

Cosmic Pathways NYC
Adelphi University
November 7, 2026

PROGRAM

A. Cosmic Pathways Program Schedule

9:00-10:00 **Conference Registration and Exhibit Space Open**
Location: University Center 1st Floor Lobby

10:00-10:15 **Conference Introduction**
Location: University Center Ballroom
Matthew Wright, Ph.D.

10:15-11:00 **Keynote: Career Pathways: Internships, Skills, and Careers in Industry**
Location: University Center Ballroom
Introduction by Dahlia Corporan and Sara Shikder
Brad Conrad, Ph.D.

Abstract: Physicists, astronomers, scientists, and engineers hone an extremely valuable set of skills that position them to succeed in an exceptionally wide variety of industry careers, graduate programs, and positions. We'll touch on some of the ways we can impact the world with our skill sets. I'll go over careers and the skills within different technology areas, from technicians to Ph.D.'s, and talk about how you can begin to see yourself as a maker, builder, and problem solver.

11:00-11:10 **Lightning Talks:**
Location: University Center Ballroom

11:10-11:50 **Student Research Presentations (see Section C for abstracts):**
1A: High Energy Physics
Location: University Center Ballroom
1B: General Physics
Location: University Center Room 211/212
1C: Experimental Design
Location: University Center Room 213/214
1D: Quantum Physics
Location: University Center Room 215/216

11:50-12:30 **Lunch:**
Location: University Center Ballroom

12:30-1:30 Student Poster Session (see E. Poster Abstracts) & Vendor Exhibition:
Location: University Center 1st Floor Atrium and Rooms 113, 114, 115

1:30-2:15 Workshop Session #1 (see Section D for abstracts):

QuarkNet for High School Teachers
Location: University Center Ballroom

Is Our Universe A Hologram?
Location: University Center Room 211/212

Grad Student Panel
Location: University Center Room 213/214

Navigating the College Search Process - Adelphi Admissions
Location: University Center Room 215/216

Using Particles To Treat Cancer!
Location: Swirbul Library Room 100

Jumping Across the Solar System with Mathematica: Your First Hour of Coding, Data, and Visualization
Location: Swirbul Library Room 101

Classroom Physics Visualized: The Science Behind Everyday Life?
Location: Physics Dept., Blodgett Hall Basement

Traveling Planetarium
Location: TBA

2:15-3:00 Workshop Session #2 (see Section D for abstracts):

QuarkNet for Students
Location: University Center Ballroom

Strings on Long Island: Using Black Holes to Understand Quarks and Gluons
Location: University Center Room 211/212

Grad Student Panel
Location: University Center Room 213/214

Laser Cooling and Trapping Atoms
Location: University Center Room 215/216

Using Particles To Treat Cancer!
Location: Swirbul Library Room 100

Jumping Across the Solar System with Mathematica: Your First Hour of Coding, Data, and Visualization
Location: Swirbul Library Room 101

Classroom Physics Visualized: The Science Behind Everyday Life?
Location: Physics Dept., Blodgett Hall Basement
Traveling Planetarium
Location: TBA

3:00-3:45 Career Panel
Location: University Center Ballroom
Introduction by Katyanna Sciorra
Moderator: Carissa Giuliano

3:45-4:00 "Get The Facts Out"
Location: University Center Ballroom
Michael C. Smith

4:00-5:00 Be A Shark
Location: University Center Ballroom
Introduction by Carolina Guekjian
Dr. Matthew Wright

Abstract: In this workshop, congress participants will channel their inner shark to explore taking control over their career pathways and how to overcome hurdles. Participants will learn how to actually network and how to use their own sharkiness to innovate, have fun, and take their physics career to the next level.

B. Research Presentation Sessions (11:10am - 12:00pm)

Refer to C. Research Presentation Abstracts for further information about each talk.

Session 1A (University Center Ballroom) – High Energy Physics
Chair: Dr. Bilas Paul, *Farmingdale State College*

The Effect of Changing Magnetic Field on 10-inch Photomultiplier Tube Gain
Edmund Yan, *SUNY Old Westbury College*

The Next Generation of Neutrino Detection
Douglas Brady, *SUNY Old Westbury College*

Impact of the Density Dependence of the Nuclear Symmetry Energy on Properties of Neutron Stars
Nelson Paredes, *Manhattan University*

Session 1B (Room 211) – General Physics
Chair: Dr. Neda Naseri, *Adelphi University*

Principle of Least Action
Benjamin Chau, Sowman Choudhury, Aiden Ocasio, and Sophia Domokos, *New York Institute of Technology*

Developing an Undergraduate-Led After-School STEM Outreach Program
Shoshana Shapiro, *SUNY New Paltz University*

Using Satellite-Observed Land Surface Properties to Explore the Mechanistic Drivers of the 2018 Montecito Post-Fire Debris Flows
Sierra Dages, *Ithaca College*

Session 1C (Room 213) – Experimental Design
Chair: Dr. George Hassel*, Siena College*

The Memcapacitive Properties of Voltage Stimulated Phospholipid Membranes
Miles Powell, *Stony Brook University*

Construction of an Arbitrary Waveform Generator with an FPGA and Resistor Ladder Network
Dahlia Corporan, Herricks High School

When Does a Noisy Network Forget? Critical Thresholds and Information Loss on Random Trees
Angelina Liu, *Scarsdale High School*

Session 1D (Room 215) – Quantum Physics
Chair: Dr. Merideth Frey, *Sarah Lawrence College*

Spin Dynamics of the Divacancy: Microfabrication of a Microwave Microstrip for Spin Control in SiC
Ariam Yohannes, *Stony Brook University*

Qutrit-Based Quantum Kernel Methods: A Comparison with Qubit Models on ECG Arrhythmia and Higgs Boson Classification
Hernan Lema, *Manhattan University*

Updated Design and Electronic System for Injection Locked Diode Laser Modulated at GHz Frequencies
Sara Shikder, *North Shore High School*

Probing Quantum Information Scrambling On Bench-top NMR
Bruce Marji, *Sarah Lawrence College*

C. Research Presentation Abstracts (11:10am-12:00pm)

Session 1A (University Center Ballroom) – High Energy Physics
Chair: Dr. Bilas Paul, *Farmingdale State College*

The Effect of Changing Magnetic Field on 10-inch Photomultiplier Tube Gain
Edmund Yan, *SUNY Old Westbury College*

Photon-based neutrino research tracks photons excited by neutrinos in scintillators, which produce flashes of light from charged particles, to track neutrinos. One way that these photons are observed is Photomultiplier tubes (PMTs). PMTs detect photons and convert them into photoelectrons then magnify the number of photoelectrons into a signal large enough to be detected. PMT gain is the amount that the PMT magnifies each photoelectron. A magnetic field will disrupt this magnification because it will change the path of the electron. This loss of electrons causes the effective gain of the PMT to decrease and fail to meet the required threshold to be converted into a detectable signal, decreasing the gain. Under the guidance of the Instrumentation Department at Brookhaven National Lab, we experimented with various magnitudes and orientations of external magnetic fields to study its impact on PMT gain. We found that gain stayed in a consistent range through our changing magnetic fields, though we were able to see clear patterns corresponding to the angle of rotation of the PMT due to its asymmetry.

The Next Generation of Neutrino Detection
Douglas Brady, *SUNY Old Westbury College*

Neutrino detection began in 1956 with the Cowan-Reines neutrino detector and continues to be a heavily researched area of particle physics today; and perhaps one of the most exciting, as it stands to push physics past the standard model with the recent experimental discovery of neutrino oscillations. An exciting innovation in neutrino detection is currently being developed at Brookhaven National Laboratory (BNL) and implemented into experiments, such as the Accelerator Neutrino Neutron Interaction Experiment (ANNIE) at Fermilab. This innovation comes in the form of a hybrid detection technique involving both Cherenkov and Scintillation light. Most neutrino

detection experiments today involve only Cherenkov radiation; through event reconstruction and analysis of the Cherenkov radiation the particle from which the radiation originated can be identified. Accurate particle identification is a difficult task and with more information, more accuracy can be achieved. Changing the medium from water, which only results in Cherenkov radiation, to Water-based Liquid Scintillator (WbLS) would produce both Cherenkov and Scintillation light, increasing the accuracy of particle identification (PID). The stability of WbLS is being tested at BNL in a 1-ton and 30-ton demonstration in the hopes that it can be implemented into larger experiments like the Deep Underground Neutrino Experiment (DUNE). The stability of WbLS is crucial, as an experiment like DUNE will be running for years and the light yield of the detector cannot decrease over time. Crossing muon selection via paddle coincidence cuts and waveform validation enables clean isolation of through-going tracks. Merged photoelectron (PE) distributions from these events provide a high-statistics benchmark for evaluating light-yield uniformity. This project has allowed me to begin learning about data acquisition and using computer programming for data analysis; it also supports Brookhaven's mission to further understand the fundamental building blocks of our universe.

Impact of the Density Dependence of the Nuclear Symmetry Energy on Properties of Neutron Stars

Nelson Paredes, *Manhattan University*

The structure of neutron stars is best described by complex astrophysical concepts. One known concept is nuclear symmetry energy which describes how the binding energy inside of the nucleus of an atom changes as the neutron-to-proton ratio changes. Nuclear symmetry energy is a property that varies in response to the baryon density of the star, and the exact density dependence is currently unknown. From crust to core, there are differing descriptions of the nuclear and subatomic structure of these stars. As a result, different Equations of State (EOS) which describe how the pressure and energy density change based on an increasing baryon density are used to model the structure of neutron stars. In our research, we have developed Python code to build a unified EOS from crust to core and compared it with EOS in literature of varying density dependence. We then develop code to solve the Tolman-Oppenheimer-Volkoff (TOV) equations for mass-radius output and plot their curves alongside observational constraints from NICER analyses of pulsars. The comparison favored a narrower range of symmetry-energy slopes within the EOS models considered, highlighting softer EOS in this research.

Session 1B (Room 211) – General Physics
Chair: Dr. Neda Naseri, *Adelphi University*

Principle of Least Action
Benjamin Chau, Sowman Choudhury, Aiden Ocasio, and Sophia Domokos, *New York Institute of Technology*

Most people are familiar with Newton's Laws that describe objects' motion using forces. This approach works well for many everyday systems – like blocks sliding down planes – but becomes cumbersome when dealing with more complex systems like hanging strings. In this presentation, we describe how we can instead use the "Principle of Least Action" to derive equations that describe an elastic string. We incorporated various material properties like the Young's modulus, and set up appropriate boundary conditions to constrain our model into a static elastic string. As a result, our model of a hanging string provides a baseline for extended analysis on more complex configurations such as the dynamics of a rotating elastic string.

Developing an Undergraduate-Led After-School STEM Outreach Program
Shoshana Shapiro, *SUNY New Paltz University*

Community involvement in STEM programming is an incredibly valuable experience for undergraduate students and the communities they serve. In this project, we developed and implemented an after-school STEM program at a local middle school with the goal of establishing a program that can continue for many years. Through hands-on activities in multiple STEM subjects, middle school students are given opportunities to experiment, problem-solve, and make decisions. Undergraduate students benefit by developing skills in teaching, communication, leadership, and program development. The program also strengthens connections between the university and the surrounding community. This talk will discuss the development and implementation of the program, its benefits to both groups of students, and the frameworks for a long-standing undergraduate-led outreach program.

Using Satellite-Observed Land Surface Properties to Explore the Mechanistic Drivers of the 2018 Montecito Post-Fire Debris Flows

Sierra Dages, *Ithaca College*

In December 2017, the Thomas fire burned over 114,000 hectares (280,000 acres) in the Santa Ynez mountain range near Santa Barbara, CA. The following month, intense rainfall triggered destructive post-fire debris flows in and around Montecito. Predicting which burned watersheds are most likely to generate damaging debris flows remains challenging, particularly where steep terrain intersects the Wildland Urban Interface (WUI). This study asks whether satellite-derived vegetation condition, burn severity, and topographic variables distinguish watersheds that generated debris flows from nearby burned control watersheds. Watershed topography was characterized using 30 m TanDEM-X digital elevation data, including median elevation, maximum elevation, and slope. Fire effects were quantified from pre- and post-fire Sentinel-2 imagery using NBR-based burn metrics. Within the burned area, debris-flow watersheds had higher pre-fire NDVI and higher NBR-derived burn severity than burned watersheds without debris flows, suggesting that pre-fire vegetation structure and fire effects may have contributed to post-fire runoff and sediment mobilization. Debris flow watersheds were characterized by elevation distributions with a narrower range of values toward both low and high ends than control watersheds, indicating fewer areas with either very low or very high elevations. These results provide an initial framework for identifying burned watersheds where satellite-derived vegetation, burn severity, and topographic indicators may improve post-fire debris-flow susceptibility assessments, particularly in WUI settings.

Session 1C (Room 213) – Experimental Design
Chair: Dr. George Hassel*, Siena College*

Construction of an Arbitrary Waveform Generator with an FPGA and Resistor Ladder Network
Dahlia Corporan, *Herricks High School*

The primary goal of this study is to construct an FPGA-based white noise generator and use it to modulate a laser by rapidly changing the index of refraction in a lithium niobate optical fiber. We will discuss our progress toward developing the FPGA-based white noise generator. Although rapid arbitrary waveform generators exist, they are very expensive to buy. We seek to develop the technology to construct these devices in-house inexpensively. We envision using this FPGA-based white noise generator to generate pseudo white light.

When Does a Noisy Network Forget? Critical Thresholds and Information Loss on Random Trees
Angelina Liu, *Scarsdale High School*

Can distant observations reveal a signal's origin after repeated noisy transmission? Reconstruction on trees studies this question, with implications for inference and sample efficiency in related evolutionary models.

For binary signals with probabilities p and q, previous regular-tree results show that, at large degree, reconstruction fails at the Kesten–Stigum threshold when $pq > 1/6$ but can survive below it when $pq < 1/6$. At $pq = 1/6$, the linear drift and quadratic correction both vanish at the threshold, leaving this critical case unresolved. We resolve it on Poisson random trees with sufficiently large fixed average branching. We prove that root information disappears at both critical endpoints and below the threshold. At the endpoints, we determine exactly how quickly it fades, averaged over random trees. For the corresponding network model with unequal community sizes and equal average degrees, no method using only connections can asymptotically beat majority-class accuracy. These results establish when a noisy network forgets, how fast it forgets, and the resulting limits of community inference.

The Memcapacitive Properties of Voltage Stimulated Phospholipid Membranes

Miles Powell, *Stony Brook University*

Currently, there is knowledge on where memory-related electrical signals in the brain are located, and how these signals propagate via neuronal synapses. However, there is limited knowledge on the mechanisms and physical substrates behind how the brain converts electrical signals into stored memory to be retrieved later. Phospholipids take up over 50 percent of the brain's dry weight, and therefore these molecules have been suspected to have a role in the brain's memory storage system. It has been proven that phospholipid membranes are capable of memcapacitive behavior, meaning that the capacitance of the membrane is reliant not only on its present input voltage and charge, but also an internal memory state. In order to further understand the memcapacitive properties of phospholipid membranes, we performed experiments from both a macro and microscopic lens. From the macroscopic perspective, we utilized a nanion orbit, to create POPC lipid bilayers in various aqueous ionic solutions, and drive them with varying voltage stimulation conditions. We would then collect their respective output currents, and using a data analysis pipeline in Python we calculated QV, CV, and IV diagrams. We also were able to calculate the Work per Voltage Cycle for each condition. From the microscopic perspective, we utilized Molecular Dynamics (MD) simulations using GROMACS and the CHARMM36 forcefield to investigate the effects of voltage stimulation and various ionic solutions on POPC membrane thickness, area per lipid, and acyl chain order parameters. Thus far, we have observed that the aqueous ionic solution does have an impact on the Work per Voltage Cycle of the membrane. We have also observed from MD simulations that membrane thickness does change depending on the ionic solution. In the future, we plan to expand to different types of phospholipids to see if they react similarly to POPC. In the future we plan to explore the effects of ion channels, cholesterol, and inhibitory substances on the memcapacitive behavior of these membranes.

Session 1D (Room 215) – Quantum Physics
Chair: Dr. Merideth Frey, *Sarah Lawrence College*

Spin Dynamics of the Divacancy: Microfabrication of a Microwave Microstrip for Spin Control in SiC
Ariam Yohannes, *Stony Brook University*

Silicon carbide can host divacancy defects which act as spin qubits that possess a natural spin photon interface. This interface allows emitted photons to be entangled with the defect's spin state to mediate long distance quantum interactions. The spin state of the defects in the device can be manipulated with microwave signals transmitted through a stripline. We simulated the microwave striplines on COMSOL, designed on GDS Factory, and fabricated them using a Heidelberg direct write optical lithography system and an E-beam Evaporator. Finally, we demonstrated optically detected magnetic resonance of single spins using this microstrip. In the future, we will continue to use and optimize microstrip design for faster control and fast quantum gates, useful for quantum technology applications.

Qutrit-Based Quantum Kernel Methods: A Comparison with Qubit Models on ECG Arrhythmia and Higgs Boson Classification
Hernan Lema, *Manhattan University*

Most of the work done nowadays in quantum machine learning (QML) relies on using qubits, while there hasn't been much done with qutrits when it comes to classification. A qutrit is a three-level system instead of two, so there is no reason why we should not be able to fit more information into each unit and encode the data more efficiently. For this work, we took our quantum support vector machine (QSVM) research from a prior year, which was built with qubits, and rebuilt it with qutrits, where each qutrit holds three features instead of one, as with qubits. The qutrit model was then compared to our previous qubit results and to classical models (SVM, neural network, BDTG (TMVA), and SVM (TMVA)). Both versions were tested on two problems, heartbeat classification with four classes using the MIT-BIH Arrhythmia Database, and Higgs boson signal vs. background classification. To compare the performance between the models, we used metrics like ROC/AUC, accuracy, and precision. Preliminary results show that the qutrit kernel model performs about the same as the qubit one on both the ECG data and the Higgs data. Due to the qutrit's extra level, each qutrit can hold up to three features, so the qutrit version needed fewer units and ran a lot faster in simulation. However, the

classical neural network model performed the best on both datasets. Overall, this suggests that qutrits are worth looking into further in the future, but for now classical methods are still a better option for these types of problems.

Updated Design and Electronic System for Injection Locked Diode Laser Modulated at GHz Frequencies

Sara Shikder, *North Shore High School*

Research and manipulation of ultracold atomic gases can be done by capturing and cooling atoms to ultracold temperatures using a Magneto-Optical Trap (MOT). At least two distinct frequency-controlled lasers are required to run a magneto-optical trap for most species. During the laser cooling process, the cycling is often not perfect, which causes there to be an occasional decay to the ground-state hyperfine level, disrupting the cooling cycle. A separate repumping laser is needed in order for the atoms to return to their cooling cycle. An additional external cavity diode laser (ECDL) system can be expensive both in cost and in the time spent maintaining the laser.

Injection-locked lasers are typically easier to build and maintain than ECDLs. Additionally, we can generate multiple frequencies on the laser by modulating the driving current of the laser, allowing us to generate one beam with both the cycling and repump transitions encoded on it. This will allow laser cooling and trapping using Magneto-Optical Trapping (MOT) to be more efficient using only a single laser beam. We have designed and built the entire laser system, including laser housing, temperature control and stabilization electronics, current driver electronics, and RF modulation electronics. Development in this area of research will lead to improved rapid communication and advance further research on molecular gases.

Probing Quantum Information Scrambling On Bench-top NMR

Bruce Marji, *Sarah Lawrence College*

Quantum scrambling is the phenomenon that describes how quantum information spreads and becomes inaccessible through an interacting system. My project attempts to adapt a recent quantum scrambling experiment to a less powerful TeachSpin benchtop NMR apparatus. We use a sequence of radiofrequency pulses to essentially evolve forward under a Hamiltonian, apply a controlled perturbation to the system, then evolve through the same Hamiltonian but reversed. The resulting Loschmidt echo allows us to extract an out-of-time-order correlator (OTOC), a measure of quantum scrambling that is also used to study how black holes scramble information.

D. Workshop Schedules (1:30pm-3:00pm)

Jumping Across the Solar System with Mathematica: Your First Hour of Coding, Data, and Visualization
Location: Swirbul Library Room 101
Dr. Adam Copeland
Session A: 1:30 - 2:15 PM
Session B: 2:15 - 3:00 PM

Abstract: Mathematica is software that scientists, engineers, and students use to perform rigorous calculations, process objective data, and make engaging visualizations, all in one place. In this one-hour, hands-on workshop, you will learn the basics of Mathematica and use it to answer one question: how high could you jump on other planets? First, we will get familiar with what Mathematica can do, from visualizing our solar system to modelling a swinging double pendulum. Then you will write your first code. You will use Mathematica as a super calculator and ask questions in natural language to get real planetary data. You will build your own jump height function and make a chart that compares Mercury, Earth, and Jupiter. At the end, we change the takeoff speed with a slider and send a basketball player to each planet. You will walk away ready to start leveraging the capabilities of Mathematica for work in the physical sciences.

Using Particles To Treat Cancer!
Location: Swirbul Library Room 100
Marissa Vaccarelli
Session A: 1:30 - 2:15 PM
Session B: 2:15 - 3:00 PM

Abstract: Have you ever thought about the properties of a photon? These massless, chargeless particles traveling at the speed of light can be harnessed into a focused beam with great precision and accuracy. This high energy ionizing radiation interacts on the cellular level, creating a therapeutic intent to treat cancer, referred to as external beam radiation therapy. Together, we will examine the photon beam generation process of a linear accelerator, highlighting the basic principles of electromagnetic theory. Next, we will work on calculations to develop a treatment plan, which tells the linear accelerator how to behave. At this stage, we will walk through step by step by

optimizing a cost function to inversely determine multi-leaf collimator sequence and then utilize a 3D Monte-Carlo based convolution-super position algorithm to finalize the process. This will provide the opportunity to work on an anonymized test patient together in a race to see who can compute the most ideal radiation therapy treatment plan!

Classroom Physics Visualized: The Science Behind Everyday Life?
Location: Physics Dept., Blodgett Hall Basement
Dr. Kevin Liang
Session A: 1:30 - 2:15 PM
Session B: 2:15 - 3:00 PM

Abstract: Come watch how the concepts you learn in physics class come to life with guided demonstrations. From a baseball bat's "sweet spot" to how static electricity can make your hair rise, this workshop will encourage you to think more deeply about, and ultimately explain, foundational physics concepts that may have slipped your attention in the classroom. The strength of demonstrations like the ones you'll see in this workshop is that they provide an accessible and tangible path to understanding how many of the complex phenomena and technologies around us are fueled by relatively simple physical laws. By seeing a ping pong ball levitate in a stream of air, you may begin to understand how planes fly. By watching a wheel spin under the influence of steam, you get a window into how locomotives were powered in the early 1800s. The world is complicated! Come simplify some of it with this workshop.

Is Our Universe A Hologram?
Location: University Center Room 211
Dr. Andrew O'Bannon
Session A: 1:30 - 2:15 PM

Abstract: Take a journey to the cutting edge of theoretical physics: string theory! In this workshop we will explore one of string theory's most surprising predictions, that all the information in our 3D universe may be contained in a mysterious 2D image, like a hologram. This "holographic principle" promises not only to unite Einstein's relativity with quantum physics, but also has the potential to someday provide us with cleaner energy, faster computers, and novel electronics. Only a high school level of physics is assumed. The workshop will be informal, so bring lots of questions!

Graduate Student Panel, Panelists include: Zoya Shafique (moderator), Abigail Swanson, Edward Jansen, Kevin O'Shea
Location: University Center Room 213/214
Session A: 1:30 - 2:15 PM
Session B: 2:15 - 3:00 PM

Abstract: In this panel, students will meet graduate school students in engineering, physics, and astronomy. Students will learn the secret sauce to getting into graduate school, what graduate school is like in various fields, and available opportunities.

QuarkNet for Teachers
Location: University Center Ballroom
Susan Wetzler
Session A: 1:30 - 2:15 PM

Teachers will explore QuarkNet activities they can use to introduce particle physics concepts to high school students at almost any level. With “Shuffling the Particle Deck”, teachers can make a basic introduction to the particles that comprise the Standard Model. In “Rolling with Rutherford”, students learn how indirect evidence, probability, and statistics are used by particle physicists to make measurements of the tiniest particles. They will also be able to explore the QuarkNet Data Activities Portfolio to find other useful and interesting ways to connect the physics students learn in school to the forefront of research.

QuarkNet for Students
Location: University Center Ballroom
Susan Wetzler
Session B: 2:15 - 3:00 PM

Students will explore cosmic rays by working in groups with small, portable cosmic ray detectors. They will explore a suite of activities that includes measurement of beta radiation, determination of the direction from which cosmic rays come, and relating the angle of acceptance to the cosmic ray rate.

Strings on Long Island: Using Black Holes to Understand Quarks and Gluons
Location: University Center Room 211/212
Dr. Matthew Lippert
Session B: 2:15 - 3:00 PM

String theory is sometimes criticized for not making testable predictions, but one of its most striking successes was tested right here on Long Island. The Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Lab (BNL), which completed its final run in 2025, created a quark-gluon plasma (QGP) that flows as a nearly "perfect liquid." Its extremely low viscosity was predicted using the physics of black holes. Holography, a powerful technique from string theory, allows certain strongly interacting systems like the QGP to be described using gravity and strings in a space with one extra dimension, turning many nearly unsolvable problems into tractable computations. The new Electron-Ion Collider (EIC), now under construction at BNL, is designed to investigate the internal structure of the proton and may help resolve puzzles such as the origin of the proton's spin, and holography may offer new ways to model the proton itself. No background in string theory is assumed.

Navigating the College Search Process & Essay Writing Workshop
Location: University Center Room 215/216
Sierra Romano
Session A: 1:30 - 2:15 PM

Abstract: There are many things to consider when searching for and choosing a college to attend. Going through the application process itself can be overwhelming. Thinking about logistics such as majors, locations, finances, and where you are going to fit in can also cause a lot of stress and anxiety for students. Join an Adelphi Admissions Counselor in this session who will break down the whole process so you feel confident in applying and taking the next steps in your academic career!

Laser Cooling and Trapping Atoms
Location: University Center Room 215
Dr. Matthew Wright
Session B: 2:15 - 3:00 PM

Abstract: In this chalk talk, participants will learn the basics of how atoms and molecules can be cooled down to extreme temperatures with lasers and external fields. They will learn the basic physics in the process and why laser cooling atoms and molecules is an exciting field of physics.

Traveling Planetarium
Location: TBA
Presenter: TBA
Session A: 1:30 - 2:15 PM
Session B: 2:15 - 3:00 PM

Abstract: Long before television, GPS, or street lights, people looked to the stars to navigate and understand the world around them. This live planetarium show takes visitors on a guided tour of the seasonal night sky, exploring visible constellations, sharing the myths behind them, and highlighting what can be seen in the current Long Island sky.

E. Poster Abstracts (12:30pm-1:30pm)

ROOM 113

Poster 1: Fueling the Future: Investigating Space Contested Logistics by Modeling Orbital Transfers

Zoe Gorbachev, *Lindenhurst High School*

"Space maneuver without regret" describes an era in which satellites can move, evade, and change orbits freely, without the historic constraints of fuel conservation or shortened operational lifespans. This work developed a test matrix to calculate the propellant mass needed for orbital maneuvers between different altitude bands, considering factors such as cost and initial orbital positions. We used MATLAB and System Tool Kit (STK) models to estimate fuel usage, cost, velocity change, and time to inform our recommendations on the optimal orientation of fuel depots and client satellites.

Poster 2: [Withdrawn]

Poster 3: SPION@PDA/CGO Nanosheets for Visible-Light-Driven Degradation of Pharmaceuticals

Leonzio Cataldo, *Plainview-Old Bethpage JFK High School*

Persistent pharmaceutical pollutants like carbamazepine (CBZ) often aren't broken down from conventional municipal wastewater treatment methods, necessitating Advanced Oxidation Processes (AOPs). Traditional photo-Fenton systems, a type of AOP, suffer from a narrow operational pH, particle diffusion limits, along with expensive and time-intensive catalyst recovery. To address these challenges, a novel two-dimensional nanocomposite was synthesized by functionalizing carboxylated graphene oxide (CGO) nanosheets with dopamine via EDC/NHS coupling, followed by co-precipitation of magnetite nanoparticles. Transmission Electron Microscopy (TEM) confirmed successful nanoscale assembly and formation of catalytic sites. Preliminary testing verified dopamine cross-linking via its UV-signature and magnetic recoverability using external fields, addressing catalyst loss and allowing for reuse. The nanocomposite is designed to optimize ligand-to-metal charge transfer (LMCT), promoting iron cycling from iron(III) to iron(II), and stabilize the iron catalyst on a flat plane at near-neutral pH (~6.0). Ongoing experimental trials evaluate CBZ photo-Fenton

degradation across a synthetic wastewater matric containing humic acid and sodium chloride as model radical scavengers. Degradation profiles will be coupled with a Langmuir-Hinshelwood kinetic modeling framework including surface adsorption and degradation rate. This material presents a scalable, recoverable solution for industrial wastewater remediation.

Poster 4: A Biomedically-Inspired Torque Apparatus for Teaching Static Rotational Equilibrium

Maylin Cage, *Adelphi University*

Traditional “equilibrium of a body” labs often rely on abstract stands and hanging masses, which can leave students disconnected from the physical intuition behind torque. This project presents the design and construction of a wood-based human forearm apparatus intended to replace the standard lab with a biomechanically grounded alternative. The device models the forearm as a lever pivoting at the elbow, a fixed hanging load at the hand representing holding some object, and an elastic theraband (standing in for the biceps) providing the opposing muscle torque. An inline digital force sensor is used in place of Hooke’s Law calculations, allowing students to read muscle force directly and focus on the geometric relationships in the torque equation ($\tau = rF\sin\theta$) rather than spring mechanics. The apparatus isolates two specific relationships of interest for investigation: force versus insertion distance (r) at a fixed angle, and force versus pull angle (θ) at a fixed insertion point. Both of these relationships follow predictable inverse relationships that students can verify graphically. The poster covers the design rationale, construction process, and planned classroom implementation, and the team invites feedback on further refinements before broader deployment in introductory physics courses.

Poster 5: Building a Dust Lookup Table with UCLCHEM using TNG Hydrodynamic Simulations

Aleeza Ahmed, *Adelphi University*

The goal of this project is to develop a representation of gas particles from the simulation IllustrisTNG that can be processed by UCLCHEM. This helps computationally by providing an easier way to predict parameters inputted into UCLCHEM instead of running astrochemical calculations on the full simulation containing billions of particle cells. The resulting UCLCHEM calculations can contribute to a lookup table that

connects parameters like physical gas conditions as well as elemental abundances to dust properties. Our recent work has focused on establishing the UCLCHEM post-processed pipeline to convert TNG particle data into inputs that UCLCHEM is compatible with. This process is used to test the computational behavior of individual representative particles.

Poster 6: Assessing Pelvic Tissue Organization in MRIs as a Diagnostic Marker of Endometriosis through Entropy Metrics

Taniya Raipatriwar, *Plainview-Old Bethpage JFK High School*

Endometriosis is a condition characterized by the presence of endometrial tissue outside of the uterine cavity resulting in chronic pelvic pain, irregular uterine bleeding, and even infertility. Pelvic MRIs and ultrasounds have been used with success to diagnose patients with this condition, but with varying diagnostic confidence of the current use of MRIs, leading to the large misdiagnosis rate of endometriosis. The gold standard for diagnosis is a laparoscopy, which may be an invasive option. This study serves as an initial investigation of a specific metric, Shannon entropy, or the measure of disorder in a system, as a potential biomarker for the presence of endometriosis to design a non-invasive accurate diagnostic method for endometriosis and regionalize effects of endometriosis. This study used 45 MRIs from the UTHealth Endometriosis MRI Dataset and 800 MRIs from the SynthUtero Dataset to compare Shannon entropy in MRIs with endometriosis to MRIs without endometriosis. All analyses were done using an unpaired t-test to determine significant differences. Findings indicate that there were no significant differences between segmented regions of the ovaries and uterosacral ligaments but that there were significant differences between the Shannon entropy in MRIs with endometriosis and MRIs without endometriosis (p-value = 0.0000101, Cohen's d = 0.748). Findings call for the development of medical devices that utilize the current study's methodology to improve the diagnostic experience for women who suspect they have endometriosis.

Poster 7: Predicting Tropical Infrastructure Deterioration Risk and Climate Feature Dominance Using Climate-Adaptive Machine Learning

Daniel Jung, *Plainview-Old Bethpage JFK High School*

Machine learning frameworks currently used for assessing bridge deterioration depend greatly on large-scale inspection datasets from temperate climates, which results in a

serious lack of data for bridge deterioration in climate-sensitive tropical developing regions. In order to overcome this limitation, an open-source transfer framework was developed using Python (with the use of pandas and scikit-learn) to assess the risk of climate-driven bridge deterioration. Baseline models based on Random Forest and Gradient Boosting methods were trained on data from the U.S. National Bridge Inventory for Louisiana, Texas, and Puerto Rico, incorporating environmental factors from Daymet (produced by NASA). To simulate tropical hazards, climate feature substitution was carried out by using World Bank indicators for Central America (Guatemala, Honduras, El Salvador). The procedure involved measuring the predicted changes in risk and assessing sensitivity using Permutation Importance and two-sample t-tests. The approach examines whether hydrometeorological factors, namely the criticality of riverbed scour and channel degradation, show a statistically significant increase in permutation importance when compared to the baseline temperate conditions ($p < 0.05$), thus surpassing the traditional structural aging indicators.

Poster 8: Water-Cooled Cloud Chamber
Robert Oechslin, *Siena University*

Cloud chambers make subatomic particles visible to the naked eye by forming trails in cold, vapor-filled air. While smaller fan-cooled models are easy to build, they have small viewing areas and struggle to stay cold enough. My project details the construction of a larger cloud chamber that uses a circulating water-cooling system to keep the chamber cold and maintain a steady cloud layer for seeing alpha and beta decay trails. To make the particle tracks sharper and clearer, the chamber uses an internal wire that creates a high voltage potential between a metal mesh and the cooling base. Instead of using an expensive lab power supply, this high voltage was created by repurposing a mini Van de Graaff generator. The finished setup successfully displays clear, continuous particle tracks across a much larger viewing area than previous designs.

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Poster 9: VIPER Radio Telescope Drift Scans of the Milky Way
Violet Chang, *Siena University*

VIPER is Siena University's own radio telescope which can be used for astronomy research even when skies are cloudy. Radio waves emitted from space reflect off of VIPER's solid dish and focus into the antenna before being processed through a software-defined radio (SDR). We replaced the telescope's original, sun-damaged antenna and reconnected it to the main computer it sends the radio data to. We then

used a program called GNU Radio Companion to filter, tune, and/or adjust the radio data using Python-based blocks of code. During this research, we kept VIPER still on a single point in the sky to detect radio waves emitted from the center of the Milky Way galaxy as it passed overhead for several nights; this is called a drift scan. Using Python, we graphed the resulting data, filtered out interference spikes from sources other than the galactic bulge, and combined several of these graphs to create an interactive three-dimensional heat map. Going forward, this research may open opportunities for further radio astronomy education and research for faculty and undergraduate students.

Poster 10: Symmetry and Simulations of Large Scale Structure in the Universe
Yuting Huang, *Manhattan University*

This research simulates the velocity potential of large-scale structure in the Universe in order to verify the time dependent translation symmetry. Using Python to simulate Gaussian and non-Gaussian initial conditions, we can use the fluid equations or N-body simulations to simulate growth of structure and then analyze correlations of the bispectrum and power spectrum. The results show consistency relations from symmetry hold in the simulation, which may be broken in the presence of local non-Gaussianities.

Poster 11: Horizontal Flux Growth of Cobalt Indium Two Crystals and their Electromagnetic Properties
Benjamin Jenkins, *New York Institute of Technology*

The Horizontal Flux Growth Configuration used alongside a temperature gradient allows for the growth of large, homogeneous Cobalt Indium 2 crystals. The elemental compound $CoIn_2$ possesses many interesting structural distortions at different temperatures. Most notably, it undergoes a Peierls distortion when cooling through 194 Kelvin. The result of this distortion is a standing charge density wave. My goal is to measure the Hall Effect while this charge-density wave is present. In the presence of charge density waves, the relationship between current and voltage is non-linear. I believe that the results of applying a transverse voltage by way of a magnetic field could be extremely interesting for this reason.

Poster 12: Searching for Baryon Number Violation with Top to Five Jet Analysis
Emily Rensch, *Siena University*

Our universe should currently have equal parts matter and antimatter. However, we know this to not be true. If there were equal parts matter and antimatter, they would completely annihilate each other leaving nothing but photons. Today's universe contains much more matter. To understand this phenomenon, theorists have theorized that baryon number violation (BNV) exists in the universe. This search suggests that a top quark decays into five quarks and the baryon number is violated by two. Since this decay requires a dimension-9 operator in which MadGraph cannot simulate, a custom implementation was built in order to acquire the signal data. These BNV events were then fed through a MadGraph-Pythia-Delphes pipeline in order to get the full data. Then, using CMS Open data of a semi-leptonic decay, jet substructure analysis was performed in order to determine the key challenge of the search: the soft jet threshold. To improve jet purity at these soft jets, a quark-gluon classifier was built using a Deep Sets machine learning network trained on a PFNanoAOD dataset produced from a miniAOD on CERN's lxplus. Future work of this research will include scaling up the simulation with HTCondor, refining the classifier, and performing a blind analysis to set an expected limit.

Poster 13: Advancing Scalable Quantum Algorithms for Simulating Multi-Qubit Systems with Colored Noise
Eric Guo, *High Technology High School*

Ultra-sensitive, scalable quantum computing relies on the precise control of open quantum systems, where environmental memory effects lead to non-Markovian noise. As quantum systems continue to develop, inaccuracies from memoryless approximations heavily limit hardware reliability and lead to measurement error. Non-Markovian dynamics arise in realistic environments and pose a challenge for accurately modeling qubit evolution, including decoherence and disentanglement. This research develops a novel, complete operator-based framework for simulating non-Markovian dynamics in multi-qubit systems, enabling clear analysis beyond specific noise models. The environment interactions were modeled using the stochastic Quantum State Diffusion approach, allowing for memory effects to be incorporated through propagator functions. To separate the noise, the dynamics were expressed as separate quantum channels in Kraus operator form, allowing for the construction of the density matrix and analysis of population, coherence, and entanglement. Python was

used to simulate dissipative and dephasing channels, demonstrating expected physical behavior. Furthermore, the model was shown to accurately compute key physical properties such as entanglement and superposition. Algorithms were implemented across multiple circuits on IBM quantum processors to compare model predictions with experimental results. It was shown that the novel non-Markovian model achieved a 3x smaller fidelity error rate compared to the standard Lindblad model. These results demonstrate that our algorithmic modeling provides more accurate descriptions of open quantum systems, alongside a scalable framework for analyzing larger noisy systems.

Poster 14: Pulling DNA Base Stacks with Optical Tweezers
Lisa Kotkiewicz, *SUNY New Paltz University*

Our goal is to understand how base stacking contributes to the structural integrity of DNA. We attach DNA to a sample surface and pull the other end with optical tweezers to find the trap strength to stretch the strand to its limit. We explain our innovative sample preparation, testing procedure, and preliminary results.

Poster 15: Ultra-fast implementation of a new fully-relativistic electronic structure theory enables high-fidelity plasma modeling
Lucas Rhode, *Stony Brook University*

This work presents a finite-basis method for obtaining fully relativistic one-electron Green's functions or wave functions in a general nonspherically symmetric, finite-range potential. The approach reformulates the problems in terms of a T-matrix with finite support, allowing the Green's functions or wave functions to be evaluated at real or complex energies. We extend the method to the fully relativistic regime and apply it to several systems, demonstrating that it reproduces analytic results in the spherically symmetric case while enabling predictions of energy splittings and modified charge densities in nonspherical systems. The results demonstrate the capability, flexibility, and robustness of the relativistic T-matrix approach. Our method addresses the long-standing challenge of constructing numerically stable Green's functions for nonspherical potentials with relativistic multiple scattering theory, opening the door to high-fidelity electronic structure calculations for warm dense matter and plasma modeling. This work was conducted at Los Alamos National Laboratory.

Poster 16: Increasing the Predictability Of Classical Machine Learning Algorithms Through Python

Tasnim Jannat, Alex Zhuo, and Dr. Yusuf Danisman, *Department of Mathematics and Computer Science, STEP Queensborough Community College*

The stock market is a highly predictive digital marketplace where the exchange of the stocks of publicly held companies is done. Stock prediction with machine learning is an effective but still experimental sector. Our research project aims to determine the precision of multiple classical supervised machine learning algorithms based on the hypertuning of the algorithms. These algorithms are given the same dataset to create models with changes for a minimum of 5 different parameters. There is experimentation with different combinations of the parameters to determine the parameters that provide the most accuracy. Moreover, certain algorithms will require the same parameter: max_depth parameter is used by both decision tree and XGBoost. This research also aims to see how the same parameter affects the output of many algorithms and increase the predictability of the algorithms.

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Poster 17: Synthesis and characterization of high-quality single crystals of CrSn2

Yuqing Mao, *Farmingdale State College*

Abstract: N/A

Poster 18: SGA-2025 Morphology Classification with Machine Learning

Muhammad Fatin Rajput, *Siena University*

A galaxy's shape offers clues about how it formed, but surveys now contain hundreds of thousands of galaxies, too many to classify by hand. This project uses a pretrained self-supervised model to turn each galaxy's image into a set of numerical features, without needing any human labels. We used UMAP to visualize these features in two dimensions, grouping galaxies with similar appearances, and ran similarity searches to check whether nearby galaxies in this space actually looked alike. We also tested simple classification using these features with logistic regression. Ongoing work compares our results to Galaxy Zoo DESI classifications to see how well this approach scales to large surveys.

Poster 19: Modeling Charged Multilayer Devices with Defects Using JAX
Emilia Szynwald, *Hofstra University*

Multilayer van der Waals devices, such as twisted WSe_2 bilayers, have emerged as versatile platforms for realizing exotic correlated states, including atomic and molecular Wigner crystals and excitonic crystals. While integer lattice fillings have been extensively studied through both experiments and theory, the role of defects remains less explored. A major challenge lies in the lack of efficient and user-friendly computational tools capable of handling long-range Coulomb interactions in such systems.

In this work, we introduce an open-source computational framework built on the JAX automatic differentiation and just-in-time compilation ecosystem to model charged multilayer systems with vacancies and interstitials. The tool enables flexible simulations of multilayer electron configurations within variable simulation cells and supports optimization of the structural degrees of freedom. We benchmark the efficiency and robustness of various optimization algorithms from the machine learning community, providing insights that help bridge the gap between the two disciplines. Our results demonstrate that this approach significantly streamlines the study of defect-driven physics in 2D materials, providing an accessible platform to explore future multilayer quantum devices.

Poster 20: Development of Interactive Fluid Mechanics Demonstrations for ENGR 320
Traevon Ruddock, *Siena University*

This research developed two hands-on demonstrations on the Armfield F1-10 Hydraulic bench for Siena University's Fluid Mechanics & Heat Transfer course. The first demo investigates Bernoulli's theorem using a converging-diverging venturi to change fluid flow speed due to change in area. The continuity equation predicts that a decrease in area must produce an increase in fluid velocity and vice versa. A multi-tube manometer attached to the venturi measures the change in total fluid energy along its path, verifying Bernoulli's theorem. The second demo investigates energy losses in pipes and characterized flow regimes over the range of Reynolds numbers 600-6,300. The scaling of the losses varied across flow regimes with friction factor scaling as $f \propto Re^{-1}$ in the laminar regime and $f \propto Re^{-¼}$ in the turbulent regime, verifying both the Hagen-Poiseuille resistance relation and Blasius correlation.

Poster 21: Quantum Enhanced Gamma Ray Imaging
Carolina Guekjian, *Adelphi University*

At Brookhaven National Laboratory, the use of entangled gamma rays from positronium decay is being investigated across a range of material densities, with the goal of improving noninvasive imaging of low-density objects through quantum-enhanced imaging. Quantum gamma-ray imaging, where only one of the entangled 511-keV photons interacts with the object while the correlated photon is detected, is used to study a variety of samples that mimic biological materials of varying densities using a 210-ps time-resolution dual-detector system and a sodium-22 positron source. Classical and quantum imaging modalities are compared by isolating true 511-keV coincidence events from background noise. Image quality is assessed using metrics such as signal-to-noise ratio (SNR), image contrast, and contrast-to-noise ratio (CNR) to compare the performance of the two imaging approaches. Preliminary results indicate that quantum-correlated images can provide improved image contrast and background suppression for selected samples, consistent with the expected benefits of coincidence-based imaging. Ongoing analysis is focused on quantifying these improvements across samples with a wider range of material densities. These results demonstrate the potential of quantum gamma-ray imaging with positronium-based entangled gamma rays for noninvasive imaging of objects, with possible future applications in medicine.

Poster 22: An Interpretable Approach to Stock Market Prediction
Hamza Danisman, *Commack High School*

Stock market prediction is challenging due to various economic and political factors, including interest rates and market uncertainty. Although many machine learning models have been developed for stock market forecasting, most lack interpretability. This paper proposes an interpretable approach based on encoded candlestick patterns, providing a clear decision-making process that can be valuable for financial institutions and hedge funds.

Poster 23: Sleep Restriction, Aging, and Neural Responses to Observed Pain: An Equivalence-Tested fMRI Reanalysis with Fieldmap Phase-Error Correction

Jacob Lee, *Plainview Old-Bethpage John F. Kennedy High School*

Functional MRI infers brain activity through magnetic-field physics, and errors in that measurement can silently shape scientific conclusions. The present study re-evaluated the Stockholm Sleepy Brain Study (OpenNeuro ds000201), utilizing a within-subject crossover in which younger (20–30) and older (65–75) adults were scanned once after normal sleep and once after sleep restriction while viewing images of hands receiving painful or non-painful stimulation. Using FSL with GE two-echo fieldmap correction, I extracted Pain > No-Pain responses from a pre-registered insula and anterior midcingulate region. I then tested whether the sleep-restriction change differed by age group and by empathic personal distress.

Building the pipeline surfaced a physics problem. Unwrapping each echo's phase independently left whole-2π offsets in half of all fieldmap sessions (71/142), and these offsets caused every catastrophic registration failure. Rebuilding fieldmaps from the complex source data recovered every recoverable session.

Sleep restriction did not affect pain-related brain responses differently in younger and older adults ($p = 0.61$, $N = 68$). An equivalence test ruled out any difference larger than a small-to-medium effect ($f^2 < 0.077$, $p = 0.016$), so this is evidence against a meaningful effect, not just a failure to find one. Whether personal distress shapes the effect remains unknown. The result held when each participant was removed in turn and across 104 alternative analysis pipelines, none of which produced a significant result after correcting for multiple comparisons. Most of the variability in participants' sleep-related changes came from genuine session-to-session fluctuation (ICC = 0.26) rather than measurement error, which explained only 4%. For neuroimaging, how stable a brain signal is matters as much as how precisely it is measured.

F. Adelphi University Map/Directions

Most of the conference will take place in the University Center (UNC). There will be a few workshops that will take place in Swirbul Library (SWL) and Blodgett Hall (BLH). There will be signs and people to help.



By Car:

Cosmic Pathways will take place at Adelphi University in the University Center. Type “Adelphi University, University Center” into your directions app. If you need an address use 1 South Avenue Garden City, NY 11530, but keep in mind that this address refers to the whole campus. It is best to park in Field 2. Parking will be free on a Saturday and there will be plenty of parking available.

By Train:

Cosmic Pathways is available by LIRR. The Long Island Rail Road (LIRR) provides service from Manhattan to the eastern tip of Suffolk County, Long Island. Adelphi University is located near both the Nassau Boulevard Station (on the Hempstead line) and the Mineola Station (on the Port Jefferson Line).

Adelphi University runs a shuttle bus from both the Nassau Boulevard Station and Mineola Station. For additional details, please visit
https://www.adelphi.edu/visit/explore/transportation/

G. Speaker Bios

Matthew Wright, Ph.D.
Co-chair of Cosmic Pathways and "Be a Shark" Speaker
Matthew Wright, Ph.D. is the chair of the physics department at Adelphi University, where he holds the rank of Professor of Physics. He obtained his Ph.D. from the University of Connecticut as an experimental atomic physicist. He has held research positions as an atomic physicist at the University of Innsbruck as a Marie Curie Fellow and Harvard University. He also held a position at Princeton Consultants, Inc where as a management consultant focused on the logistics and technology industries. Professor Wright has focused on helping the students make the transition from high school to college and then beyond. His recent book, "Sustaining Colleges and Universities through Community" discusses how members of the academic leaders can improve our current situation by connecting more deeply with the community. Another recent book he authored "Be A Shark: The Secret Sauce to Winning in Life after High School" helps students navigate college. He has also written over 21 op-eds on this topic and many others.

Brad Conrad, Ph.D.
Keynote Speaker
Brad R. Conrad, Ph.D. is the Workforce Development Manager within the Partnerships and Outreach Division at the National Institute of Standards and Technology (NIST) Office of Advanced Manufacturing (OAM). Brad received a Ph.D. in physics from the University of Maryland – College Park, is a former director of a science member society, and an associate professor of Physics and Astronomy at Appalachian State University. At OAM, Brad strengthens collaboration across education and workforce development initiatives for Manufacturing USA and participating U.S. government agencies. He leads advanced manufacturing education and workforce development partnerships and outreach opportunities to expand awareness and engagement with industry stakeholders, educators, workers, and students. He's spoken at over 160 colleges and universities and is passionate about there being a home for everyone in STEM and advanced manufacturing.

Rena Beban
Career Panelist
Rena Beban is a 25-year-old Physics and Physical Science teacher in the Bronx who received her Bachelor's and Master's degrees from Adelphi University in Physics and STEAM Education respectively. Her teaching practice focuses on hands-on, experienced-based learning for students who outside the classroom do not have access to such experiences. This includes designing and building functional machines, conducting scholarly research and presenting to an audience, and many other projects. In the future, she intends to pursue an additional Masters Degree in Educational Technology.

Adam Copeland, Ph.D.
Workshop Leader
Adam Copeland is an Academic Account Manager at Wolfram Research. He works with universities, colleges, and high schools across the United States and Canada to bring Mathematica and other Wolfram tools into teaching and research, mainly in STEM departments. Before he joined Wolfram, Adam was a faculty member at Augusta University and Director of Operations at RISE Academy. He has a Ph.D. from the University of Michigan. His dissertation used computational text analysis on a large collection of professional sports rulebooks to study how rules change in response to organizational performance, and how the language of the rules encodes fairness. A New York City native, he now lives in Ferndale, Michigan.

Matthew Lippert, Ph.D.
Workshop Leader
Matthew Lippert is an Associate Professor of Physics at SUNY Old Westbury. He was previously on the faculty at LIU Brooklyn and completed postdocs at the University of Amsterdam, the University of Crete, the Technion, and the University of Kentucky. His PhD is from the University of California Santa Barbara, and his BS is from Yale University. Dr. Lippert is a string theorist using holography to study strongly interacting systems in nuclear and condensed matter physics. He also explores high-energy and strongly gravitating astrophysical systems in order to learn about fundamental physics.

Andrew O'Bannon, Ph.D.
Workshop Leader
Andy O'Bannon is an Assistant Professor at SUNY Old Westbury in the department of Chemistry and Physics. He was previously a Royal Society University Research Fellow at the University of Southampton and the University of Oxford, and a postdoc at the University of Cambridge and the Max Planck Institute for Physics in Munich, Germany. He completed his PhD at the University of Washington in Seattle and his BA at the Johns Hopkins University in Baltimore. His research is in applications of holography and gauge-gravity duality to strongly-coupled systems, including the quark-gluon plasma and condensed matter systems.

Chloe Ong
Career Panelist
Chloe Ong graduated from Adelphi University with a Physics B.S. in 2019 and earned a Biomedical Engineering M.E. from SUNY Stony Brook in 2020. She has participated in student governance through the Physics Club, the Society of Physics Students (SPS), and the Fencing Club. Chloe's initial focus of research was Medical Physics, but she switched careers to Software Engineering. She has worked as a Software Developer for JP Morgan, but now works as a Lab Automation Scientist at Pfizer. Every single twist and turn in Chloe's education and career benefits her tremendously in her current role.

Sierra Romano
Workshop Leader
Sierra Romano is the Senior Assistant Director of Admissions. Sierra has been on Adelphi's Admissions team for the past 4 years and is very passionate about higher education and helping students through the enrollment process. She also graduated from Adelphi in 2022 with a BA in Communications and leans on her experience as a first-generation student to support future Panthers! Pro tip for those applying to college: take some time for yourself and enjoy every moment!

Michael C. Smith
"Get The Facts Out" Presenter
Michael C. Smith, High School Physics Teacher, is in his 31st year of teaching at Lindenhurst High School, where he teaches AP Physics 1, AP Physics 2, and Honors Physics. A committed lifelong learner, he is currently pursuing doctoral studies in STEM Education at Stony Brook University. He believes physics teaching is one of the most rewarding careers for anyone who loves watching young minds grow and solve challenges.

Kritika Suri
Career Panelist
Kritika Suri is a Product Quality Engineer at Weber with degrees in Physics from Adelphi University and Chemical Engineering from Columbia University. She is a certified Six Sigma Green Belt, Six Sigma Black Belt, and PMP, with experience leading product quality initiatives and new product launches.

Kevin Teng
Career Panelist
Kevin Teng is a dual-graduate class of 2017 at Adelphi University and Columbia University, with degrees in physics and materials science and engineering, respectively. He worked in a variety of different industries before deciding to attend Boston College law school to do a career reset. He is now working at Sullivan & Cromwell LLP as a General Practice Corporate Associate.

Marissa J. Vaccarelli, MS, DABR
Workshop Leader & Career Panelist
Marissa Vaccarelli earned her Bachelor of Science in Engineering Physics with concentrations in biomedical and mechanical engineering from Fordham University with honors. During her undergraduate studies, she was a Clare Boothe Luce Fellow. She received her Master of Science in Medical Physics from Hofstra University with distinction. Ms. Vaccarelli is a graduate of The University of Texas MD Anderson Cancer Center Radiation Physics Residency Program where she served as Chief Resident.

Ms. Vaccarelli is currently a Senior Radiation Physicist at Northwell Health. She is certified by the American Board of Radiology in Therapeutic Medical Physics, holding technical expertise in brachytherapy treatments as well as external beam specialty procedures such as stereotactic radiosurgery. She is involved with the implementation of adaptive radiotherapy regarding on-board imaging and treatment plan design. Additionally, Ms. Vaccarelli leads the physics protocol team as well as radiation machine clinical trial credentialing for Northwell Health and its Cancer Institutes. Alongside clinical responsibilities, she serves as a topical instructor for radiation oncology and medical physics residents. Ms. Vaccarelli's research interests include clinical workflow optimization, failure modes and effects analysis, as well as quality improvement projects.

Ms. Vaccarelli is an Assistant Professor of Radiation Medicine at Zucker School of Medicine. She also holds a faculty appointment at the Hofstra College of Liberal Arts

and Sciences and serves as the Deputy Program Director of the Medical Physics Master's Program, facilitating graduate student involvement in clinical medical physics and research. Ms. Vaccarelli is a member of the American Association of Physicists in Medicine (AAPM) as well as the AAPM special interest group Society of Directors of Academic Medical Physics Programs. She is a member of AAPM Task Group 263U1 focusing on radiation oncology nomenclature standardization updates. Ms. Vaccarelli also serves as a reviewer for Medical Dosimetry and the Journal of Applied Clinical Medical Physics.

Susan Wetzler
Workshop Leader
Susan Wetzler received a B.S. in Physics in 1988 from Fairfield University. She worked at a fortune 500 company for 10 years and became an expert in laser light scattering particle sensors. She transitioned into education and has been teaching high school physics for over 20 years. She became a member of QuarkNet in 2012 and a fellow in 2021.

H. Participating and Sponsoring Companies

PhysTEC - Donor (American Physical Society, American Association of Physics Teachers, National Science Foundation)







Turner Construction Company – Donor



Society of Physics Students / American Physical Society – Donor





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Step Up - American Physical Society

STEP UP
PHYSICS TOGETHER

Colleges

Adelphi University



Sarah Lawrence College



Farmingdale State College



High Schools
Manhasset School District



Mineola School District



Westbury School District



I. Cosmic Pathways Organizing Team

Brad Conrad, National Institute of Standards and Technology

Merideth Frey, Sarah Lawrence College

Carissa Giuliano, Mineola High School

Kylie Goldade, Cooperstown Graduate Program , SUNY Oneonta

Rob Krakehl, Manhasset High School

Patricia Mueller, Westbury High School

Dana Molloy, Dobbs Ferry High School

Bilas Paul, Farmingdale State College

Michael Smith, Lindenhurst High School

James St. John, Stony Brook University

Zoya Shafique, City College of New York

Matthew Wright, Adelphi University

Alyssa Zambuto, Adelphi University