AARON STAHL

Ph.D. Candidate, Georgia Institute of Technology
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EXPERIENCE

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

- Developed comprehensive, highly-parallelized, three-dimensional computational models in C++ to study fluid and plasma dynamics as well as wave propagation in planetary magnetospheres.
- Designed novel three-dimensional model of Ganymede's unique exosphere and ionization mechanisms in C++, integrating the result with a hybrid plasma model to self-consistently model the moon's ionospheric outflow and plasma tail.
- Applied statistical techniques to extract plasma and magnetic field signatures from data obtained by NASA's Juno mission in Python and C++. Created data processing and visualization pipeline using Python and NASA's SPICE API.
- 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).
- Published findings across three peer-reviewed scientific publications, and delivered presentations at international scientific conferences.

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

- Leveraged tensor network methods to develop several novel algorithms for reconstructing quantum wavefunctions from sparse, random samplings of the state coefficients using Matlab and Python.
- Employed original tensor algorithms to extract new properties about the scaling behavior of entanglement entropy and information density in locally interacting quantum systems on finite one-dimensional and two-dimensional lattices.
- Generalized algorithm functionality to higher dimensions and successfully applied the method to established matrix completion problems in data science, yielding competitive results (e.g., "Netflix problem", image correction).
- Published findings on arXiv.org, in preparation for submission to peer-reviewed journal. Research results presented across several invited talks at international scientific conferences.
- Note: Glen Evenbly left Georgia Technology and discontinued advising students in the Spring of 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 - Present*
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* (under review)

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

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

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

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