NATHAN A. WAGNER

Madison, WI | <u>LinkedIn Profile</u>

SUMMARY

- 3.96 cumulative undergraduate GPA towards dual major (UW-Madison, B.S. Math and Physics, Expected May 2026); Math and Physics GPA 4.00 (for 400+ courses)
- Recipient of five national scholarships, including research-oriented Astronaut and Barry Goldwater Scholarships
- Over four years academic level research experience across three different and non-course related physics projects
- Eight math and physics courses already taken at graduate/advanced level
- Graduate-level physics/math courses currently underway or to be enrolled in next semester: Statistical Mechanics, Theoretical Physics (Dynamics), Elementary Topology, Advanced Solid State Physics, Advanced Quantum Mechanics, Group Theory for Physics and Quantum Information Science
- One first-author manuscript published (*International Journal of Quantum Information)* and a second first-author paper prepared for pre-print status pending imminent submission (*Quantum* or *Physical Review A*).

EDUCATION

University of Wisconsin – Madison; Madison WI
Bachelor of Science, Physics and Mathematics   *Expected May 2026*
Cumulative GPA 3.96/4.0
- Have taken eight math and physics courses (24 credits) at graduate/advanced-level (500-level and above)
- Enrolling in graduate-level classes senior year (Fall 2025 – Spring 2026): Statistical Mechanics, Theoretical Physics (Dynamics), Elementary Topology, Advanced Solid-State Physics, Advanced Quantum Mechanics, Group Theory for Physics and Quantum Information Science

Madison College, UW-Madison Pathways/Humanities Transfer Program, Madison WI   *Fall Semester, 2022*
Cumulative GPA 4.0/4.0
- Completed required humanities/general education courses (5 courses, 15 credits) prior formal UW-Madison start

RESEARCH EXPERIENCE

Undergraduate Researcher – Wisconsin Quantum Institute (WQI) – Saffman Group
University of Wisconsin-Madison, Physics Department – Madison WI
September 2021 – Present *(with three-month absence to work at Argonne National Laboratory in Summer 2024)*

Project 1: Benchmarking a Neutral-Atom Quantum Computer; September 2021 – November 2023
Advisors: Professor Mark Saffman and Assistant Professor Trent Graham
- Developed software-based quantum computing noise simulator and used benchmarked simulator to determine optimum entangled Cesium atom configuration for scalability while maintaining data fidelity
- Tools/Methods: Python, C++, publicly available quantum benchmarking standards, JAX, HTML, public dataset library integrations, Anaconda, JupyterLab, Visual Studio and Visual Studio Code
- Resulted in first-author publication in *International Journal for Quantum Information* and multiple presentations

Project 2: Robust Optimal Control of a Neutral-Atom Quantum Processor; August 2024 – Present
Advisors: Professor Mark Saffman, Dr. Jeffrey Larson (ANL), Assistant Professor Matt Otten
- Project continuation started as a SULI intern at Argonne National Laboratory (below, title changed in move to UW)
- Using similar tools and methods summarized in SULI research below, have performed more advanced automatic differentiation and other analyses to refine results; has also included more detailed comparative analysis to associated international research (project title slightly modified in move to UW-Madison)
- In collaboration with research team, I've led development of first-author paper now being prepared for pre-print status with submission to *Quantum* or *Physical Review A* by 31 December 2025; details below in *Publications* section

RESEARCH EXPERIENCE (CONTINUED)

Undergraduate Research Intern – Summer Undergraduate Laboratory Internship (SULI) Program
Argonne National Laboratory (ANL), U.S. Department of Energy (DoE) – Chicago IL
May 2024 – August 2024

Project: Optimal Control of a Neutral-Atom Quantum Processor
Advisors: Dr. Jeffrey Larson (ANL), Dr. Matt Otten (ANL, project moved to UW-Madison Fall 2024)
- Project goal was to begin determination optimal robust gate design via multivariable qubit entanglement methods in neutral-atom quantum computers
- Using tools/methods below, developed multiple software-based models to model, simulate and test multiple atomic lattice laser trap configurations necessary to optimize neutral-atom-based quantum processors (i.e., laser pulsing, detuning, etc.)
- Tools/Methods: Julia, Python, C++, JAX, HTML, public dataset library integrations/NLOpt, Anaconda, JupyterLab, Visual Studio and Studio Code
- DoE Technical Research Report and end-of-summer presentation at graduate-level research symposium, multiple poster and interim paper presentations sessions since; work carried over to UW-Madison WQI *Project 2* above (new title at UW)

Undergraduate Researcher – High Energy Physics Group – International CERN-CMS Future Collider Design Collaborative
University of Wisconsin-Madison, Physics Department – Madison WI
May 2023 – October 2023

Project: Delphes Studies On Angles of Acceptance
Advisors: Professor Sridhara Dasu and Professor Tulika Bose
- Project goal was to determine viability of future high-energy particle collider collimators ("lenses" that steer particles)
- Used several 3-D modeling, CERN ROOT particle collision datasets, event generation and reconstruction software tools to determine what shape, size and materials could withstand and steer future 15-20 TeV particle collisions
- Determined models likely not viable with known materials; presented results to internal UW-Madison and international collaborative design teams; findings contributed to 2025 *Nature* article discussing future of European exascale collider(s)

PUBLICATIONS, MANUSCRIPTS, AND PRESENTATIONS

Publication
Wagner N, Poole C, Graham T, Saffman M. "Benchmarking a Neutral-Atom Quantum Computer." *International Journal of Quantum Information*. arXiv identifier 2311.04141. doi: 10.1142/s0219749924500011. Published 17 February 2024.

Being Finalized For Submission / Pre-Print
Wagner N, Otten M, Larson J, Saffman M. "*Optimal Control of a Neutral-Atom Quantum Processor*." In final editorial phase. arXiv pre-print manuscript will soon be available at https://nwhome.page/research_artifacts/. Anticipated manuscript submission date by 31 December 2025, *Quantum* or *Physical Review A.*

Major Oral Presentations
Wagner, N. "Benchmarking a Neutral-Atom Quantum Computer." Astronaut Scholarship Foundation Technical Conference, 16 August 2025. Houston, TX.

Wagner, N. *"Robust Optimization of Entangling Gates on a Neutral-Atom Quantum Computer."* 2025 Undergraduate Symposium, 25 April 2025. UW-Madison, Madison, WI.

Wagner, N. *"Robust Optimization of Entangling Gates on a Neutral-Atom Quantum Computer."* 2024 Graduate Research Symposia, 30 July 2024. Argonne National Laboratory, Lemont, IL. National audience and participation.

Wagner, N. "Benchmarking a Neutral-Atom Quantum Computer," UW-Madison Physics Department Board of Visitors Annual Meeting, 13 October 2023. UW-Madison, Madison, WI.

Wagner, N. *"Delphes Studies On Angles of Acceptance."* International CERN-CMS Future Colliders Design Meeting, 17 August 2023. UW-Madison, Madison WI and via Zoom with Geneva/FermiLab-based CERN/CMS collaborators.

Wagner, N. "Benchmarking a Neutral-Atom Quantum Computer." 2023 Undergraduate Symposium, 28 April 2023. UW-Madison, Madison, WI.

SCHOLARSHIPS AND AWARDS (INCLUDING STATUS OF THOSE IN FINALIST STATUS)

- **2026 Hertz Foundation Fellowship** – *Finalist Status - Pending* (informed in late November 2025 of my status as Finalist, within top 10% of largest applicant pool in Foundation's history; next round interview in mid-January 2026; if awarded, up to $250,000 across five years)
- **2025 Astronaut Foundation Scholarship** (nationally competitive scholarship recognizing and supporting outstanding undergraduate STEM students who demonstrate exceptional motivation, imagination, and performance in their chosen fields; 16 August 2025 in Houston, TX; $15,000)
- **2024/2025 Barry Goldwater Scholar for Excellence in Undergraduate Research** (nationally competitive scholarship awarded to outstanding undergraduate STEM students for academic excellence, research experience, and potential for significant contributions in their field; 29 April 2024; awarded for junior and senior years at $7,500/year)
- **2025 UW-Madison Physics Department Hagengruber Award** (awarded to one UW-Madison physics student per year deemed by Department demonstrating "exceptional promise for a future in physics"; 02 May 2025, $10,000)
- **2024 Optica Bonenfant International Travel Scholarship** (one of two top $9,000 named awardees selected nationally; declined for Spring 2025 semester due to research/academic scheduling conflicts; 11 June 2024)
- **2024 UW-Madison Pulvermacher Scholarship** (27 August 2024; $1,000)
- **2022 SPIROL International Charitable Foundation Scholarship** (26 May 2022; $5,000/year; ongoing)
- **2022 American Nuclear Society (ANS) Freshman Scholarship** (top freshmen award offered nationally; 06 May 2022; $3,000)
- **2022 Wisconsin Assoc. of School Business Officials Freshman Scholarship** – One of two top awards granted in State of Wisconsin (03 May 2022; $4,000)
- **2022 West High School Senior Scholarship for Academic Excellence** (For Freshman Year; 26 May 2022; $2,500)

SOCIETIES AND MEMBERSHIPS

- American Physical Society (APS, 2022 – Present)
- American Mathematical Society (AMS, 2023 – Present)
- American Nuclear Society (ANS, 2022 – Present)
- Optica (formerly Optical Society of America, 2023 – Present)
- Society of Physics Students (SPS, 2023 – Present)

LABORATORY SKILLS, ANALYSIS, AND SOFTWARE TOOLS

- *Advanced Optics and Atomic Physics*: Laser beam walking with single-mode polarization maintaining optical fiber, laser locking, orientation of wave plates, use of magneto-optical traps for laser alignment and cooling, development of time-sequenced imaging controller for use with laser pulse sequencing and experimental electronic controls, use of acousto-optic modulators (AOMs) and electro-optic modulators (EOMs)
- *Advanced Modern Physics Laboratory Coursework (see above for optics related laboratory coursework):* Experimental setup of gamma-ray spectroscopy, x-ray diffraction, blackbody radiation, Cavendish measurements of gravitational constant
- *Programming Languages and Datasets*: Julia, Python, C++, JAX, HTML, public dataset library integrations, Anaconda, JupyterLab, Visual Studio and Visual Studio Code, NLOpt
- *Analysis*: Mathematica, Numpy/Scipy, Matplotlib, Pandas, Tensorflow, MATLAB
- *Quantum Computing*: QuTIP, Qiskit/Cirq (both used for quantum simulations)
- *High Energy Physics*: ROOT (CERN-based large data set analysis), Pythia8 (event generation), Delphes (event reconstruction), MadGraph (event generation), Whizard (event generation)
- *Modeling*: Geant4 (detector simulation and 3D modeling), SolidWorks (3D modeling), COMSOL (3D modeling)

SERVICE AND COMMUNITY ACTIVITIES

- Food Distribution Volunteer – Second Harvest Foodbank, Madison WI (2021–Present)
- Conservatory Volunteer – Owen Park, Madison WI (2021–Present)
- Badger Volunteer – Morgridge Center for Public Service [STEM outreach/mentoring to local schools], Madison WI (2023)
- Student Advisory Member – Wisconsin Center for Academically Talented Youth, Madison WI (2021–2023)
- STEM Education Youth Team Lead – Madison Public Schools, Madison WI (2021)