Andrew Valentini

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Education

University of Florida — Gainesville, FL
Ph.D in Physics — *2025 – Present*

Carthage College — Kenosha, WI
Bachelors in Physics and Mathematics, GPA - 3.988/4.0 — *2021 – 2025*

- Physics Thesis: Considering the Existence of Exotic Structure in the Cosmic Microwave Background
- Mathematics Thesis: ADM Formulation of Scalar-Tensor-Vector Gravity

Publications

[1] **PINCH: pipeline-informed noise characterization in LIGO's third observing run** | August 14th, 2025
Classical and Quantum Gravity

Research Interests

Research Experience

NSF-REU at Pennsylvania State University — May 2024 – August 2024
Mentored by Dr. Sarah Shandera — *Pennsylvania State University*

- Designed a quantum circuit simulation from scratch to analyze the domain of positivity, aiming to identify higher-order entanglement. Tracked thermodynamic and information-theoretic properties on the circuit and developed multiple original animations and data visualization techniques.
- Used the LIGO high-performance computing grid housed at PSU to process data-intensive large-qubit simulations.
- Determined no significant correlation between the arrival of NCP maps and spikes in mutual information and concurrence between qubit pairs in our class of circuits.

Cosmic Strings and Materials Theory Research — February 2024 – Present
Mentored by Dr. Joseph Anderson — *Carthage College*

- Developed a novel analytic method to derive the nth-order correlation function for circular objects, utilizing Fourier analysis and Bessel function properties.
- Have extended this easily-generalizable method to Gaussian and concentric loop configurations.
- Applying this method in the context of cosmic strings to derive their gravitational wave power spectra for my senior thesis in physics.

NSF-REU at Louisiana State University — May 2023 – August 2023
Mentored by Dr. Gabriela González — *Louisiana State University*

- Employed a variety of data analysis techniques to determine the causal probability of gravitational wave triggers by glitch type for the GstLAL pipeline.
- Developed a multi-dimensional statistical weighting approach to classify gravitational wave candidates based on the inferred physical black hole binary properties and pipeline-specific statistical parameters. Although the method did not confidently predict progenitor glitch types, it laid groundwork for ongoing enhancements to the detection confidence of GstLAL.
- Used LIGO's high-performance computing grid to extract data from the GstLAL pipeline and generate statistical measures.

Theoretical Gravitational Wave Physics and Data Analysis Research — January 2022 – Present
Mentored by Dr. Jean Quashnock — *Carthage College*

- Created a physics-informed algorithm for predicting the astrophysical distance of an observed event given its chirp mass and SNR, and verified its accuracy using the fourth observing run's data.
- Analyzed the dependence of overtones on the merger remnant's mass and spin and confirmed that the first overtone dominates the waveform of an event.
- Developed models for gravitational wave emission as it would appear in a spectrogram, capturing the time-frequency evolution of the waveform.
- Developed comparative plots demonstrating the relationship between binary system component masses, final merger mass, and radiated energy via gravitational waves.

Modal Propellant Gauging-Fiber Optic Sensing System — June 2022 – April 2023
Funded by NASA's T2U Program and the WSGC, Mentored by Dr. Kevin Crosby — *Carthage College*

- Developed software to translate data packets from an optical interrogator for interpretation within the Modal Propellant Gauging framework.
- Designed experiments to evaluate the feasibility of integrating Fiber Optic Sensing Systems (FOSS) into the Modal Propellant Gauging framework.

Magneto-Active Slosh Control September 2021 – May 2022
Funded by the WSGC, Mentored by Dr. Kevin Crosby *Carthage College*

- Utilized CAD simulations to model and assess the effectiveness of magnetic coils in reducing propellant slosh under microgravity conditions.
- Designed CAD models that were used in the mechanical design of the experiment.

Teaching Experience

[1] **Teaching Assistant** | *University of Florida* - Fall 2025
Lab instructor for PHY 2053, a first semester of algebra-based physics lab

[2] **National Youth Science Camp** | Davis, WV - July 2025
Taught a short course on special and general relativity to advanced high schoolers

[3] **Brainard Writing Center Fellow** | *Carthage College*, January 2022 - May 2025
- Assisted students in over 120 individual sessions, either an hour or half-hour long, from various disciplines, helping students identify their paper's argument and sharpen their support of it.
- Additionally was instructor of record for a one-credit course during Spring 2024 called Writer's Workshop, where freshmen and students for whom English is not a first language developed their general writing and critical thinking skills.

Conference Presentations

[1] **Non-Completely Positive Dynamics as a Probe of Entanglement in Quantum Circuits** | *Washington University* November 2024
Midstates Consortium for Math and Science Undergraduate Research Symposium - Oral Presentation

[2] **ADM Formulation of Scalar-Tensor-Vector Gravity** | *St. Norbert's College* November 2024
Pi Mu Epsilon Annual Undergraduate Regional Math Conference - Oral Presentation

[3] **Non-completely Positive Dynamics as a Probe of Entanglement in Quantum Circuits** | *Penn State University* August 2024
PSU REU Research Symposium - Oral & Poster Presentation

[4] **An Analytic Method for Computing the Pair Correlation Functions of Dislocation Loops** | *Carthage College* May 2024
Celebration of Scholars - Poster Presentation

[5] **Estimating the Luminosity Distance and Mass Properties of BBH Merger Events in LIGO O4 Data** | *Carthage College* May 2024
Celebration of Scholars - Poster Presentation

[6] **Analyzing Causes of Gravitational Wave False Alarms** | *St. Norbert's College* November 2023
Pi Mu Epsilon Annual Undergraduate Regional Math Conference - Oral Presentation

[7] **Analyzing Causes of Gravitational Wave False Alarms** | *University of Chicago* November 2023
Midstates Consortium for Math and Science Undergraduate Research Symposium - Poster Presentation

[8] **Analyzing Causes of Gravitational Wave False Alarms** | *Virtual* August 2023
APS National Physics REU Poster Symposium - Poster Presentation

[9] **Analyzing Causes of Gravitational Wave False Alarms** | *Louisiana State University* August 2023
Summer Undergraduate Research Forum - Poster Presentation

[10] **Measuring Quasinormal Modes of Simulated Binary Black Hole Mergers in the SXS Catalog** | *Carthage College* May 2023
Celebration of Scholars - Poster Presentation

[11] **Modeling Binary Compact Object Merger Events Detected by the LIGO and Virgo Gravitational Wave Observatories** | *Argonne National Laboratory* January 2023
CUWiP - Poster Presentation

[12] **Modeling Binary Compact Object Merger Events Detected by the LIGO and Virgo Gravitational Wave Observatories** | *Washington University* November 2022
Midstates Consortium for Math and Science Undergraduate Research Symposium - Poster Presentation

[13] **Carthage Space Sciences: MPG-FOSS** | *Washington, D.C.* October 2022
Society of Physics Students Physcon - Poster Presentation

[14] **Carthage Space Sciences: MPG-FOSS** | *Carthage College* September 2022
Fall Research Presentation - Poster Presentation

[15] **Modal Propellant Gauging Projects Overview** | *Carroll University* August 2022
Wisconsin Space Grant Conference - Oral Presentation

[16] **Carthage Space Sciences: MPG-FOSS** | *Carroll University* August 2022
Wisconsin Space Grant Conference - Poster Presentation

[17] **Determining the Masses of Black Holes and Neutron Stars Seen in LIGO and Virgo Merger Events** | *Carthage College* April 2022
Celebration of Scholars - Poster Presentation

[18] **The Bible as Interpreted through Jean-Jacques Rousseau's Second Discourse** | *Carthage College* April 2022
Celebration of Scholars - Poster Presentation

Relevant Coursework

Physics: Quantum Mechanics, Electricity and Magnetism, Astrophysics, Computational Physics, Thermal Physics, Classical Mechanics, Optics and Waves, Modern Physics, Experimental Physics, Senior Research in Physics
Mathematics: Real Analysis, Complex Variables, Abstract Algebra, Senior Research in Math, Mathematics for Scientists and Engineers, Statistics, Linear Algebra, Differential Equations, Multivariate Calculus, Discrete Structures, Data Science 1

Technical Skills

Programming Languages: Python, MATLAB, C++, R, HTML/CSS
Tools & **Software**: Mathematica, LaTeX, scikit-learn, Git/Github, Fusion 360, Qiskit

Awards & Fellowships

[1] **Graduate School Opportunity Award** | *University of Florida* September 2025 - September 2029
Four year fellowship with increased stipend and reduced teaching load.

[2] **Intellectual Foundations Scholarship** | *Carthage College, First Place* April 2022
Carthage College – Received for my essay entitled "The Bible as Interpreted through Jean-Jacques Rousseau's Second Discourse"

Outreach & Service

Physics Graduate School Application Panel | *University of Florida* October 2025
Panel contributor

Graduate Student Council Representative | *University of Florida* September 2025 – Present
Represented the physics department at the University of Florida's Graduate Student Council's monthly meetings.

Graduate School Panel | *Forest Lake High School* May 2025
Panel contributor

Astrofest Volunteer | *Pennsylvania State University* July 2024
Gave three talks on the science and history of gravitational waves to a combined audience of ∼50 attendees of varying age and ran educational stations.

Physics Demonstration Planning & **Building** | *Carthage College* October 2023 - Feburary 2024
Planned a repository of physics demonstrations and built a Rubens' tube for public outreach.

Summer Astronomy Night Volunteer | *Louisiana State University* June 2023
Helped organize an astronomy-focused public outreach event and performed a Ruben's tube demonstration for an audience of 50+ attendees of varying age.

Philosophy Club Vice President | *Carthage College* September 2022 – May 2023
Conducted the reading and research on philosophical topics necessary to lead our club's weekly meetings and construct slideshows to facilitate the group's discussion.

NASA Summer High School Intern Program | *University of Texas at Austin (Virtual)* July 2022
Presented an overview of Carthage College's Modal Propellant Gauging projects being worked on in the summer of 2022 to an audience of 70+ high school students.

Certifications

[1] The Complete Quantum Computing Course | August 2023
[2] Linux Command Line Bootcamp | July 2022
[3] Fusion 360 Beginners Course | June 2022
[4] Gravitational Wave Open Data Workshop #5 | May 2022