Sarah Henderson, Ph.D.

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https://shend52.github.io/simple-website-template/

Education

University of Iowa: Iowa City, IA **Aug. 2021 – Sep. 2023**

PhD in Physics

University of Iowa: Iowa City, IA **Aug. 2017 – Aug. 2019**

MS in Physics GPA: 3.94

Lafayette College: Easton, PA **Aug. 2012 – May 2016**

BA in Physics, German GPA: 3.79

Experience

Postdoctoral Research Scholar **Dec. 2023 – Present**

Montana State University Bozeman, MT

Examining temporal and spatial evolution of corotating interaction regions (CIRs) in the solar wind using a combination of STEREO, MAVEN, and Juno data under the advisory of Prof. Rachael Filwett. Generating catalog of MAVEN CIRs to then cross-correlate with other heliospheric assets to understand particle acceleration processes within these structures.

Graduate Research Assistant **Aug. 2021 – Sep. 2023**

The University of Iowa Iowa City, IA

Worked under the advisory of Prof. Jasper Halekas as a member of the Mars Atmosphere and Volatile EvolutioN (MAVEN) team. I focused on the behavior of precipitating solar wind hydrogen in the Martian environment. I examined the global behavior of charged byproducts that result from solar wind interactions with the extended Martian hydrogen corona. Analyzed the behavior of H^- and H^+ in the Martian atmosphere using electron, ion, and neutral data from three instruments onboard MAVEN. Familiar with data products of MAVEN's SWIA, SWEA, NGIMS, EUVM, and MAG instruments. All of my work was done utilizing a combination of TPLOT and SPEDAS libraries, as well as my own Python and IDL scripts.

Research Scientist **Sept. 2019 – July 2021**

Science Systems and Applications Inc. Greenbelt, MD

Former member of the Moderate Resolution Imaging Spectroradiometer (MODIS) characterization and support team. Helped to calibrate data from the MODIS instrument onboard NASA's Aqua and Terra spacecraft, as well as assisted in instrument operations by scheduling calibration events. Researched ways in which our calibration could be improved by analyzing data from various onboard calibration instruments, including the Solar Diffuser and Solar Diffuser Stability Monitor. All of our major calibration work was done using historic IDL codes maintained on GitHub, and personal research was done using code that I wrote in Python to unpack and model data using a multitude of libraries and modules.

Graduate Research Assistant **Jan. 2018 – Aug. 2019**

The University of Iowa Iowa City, IA

Analyzed global characteristics of penetrating protons at Mars using a combination of pre-written scripts and my own IDL and Python scripts to unpack data collected by two instruments onboard the Mars Atmosphere and Volatile EvolutioN (MAVEN) spacecraft under the advisory of Prof. Jasper Halekas. Specifically focused on the behavior of these ions as a function of solar zenith angle, altitude, column depth, season, magnetic field orientation, and solar wind parameters. Also compared the observed behavior of this particle population to various models. Completed writing a Master's thesis entitled: *An Analysis of Precipitating Solar Wind Hydrogen at Mars: Observations by the MAVEN Spacecraft.*

Teaching Assistant **Aug. – Dec. 2017**

The Univeristy of Iowa Iowa City, IA

Taught four labs per week for an introductory astronomy course. Responsible for leading labs independently and grading students' work.

EXCEL Scholar **Aug. 2015 – May 2016**
Lafayette College Easton, PA

Worked under the advisory of David Nice to complete my Bachelor's thesis. Analyzed raw pulsar data from the Arecibo Telescope backend, Wideband Arecibo Pulsar Processor (WAPP). Removed dispersive effects and scintillation from 9 years of WAPP data from multiple pulsar sources using PSRCHIVE tools and original Python scripts. Calculated times of arrivals of pulses, dispersion measure, and other astronomical constants in these data files and incorporated results into the preexisting NANOGrav 9-year data set. Goal of this project was to provide more calibrated data for the NANOGrav dataset in order to increase likelihood of gravitational wave perturbation detection using pulsar array timing.

EXCEL Scholar **June 2015 – Aug. 2015**
Universität Bielefeld Bielefeld, NRW, DE

Independently conducted research under the advisory of Joris Verbiest using data collected from the Low Frequency Array (LOFAR). Focused on determining temporal characteristics of "mode-switching" (i.e., when a pulsar's profile seemingly changes its characteristic shape) in PSR J0332+5434. This was done by analyzing large quantities of single-pulse files from PSR J0332+5434 using PSRCHIVE routines and my own Python scripts.

Supplemental Instructor **Jan. 2014 – May 2016**
Lafayette College Easton, PA

Class tutor resource for introductory physics courses. Conducted two one-hour sessions per week, attended lecture three times per week, and held office hours two hours per week.

EXCEL Scholar **May 2014 – Dec. 2014**
Lafayette College Easton, PA

Conducted research under the advisory of David Nice on the NANOGRAV project, PIRE: An International Pulsar Timing Array for Gravitational Wave Detection. Viewed various pulsar profiles and developed programs in Python to analyze the shape of pulses. Sought to model pulse profiles from various pulsars using superposition of Gaussian curves to be implemented in generating times of arrival for the NANOGrav dataset.

Conferences

MAVEN PSG **June 10-14, 2024**
Cité de l'espace Toulouse, France

Gave three 6 minute oral presentations: *Characterizing Precipitation Behaviors of H^- in the Martian Atmosphere through MAVEN Observations*, *Determining Atmospheric Drivers of H^- Precipitation: A Simple Mathematical Model*, and *Creating a Catalog of Corotating Interaction Region Events at MAVEN*. Served as chairperson for the "Ionosphere" session.

TESS **April 7-12, 2024**
Hilton Anatole Dallas, TX

MAVEN PSG **May 23-25, 2023**
University of Colorado at Boulder Boulder, CO

Presented poster titled *Precipitating Solar Wind Hydrogen: A Tale of Equilibrium.*

European Geosciences Union **April 23-28, 2023**
Austria Center Vienna, AT

Gave oral presentation titled *Influence of Magnetic Fields on Precipitating Solar Wind Hydrogen at Mars* and served as chairperson for "Mars science and exploration" session.

American Geophysical Union **Dec. 12-16, 2022**
McCormick Place Chicago, IL

Presented poster titled *Characterizing Energy Spectra of Precipitating Solar Wind H^+ and H^- at Mars.*

MAVEN QSR PSG **Oct. 17–20, 2022**
Boston University Boston, MA

Gave 7 minute oral presentation titled *Characterizing Energy Spectra of Precipitating Solar Wind H^+ and H^- at Mars.*

MAVEN QSR PSG **May 9–12, 2022**
University of Colorado at Boulder Boulder, CO

Gave 7 minute oral presentation titled *Influence of Magnetic Fields on Precipitating Solar Wind Hydrogen at Mars.*

MODIS/VIIRS Science Team Meeting **Nov. 18–19, 2019**
University of Maryland College Park, MD

American Geophysical Union **Dec. 10–14, 2018**
Walter E. Washington Convention Center Washington, DC

Gave 15 minute oral presentation titled *Observations of Precipitating Solar Wind Hydrogen in the Martian Ionosphere.*

MAVEN PSG **Oct. 24–27, 2018**
University of Colorado at Boulder Boulder, CO

Presented a poster *An Analysis of Precipitating Solar Wind Hydrogen in the Martian Ionosphere.*

MAVEN PSG **March 12–16, 2018**
University of Colorado at Boulder Boulder, CO

NANOGrav Conference **Oct. 19–21, 2015**
McGill University Montreal, Canada

Gave ten minute oral presentation, *An Analysis of Mode-Switching in PSR J0332+5434.*

Workshops

Heliophysics Summer School **Aug. 1 – 12, 2022**
NASA Living With A Star Remote

Participated in two week school that focused on the connection between observational and modeling heliophysics. Listened to lectures given by experts in the field and completed various lab activities.

CaNoRock Research Workshop **June 24 – July 5, 2019**
The University of Iowa Kananaskis, Alberta, Canada

Participated in two week research workshop with PhD students from Canada, Norway, and the US. Analyzed ESA Swarm data to characterize behaviors of region 1 and 2 currents and conductances in the Earth's ionosphere/magnetosphere. Wrote Python code to analyze how these parameters changed as a function of solar zenith angle and contributed to writing a manuscript.

Publications

- Henderson, S., Halekas, J. S., Jolitz, R. D., Mitchell, D., Eparvier, F., and Elrod, M. (2024) "Characterizing Precipitation Behaviors of H^- in the Martian Atmosphere", *Journal of Geophysical Research: Space Physics*, 129, e2024JA032420. https://doi.org/10.1029/2024JA032420 .
- Henderson, S., Halekas, J. S., Girazian, Z., Elrod, M., and Espley, J. (2022) "Influence of Magnetic Fields on Precipitating Solar Wind Hydrogen at Mars", *Geophysical Research Letters*, doi:10.1029/2022GL099114 .
- Sarah Henderson, Kevin Twedt, Xiaoxiong Xiong, "Impact of the screen configurations on the estimated Terra MODIS SD degradation," Proc. SPIE 11858, Sensors, Systems, and Next-Generation Satellites XXV, 118581C (12 September 2021); https://doi.org/10.1117/12.2597322
- K. A. Twedt, S. Henderson, X. Xiong, A. Angal and X. Geng, "Nonlinear Detector Response of Aqua MODIS Land Imaging Bands," in IEEE Transactions on Geoscience and Remote Sensing, doi: 10.1109/TGRS.2021.3075384.
- Henderson, S., Halekas, J.S., Lillis, R., and Elrod, M. (2021). "Precipitating Solar Wind Hydrogen as Observed by the MAVEN Spacecraft: Distribution as a Function of Column Density, Altitude, and Solar Zenith Angle", *Journal of Geophysical Research: Planets*, doi:10.1029/2020JE006725
- Olifer, L., Feltman, C., Ghaffari, R., Henderson, S., Huyghebaert, D., Burchill, J., Jaynes, A., Knudsen, D., McWilliams, K., Moern, J., Spicher, A., Wu, J. (2021). "Swarm Observations of Dawn/Dusk Asymmetries Between Pedersen Conductance in Upward and Downward Field-Aligned Current Regions". *Earth and Space Science*, doi:10.1029/2020EA001167

Funding

- Recipient of the Pfeiffer Family Scholarship 2023
- Recipient of the Pierazzo International Student Travel Award 2023
- Recipient of NASA Iowa Space Grant 2022/23
- Recipient of NASA Iowa Space Grant 2018/19

Academic Honors

- Nominated for L.B. Sims Outstanding Master's Thesis Award, 2021
- Graduated magna cum laude: Lafayette College, 2016
- **ΦBK**: National Honors Society for Arts and Sciences, inducted Spring 2016
- ΣΠΣ: National Physics Honors Society, inducted Spring 2015
- **ΔΦA**: National German Honors Society, inducted Fall 2013

Service

2024	NASA FINESST review panel, member
2024	Journal of Geophysical Research, Publications, reviewed 1 manuscript
2023	Journal of Geophysical Research, Publications, reviewed 1 manuscript
2023	Invited to attend Conference for Undergraduate Women in Physics (CUWiP) at Montana State University as a panel speaker
2022 - 2023	Member of Graduate Student Advisory Committee (Summer 2022-Summer 2023). This group serves as a means of direct communication between graduate students and faculty to discuss various issues within the department (classes, wages, policies, etc.).
2022 - 2023	Graduate Student Mentor (Fall 2022-Spring 2023). I served alongside two other senior graduate students as a mentor to first and second year PhD students in the physics department. We met on a monthly basis to discuss classes, research, and graduate school in general.
2022	Helped to organize Conference for Undergraduate Women in Physics (CUWiP) at the University of Iowa (Jan. 20 - 23, 2023). Recruited plenary speakers, panelists, and applicants for the conference. Led panel on "Careers Outside of Academia" and was responsible for advertising the conference and responding to email inquiries.
2022	Founded Women$^+$ in Physics group at the University of Iowa. This group serves as a space for women and genderqueer people to come together and discuss their experiences. We seek to highlight women in various fields of STEM by inviting them to give seminars at the University of Iowa. We also hold monthly coffee runs for students and staff in order to create an inclusive and safe environment for women$^+$ in our department.
2018	NASA Solar Systems Workings review panel, executive secretary