michigan, Ann Arbor, MI, USA

Dissertation: Modeling Anomalous Electron Transport in a Fluid Hall Thruster Code

Advisor: Professor Benjamin Jorns

Bachelor of Science in Aerospace Engineering — May 2018

Texas A&M University, College Station, TX, USA

Magna cum laude

RESEARCH EXPERIENCE

Assistant Research Scientist — November 2025–Present

Department of Aerospace Engineering, University of Michigan

Computational Autonomy Group

- Pursuing generative modeling techniques to accelerate closure modeling and to solve inverse problems in low temperature plasmas.
- Modeling complex plasma chemistry in a Hall thruster as part of the Space Power and Propulsion for Agility, Responsiveness, and Resilience (SPAR) institute.

Postdoctoral Research Fellow — 2023 – 2025

Department of Aerospace Engineering, University of Michigan

Supervisor: Professor Alex Gorodetsky

- Applied high-performance, GPU-accelerated computing to kinetic simulations of low-temperature plasma devices.
- Developed predictive engineering models of Hall thrusters as part of the NASA's Joint Advanced Propulsion Institute (JANUS).

Graduate Student Research Assistant — 2018–2023

Department of Aerospace Engineering, University of Michigan

Advisor: Professor Benjamin Jorns

- Simulated plasma expansion in magnetic nozzles.
- Assisted in high-power Hall thruster design and testing.
- Wrote one-dimensional open-source Hall thruster code *HallThruster.jl*.
- Developed and tested models for Hall thruster anomalous electron transport.

Intern — June–August 2020

Jet Propulsion Laboratory, Pasadena, California (remote)

Supervisor: Dr. Alejandro Lopez Ortega

- Modified Hall thruster code Hall2De to simulate magnetic nozzles.
- Assessed role of instability-induced transport in magnetic nozzle electron dynamics.

Undergraduate Research Assistant — 2017–2018

Department of Aerospace Engineering, Texas A&M University

Advisor: Professor Christopher Limbach

- Aligned Nd-YAG laser for use in laser-induced fluorescence (LIF) experiments.
- Assembled and aligned infrared dye laser for use in LIF experiments.
- Performed LIF of xenon-helium glow discharge to probe metastable Xe density.

Advisor: Professor Kentaro Hara

- Wrote numerical model of electrostatic potential at plasma-liquid interface.
- Assessed depth of charge penetration into liquid to evaluate plasma medicine concept.

TEACHING EXPERIENCE

Graduate Student Instructor — January–May 2021

Department of Aerospace Engineering, University of Michigan
AEROSP 335: *Aerospace Propulsion*
- Wrote weekly homework assignments for third-year aerospace students
- Graded exams and hosted weekly office hours.

Teaching Assistant   2016–2017
Department of International Studies, Texas A&M University
GERM 101: *Beginning German I* & GERM 102: *Beginning German II*
- Taught biweekly classes to first-year students.
- Tutored students in German twice/week outside of class.

SKILLS

- **Numerical methods:** Particle and fluid methods for PDEs, Diffusion models, surrogate modeling, Bayesian inference, Monte Carlo methods.
- **Experimental techniques:** Hall thruster operation, plasma probe construction, laser system setup and alignment. Analysis of common plasma diagnostics.
- **Software:** Linux, MacOS, Windows. High-performance computing on SLURM clusters. LaTeX, Typst, Microsoft Office.
- **Programming languages:** Julia, C, C++, CUDA, Python, Fortran, MATLAB, Javascript.
- **Human languages:** English (native), German (intermediate), Italian (intermediate).

HONORS AND AWARDS

Best Paper in Session   June 2024
2024 International Electric Propulsion Conference. Toulouse, France.
> T.A. Marks and A.A. Gorodetsky, *Hall thruster simulations in WarpX.*

Best Paper: Electric Propulsion   January 2023
2023 AIAA SciTech Forum. National Harbor, MD.
> L.L. Su et al. *Operation and Performance of a Magnetically Shielded Hall thruster at Ultrahigh Current Densities on Xenon and Krypton.*

Best Paper: Electric Propulsion   2020
2020 AIAA Propulsion and Energy Forum. Remote.
> B.A. Jorns, T.A. Marks, and E.T. Dale. *A Predictive Hall Thruster Model Enabled by Data-Driven Closure.*

JOURNAL PUBLICATIONS

- **Marks, T. A.,**, Eckels, J.D, Mora, G.A., & Gorodetsky, A.A. (2025). *Uncertainty quantification of a multi-component Hall thruster model at varying facility pressures.* Journal of Applied Physics, 138 (15).
- **Marks, T. A.,** & Gorodetsky, A.A. (2025). *GPU-accelerated kinetic Hall thruster simulations in WarpX.* Journal of Electric Propulsion, 4(34).
- Eckels, J.D., **Marks, T. A.,** Allen, M.G., Jorns, B.A., & Gorodetsky, A.A. (2024). *Hall thruster model improvement by multidisciplinary uncertainty quantification.* Journal of Electric Propulsion, 3(19).
- Su, L.L., **Marks, T. A.,** & Jorns, B.A. (2024). *Trends in mass utilization of a magnetically shielded hall thruster operating on xenon and krypton.* Plasma Sources Science and Technology, 33(6), 065008.
- Su, L.L., Roberts, P.J., Gill, T.M., Hurley, W.J., **Marks, T. A.,** Sercel, C.L, Allen, M.G., Whittaker, C.B., Viges, E. and Jorns, B. A. (2024). *High-current density performance of a magnetically shielded Hall thruster.* Journal of Propulsion and Power, 1-18.
- **Marks, T. A.** & Jorns, B.A. (2023). *Evaluation of algebraic models of anomalous transport in a multi-fluid Hall thruster code.* Journal of Applied Physics, 134(15), 153301.
- **Marks, T. A.** & Jorns, B.A. (2023). *Challenges with the self-consistent implementation of closure models for anomalous electron transport in fluid simulations of Hall thrusters.* Plasma Sources Science and Technology, 32 (4), 0450516.
- **Marks, T. A.,** Schedler, P. & Jorns, B.A. (2023). *HallThruster.jl: A Julia package for 1D Hall thruster discharge simulation.* Journal of Open Source Software, 8 (86), 4672.

CONFERENCE PUBLICATIONS

- **Marks, T. A.** & Gorodetsky, A.A. (2025). *Towards kinetic axial-azimuthal Hall thruster simulations including ionization.* 39th International Electric Propulsion Conference, London, United Kingdom. #129.
- **Marks, T. A.** & Gorodetsky, A.A. (2024). *Hall thruster simulations in WarpX.* 38th International Electric Propulsion Conference, Toulouse, France. #409.
- Eckels, J.D., **Marks, T. A.**, Aksoy, D., Vutukury, S., & Gorodetsky, A.A. (2024). *Dynamic mode decomposition for particle-in-cell simulations of a Hall thruster and plume.* 38th International Electric Propulsion Conference, Toulouse, France. #412.
- Aksoy, D., Vutukury, S., **Marks, T. A.**, Eckels, J.D. & Gorodetsky, A.A. (2024). *Compressed analysis of electric propulsion simulations using low-rank tensor networks.* 38th international Electric Propulsion Conference, Toulouse, France. # 795.
- Lipscomb, C.P., Stasiukevicius, M.J., Boyd, I.D., Hansson, K.B., **Marks, T. A.**, Brick, D.G., & Jorns, B. A. (2024). *Evaluation of H9 Hall thruster plume simulations using coupled thruster and facility models.* 38th International Electric Propulsion Conference, Toulouse, France. #483.
- Allen, M.G., **Marks, T. A.**, Eckels, J.D., Gorodetsky, A.A., & Jorns, B.A. (2024). *Optimal Experimental Design for Interring Anomalous Electron Transport in a Hall thruster.* AIAA SciTech 2024 Forum, Orlando, FL, USA. #2164.
- **Marks, T. A.** & Jorns, B.A. (2023). *Evaluation of several first-principles closure models for Hall thruster anomalous transport.* AIAA SciTech 2023 Forum, National Harbor, MD, USA. #0067.
- Su, L.L., Roberts, P.J., Gill, T.M. Hurley, W.J., **Marks, T. A.**, Sercel, C.L., Allen, M.G., Whittaker, C.B., Byrne, M., Brown, Z., Viges, E. and Jorns, B.A. (2023). *Operation and performance of a magnetically-shielded Hall thruster at ultrahigh current densities on xenon and krypton.* AIAA Scitech 2023 Forum, National Harbor, MD, USA. #0842.
- Hurley, W.J., **Marks, T. A.**, & Jorns, B.A. (2023). *Design of an air-core circuit for a Hall thruster.* AIAA SciTech 2023 Forum, National Harbor, MD, USA. #0841.
- **Marks, T. A.** & Jorns, B.A. (2022). *Modeling anomalous electron transport in Hall thrusters using surrogate methods.* 38th International Electric Propulsion Conference, Boston, MA, USA. #344.
- Su, L.L., **Marks, T. A.**, & Jorns, B.A. (2022). *Investigation into the efficiency gap between krypton and xenon operation on a magnetically shielded Hall thruster.* 38th International Electric Propulsion Conference, Boston, MA, USA.
- Hurley, W.J., **Marks, T. A.**, Gorodetsky, A.A. & Jorns, B.A. (2022). *Application of Bayesian inference to develop an air-core magnetic circuit for a magnetically shielded Hall thruster.* 38th International Electric Propulsion Conference, Boston, MA, USA.
- **Marks, T. A.**, Lopez Ortega, A., Mikellides, I.G., & Jorns, B.A. (2021). *Self-consistent implementation of a zero-equation transport model into a predictive model for a Hall effect thruster.* AIAA Propulsion and Energy 2021 Forum, Remote. #3424.
- **Marks, T. A.**, Lopez Ortega, A., Mikellides, I.G., & Jorns, B.A. (2020). *Hall2De simulations of a magnetic nozzle.* AIAA Propulsion and Energy 2020 Forum, Remote. #3642.
- Jorns, B.A., **Marks, T. A.**, & Dale, E.T. (2020). *A predictive Hall thruster model enabled by data-driven closure.* AIAA Propulsion and Energy 2020 Forum, Remote. #3622.