

Curriculum Vitae

Dr. Thomas A. Marks

Postdoctoral Research Fellow

Department of Aerospace Engineering

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Education and Training

2023 **Ph.D. in Aerospace Engineering and Scientific Computing**

University of Michigan

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

Committee: Alec Gallimore, Alejandro Lopez Ortega, Alex Gorodetsky, Mark Kushner, and Benjamin Jorns (chair)

2018 **B.S. Aerospace Engineering, *magna cum laude***

Texas A&M University

Research and Professional Experience

Dr. Thomas Marks currently investigates the application of high-performance computing to the simulation of non-equilibrium plasmas as part of the Computational Autonomy group at the University of Michigan. In particular, he is leveraging particle-based kinetic methods to investigate anomalous cross-field momentum and energy transport in low temperature magnetized plasmas for space propulsion and materials processing applications. In addition, Dr. Marks is also pursuing novel tensor-based methods of data reduction and compression for fully kinetic plasma simulations, as well as leading predictive Hall thruster modelling efforts as part of NASA's cross-institutional Joint Advanced Propulsion Institute (JANUS). During his Ph.D., Dr. Marks's research focused on the development and evaluation of reduced-order closure models for anomalous electron transport in Hall effect thrusters. During this time, Dr. Marks also assisted in the design, construction and testing of ultra-high-current density Hall thrusters as part of the Plasmadynamics and Electric Propulsion Laboratory (PEPL). As part of the lab, Dr. Marks worked in close collaboration with his experimental colleagues and gained experience obtaining and analyzing data gathered from low-temperature plasma diagnostics, including non-invasive techniques such as Laser Induced Fluorescence (LIF) as well as conventional plasma probes.

Skills

- **Modeling and simulation**
 - Fluid (finite volume, finite difference) and kinetic (particle-in-cell)
 - Programming languages: C, C++, Fortran, Julia, CUDA, Python, Matlab
- **Experimental**
 - Hall thruster operation
 - Plasma diagnostic data analysis

Publications and Activities

- **Member:** American Institute of Aeronautics and Astronautics (AIAA)
- **Journal Reviewer:** Journal of Electric Propulsion, Journal of Open-Source Software
- **Open-Source Software Contributor:**
 - WarpX (Exascale Computing Project), HallThruster.jl (University of Michigan).
- **Honors and Awards**
 - 2020 AIAA Propulsion and Energy Forum Best Paper Award, Electric Propulsion
 - 2023 AIAA SciTech Best Paper Award, Electric Propulsion
- **Selected Publications:**
 1. T. A. Marks and Alex A. Gorodetsky, **2024**. *Hall thruster simulations in WarpX*. 38th International Electric Propulsion Conference, Toulouse, France.
 2. L. L. Su, P.J. Roberts, T. M. Gill, W. J. Hurley, T.A. Marks, C.L. Sercel, M. G. Allen, C. B. Whittaker, E. Vigés, and B. A. Jorns. **2024**. *High-current density performance of a magnetically shielded hall thruster*. AIAA Journal of Propulsion and Power, 1–18.
 3. L. L. Su, T. A. Marks, B. A. Jorns. **2022**. *Trends in mass utilization of a magnetically shielded hall thruster operating on xenon and krypton*. Plasma Sources Science and Technology, 33(6), 065008.
 4. T. A. Marks and B. A. Jorns, **2023**. *Evaluation of algebraic models of anomalous transport in a multi-fluid Hall thruster code*. Journal of Applied Physics 134, 153301.
 5. T. A. Marks and B. A. Jorns, **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, 045016
 6. T. A. Marks, P. Schedler, and B. A. Jorns, **2023**. *HallThruster.jl: a Julia Package for 1D Hall thruster discharge simulation*. Journal of Open Source Software 8 (86), 4672
 7. T. A. Marks, B. A. Jorns. **2023**. *Evaluation of several first-principles closure models for Hall thruster anomalous transport*. AIAA SciTech 2023 Forum, 0067.
 8. L. L. Su, P.J. Roberts, T. M. Gill, W. J. Hurley, T.A. Marks, C.L. Sercel, M. G. Allen, C. B. Whittaker, M. P. Byrne, Z. Brown, E. Vigés, and B. A. Jorns. **2023**. *Operation and Performance of a Magnetically Shielded Hall Thruster at Ultrahigh Current Densities on Xenon and Krypton*. AIAA SciTech 2023 Forum, 0842.
 9. W. J. Hurley, T. A. Marks, B. A. Jorns. **2023**. *Design of an Air-Core Circuit for a Hall Thruster*. AIAA SciTech 2023 Forum, 0841.
 10. L. L. Su, T. A. Marks, B. A. Jorns. **2022**. *Investigation into the efficiency gap between krypton and xenon operation on a magnetically shielded Hall thruster*. 37th International Electric Propulsion Conference, Boston, MA.
 11. T. A. Marks, A. Lopez Ortega, I. G. Mikellides, B. A. Jorns. **2021**. *Self-consistent implementation of zero-equation transport model into a predictive model for a Hall effect thruster*. AIAA Propulsion and Energy 2021 Forum, 3424.
 12. T. A. Marks, A. Lopez Ortega, I. G. Mikellides, B. A. Jorns. **2020**. *Hall2De Simulations of a Magnetic Nozzle*. AIAA Propulsion and Energy 2020 Forum, 3642.
 13. B. A. Jorns, T. A. Marks, E. T. Dale. **2020**. *A Predictive Hall Thruster Model Enabled by Data-Driven Closure*. AIAA Propulsion and Energy 2020 Forum, 3622.