Jacob Fruchtman | Curriculum Vitae

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Research Interests

- Solar Wind – Magnetosphere interactions
- Heliospheric particle energization processes
- Interpretation of spacecraft measurements of particle and field data
- Multipoint space weather monitoring

Education

Ph.D. Physics **University of Iowa**
Advisor: Jasper Halekas 8/2020 – 11/2024

Statistical analyses of the multi-scale spatial and temporal variation of Martian bow shock and magnetosheath structure

- Designed and implemented refined organizational methods for large datasets of solar wind and magnetosheath spacecraft measurements which provides finer scale resolution, enabling precision statistical analyses.
- Wrote algorithm to run through MAVEN dataset and identify bow shock crossings and associated characterizing intervals of interest, allowing for large scale statistical analyses of bow shock structures.
- Promoted research transparency by releasing full codebase, dataset, and documentation of papers' algorithms on GitHub to facilitate replication and verification of results.

M.S. Physics **Case Western Reserve University**
Advisor: Corbin Covault 8/2018 – 4/2020

Analysis on the Feasibility of a prototype SOFOS Telescope Module for Optical SETI

- Built and tested Optical SETI prototype using high energy cosmic ray detection techniques
- Conducted Monte Carlo simulations to assess performance of simultaneous telescope detections.
- Employed new laboratory techniques and applied expertise in carrying out enhanced experiments under supervision of senior lab members.
- Interfaced with manufacturers to troubleshoot lab equipment.
- Sourced and distributed historical user manuals to enhance operational efficiency of laboratory equipment.

B.S. in Engineering Physics (PHYS) **Ramapo College of New Jersey**
Minors: Math, Computer Science (MATH, COMP) 9/2013 – 12/2017

Final year summer research internship, under Catalin Martin: Setup and measured Kerr magneto-optical effects in YIG crystal

Scholarships and Awards

- The 2022 G. William Pfeifer & Marilyn M. Maltby Scholarship
- The Andrew Nelson Scholarship (*2021)*
- *Ramapo College Dean's List (Spring 2015, Fall 2015, Fall 2016, Spring 2017, Fall 2017)*
- *The 2015 Frank E. and Lillian A. Mutter Scholarship*
- *Ramapo College Merit Scholarship*

Teaching Experience & Service Work

Graduate Teaching Assistant: Physics 2 for Engineers **09/2020 –12/2020**
University of Iowa Department of Physics and Astronomy

Math Tutor: Calculus and Discrete Mathematics **11/2016 – 12/2017**
Ramapo College TAS Mathematics and Science Tutoring Center (now the the "STEM Center")

The Mars Space Weather Collaboration **6/2023 – Present**

- Participated in meetings to develop collaboration between MAVEN and NASA's Community Coordinated Modeling Center (CCMC) and Moon-to-Mars (M2M) Space Weather Analysis Office for predicting, monitoring, and studying space weather at Mars in preparation for human exploration.

MAVEN *Tohban* **03/2024 – 12/2024**

- As part of cycling team duty, created Tohban reports, analyzing most recent week MAVEN spacecraft Particle and Fields (PFP) instrument time-series data to identify data gaps and plasma processes of interest for download of MAVEN PFP high-resolution / burst mode datasets.

Peer Reviewer: *Astronomy & Astrophysics* (2026), *Earth and Space Science* (2026), *Journal of Geophysical Research: Space Physics* (2026).

Publications

Burne, S., Boscoboinik, B., …, **Fruchtman, J.**, …, Gomez, D. (2026). Correlated response of the Martian day-side Magnetic Pileup Boundary and Bow Shock to atmospheric and solar wind-related drivers. *The Astrophysical Journal, 1005*(2), 233.

Mazelle, C., Meziane, K., Wedlund, C. S., …, **Fruchtman, J.**, …, Curry, S. (2026). Foreshock Electrons Impact Ionization Effect on the Amplitude of Pickup-Proton Generated Waves:

Consequence on Exosphere Density Determination. *Journal of Geophysical Research: Space Physics.* (submitted)

Halekas, J. S., Mitchell, D. L., Mazelle, C. X., Espley, J. R., & **Fruchtman, J.** (2025). Ion reflection from the Martian bow shock. *Journal of Geophysical Research: Space Physics*, 130, e2025JA034317.

Zhang, C., Dong, C., …, **Fruchtman, J.**, …, Li, X. (2025). Role of ULF waves in reforming the Martian bow shock. *AGU Advances*, 6, e2025AV001654.

Fruchtman, J., Halekas, J., Eparvier, F. G., Gruesbeck, J., Mazelle, C., & Mitchell, D. (2024). Application of a scale normalization technique for high resolution analysis of the magnetosheath at mars. *Journal of Geophysical Research: Space Physics*, 129, e2024JA033166.

Fruchtman, J., Halekas, J., Gruesbeck, J., Mitchell, D., & Mazelle, C. (2023). Seasonal and Mach Number Variation of the Martian Bow Shock Structure. *Journal of Geophysical Research: Space Physics*, *128*(8), e2023JA031759.

Conference Posters

Mazelle, C. X., Meziane, K., Wedlund, C. L. S., Bertucci, C., Romanelli, N., Zhang, C., ... & Curry, S. (2025). Foreshock Electron Impact Ionization Effect on the Amplitude of Pickup Proton-Generated Waves. *AGU25*.

Fruchtman, J., Halekas, J., Eparvier, F., Gruesbeck, J., Mazelle, C., & Mitchell, D. (2024). Utilization of a new length scale normalization binning technique to resolve high resolution structure in the Martian magnetosheath. *AGU24*

Halekas, J. S., Fruchtman, J., McFadden, J. P., Mitchell, D., Mazelle, C. X., & Espley, J. R. (2024) The Effects of Exospheric Hydrogen on the Martian Upstream, Bow Shock, and Magnetosheath. *AGU24*.

Mazelle, C. X., Meziane, K., Wedlund, C. S., Halekas, J. S., Romanelli, N., Hamza, A. M., ... & Curry, S. Fast Proton Beams Observed Upstream of the Martian Bow Shock. *AGU24*.

Chamberlin, P. C., DiBraccio, G. A., Lee, C. O., Collado-Vega, Y. M., Mays, M. L., Wiegand, C., ... & Thiemann, E. (2023). The Mars Space Weather Collaboration. *AGU23*.

Fruchtman, J., Halekas, J. S., & Gruesbeck, J. (2023). Refined Analysis of Martian Magnetosheath Structure. *AGU23*.

Fruchtman, J., Halekas, J. S., & Gruesbeck, J. (2022, December). Seasonal invariance of the Martian Bow Shock structure. In *AGU Fall Meeting Abstracts* (Vol. 2022, pp. SM32A-69).

Fruchtman, J., Halekas, J., & Gruesbeck, J. (2021, December). Analysis on the dependence of the

Martian Bow Shock on Seasonal and Solar Wind Variations. In *AGU Fall Meeting Abstracts* (Vol. 2021, pp. SM55C-1794).

Fruchtman, J., & Covault, C. (2020). Performance of a Prototype Telescope Module for Optical SETI. *Bulletin of the American Physical Society*, *65*.

Selected Talks

Departmental Space physics and astrophysics seminar series 10/2024
An improved technique for analyzing spatial distributions of spacecraft measurements, as applied to the Martian Magnetosheath

Halekas research group weekly meeting 3/2024
Exploiting Scale Normalization to study fine scale structure in the Martian Magnetosheath

MAVEN PSG Meeting 10/2023
Exploiting Scale Normalization to study fine scale structure in the Magnetosheath

Departmental Space physics and astrophysics seminar series 3/2023
Seasonal and Mach number variation in the Martian bow shock structure

Halekas research group weekly meeting 8/2022
Seasonal invariance of the Martian Bow shock

MAVEN PSG Meeting 5/2022
Seasonal (in)variance of Martian bow shock structure via statistical analysis

Professional Memberships

The Mars Space Weather Collaboration *2023 - Present*
American Geophysical Union *2021 - 2024*
MAVEN team *2021 - 2024*

Research Skills

Data Analysis:
Spacecraft time-series data, Statistical aggregation techniques, Data visualization, Spatial analysis, Machine learning
Spacecraft Instruments
Magnetometer data, electrostatic analyzer data (solar wind electrons and ions)
Experimental Equipment:

Lasers, Optics, Photomultiplier tube construction and use, High Voltage power supply handling, Soldering electronic devices

Programming Languages:

IDL, Python, C++, C#, Shell Script, Matlab, Wolfram Mathematica

Advanced Graduate level coursework:

Space and Astrophysical Plasma, Plasma Physics 1 and 2, Advanced Plasma Physics, General Relativity, Particle Physics, Quantum Field Theory, Non-equilibrium Statistical Mechanics