Anthony M. Charles

Software Engineer ▪ Physicist ▪ Research Scientist

Experience

Senior Software Engineer (current position) — January 2026 - present
Software Engineer — January 2021 - January 2026
Metron, Inc. — Reston, VA, USA

> Developed, maintained, and tested production-grade Java for a state-of-the-art Markov chain Monte Carlo particle filtering and Bayesian tracking application, delivering impactful contributions across the full software stack.
> Designed, implemented, and validated a novel algorithm for processing multi-range passive sonar data, significantly improving target localization and mitigating particle degeneration in sequential Monte Carlo methods for sensor data fusion.
> Independently managed software deliveries and integrated into diverse client production environments, including MongoDB clusters and Dockerized systems deployed with Kubernetes.
> Conducted a data-driven analysis to diagnose and quantify weaknesses in a frequency-processing algorithm, identifying four distinct problem areas; developed targeted solutions for each and demonstrated substantial improvements in localization accuracy and consistency through rigorous validation across large datasets.
> Researched and evaluated novel applications of quantum computing and quantum annealing to solve NP-hard multi-target data association problems for use in a joint probabilistic filter.

Postdoctoral Research Fellow — September 2018 - October 2021
Institute for Theoretical Physics, KU Leuven — Leuven, Belgium

> Conducted collaborative research in theoretical physics, leveraging advanced mathematical and computational tools to solve complex interdisciplinary problems.
> Developed a Python-based suite of network theory tools to perform dynamic random walks and analyze late-time steady-state configurations on large networks, applying these tools to novel studies of tunneling in quantum physics.
> Designed and implemented numerical shooting algorithms in Python and Mathematica to solve complex multivariate non-linear partial differential equations, rigorously validating analytic results I formulated on Euclidean geometries in string theory.
> Supervised Master's and Ph.D. students, mentoring them in high-level scientific research across theoretical and computational physics, fostering their development as independent researchers.

Graduate Student Researcher — August 2013 - August 2018
Department of Physics, University of Michigan — Ann Arbor, MI, USA

> Conducted long-term, large-scale physics research projects, leveraging high-performance computational tools and advanced mathematical techniques to address fundamental questions.
> Developed efficient methods for computing quantum corrections to entropy in particle physics settings and designed a robust Python-based numerical implementation.
> Implemented semidefinite programming algorithms in Python to refine and advance prior results in mapping the space of consistent conformal quantum field theories.

Curriculum Designer and Instructor — August 2016 - August 2017
Michigan Math and Science Scholars — Ann Arbor, MI, USA

> Designed and co-taught a highly selective course on General Relativity for advanced high school students, blending mathematical rigor with hands-on programming experience.
> Developed interactive Mathematica simulations to explore astrophysical phenomena and orbital dynamics, fostering engagement through visual learning.
> Co-authored and published a comprehensive 170-page textbook to support a dynamic classroom approach, emphasizing student-led discussions and thought experiments.

Contact

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Reston, VA, USA

Education

University of Michigan
2013 – 2018
Ph.D. in Physics

University of Virginia
2009 – 2013
B.S. in Physics
B.A. in Mathematics

General Skills

Analytic problem solving
Critical thinking
Collaborative research
Scientific communication
Technical writing
Public speaking

Technical Skills

Software development
Statistical modeling
Large-scale data analysis
Linear algebra
Theoretical physics
Computational physics
Markov chain processes
Monte Carlo methods
Particle filtering
Bayesian inference
Network theory
Quantum computing

Tools

Java
Python
Mathematica
Docker
Kubernetes
MongoDB
Git
Azure DevOps / Jira
LaTeX

Publications

amcharles.com/pubs