# AARON M. STAHL

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Ph.D., Georgia Institute of Technology
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## EXPERIENCE

**Research Affiliate** — Atlanta, GA
*Georgia Institute of Technology* — *April 2024 - Present*

- Create NLP-based market sentiment classification tools for large social media datasets using fine-tuned finBERT and OpenAI endpoint completion models (GPT-3.5 Turbo, Davinci) to characterize behavioral trends in retail investing; programmed in Python with Hugging Face transformer libraries.
- Build AI-driven investment "idea classification" models which generate trade signals from a network that evaluates the merit of a trade idea; trained on social media word embeddings, market sentiment classifications, network metrics and cluster analysis, and time-series of underlying market securities.
- Conduct original research in computational space physics in collaboration with the *Magentospheres in the Outer Solar System* research group and Professor Sven Simon using highly-parallelized C++ plasma simulation codes.

**Graduate Research Assistant, School of Physics** — Atlanta, GA
*Georgia Institute of Technology, Advisor: Sven Simon* — *July 2022 - May 2024*

- Developed comprehensive, highly-parallelized, three-dimensional computational models in C++ to study fluid and plasma dynamics as well as wave propagation in planetary magnetospheres.
- Translated broad scientific research goals into quantitative questions that could be answered by combining computational model results with empirical data (e.g., *in situ* spacecraft measurements).
- Designed novel three-dimensional model of Ganymede's unique exosphere and ionization mechanisms in C++, integrating the result with a hybrid plasma model to create first self-consistent model of the moon's multi-species ionospheric outflow and plasma tail.
- Applied statistical techniques (e.g., minimum variance analysis, multivariate regression) to large, multi-dimensional datasets to extract key features of moon-plasma interaction dynamics in Python.
- Published findings across three peer-reviewed scientific publications (two more in preparation) in leading space physics journal and delivered presentations at international scientific conferences.
- Built data processing, analytics, and visualization pipeline using Python, NASA's SPICE API for spacecraft and ephemeris data, and the VisIt API.
- Collaborated with other team members to complete a collective research project, resulting in *Geophysical Review Letters* cover story article; presented results at an international scientific conference.
- Regularly developed software and analyzed data both independently and in collaborative environments.

**Graduate Research Assistant, School of Physics** — Atlanta, GA
*Georgia Institute of Technology, Advisor: Glen Evenbly* — *Jan 2019 - May 2022*

- Created novel deep learning model of stacked convolutional neural networks to accurately reconstruct sparsely sampled low-energy quantum states via supervised learning with Python and TensorFlow.
- Programmed original algorithms for matrix and tensor completion from scratch using tensor network methods in Matlab and Python; demonstrated optimal convergence properties on ground state wavefunctions and cross-application functionality for image correction.
- Presented scientific results to both highly specialized and general audiences alike at several invited talks, including corporate (Google Quantum AI) and student groups (Georgia Tech Quantum Alliance).
- Utilized original tensor algorithms to extract new properties about how information density of wavefunctions scales with system size in locally interacting quantum systems on finite 1-D and 2-D lattices.
- Note: Glen Evenbly left Georgia Tech and discontinued advising students in spring 2022.

**Undergraduate Research Assistant, Joint Quantum Institute** College Park, MD
*University of Maryland, Advisor: Steve Rolston* *Nov 2015 - Nov 2017*

- Worked in experimental atomic physics laboratory to study the effects of disorder on trapped quasi two-dimensional Bose gasses. Contributed to identification of phase crossover regions compatible with intermediates Griffiths phases between a thermal state and three-dimensional bulk superfluidity.
- Developed bespoke supercapacitor circuitry to generate a high current pulse generator used to levitate Bose gase samples. This device was used on daily basis to produce both square and ramped pulses of duration ranging from 5-150 ms at up to 300 amps.
- Other activities included programming microcontrollers to communicate with various ICs, locking a DBR laser to a Rubidium transition, writing temperature control PIDs, performing optics alignments, and programming circuit simulations with LTSPICE.

## EDUCATION

**Georgia Institute of Technology** *August 2018 - May 2024*
Doctor of Philosophy (Ph.D.), Physics
Advisor: Sven Simon

**University of Maryland** *August 2014 - May 2018*
B.S., Physics

**University of Southern California** *August 2004 - May 2008*
B.A., Business, Concentration: Finance

## SKILLS

**Physics:** Electrodynamics | Fluid Dynamics | Plasma Physics | Magnetohydrodynamics (MHD) | Remote Sensing | Magnetospheric Physics | Ionospheric Physics | Radiation Processes | Spectroscopy | Orbital Mechanics | Relativity | Thermodynamics | Quantum Mechanics | Statistical Mechanics

**Computational:** Numerical simulations | Analytical Modeling | Algorithms | Data Analysis | Parallel Computing | High Performance Computing | Three-Dimensional Visualization | Software Development | C++ | C | Python | MATLAB | IDL | VisIt | MPI | OpenMP | Linux | LaTeX | Git

**Mathematical:** Linear Algebra | Statistics | Calculus | Differential Equations | Numerical Methods | Curvilinear Coordinate Systems | Coordinate Transformations | Nonlinear Dynamics

**Communication:** Technical/Scientific Writing | Peer-Reviewed Publications | Technical Presentations

## PUBLICATIONS

**On the Formation of Trapped Electron Radiation Belts at Ganymede**
Lucas Liuzzo, Andrew Poppe, Quentin Nénon, **Aaron Stahl**, Sven Simon, Shahab Fatemi (2024), *Geophysical Review Letters*, doi: 10.1029/2024GL109058

**Magnetic Signatures of the Interaction Between Europa and Jupiter's Magnetosphere During the Juno Flyby**
Peter Addison, C. Michael Haynes, **Aaron Stahl**, Lucas Liuzzo, Sven Simon (2024), *Geophysical Research Letters*, doi:10.1029/2023GL106810

**A Model of Ganymede's Magnetic and Plasma Environment During the Juno PJ34 Flyby**
**Aaron Stahl**, Peter Addison, Lucas Liuzzo, Sven Simon (2023), *Journal of Geophysical Research - Space Physics*, doi: 10.1029/2023JA032113

**Reconstruction of Randomly Sampled Quantum Wavefunctions using Tensor Methods**
**Aaron Stahl**, Glen Evenbly (2023), *arXiv*, doi: 10.48550/arXiv.2310.01628

## PRESENTATIONS

**A. Stahl**, P. Addison L. Liuzzo, and S. Simon. **Three-Dimensional Model of Ionospheric Outflow at Ganymede**. *AGU Fall Meeting*, San Francisco, USA, 11-15 December, 2023.

**A. Stahl**, P. Addison L. Liuzzo, and S. Simon. **Ionospheric Outflow at Ganymede: Hybrid Modeling of Ganymede's Plasma Environment During the PJ34 Juno Flyby**. *AGU Fall Meeting*, San Francisco, USA, 11-15 December, 2023.

P. Addison, **A. Stahl**, C. Haynes, S. Simon, L. Liuzzo. **Magnetic Signatures of the Interaction Between Europa and Jupiter's Magnetosphere During the Juno Flyby**. *AGU Fall Meeting*, San Francisco, USA, 11-15 December, 2023.

**A. Stahl**, G. Evenbly. **Reconstruction of Randomly Sampled Quantum Wavefunctions using Tensor Methods**. *Tensor Networks / Google Quantum AI Seminar*, online, 4 December, 2023.

**A. Stahl**, P. Addison, S. Simon, L. Liuzzo. **Three-Dimensional Ionospheric Outflow at Ganymede During the Juno PJ34 Flyby**. *DPS Meeting 2023*, San Antonio, USA, 6-10 October, 2023.

G. Evenbly, **A. Stahl**. **Applications of Tensor Networks to Data Compression and Completion**. *QIMG 2023*, Atlanta, USA, 4 Sept. - 6 October, 2023.

**A. Stahl**, G. Evenbly. **Wavefunction Completion: Reconstructing Quantum States from a Subset of Randomly Sampled Coefficients**. *GT Quantum Alliance Workshop*, Atlanta, USA, 5 May, 2022.

## SELECTED HONORS AND AWARDS

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| **Georgia Tech Quantum Alliance Fellowship** | January 2021 - June 2021 |
| **Georgia Tech Quantum Alliance Fellowship** | January 2022 - June 2022 |
| **Herbert P. Haley Fellowship** | August 2018 - May 2019 |

## PROFESSIONAL REFERENCES

**Sven Simon, Professor** — Ph.D. Advisor
*School of Physics*, Georgia Institute of Technology
Email: sven.simon@eas.gatech.edu
Phone: (404) 385-1509

**Lucas Liuzzo, Research Scientist** — Collaborator
*Space Sciences Laboratory*, University of California, Berkeley
Email: liuzzo@berkeley.edu

**James Wray, Professor** — Ph.D. Committee Member
*School of Earth & Atm. Sciences*, Georgia Institute of Technology
Email: jwray@gatech.edu

**David Ballantyne, Professor** — Ph.D. Committee Member
*School of Physics* Georgia Institute of Technology
Email: dballantyne3@gatech.edu

**Steve Rolston, Professor, Department Chair** — Research Advisor
*School of Physics* University of Maryland - College Park
Email: rolston@umd.edu

**Larry Harris, Professor, Keenan Chair in Finance** — Advisor and Mentor
*Marshall School of Business* University of Southern California
Email: lharris@usc.edu