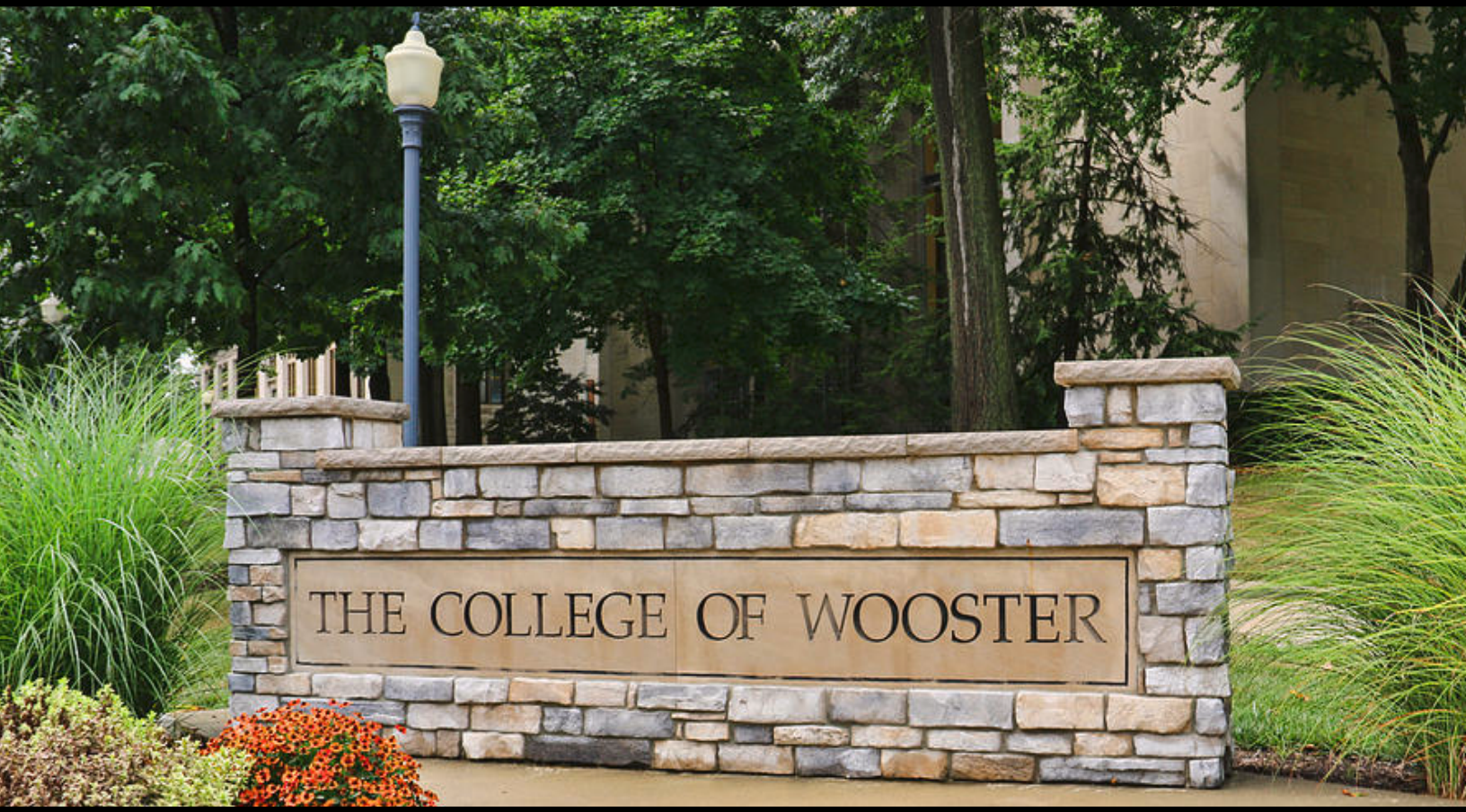




WOOSTER

Physics



2025 – 2026 Annual Report

Physics.wooster.edu

A NOTE FROM DR. CODY LEARY



Greetings from the physics chair!

The 2025-2026 academic year was an eventful one for the physics department. Dr. Lehman took a research leave awarded for fall 2025, the physics faculty mentored twelve senior independent study theses, and we welcomed alumna Dr. Abigail Ambrose '20 as a colloquium speaker, who recently earned her PhD from the University of Toledo. Congratulations are in order for Dr. Laura DeGroot who earned tenure and promotion to Associate Professor effective August 2026!

Tim Siegenthaler retired in May after over a decade of service to the physics department and other Wooster sciences. Whenever a physics faculty or student had a new research idea that required a new or improved experimental apparatus, Tim was there to help us to refine our vision and turn it into reality. He will be missed!

In other news, Wooster Physics Alumni Dr. Joseph Smith '15 and Dr. Michael Bush '16 both started tenure track appointments on the 3rd floor of Taylor Hall, with Dr. Bush appointed to the department of mathematics and computational sciences, and Dr. Smith to statistical and data sciences.

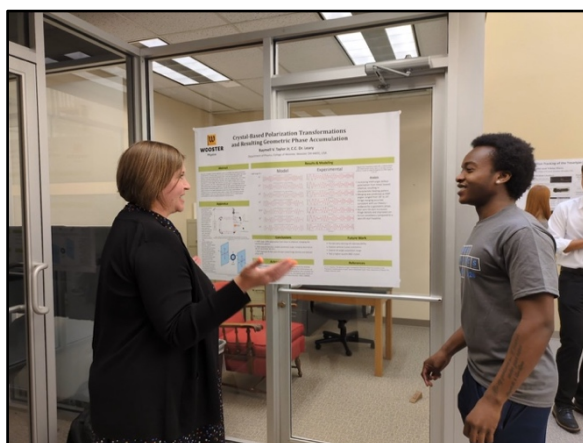
Thanks to the leadership of Dr. Niklas Manz, Wooster's physics department will host the regional Eastern Great Lakes Section of the American Physical Society's (EGLS of APS) Fall 2027 meeting on October 22/23, 2027! The theme is '*Wave-particle dualism - 100 Years of Arthur Compton's Nobel Prize*' to celebrate Wooster's 1913 graduate winning the physics Nobel Prize in 1927 for his 1923 article 'A Quantum Theory of the Scattering of X-rays by Light Elements', now known as the Compton Effect.

Special thanks also to Manon Grugel-Watson, who wears many hats as Physics Lab Instructor, Safety Liaison, Laboratory Coordinator, Project Coordinator for Wooster's B-WISER Science Camp, for continuing to make the B-WISER Science Camp for middle school girls a successful event, year after year!

Last but not least, we recently wrapped up another successful summer of our long running NSF-sponsored Research Experience for Undergraduates program. I've included two nice photos below: (1) a July Ohio sunset reflected in a large bubble made at Dr. Lehman's famous annual pie festival; (2) REU participant Raymell Taylor '28 presenting his experimental results on the geometric phase of light to Dr. DeGroot at our end-of-summer poster session.

Here's to a great 2026-2027!

Cody Leary, Chair of Physics



Class of 2026



Front (L to R): Sutton Ursillo, Akshit Deshpande, Molly Cohan, Juno Ryan, Abby Hovorka, Caitlin O'Neil

Back (L to R): Yuhe Ren, Anthomy Gomes, Noah Hankin, Gustav Bourdon, Chive Paradowski, Joe Russo

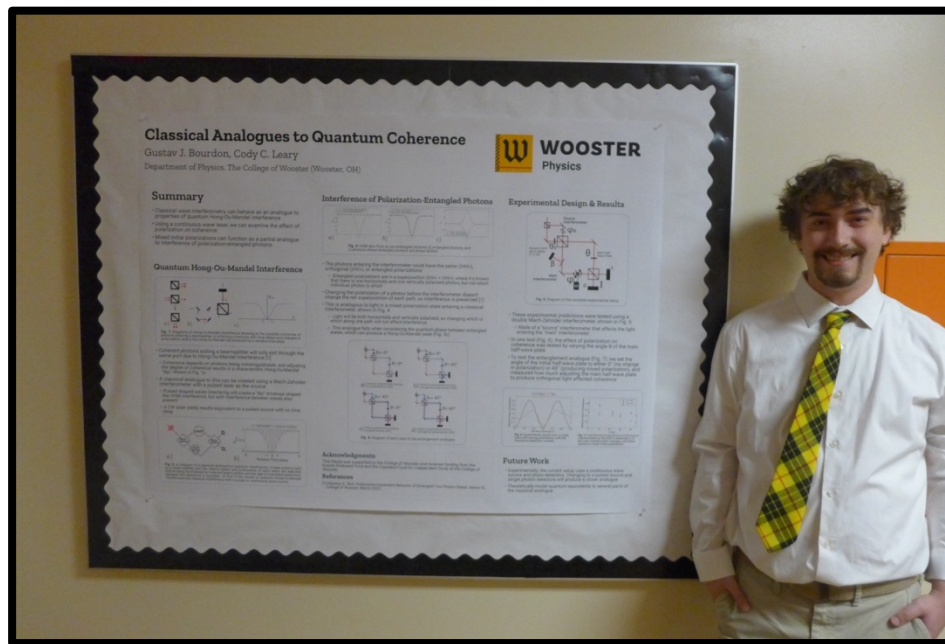
3/2 Engineering Dual Degree Program



2026 Commencement



SENIOR INDEPENDENT STUDY



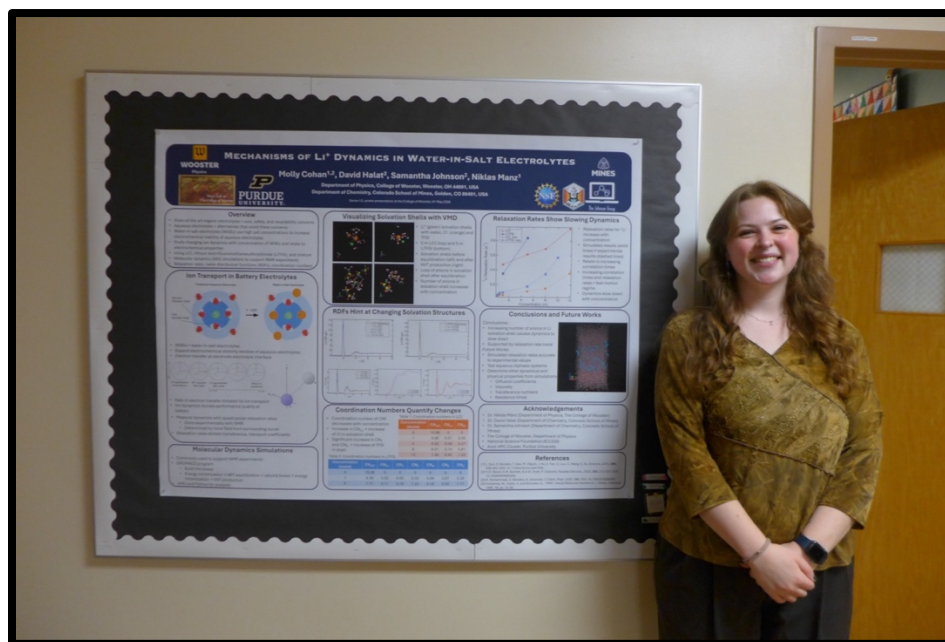
Gustav Bourdon

Classical Analogues to Quantum Coherence

Advised By: Cody Leary

One property of light that cannot be fully explained using classical methods is Hong-Ou-Mandel interference between entangled photon pairs, where a pair of indistinguishable pair of photons will always leave a beam-splitter through the same output. This work focuses on examining how classical wave interferometry can behave as an analogue to properties of quantum Hong-Ou-Mandel interference. By splitting a laser pulse and adjusting properties of one split beam relative to the other before re-combining them, behavior analogous to Hong-Ou-Mandel interference can be observed. In addition, the relative phase difference between two beams entering a beam-splitter can be used analogously to the time delay between them, allowing an analogue to be constructed and experimentally tested using a continuous wave laser. An extended analogue using multiple input sources can model more complex behavior, such as photons whose polarizations are entangled. Initial experimental testing confirms the validity of these analogues, and future experimental and theoretical work will allow for a closer analogue to be constructed.

SENIOR INDEPENDENT STUDY



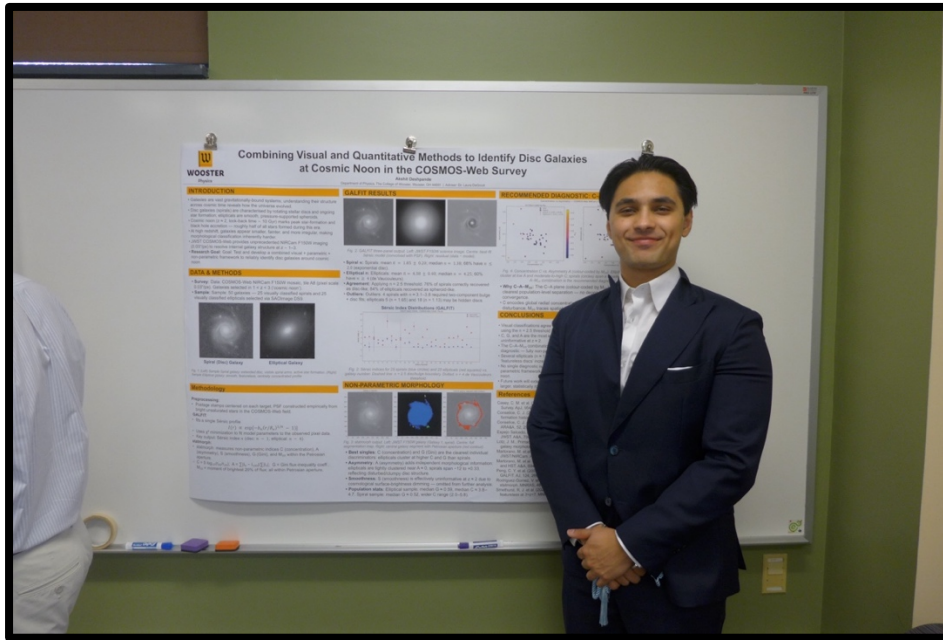
Molly Cohan

WiSE Up: Investigating the Mechanisms of Li-Ion Dynamics in Water-In-Salt Electrolytes

Advised By: Niklas Manz

Electrolytes are a crucial component of lithium-ion batteries (LIBs) because they are the source of ion transport and electron transfer that permit recharging of the cell. Current state-of-the-art electrolytes utilize organic solvents, raising concerns about safety, cost, and recyclability of the batteries as they are scaled up for larger energy storage. To address the concerns of organic solvents, alternative electrolyte systems have been proposed, one of them in the form of aqueous systems. These aqueous electrolytes have become more promising through the utilization of high salt concentrations to create water-in-salt electrolytes (WiSEs), which increase the usable voltage range of typical aqueous electrolytes. To further supplement the study of aqueous electrolytes and WiSEs for use in LIBs, this project investigates the changing ion dynamics with Li-salt concentrations. Using LiCl, lithium bis(trifluoromethanesulfonyl)imide (LiTFSI), and a mixture of both, the dynamics of Li^+ were studied with molecular dynamics (MD) simulations to supplement results from preliminary NMR experiments. By comparing radial distribution functions (RDFs), coordination numbers, and NMR quadrupolar relaxation rates, this project begins to draw connections between the changing solvation structure and changing Li^+ dynamics. While the MD and NMR results do not match numerically, the same general trend of dynamical changes was observed in both. The relaxation rates increase with concentration in both LiCl and LiTFSI, implying that the dynamics of Li^+ are slowing down with increased concentration. Pairing this with the change in RDFs and coordination numbers for the same systems, it was confirmed that there is an increase in the number of anions in the Li^+ solvation shell as concentration increases, causing the slower dynamics of lithium.

SENIOR INDEPENDENT STUDY



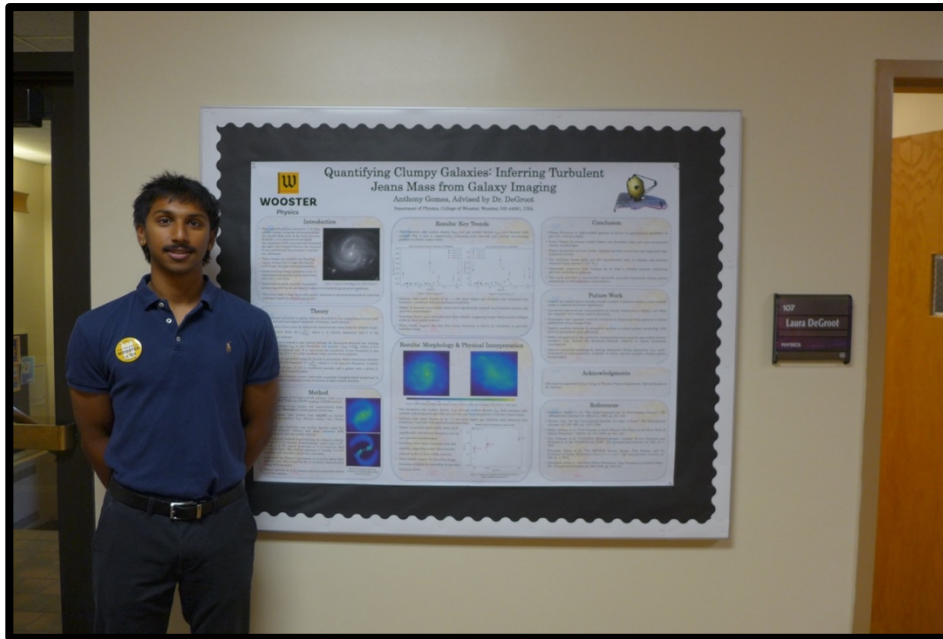
Akshith Deshpande

Combining Visual and Quantitative Methods to Identify Disc Galaxies around Cosmic Noon in the COSMOS-Web Survey

Advised By: Laura DeGroot

One of the biggest open questions in astronomy is how galaxies like our Milky Way formed and evolved over billions of years. To answer this, astronomers study galaxies as they appeared in the early Universe, but this comes with a challenge: the farther away a galaxy is, the smaller and harder it becomes to examine. This thesis focuses on galaxies around “cosmic noon,” a period roughly 10 billion years ago, when star formation across the Universe was at its peak. Using high-resolution images from the James Webb Space Telescope (JWST), this work develops a method to identify flat, rotating disc galaxies, like the Milky Way, among the many galaxies visible in deep-sky observations, a necessary step to study the method in which these galaxies grow and evolve with time. A sample of 50 galaxies was analyzed using both visual inspection and computational tools that measure shape, structure, and light distribution. The results show that combining visual classification with quantitative measurements produces far more reliable identifications than either method alone. Certain shape-based measurements, particularly how concentrated and how asymmetric a galaxy’s light appears, proved most useful in distinguishing disc galaxies from rounder, elliptical ones. Other measurements, like galaxy smoothness, turned out to carry very little useful information at these distances. This work presents a tested, practical toolkit for classifying distant galaxies, highlighting that even with cutting-edge data, galaxy classification at cosmic noon remains a nuanced challenge that requires multiple lines of evidence.

SENIOR INDEPENDENT STUDY



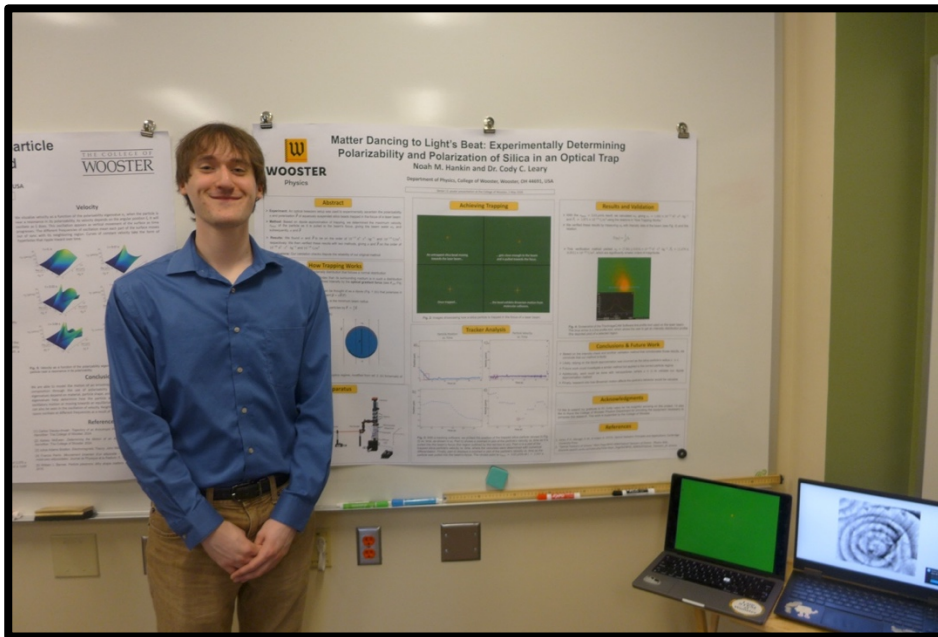
Anthony Gomes

Quantifying Clumpy Galaxies: Inferring Turbulent Jeans Mass from Galaxy Imaging

Advised By: Laura DeGroot

High-redshift galaxies around cosmic noon frequently display irregular, clumpy appearances quite different from the smooth, spiral galaxies common in the nearby universe. This work develops a physically motivated method for characterizing where and why galaxies form clumps, applied to James Webb Space Telescope (JWST) imaging from the Cosmic Evolution Early Release Science (CEERS) Survey. For a sample of 24 galaxies, we calculated two key quantities: the Toomre stability parameter Q , which measures how susceptible a rotating gas disk is to gravitational collapse, and the turbulent Jeans mass M_J , which estimates the minimum mass of gas needed for a clump to collapse under its own gravity despite turbulent pressure. Both star formation rate surface density and gas surface density increased systematically with redshift, consistent with galaxies at earlier cosmic times containing larger reservoirs of raw star-forming material. Galaxies in the low-stability regime ($Q = 1-20$) had a median gas surface density of $17.6 M_{\odot} \text{ pc}^{-2}$ and a median clump mass scale of $2.95 \times 10^9 M_{\odot}$, consistent with the observed masses of giant star-forming clumps seen in high-redshift imaging, while more gravitationally stable systems showed clump mass scales roughly 2.6 times larger and star formation rate surface densities three orders of magnitude lower, which was confirmed through visual inspection of JWST images. Together, these results show that standard observable galaxy properties, combined with disk instability theory, provide a reproducible and physically grounded framework for quantifying clump formation in distant star-forming galaxies.

SENIOR INDEPENDENT STUDY



Noah Hankin

Matter Dancing to Light's Beat: Experimentally Determining Polarizability and Polarization of Silica in an Optical Trap

Advised By: Cody Leary

An optical tweezers setup was used to experimentally ascertain the polarizability and polarization of aqueously suspended silica beads trapped in the focus of a laser beam. Our method, based in the dipole approximation of trapping, hinged on determining the maximum velocity v_{max} of the particle as the gradient force pulls it to the beam's focus, giving the beam waist w_0 and subsequently, the polarizability and polarization. We measured $U_{max} = -5.03 \pm 2.12 \text{ } \mu\text{m/s}$, which yielded a beam waist $w_0 = 4.586 \pm 0.2 \text{ } \mu\text{m}$. This gave the polarizability as $\alpha_1 = (1.081 \times 10^{-17} \pm 0.459) \text{ A}^2 \cdot \text{st. kg}$ and the polarization as $P_1 = (1.874 + 1.666) \times 10^{-14} \text{ C/m}^2$. We verified this method in two ways. The first utilized intensity data of the beam, and the second was based on formulae found in the literature for a focused beam. These yielded the following values $\alpha_2 = (7.381 + 0.014) \times 10^{-20} \text{ A}^2 \cdot \text{st. kg}$, $P_2 = (1.279 \pm 0.351) \times 10^{-16} \text{ C/m}^2$; $\alpha_3 = (3.223 \pm 0.147) \times 10^{-20} \text{ A}^2 \cdot \text{st. kg}$, $P_3 = (5.584 \pm 1.326) \times 10^{-17} \text{ C/m}^2$. Due to the similarity between α_1 and α_2 and their collective difference in magnitude between α_1 , the validity of our method can be disputed. All of these values were compared to the polarizability and polarization found by the Clausius-Mossotti relation, which gave $\alpha_{CM} = 1.25 \times 10^{-30} \text{ A}^2 \cdot \text{s}^4 \cdot \text{kg}$ and $P_C = 2.166 \times 10^{-27} \text{ C/m}^2$. As this relation is well-trusted throughout the literature, further work is necessary to refine the results of this experiment.

SENIOR INDEPENDENT STUDY



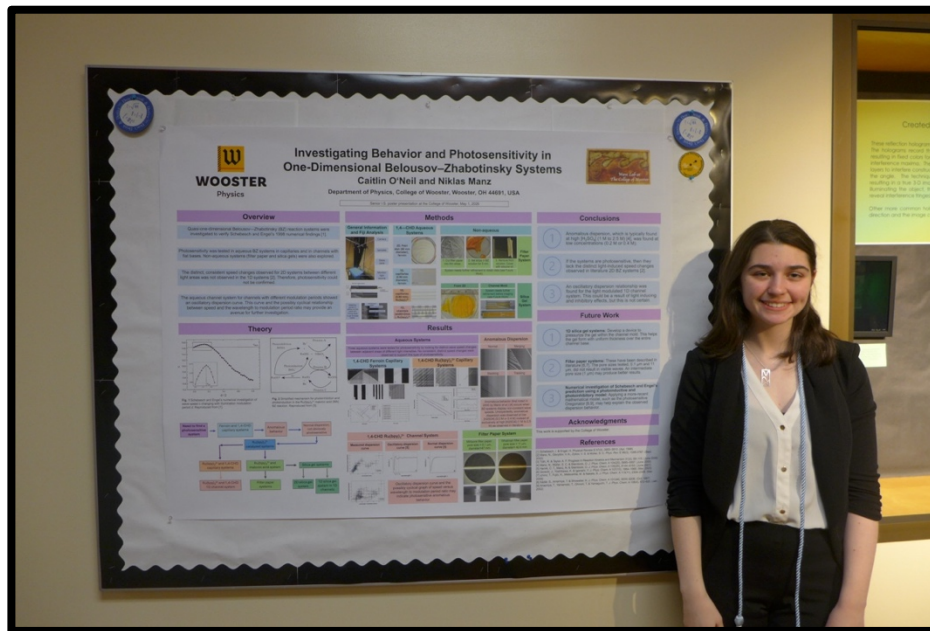
Abby Hovorka

The Memory of Light: Investigating a Nonlinear Phase Accumulation in the Polarization Transformations of Light

Advised By: Cody Leary

Depending on how the polarization of light evolves, it can accumulate subtle phase changes. This project investigates a nonlinear phase known as geometric phase, which, in this experiment, depends not on the distance light travels, but on the path, it takes through different polarization states. In this research, a laser beam with controlled polarization was sent through an interferometer, where it was split into two paths. One path retained the initial polarization, while the second path passed through a birefringent crystal. Adjusting the crystal tilt angle caused the polarization of the second beam to evolve continuously. The experiment was repeated for different initial polarization states while rotating the crystal over the same tilt-angle range, ensuring consistency across data runs. When the two beams were recombined, they produced interference patterns based on differences in their polarizations. Across runs with various initial polarizations, the resulting interference patterns showed clear beating patterns and systematic shifts in interference extrema, providing qualitative evidence of a rapid phase shift approaching π . Although a precise numerical value of the phase shift was not determined, the observed behavior aligns with theoretical predictions from a heuristic model and the Poincaré sphere representation. What makes this project particularly interesting is the combination of experimental optical research with theoretical modeling, allowing for comparisons between predicted and observed behavior. Future work could involve exploring additional crystal orientations and tilt angles, improving experimental control over tilt angle increments, and refining the theoretical model to better predict how polarization changes contribute to geometric phase.

SENIOR INDEPENDENT STUDY



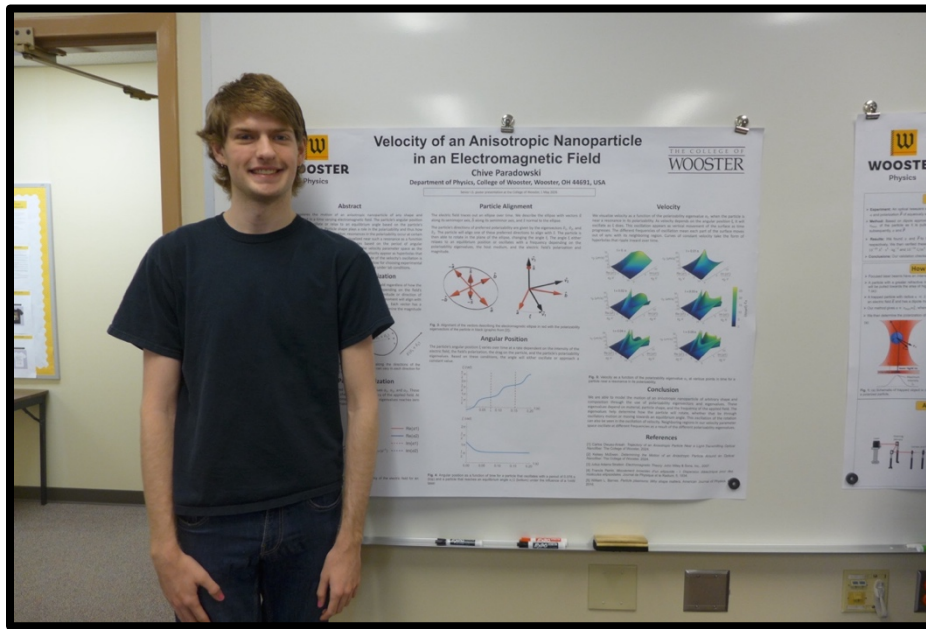
Caitlin O'Neil

Investigating Behavior and Photosensitivity in One-Dimensional Belousov-Zhabotinsky Systems

Advised By: Niklas Manz

Several variations of a quasi-one-dimensional Belousov–Zhabotinsky (BZ) reaction were investigated in an attempt to verify Schebesch and Engel's 1998 numerical findings [1]. They predict, for a photosensitive BZ system, a relationship between wave speed v and modulation period d where v increases with d to reach a maximum at d_{opt} before decreasing. A photosensitive system must be found to test this relationship. Aqueous capillary BZ systems were examined for speed changes between areas of different light intensities. No consistent, distinct changes were found. Non-aqueous BZ media, specifically silica gel and filter papers, were also explored since the aqueous system's behavior could be influenced by hydrodynamic effects. While the 1D gel and filter paper systems were not usable for data collection, they have potential as non-aqueous systems if further refined. Aqueous BZ systems were also prepared in quasi-1D channels with flat bases to avoid the curved sides of the capillaries that may affect wave behavior. The dispersion relationship between wave speed and wavelength was further explored in this system. For one experiment using different modulation period sizes for each channel, this unexpectedly resulted in an oscillatory dispersion curve. While Schebesch and Engel's 1998 work remains unverified, this dispersion curve and the possibly cyclical relationship between speed and the ratio of wavelength to modulation period may provide an avenue for further investigation.

SENIOR INDEPENDENT STUDY

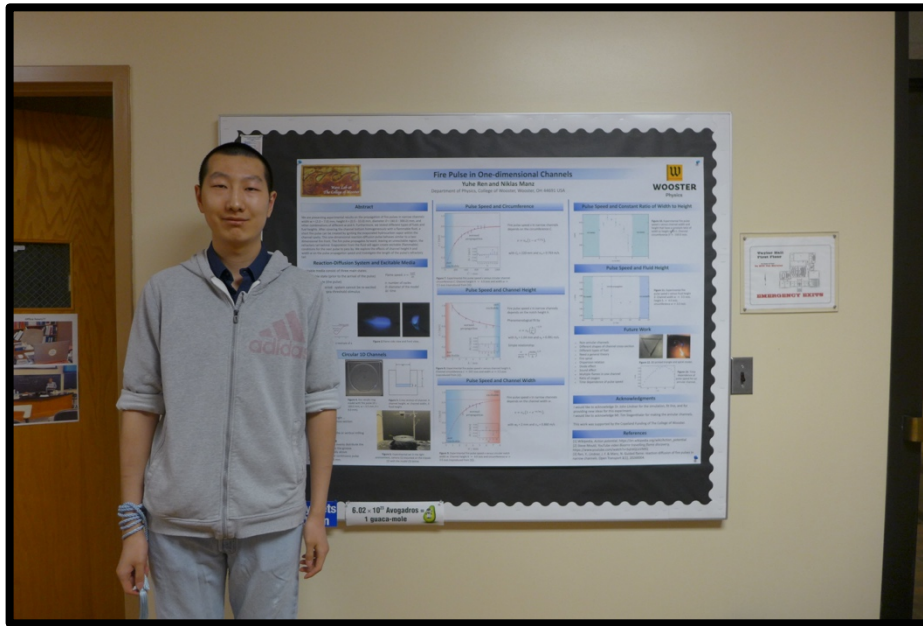


Chive Paradowski

Velocity of an Anisotropic Nanoparticle in an Electromagnetic Field

This work theoretically explores the motion of an anisotropic nanoparticle placed in a time varying electro-magnetic field. Equations for the force and torque experienced by the particle are derived from the Lorentz force, which readily yield equations of motion of velocity and angular velocity by considering the drag from the host medium the particle is in. The angular velocity differential equation is solved to give angular position as a function of time, where the angle will either oscillate or relax to a particular angle based on the particle's polarizability. The coordinate systems used for the final equations of motion are derived from the directions the particle polarizes in based on its polarizability tensor, the ellipse traced out by the electromagnetic field, and a beam described in cylindrical coordinates. Under a chosen Gaussian beam, the intensity gradient directs the particle towards a radius of maximal intensity. Velocity is visualized over the parameter space of polarizability eigenvalues near resonance, obtainable at certain frequencies of the surrounding electromagnetic field under the Drude model for conductors. Velocity oscillates based on the period of angular displacement, creating ripples over the surface of the parameter space as the velocity gradually devolves over time based on the polarizability eigenvalues. Curves of minimal velocity appear as hyperbolas that propagate over time in the parameter space. The amplitude of the velocity's oscillation varies linearly with the eigenvalues, which could allow for choosing experimental particles such that the changes in velocity would be noticeable under lab conditions.

SENIOR INDEPENDENT STUDY



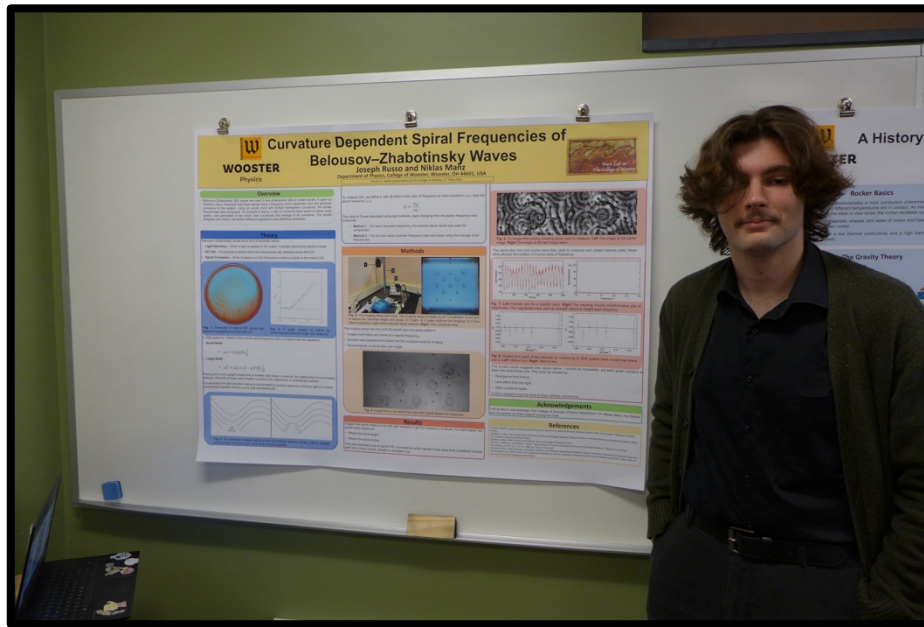
Yuhe Ren

Fire Pulse in One-dimensional Channels

Advised By: Niklas Manz

We experimentally studied the fire propagation in annular channels with different parameters and fuels, such as Zippo® lighter fluid, methyl alcohol and ethyl alcohol. The fuel mainly used in this experiment was Zippo® lighter fluid. The annular channel has a rectangular cross-section and changing parameters include the channel's width, height and annular diameter. The fuel was evenly distributed into the channel and once evaporated and mixed with air, it formed a vapor that is able to ignite and burn. Once ignited, the fire pulse would start to propagate along the ring and leave a refractory tail that could not be ignited again. After a certain time, it can be ignited again. If the recovery time of the refractory period was close to or shorter than the time that the pulse arrived, the propagation could be sustained, which formed an excitable system. Our experiment mainly connected the propagation speed in the reaction diffusion system to the channel geometry, such as channel width, height and circumference. We also studied the relationship between the fuel height in the channel and the propagation speed and different types of fuel. The flame pulse speed shows a negative power law dependence for the propagation speed, which depends on the channel height ($v \propto h^{-1/4}$) from $h = 1.0$ mm to $h = 7.0$ mm. Outside this region, there is no flame propagation. The relationships between speed and channel width $v(w)$, and speed and channel circumference $v(C)$, can be fit by an exponential function. The speed's dependence on the channel width also has a specific region from $w = 3.0$ mm to $w = 5.0$ mm, as does the speed's dependence on the circumference, which approaches stable, constant asymptotic limits. When the channel dimensions are scaled up while maintaining a constant aspect ratio ($w/h = 1$), the overall speed behaves like a bell-shaped curve, and has a maximum at $w = h = 3.0$ mm. The relationship between the flame pulse speed and the fuel height shows a decreasing trend. Since this contradicts the hypotheses, we made based on the results of channel height, there is a need for further testing. The flame pulse speed also depends on the combination between C, w, h , such as bottom area Cw , which shows an increasing exponential trend. For the fuel fluid height, there is a decreasing trend as the fluid height increases.

SENIOR INDEPENDENT STUDY



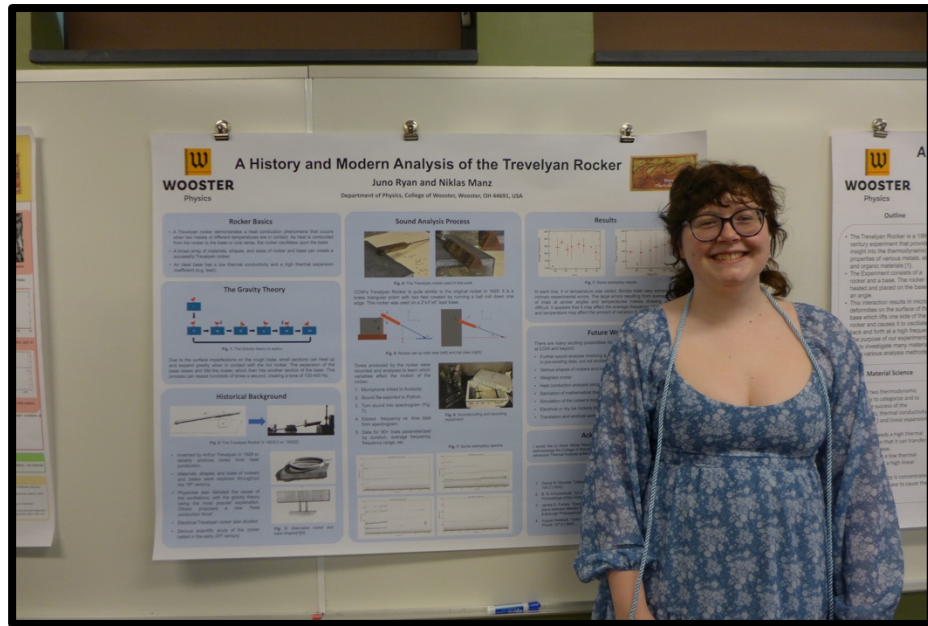
Joe Russo

Curvature Dependent Spiral Frequencies of Belousov-Zhabotinsky Waves

Advised By: Niklas Manz

Belousov-Zhabotinsky (BZ) solutions create waves when in 2D and can create spirals. In 1996, Zykov created a mathematical model to compare the frequency of the spiral's rotation on curved surfaces vs planar, however, this assertion requires experimental confirmation. Using an acrylic mold with thirteen curvatures, the solution was placed into the mold, then light was used to create spirals. Two distinct methods to compare the values as a ratio were used. The first takes each spiral on a curvature and compares it to its nearest planar spiral, the second takes the average of all planar spirals and each curvature's spirals, and uses these averages to create a ratio. In both cases, the values of averages are shown to be below the expected value; however, only a few do not have the expected value within error estimates. This evidence disagrees with current theoretical models.

SENIOR INDEPENDENT STUDY



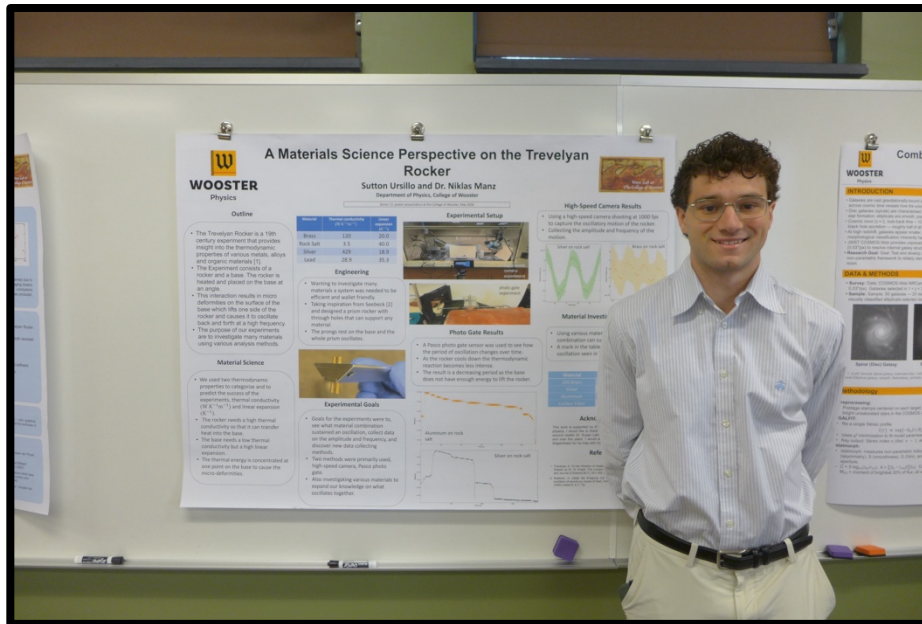
Juno Ryan

A History and Modern Analysis of the Trevelyan Rocker

Advised By: Niklas Manz

The Trevelyan Rocker, invented in 1829, offered scientists of that era an opportunity to study the combination of thermal physics, acoustics, materials science, and mechanics in one complex phenomenon. Despite great advances in these fields since that time, little progress has been made on the study of the Trevelyan Rocker in the last century. This work provides a foundation for the modern study of the Trevelyan Rocker. A review of historical literature highlights what progress has already been made and where further work is needed. A brief discussion of the theory of the rocker is intended to make future advances in the explanation and simulation of the rocker easier to begin. Finally, an initial exploration into the rocker using modern recording and sound analysis tools increases understanding of the phenomenon using a novel method, and highlights areas where future researchers can expand upon this work.

SENIOR INDEPENDENT STUDY



Sutton Ursillo

A Materials Science Perspective on the Trevelyan Rocker

Advised By: Niklas Manz

The Trevelyan Rocker is a 19th century experiment that provides insight into the thermodynamic properties of various metals, alloys and organic materials. The experiment consists of several components, the rocker which is (normally) a prism shaped object, and a base where the rocker is rested on at some angle. The rocker is heated and placed on the base which begins the experiment. This interaction results in micro deformities on the surface of the base which causes the rocker to oscillate back and forth at a high frequency. For the experiments in the upcoming chapters, we examine how different materials interact with each other, i.e., looking at if the combination can sustain an oscillation. Many lists and tables of material combinations have been created, which throughout this thesis are added to and explored. The main thermodynamic properties that are taken into consideration is the thermal conductance and linear expansion coefficients. Looking at these can indicate if the material has potential to be a good base or rocker. While most of the research done on the Trevelyan Rocker is derived from material science work, some of it investigates how to analyze and categorize the oscillation that is created. In the early 20th century, the Gravity Theory was developed to describe the relationship between the amplitude and frequency of the rocker. For the following experiments, we test many different materials while using various analysis methods.

Over the course of these trials, we were able to see sustained oscillation from many different rocker and base materials. The purpose of these experiments was not to find the materials that work the 'best' but more exploration of this generally untouched phenomenon. This study aims to create a foundation of ideas and results so in the future someone can use this as a starting point in their own investigations.

2025 - 2026

COLLOQUIUM SERIES

Physics Juniors, [Junior I.S. Self-Designed Experiments](#), Tuesday, 5 May 2026

[Research Opportunities with CoW physics faculty](#), 23 April 2026

Abigail Ambrose, University of Toledo, [How Did Our Universe Get Here? Studying the First Galaxies and the Beginning of the Universe with Intensity Mapping Simulations](#), 19 February 2026

[Joseph Smith](#), College of Wooster, Statistical and Data Sciences, [Ultra-Intense Laser-Plasma Interactions: Simulations and Data Science](#), 22 January 2026

[Senior I.S. Oral Progress Reports \(round 2\)](#), Thursday, 4 December 2025

[Senior I.S. Oral Progress Reports \(round 1\)](#), Tuesday, 2 December 2025

[Chase Fuller](#), University of Iowa, Iowa, [11 Left Turn make a Right](#), 11 November 2025

Scott Crawford, Washington University in St. Louis, "[Engineering Dual Degree Program](#)", Tuesday 28 October 2025

[Benjamin Schumacher](#), Kenyon College, Ohio, [The Force of Creation](#), 16 September 2025

[Physics Department Safety Training](#), Tuesday, 2 September 2025

CoW Students, "[I don't know what you did last summer: Physics majors share summer research experiences](#)", Tuesday, 28 August 2025

HONORS & AWARDS

The Arthur H. Compton Prize in Physics

Chive Paradowski '26

The Joseph Albertus Culler Prize in Physics

Kristen Townsend '28

The Mahesh K. Garg Prize in Physics

Abby Hovorka '26

The Karl T. Compton Scholarship

Ben Maxwell '28

Kristen Townsend '28

The Ann C. Mowery Scholarship

Anthony Gomes '26

Koontz Research Scholarship

Kristen Townsend '28

Summa Cum Laude

Gustav Bourdon '26

Molly Cohan '26

Abby Hovorka '26

Caitlin O'Neil '26

Chive Paradowski '26

Magna Cum Laude

Juno Ryan '26

Cum Laude

Andrew Chura '26

Noah Hankin '26

JUNIOR

INDEPENDENT STUDY

SELF-DESIGNED EXPERIMENTS



Brooke Benjamin '27 Falling into a Black Hole: Investigating Massive Spinning Particles in Schwarzschild Spacetime

Tim Book '27 Solution Dilution: A Continuous Measurement of Solution's Changing Index of Refraction

Jake Cammarata '27 A Stroke of Genius: Using a Pendulum Stroke to Gain Shots Putting

Nate Chartrand '27 An Experimental Investigation of How Initial Launch Conditions Affect Boomerang Landing Position

Max Francis '27 Modelling Deuteron Acceleration and Energy Profile in 2D

Jiaxi (Jessie) Ren '27 One Disk, Two Disk, Riding Waves

Jon Stowers '27 Revisiting a Laboratory Method of Demonstrating the Earth's Rotation

Martin Zwergel '27 A Method to Measure the Polarizability of Gas Phase Media

FACULTY

Niklas Manz, Associate Professor of Physics

Teaching

Environmental Physics
Physics for the Life Sciences I
Physics for the Life Sciences II
Physics for the Physical Sciences II
Lab
Modern Physics Lab
Experience in the Discipline (German)
6 Seniors I.S. Advisee
3 Research Assistants



This year was the first year after my tenure as the physics department chair. Cody Leary became chair, Susan Lehman was on sabbatical in the fall, and Laura DeGroot had her final tenure review in the fall. As a result, I advised six Sr. I.S. projects, while having a lighter teaching load. I wasn't sure how it would go but it went pretty smoothly.

Molly Cohan '26 chose a research topic on lithium-ion batteries as her self-designed I.S., which she started during the summer 2025 at the Colorado School of Mines. Next academic year, she will join the same lab while starting her Ph.D. program there. After Nina Hanus '25 graduated as the first Chemical Physics major in many years, Caitlin O'Neil '26 and Joe Russo '26 followed her footsteps working with the chemical Belousov–Zhabotinsky reaction. Perhaps the most exciting change in my lab was the introduction of two experiments, I never worked with before. Yuhe Ren '26 continued his summer REU project on a fire pulse moving in the vapor above a combustible liquid in a narrow channel. This system has never been investigated before and therefore, we were able to publish the first (hopefully out of many) article before he graduated in May. Sutton Ursillo '26 and Juno Ryan '26 worked on the other 'new' experiment, the thermo-acoustical Trevelyan rocker. This system was first described in 1806 and the last scientific article had been published in 1931. Because it was forgotten for nearly one century, it's a great 'playground' with, I think, many experimental, analytical, and theoretical directions to be taken in the next years.

And as a side note: It was fun advising my first *Experience in the Discipline* course in the German department. Because many of the early publications about the Trevelyan Rocker were in German, a student used the course to learn how to use AI in a supportive way to translate scientific texts. We learned that AI can certainly help translating texts by providing a good foundation. But a lot was questionable, especially when translating 200-year-old German texts – even I haven't seen many of those words before and we used traditional techniques to determine their meaning. We submitted the first Trevelyan rocker manuscript in the spring semester and during my summer 2026 trip visit to Germany, I visited the industrial ruin where they extracted silver from copper ore for several centuries. This was the place where the sound producing oscillations were first observed in 1805. We are now working on a science history paper which might be published 222 years later.

FACULTY

Laura DeGroot, Assistant Professor of Physics

Teaching

Physics for the Physical Sciences I
Physics for the Physical Sciences I Lab
Classical Mechanics
Computational Physics
Modern Optics
2 Senior IS Advisees



This academic year I was given the opportunity to teach multiple classes again. I was able to incorporate more active learning techniques into Classical Mechanics and Physics for the Physical Sciences I, while under a successful tenure review. I also thoroughly enjoyed teaching great groups of students in Computational Physics and Modern Optics in the spring again. It was so rewarding and still incredibly challenging trying to figure out the best ways to engage students in these courses. I also had two very engaged senior IS students this year, Anthony Gomes and Akshit Deshpande, who completed great work investigating clumpy galaxies and the automated identification of disk galaxies.

Throughout the year, I continued in my role as Physics Club and Astronomy Club advisor allowing me to work with the Physics Club to organize outreach at local elementary schools and the annual Science Day, an event that brings the campus and Wooster community to Taylor Hall to experience different STEM demonstrations and activities. The clubs had a very active spring semester with great leadership! I also completed my first year in the role of Zone Councilor for Zone 7 of the Society of Physics Students (SPS). For this, I helped organize the SPS activities at the Fall APS EGLS conference at Eastern Michigan University, attended and assisted with the SPS Physics and Astronomy Congress in Denver in October, and helped organize a Zone meeting at the Ohio State University in March. I look forward to continuing in this role again this year!

For the October APS EGLS conference, I four students attended with me, at which two of them presented posters, and I also gave a talk titled "Is galaxy disk formation driven by inside-out star formation?" Five students attended the SPS Physics and Astronomy congress in Denver, at which two also presented poster on their summer research. In June, I attended the 248th meeting of the American Astronomical Society in Pasadena, California. I gave a talk titled "Quantifying the Inside-Out Formation of Disk Galaxies at $1.5 < z < 3.0$ Using Comparable Spatial Resolution Across Rest UV-Optical Wavelengths," which was well received, and it was wonderful catching up with colleagues and hearing about new and interesting astrophysics research. At the conference, my collaborator, Swara Ravindranath (NASA Goddard), along with two Wooster physics alums, Taliah Lansing and Karmellah Buttler, submitted a paper for publication in the Astrophysical Journal, which is also available on the ArXiv. It was very exciting to submit the results of this long-term project!

FACULTY

Cody Leary, Associate Professor of Physics and Chair

Teaching

Calculus Physics I
Calculus Physics I Lab
Calculus Physics II
Calculus Physics II Lab
Modern Physics
Math Methods for the Physical Sciences
4 Senior IS Advisees



I kept myself plenty busy this past year, chairing the Physics department, filling in as advisor to Wooster's Pre Engineering program while Dr. Lehman was on research leave, participating in ARCH orientation for incoming first year students, and advising in the APEX fellows summer internship program as well as in our summer REU in physics and chemistry. I also continued research collaborations involving 4 seniors, two juniors, and two sophomores, on topics ranging from the polarization degree of freedom in interferometry and optical forces and torques to modeling the effects of gravitational space-time curvature on extended spinning bodies near black holes.

Thanks to pioneering experimental work by seniors Gustav Bourdon '26 and Noah Hankin '26, two of my long-term theoretical modeling projects, involving i.) interferometry between multiple optical modes and ii.) optical forces and torques on nanoparticles, now have functioning experimental counterparts.

Chive Paradowski '26 and Therrin Baker '28 did great work pushing forward the nanoparticles project on the modeling side, which was subsequently furthered during our summer REU by Roselyn Veras from Bennington College. And last but not least, foundational experimental groundwork on the polarization-based geometric phase laid by Max Francis '27 and Abby Hovorka '26 led to some great data taken by Raymell Taylor '28 this summer which pushed that project forward.

FACULTY

***Susan Lehman, Victor J. Andrew Professor
of Physics***

Teaching

On leave, fall semester
Junior Independent Study
Quantum Mechanics



I took a one-semester research leave in the fall semester, which allowed me the time to get a number of new analysis techniques for our bead pile research better organized. I spent a wonderful week at the University of Colorado in Boulder during the leave, visiting the lab of Prof. Nathalie Vriend who studies a wide variety of granular materials under flowing conditions. I always enjoy time in Boulder, where I was a post-doc from 2000 – 2003, and seeing a different lab and learning new techniques is inspiring and thought-provoking.

In the spring semester, I was excited to teach Quantum Mechanics for the first time in 10 years. I completely revamped the course away from the wavefunction-first version which I had taught previously (from Griffiths) and switched to a spins-first version with Dirac notation. I underestimated how much time this change would take but fortunately there are great resources out there that I could lean on, or I would not have had much sleep. I guess it has been a while since I had a new prep and I had forgotten the work involved! The students in the class were an exceptional group, so overall it was a wonderful experience.,

I traveled to Denver for the Global Summit of Physics in March, which is a combo of the March Meeting and the April Meeting of American Physical Society. Again, I love Colorado, so this was wonderful. Catching up with wonderful former REU students made the conference very fun! Definitely check out the blog posts from the students for pictures and more info!

STAFF

***Manon Grugel-Watson '99 Physics
Laboratory Coordinator & Instructor, B-
WISER Camp Project Director***

Algebra Physics I Lab

Algebra Physics II Lab



Manon Grugel-Watson is the Physics Department Laboratory and Science Education Coordinator. She is responsible for the Physics Department's laboratory and demonstration equipment as well as the setup for introductory and advanced lab courses. Manon also taught the Algebra Physics Introductory Lab sections. And she works throughout the year to secure funding and manage the on-campus logistics of running B-WISER Science Camp for teenage girls, which has taken place on Wooster's campus since 1990. Currently, the camp consists of a program for middle school girls (rising 8-9th graders) and a program from high school girls (rising 10-11th graders). The camp provides an immersive science experience, including lab-based classes in a variety of STEM fields. The one-week residential camp takes place each June, with registration opening in early in the spring semester. If you know any young women who might be interested, please direct them to the camp website: <https://bwiser.spaces.wooster.edu/>

STAFF



Halle Bielke
Administrative Coordinator,
Physics and Mathematical & Computational Sciences



Timothy Siegenthaler
Instrument and Lab Tech/Machinist,
Biology, Chemistry, Earth Sciences, Physics



Jhony Mera
Electronics and Instrument Technician,
Machinist

PHYSICS CLUB

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Independent Eyes, Observing Together

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CONFERENCES

A * denotes a Wooster physics student and a summer research student

>Susan Lehman, Abby Hovorka, *APS March Meeting*, Denver, CO (March 15th-20th, 2026)

>Niklas Manz, *How are structures on the Human Tongue connected to the Gravitational Lensing effect of light*, Physics Colloquium, Kenyon College, Gambier, OH, (February 6th, 2026)

>Simon Kalafut, Therrin Baker, Tim Book, Laura DeGroot, Yuhe Ren, *EGLS Fall Meeting*, Eastern Michigan University, Ypsilanti, MI (October 24th-25th, 2025)



Susan Lehman in Boulder, CO with the Flatirons in September during her leave in fall 2025.

SUMMER RESEARCH

- >Brooke Benjamin'27, "Calculating Neutrino Predictions for Milky Way Pulsar Wind Nebulae from TeV Gamma-Ray Data", Georgia Institute of Technology REU program.
- >Madeline Bruns'29, "Honda Mechanical Engineering Co-op/Internship", Mechanical Engineering Co-op with Honda's North American Market Quality OBD/E-Drive group.
- >Ansar Dussaliyev'29, "Fire Pulses in a Narrow Annular Channel", The College of Wooster REU program.
- >Simon Kalafut'29, "Studying Galaxy Morphology, Magnitude, and Density near Cosmic Noon", The College of Wooster REU program.
- >Jon Stowers'27, "Improvements to the EIC Compton Laser System", Department of Energy Science Undergraduate Laboratory Internship (SULI) program at Thomas Jefferson National Accelerator Facility.
- >Raymell Taylor'28, "Crystal-Based Polarization Transformations and Resulting Geometric Phase Accumulation", The College of Wooster REU program.
- >Kristen Townsend'28, "Determining Avalanche Crossover Thresholds in a Granular System", The College of Wooster REU program.

ALUMNI



Niklas Manz, Susan Lehman, **Chase Fuller'19**, Laura DeGroot,



Anthony Gomes and **Ann Mowery'82** after the Dewald Recognition Celebration.



Susan Lehman and **Graham Schattgen'16**

ALUMNI



Deepika Sundarraman'14 and Susan Lehman



Austin Carter'04 and Susan Lehman

ALUMNI



Abigail Ambrose'20 and Laura DeGroot



Laura DeGroot and **Megan Fisher'21**