Aaron Trowbridge

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Education

Syracuse University
- B.S. in Physics, with distinction (3.6 GPA); B.S. in Mathematics (3.8 GPA) — Sep 2015 – Dec 2020
- One Semester as Graduate Physics Student and TA (4.0 GPA), coursework:
Quantum Field Theory I; Lie groups, Lie algebras, and Representation Theory — Jan 2021 – May 2021

Experience

Private Tutor — Mar 2021 – Present
- Subjects include: physics, statistics, calculus, and programming in python

Teaching Assistant (Syracuse Physics Department)
- One semester as graduate TA: introductory mechanics - under Prof. Walter Freeman — Jan 2021 – May 2021
- Four semesters as undergrad TA: astronomy, mechanics, E & M, computational physics — Jan 2019 – Dec 2020

Research Assistant (Syracuse Physics Department)
- Lattice quantum gravity group, under Prof. Jack Laiho — May 2020 – May 2021
- Plourde Research Lab (superconducting quantum devices), under Prof. Britton Plourde — May 2018 – Dec 2020

Research & Projects

Personal Website and Blog
- Used the Hugo static website framework to develop my personal website and blog; learning HTML, CSS, Markdown, Go, and (just a little) JavaScript in the process.
- I have written *blog posts* about interactive web-based plotting with Julia, quantum field theory, and quantitative finance, as well as other topics, and plan on writing more about data science and machine learning in the near future.

Generative Adversarial Networks
- I am currently working on a project implementing various versions of the GAN unsupervised machine learning algorithm, using convolutional and fully connected neural networks to extract and utilize latent information of images to generate my own images in the same style. Code can be found *here*.

Gauge Theory and Topological Quantum Gravity
- As a final project for my QFT course I gave a talk on the theoretical aspects of quantizing gravity – discussing the graviton propagator, gauge theory, topological field theory, and Chern-Simons gravity. Notes found *here*.

Monte Carlo Methods for the Ising Model and Lattice Quantum Gravity
- Worked with the lattice gravity group to develop, implement, and test a novel rejection free variant of the Metropolis algorithm.
- A recorded talk I gave can be found on youtube by clicking *here* and a github repo can be found *here*.

Classical Simulation of a Quantum Computer
- As final project for a quantum information theory course, I implemented a custom quantum gate programming language and virtual quantum processor, in Julia. A github repo can be found *here*.

Barnes-Hut Tree Algorithm for Gravitational n-body Simulation
- Implemented, in Julia, this $O(n \log n)$ tree-based approximation scheme. Code found *here*.

Numerical Methods for Quantum Mechanics
- Under the supervision of Prof. Walter Freeman, I implemented and experimented with three methods for simulating quantum mechanical systems and solving the Schrödinger equation. Code found *here*.

Additional Information

Programming Languages:	Julia, Python, C, C++, Haskell, Bash, Git, HTML, CSS, Markdown, LaTeX
Operating Systems:	Linux (Arch, Manjaro i3), MacOS, Windows 10, Arduino, Visual Studio Code
Hobbies:	Reading, Chess, Snowboarding, Surfing, Skateboarding, Horseback Riding, Hiking