133rd NYSS-APS Topical Symposium

Advances in Physics Education Research

Hosted by University at Albany, SUNY

and Hudson Valley Community College

April 18, 2026

Welcome!

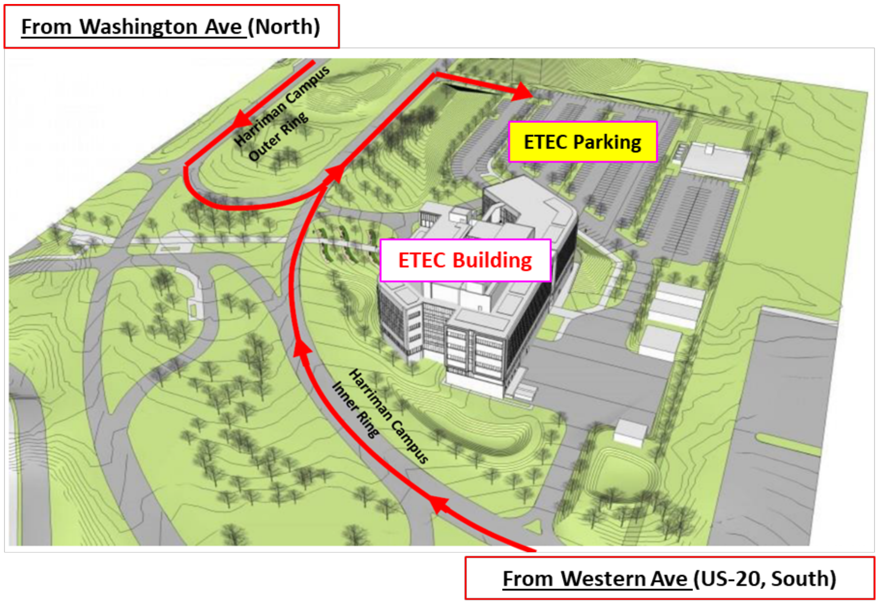
Welcome to the 133rd Topical Symposium of the New York State Section of the American Physical Society (NYSS-APS), Advances in Physics Education Research, held on Saturday, April 18, 2026, at the University at Albany. This symposium brings together physicists from across New York State to share new insights into physics education. This program provides the full schedule, talk abstracts, and poster listings. We extend our sincere appreciation to all speakers, presenters, attendees, and volunteers for contributing to the symposium . We also gratefully acknowledge the support of the American Physical Society and the College of Nanotechnology, Science and Engineering at the University at Albany.

About NYSS-APS

The New York State Section of the American Physical Society (NYSS-APS) promotes the advancement and dissemination of physics throughout New York State by organizing topical symposia twice each year at academic institutions across the region. These meetings provide a forum for researchers, educators, and students to share their latest results, foster collaborations, and engage in discussions spanning all areas of physics. The section also funds outreach projects across the state for the purpose of teaching young people about physics and related to topics.

About APS

The American Physical Society (APS) is a nonprofit organization dedicated to advancing and diffusing the knowledge of physics for the benefit of humanity. Founded in 1899, APS represents more than 50,000 members worldwide and publishes leading scientific journals, including Physical Review and Physical Review Letters. Through its meetings, publications, and outreach, APS fosters collaboration and innovation across the global physics community.



Driving Directions

The ETEC building is in the Harriman State Office Complex, which is adjacent to the University at Albany campus. The address of the ETEC building is ETEC, 1220 Washington Avenue, Albany, NY 12226. It is important that you include "ETEC" in your search if you are using a mapping program; otherwise, the search may send you to the state police barracks.

From the UAlbany Campus:

There is no direct street access to the ETEC building from the UAlbany campus. You must first drive to either Washington Avenue or Western Avenue (US-20) and go east towards downtown Albany. Just after passing the UAlbany campus, there will be an entrance to the Harriman State Office Complex (State Office Buildings).

- If entering Campus Access Road from Washington Avenue, you will see the ETEC building on your left. You will take a U-turn to access the side of Campus Access Road that passes in front of the ETEC building. The parking lot is on the north side of the building.
- If entering Campus Access Road from Western Avenue, you will also need to take a U-turn so that you are driving towards the ETEC building, not away from it. Again, the parking lot is on the north side of the ETEC building.

From the North:

Take the Northway (I-87) south to Exit 1E. Merge onto I-90 east (toward Albany/Boston). Then take Exit 3 (State Office Buildings), which will put you on Campus Access Road. Once you see the ETEC building on your left, you will take a U-turn to access the side of Campus Access Road that passes in front of the ETEC building.

Driving Directions (cont.)

From the South:

Take the Thruway (I-87) north to Exit 24. Merge onto I-90 east (toward Albany/Boston). Then take Exit 3 (State Office Buildings), which will put you on Campus Access Road. Once you see the ETEC building on your left, you will take a U-turn to access the side of Campus Access Road that passes in front of the ETEC building.

From the West:

Take the Thruway (I-90) east to Exit 24. Merge onto I-90 east (toward Albany/Boston). Then take Exit 3 (State Office Buildings), which will put you on Campus Access Road. Once you see the ETEC building on your left, you will take a U-turn to access the side of Campus Access Road that passes in front of the ETEC building.

From the East:

Take I-90 west to Exit 3 (State Office Buildings), which will put you on Campus Access Road. Once you see the ETEC building on your left, you will take a U-turn to access the side of Campus Access Road that passes in front of the ETEC building.

Venue

The symposium will be held on Saturday, April 18, 2026. All events will be on the first floor of the ETEC building. The registration/badge pickup, coffee breaks, lunch, poster session, and banquet will be in the ETEC foyer. All talks will be in the ETEC 149A/151A lecture hall. No food or drinks are allowed in the lecture hall. There are rest rooms to the right of the lecture hall.

For members of the Executive Committee of the New York State Section of the American Physical Society, there will be an executive committee meeting on Friday evening from 7:00 PM to 8:00 PM in the ETEC 203.

Wi-Fi Access

There is free Wi-Fi access in the ETEC building. The Wi-Fi network is "UAlbany Guest". No password is needed. The Wi-Fi network "eduroam" is also available for those who have an eduroam account through your university.

Advances in Physics Education

133rd Topical Symposium of the

New York State Section of the American Physical Society

ETEC Building, University at Albany

Albany, New York 12226

Saturday, April 18, 2026

Schedule of Events

8:30 AM – 9:00 AM	Reception/Badge Pickup
9:00 AM – 9:15 AM	Welcoming Remarks
9:15 AM – 9:55 AM	*Teaching the Culture and Civic Role of Physics: A PER-Informed Physics and Society Course* Evan Halstead, Skidmore College
9:55 AM – 10:35 AM	*Quantum Party! An educational board game with quantum mechanics!* Matthew Bellis, Siena University
10:35 AM – 10:50 AM	Break
10:50 AM – 11:30 AM	*Helping Students Become Critical and Ethical Users of Generative AI in Physics* Colleen Countryman, Ithaca College
11:30 AM – 12:10 PM	*Understanding and Transforming Departmental Culture in Physics Graduate Programs* Diana Sachmpazidi, Rochester Institute of Technology (RIT)
12:10 PM – 1:10 PM	Lunch
1:10 PM – 1:50 PM	*Searching for a CURE: Students' perceptions of authenticity and experimental physics during a course-based undergraduate research experience* Alexandra Werth, Cornell University
1:50 PM – 2:30 PM	*Calculus(-Ideas) based physics: Reasoning without the formalism* Charlotte Zimmerman, Cornell University

2:30 PM – 2:45 PM	Break
2:45 PM – 3:25 PM	*Student perceptions of authenticity in introductory physics labs*
	Mike Verostek, Cornell University
3:25 PM – 4:05 PM	*Integrating Experiment and Computation in the Beyond-First Year Laboratory*
	Jerome Fung, Ithaca College
4:05 PM – 5:15 PM	Poster Session
5:15 PM – 6:00 PM	Banquet
6:00 PM – 6:45 PM	*Geometric Visualizations of Quantum States*
	Paul Cadden-Zimansky, Bard College
6:45 PM – 7:00 PM	Award Presentations

Oral Presentations

9:15 am - 9:55 am

Teaching the Culture and Civic Role of Physics: A PER-Informed Physics and Society Course

Evan Halstead

Skidmore College

Physics Education Research (PER) has expanded the goals of physics instruction beyond content mastery to include attention to identity, belonging, and students' understanding of the nature of science. This talk presents a Physics and Society course that takes these concerns as its starting point. The course focuses on two main areas: barriers to participation in physics and the role of physics in science policy. Through discussions and case studies, students examine the culture of physics, interrogate common assumptions about scientific objectivity, and evaluate how physics informs public decision-making. I will highlight how the course design draws on PER ideas and share observations about its impact on student thinking. The talk concludes with open questions about the role of physics education in preparing students for engagement with science in society.

9:55 am -10:35 am

Quantum Party! An educational board game...with quantum mechanics!

Matthew Bellis

Siena University

There is a tremendous amount of competition for our students' attention (social media, extracurricular activities, jobs, etc), making it a real challenge to occupy their head space. Starting in 2018 and greatly aided by an AAPT grant from the Bauder Fund, a small group at Siena decided to address this challenge by developing a board game that teaches quantum mechanics at the middle- and high-school level. The gameplay is driven by rules inspired by the science behind 4 classic science experiments/observations: the double slit experiment, blackbody radiation, the photoelectric effect, and the Rutherford scattering experiment. The game was completed in 2021 and is currently available for purchase from an independent games-manufacturer, The GameCrafter. In addition to the game board and pieces, the game comes with a pamphlet that concisely describes the science behind the game at an introductory level. In this talk, I will share our experience designing the game, how we've used it in classrooms and summer camps at Siena, and how it fits into the broader context of teaching quantum mechanics at the undergraduate level.

10:50 am -11:30 am

Helping Students Become Critical and Ethical Users of Generative AI in Physics

Colleen Countryman

Ithaca College

Generative AI is rapidly reshaping how students approach creative, analytical, and technical work, yet many instructors are still determining how to integrate these tools in thoughtful, pedagogically-grounded ways. In this session, I will share strategies that leverage the capabilities of generative AI as a pathway to new forms of learning in a variety of different undergraduate physics environments. These approaches use AI to open opportunities that wouldn't be available otherwise within the constraints of time and prior experience.

In one such case study, we'll explore an AI-infused unit on songwriting in an introductory course on the Physics of Music. Designed for students with little prior experience in music composition, the unit lowers barriers to the songwriting process and allows an opportunity for students to discuss how AI works and the ethics around AI-assisted work. We'll discuss the activities that opened new creative paths for students while aiming to cultivate ethical uses of AI.

I will also share other assignments which involve the critical evaluation of AI-generated artifacts. In one upper-level Classical Mechanics activity, we'll discuss how to incorporate a critical evaluation of AI-generated solutions into classroom conversations.

In another, students in upper-level research settings engage in "vibe coding" projects, using AI-assisted coding practices to lower technical programmatic barriers so they can focus more deeply on physical modeling and instructional design practices.

Survey data and classroom observations suggest that structured exposure to generative AI paired with ethical framing and reflective practice can provide new learning opportunities while strengthening students' disciplinary understanding and cultivating responsible AI tool use. Participants will leave with adaptable strategies for integrating generative AI across disciplines, including methods for scaffolding evaluation skills, facilitating ethical debate, and designing assignments that emphasize creativity, rigor, and student agency.

11:30 am – 12:10 pm

Understanding and Transforming Departmental Culture in Physics Graduate Programs

Diana Sachmpazidi

Rochester Institute of Technology

Physics graduate programs across the United States continue to face persistent challenges related to student retention and diversity, particularly for individuals from historically excluded groups. While many departments have attempted to address these concerns through localized interventions, recent research and practice highlight the need for broader, systems-level approaches to change. Change theories emphasizing organizational and cultural transformation offer a promising framework for shifting attention from isolated program components toward the structures, norms, and practices that shape graduate student experiences. In this talk, I will introduce the Inclusive Graduate Programs (IGP) Project, a multi-institution initiative designed to support physics departments in creating and sustaining more inclusive, welcoming, and supportive graduate environments. Through partnerships with twelve research-intensive physics graduate programs, the IGP Project engages faculty, staff, and graduate students in a process of examining departmental culture and identifying barriers that contribute to inequitable outcomes. I will share key findings from the IGP Project, focusing on departmental profiles, surveys and interviews with students, and faculty interviews. I will conclude by outlining a developing research agenda focused on how departments can anticipate and respond to emerging challenges in higher education and the evolving STEM workforce, while continuing to advance equity, inclusion, and student success.

1:10 pm – 1:50 pm

Searching for a CURE: Students' perceptions of authenticity and experimental physics during a course-based undergraduate research experience

Alexandra Werth

Meinig School of Biomedical Engineering, Cornell University

There have been recent calls to create more opportunities for students to participate in undergraduate research experiences in order to increase persistence, interest, and identity within the sciences. Course-based undergraduate research experiences (CUREs), where students engage in authentic scientific discovery in which they answer a question where the answer is initially unknown to both students and the scientific community, is one proposed way of doing this. Here, I present student experiences with authentic research in a large, introductory physics CURE (C-PhLARE) conducted remotely during the COVID-19 pandemic. We use student responses to closed-response surveys, as well as written responses to an open-ended end-of-course assignment to investigate what aspects of real research students felt that they participated in, the extent to which students felt that they participated in authentic research, and how the authentic experience changed their views of experimental physics. We found that most students in the course felt like they engaged in real-world research during the course and many students highlighted their experience with authentic research when asked to describe their experience in the course more broadly. Additionally, we observed that the C-PhLARE CURE had a significant impact on many of the students beliefs about experimental physics aligned with the objectives of the course; notably, students had more expertlike views in areas such as communicating scientific findings to peers, understandings of authentic research practices, and students' belief in their own research capabilities.

1:50 pm – 2:30 pm

Calculus(-Ideas) based physics:
Reasoning without the formalism

Charlotte Zimmerman

Cornell University

Calculus, procedurally and conceptually, is essential to an introductory physics course. Instructors and education researchers alike cite quantitative reasoning (including reasoning about rate of change and accumulation) as an essential skill across all STEM disciplines. However, discipline-based education researchers across STEM are increasingly asking what kinds of quantitative reasoning are authentically valuable for subsets of the broad population that enroll in introductory courses. In this talk, I will share some of my work at the interface of mathematics and physics education research examining how students and experts reason about the rate of change and accumulation of scientific quantities. I will also share the implications of that work on the development of a calculus ideas-based introductory physics course that emphasizes conceptual calculus reasoning without requiring, or assuming facility with, calculus formalism.

2:45 pm – 3:25 pm

Authenticity in introductory physics labs

Mike Verostek

Cornell University

Expanding access to authentic experimental science experiences beyond students who conduct traditional undergraduate research is critical to broadening participation in physics and improving retention. In this talk, I discuss ways of conceptualizing authenticity in introductory physics labs and how different lab formats may support student perceptions of authenticity. In particular, I focus on several efforts to simulate authentic practice in lab and to embed lab exercises in the context of experimental particle physics. I draw on data about student learning and attitudes to discuss which lab features support different student outcomes, and to explore future directions for research.

3:25 pm - 4:05 pm

Integrating Experiment and Computation in the Beyond-First Year Laboratory

Jerome Fung

Ithaca College

Both experimentation and computational modeling are important epistemic approaches in physics. Both also involve skills that are valuable for students preparing for the workforce or for graduate study. Here, I discuss several case studies showing how experimentation and scientific computation can be successfully integrated in intermediate and upper-division physics laboratories. These include an intermediate experiment to quantitatively measure and model Fraunhofer diffraction patterns, a project to perform phase-sensitive detection using a low-cost microcontroller, and an upper-division experiment on thermal diffusion whose results cannot be quantitatively understood without numerically solving the diffusion equation. I will discuss lessons learned and potential challenges involved in helping students develop their skills in both domains and use them to deepen their physical understanding.

6:00 pm – 6:45 pm

Geometric Visualizations of Quantum States

Paul Cadden-Zimansky

Bard College

One of the principal challenges of learning and understanding quantum mechanics is the relative lack of meaningful and useful visual images to accompany the subject's abstract mathematical formalism. In one extreme example, the Nobel Laureate Steven Weinberg composed an entire quantum textbook that contains no pictures, diagrams, plots, or graphs at all. In contrast, starting from a very young age we have many years of experience visualizing what it means for a classical object to be moving along in a location in space -- it's classical "state" – which provide us with helpful intuitions when we first encounter the mathematical formalisms of introductory physics. To improve our corresponding quantum intuitions, this talk will present a series of geometric maps of quantum states that can be used to introduce quantum concepts, accompany the learning of the quantum formalism, and deepen one’s understanding of its algorithms. Particular emphasis will be placed on visualizing mixed quantum states, which, despite their centrality to describing the world quantum mechanically, are often absent from quantum courses due to their more involved algebraic formalism.

Poster Presentations

P1 (UG)

Estimating Environmental Coupling at LIGO Livingston Using Thunderstorms During O3

Fonsea Bagchi

Bard College

The Advanced LIGO detectors witnessed more than 90 gravitational waves (GWs) from compact binary coalescences during their third observing run (O3) in 2019-2020. For each detection, data from a network of ~100 auxiliary environmental sensors was compared to astrophysical data to determine whether environmental noise coupling to the LIGO detectors affected the GW data. This process is reliant on detailed knowledge of the coupling function (CF) of each environmental sensor. Measurement of the sensor CFs is typically made only every few months. In this poster, we propose a method to supplement the noise injection campaigns used to measure environmental sensor CFs by modeling the response of both environmental monitoring and GW data channels to thunderclaps in O3. This framework will enable us to test the environmental coupling of the LIGO detectors much more often than the infrequent noise injection campaigns which take place at the LIGO detectors.

P2 (GR)

Data-Driven by Design: Building a Reflective Physics Graduate Program

Kevin Coldren

Rochester Institute of Technology

Well-documented research on physics graduate education has demonstrated long-standing issues that hinder equitable student access and participation. Addressing these challenges can be particularly difficult because they are often rooted in entrenched disciplinary and departmental cultures that tend to be rigid and resistant to change. In this work, we aim to cultivate a data-driven culture of cyclic self-reflection and action to proactively identify and address issues that affect student well-being and success in both a new physics and a long-standing astrophysics graduate program within a single institution. Drawing on survey and focus-group interview data from students in both programs, we collaborated with program leadership to identify actionable steps for improvement. In this paper, we present findings on student experiences across the two programs and discuss implications for research and practice. More broadly, this work provides a framework for graduate programs seeking to build a data-driven culture that improves student experiences.

P3 (UG)

Statistical Validation of a Team Member Assessment Tool for Instructional Change Teams

Austin Kunz

Rochester Institute of Technology

Team-based efforts to improve undergraduate STEM education have many potential advantages over individual efforts, such as addressing broad student learning challenges and/or enabling changes to develop and solidify over multiple semesters. Further, instructional change teams can function as communities of practice that support individual members' learning of STEM education. However, not all teams are equally successful, and dysfunctional team dynamics can result in a waste of time, effort, and resources. To assess these team dynamics, we developed the Team Member Perceptions of Instructional Change Collaboration (TM-PICC) survey, and administered it to 34 teams across 9 institutions. The data were validated using Exploratory Factor Analysis, and this talk presents the final survey and results.

P4 (GR)

Engineering and Characterization of Ag Induced Deep-Level Defects in Silicon for Quantum Technologies

Shruti De[1,2] and Mengbing Huang[2]

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[2]*Dept. of Nanoscale Science & Engr., University at Albany - SUNY, Albany, NY 12203*

Silicon's compatibility with existing microelectronics makes it a compelling platform for scalable quantum technologies; however, the identification and understanding of viable quantum defects in silicon remain limited. In this work, we investigate deep-level defects introduced by transition metal doping (e.g. – Ag) using a combination of deep-level transient spectroscopy (DLTS) and X-ray photoelectron spectroscopy (XPS). DLTS provides access to defect energetics and carrier trapping dynamics, while XPS reveals the chemical states and local bonding environments associated with these impurities. By integrating these complementary techniques, we develop a more complete picture of the relationship between defect formation, electronic structure, and material chemistry. This study not only advances the experimental understanding of transition-metal-induced defects in silicon but also offers a pedagogical framework for connecting spectroscopy techniques with defect physics in semiconductors. The insights gained contribute to ongoing efforts to identify spin-active, optically addressable defect centers compatible with CMOS-based quantum architectures.

P5 (GR)

Dependence of Temperature and Pressure on Resonant Frequency and Dampening of MEMS Devices

Meghan Herbert[1], Alvar Garza[2], Matthew Strohmayer[3], Joleyn Brewer[3], Christopher Nassar[3], Christopher Keimel[3], and Carl A. Ventrice, Jr.[2]

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Microelectromechanical systems (MEMS) are micron scale devices with moving parts. MEMS-based switches have been developed by Menlo Micro for various applications, including RF signal propagation. These switches have higher switching speeds and lower power loss than conventional semiconductor-based switches. The MEMS switches use an electrostatically controlled cantilever that is made from a metal alloy. The electrical contacts of the switch are coated with ruthenium because of its resistance to oxidation. The MEMS switches are encapsulated in a proprietary gas mixture. This gas mixture helps maintain the stability of the contacts and provides dampening of the cantilevers.

The primary goal of this project is to experimentally determine the effect of temperature and the pressure of the encapsulation gas on the resonant frequency and dampening of the MEMS devices. These MEMS devices are being considered for use in quantum computers, which requires operation at cryogenic temperatures. Since the devices are incapsulated in a hermitically sealed environment, as temperature decreases, the pressure of the encapsulation gas decreases, which results in a change in the dampening of the cantilever. In addition, the stiffness of the cantilever increases as the temperature decreases, which results in a higher resonant frequency.

A custom vacuum chamber has been developed to allow testing of MEMS devices under vacuum and up to an absolute pressure of 1 atm with a variety of different gas mixtures. The system can also measure the performance of the MEMS switches from LN2 temperature up to 100 °C. Our results for measurement of the dynamic performance of the MEMS switches at temperatures ranging from 77 K to 400 K and at pressures ranging from 10-7 Torr to atmospheric pressure will be presented. In addition, the design of a chamber modification that will allow measurements at gas pressures up to 2 atm absolute, will be presented.

P6 (UG)

Hypervelocity Impact of Three L-Type Ordinary Chondrites: A Test of the Variation of Beta and Disruption Energy (Q*D) with Target Porosity and Strength

Taylor Pytel* and Dr. George Flynn

SUNY Plattsburgh

While small meteorites strike Earth daily without causing harm, there is a non-zero probability of much more energetic impacts that may disrupt our planet and way of life. A successful deflection of such meteorites requires consideration of how energy and momentum are transferred from the impactor to the target. For this, we consider "Catastrophic Disruption Energy" (Q*D) to be the critical energy point between cratering and disruption, and the "Momentum Enhancement Factor" (Beta). Both of these are dependent on the porosity and strength of the target. To gain a better understanding of Beta and Q*D, we performed hypervelocity impact cratering and disruption experiments on three L-type ordinary chondrite meteorites of similar mineralogy, but varying strength and porosities: Aba Panu, NWA 869, and Saratov. At Impacts conducted around 5 km/s, beta decreases with increasing porosity, as expected. However, the catastrophic disruption energy Q*D peaked at intermediate porosity, contradicting the common assumption that higher porosity always increases resistance to disruption, as higher-porosity targets are thought to be more resistant.

P7 (UG)

Manipulating Chladni Wave Patterns Using External Magnetic Field and Heat

Rocco Golden* and Dr. Ken Podolak

SUNY Plattsburgh

Acoustic physics plays a large part in the development of many technologies and is found in ultrasound, music, quantum computing, architecture, and geology, among other areas. Acoustics involves the manipulation of wave patterns. This can be visualized using a Chladni plate. Chladni patterns originated from Ernst Chladni by sprinkling sand on a vibrating plate and observing circular nodal patterns that occur at specific resonant frequencies. The nodal patterns are found where the plate vibrates the least. Instead of sand, we used magnetic iron filings to create circular patterns at similar frequencies. Experiments are conducted where external factors, including an external magnetic field and addition of heat are investigated. By applying a strong enough external magnetic field, the iron filings will move off natural resonance modes. Furthermore, by applying heat, the iron filings will also shift off their natural resonance locations on the plate. The effects of the external magnetic field and heat on the plate changing the wave patterns will be discussed. These findings give us clues to manipulation of external factors that can influence acoustic wave modes.

P8 (UG)

Cobalt and Tin's Effect on the Hysteresis of Nickel Iron Powdered Materials

Huan Lin*, Minseong Kim, and Dr. Ken Podolak

SUNY Plattsburgh

Magnetic information storage in cloud servers and personal computers requires substantial energy to perform computational processes. Currently, more than 2% of global energy consumption is attributed to cloud data storage, and this portion continues to increase rapidly. To better understand the energy usage associated with magnetic storage, we prepared magnetic powder samples of commonly used materials in magnetic storage with varying concentrations.

The energy of our materials were evaluated by vibrating them under a changing external magnetic field, in accordance with Faraday's law. This experiment was conducted using a custom-built Vibrating Sample Magnetometer (VSM). The resulting measurements produced hysteresis loops, from which the work done by individual magnetic grains are determined.

Samples of equal mass were prepared using three different micron-sized powders. One set consisted of magnetic materials: iron, nickel, and cobalt, while the other set consisted of iron, nickel, and tin, of which tin is non-magnetic. A comparative analysis of the hysteresis loops obtained from the cobalt-based mixtures and the tin-based mixtures will be presented.

P9 (UG)

Accessible Physics Documents

Estefania Aguilar-Oropeza* and Dr. Ken Podolak

SUNY Plattsburgh

Physics documents present unique accessibility challenges for individuals that rely on screen readers, notably people with visual impairments, dyslexia, motor disabilities, and other conditions that require assistive technology. Unlike standard written documents, physics relies heavily on dense mathematical equations, Greek letters, and data heavy figures. These are elements that are frequently not rendered appropriately in formats such as PDF. A study found that of 139 physics websites across 73 U.S. institutions only one met the minimum accessibility standards of the Web Content Accessibility Guidelines (WCAG) thus demonstrating that inaccessibility is a widespread and largely ignored issue within the physics community (Scanlon et al, 2021). This research examines the challenges presented by making physics documents accessible and the steps for creating accessible documents from scratch using LaTeX, MathJax, and MathML, as well as readily available tools built into Word and PDF documents. A before and after demonstration using an excerpt from a 2024 SUNY Plattsburgh hypervelocity impact study illustrates how the same content can be completely unintelligible by a screen reader depending on how it is formatted. As U.S. law now requires public institutions to meet WCAG 2.1 standards by 2026, making these documents accessible is no longer an option, but a professional obligation that benefits the scientific community.

P10 (UG)

Observing Ultra Diffuse Galaxies in the Near-Infrared with the James Webb Space Telescope

Fiona Boutelle

Bard College

Ultra-diffuse galaxies (UDGs) are galaxies with extremely low surface brightnesses but relatively large effective radii. UDGs are relevant to dark matter research because for a UDG to stay gravitationally bound, it requires a much higher mass than baryonic matter can account for, yet astronomers have observed UDGs with both very high and very low dark matter fraction estimates. UDG structural properties have been analyzed in the local universe (in the visible wavelength range), but analysis is sparse in the near-infrared range. Dust obscuration could contribute to low surface brightness measurements in the visible bands of nearby UDGs, but dust does not have a significant impact on light in the near-infrared and infrared wavelengths. Hence, we study UDGs in the Abell 2744 cluster (redshift ~ 0.3), whose light is captured by the James Webb Space Telescope and Hubble Space Telescope. We characterize physical properties of a set of 55 UDG candidates in the cluster by creating surface brightness profiles for each galaxy and estimating their masses. We show that the candidates fit the UDG criteria from past literature, and our set of UDGs supports the idea that the low surface brightness is intrinsic, rather than an artifact of dust obscuration.

P11 (UG)

Circuit design for noise-filtering of gravitational wave signals

Artem Protsenko

Bard College

The project aims to filter out noise from sample gravitational-wave signals using the Sallen-Key bandpass filter and a summing op-amp as a prototype. Improvements can be made in integrating an active Twin-T Notch filter and training a CNN to detect nonlinear noise.

P12 (UG)

Qudit Visualizations

Yaroslav Valchyshen

Bard College

In this work, we demonstrate interactive \$2D\$ and \$3D\$ visualization tools to build intuition for the qudit state geometry, where d denotes dimensionality of the system. Starting from the density matrix representation, we show how quantum states can be mapped onto geometric simplexes. Although a qudit state resides in a \$d^2 - 1\$ dimensional space, there always exists a basis such that the state lies on the (d-1)-simplex. Therefore, we are able to understand high-dimensional qudit systems through simple Euclidean geometry.

P13 (UG)

Observation of Defect Size Evolution with Annealing Using Optical Scattering

Eric Zhao and Fonsea Bagchi

Bard College

High-quality optical coatings require low loss, but annealing can induce crystallization and increase scattering. Standard methods struggle to detect sparse crystallites or determine their size. We use angle-resolved Rayleigh–Mie scattering with simulations to detect and size individual defects in GeO_2:TiO_2 coatings. Applied to samples annealed at 625 °C, this method tracks defect emergence and growth with sensitivity down to ~80 nm.