COSMIC PATHWAYS

March 1, 2025
City College of New York
New York, NY

A. Cosmic Pathways Program Schedule

9:00-10:00 Conference Registration and breakfast
Location: Ground floor lobby

10:00 Conference introduction
Location: Room MR3
Matthew Wright

10:00-10:20 Be A Shark
Location: Room MR3
Kyle Cash, Zahin Ritee, and 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.

10:20-10:50 Graduate School in Physical Sciences
Location: Room MR3
Introduction by Kylie Goldade and Marlene McKinney
Brittney Hauke, Molly Mcdonough, and James St. John

Abstract: This panel discussion will inform conference goers about opportunities to attend graduate school, many of the benefits of obtaining a Ph.D. and some of the perils. The conference will also introduce Material Science as a career and will discuss attending the 2025 Sigma Pi Sigma Congress (aka SPSCon).

10:50-11:00 Break

11:00-12:00 Physical Science Career Panel
Location: Room MR3
Introduction by Annie Maloney and Katyanna Sciorra
Moderated by Brad Conrad
Panelists Fabian Chacon, Mickey Chiu, and Navjot Kaur

Abstract: This panel discussion will inform conference goers about divergent career paths for students who study physics. This panel features engineers, industry experts, and leaders at national labs.

12:00-1:30 **Lunch**
Location: Ground floor lobby

Ask an expert! Career, College, and Industry Floor Show
Location: Cafe and Ground floor lobby

Poster Session
Location: Ground floor lobby
Odd Posters 12-12:45
Even Poster 12:45 - 1:30
For poster assignments see E. Poster Abstracts

1:30-4:00 **Workshops and Research Presentations**
Location: Various locations
See: B. Research Presentation Sessions, C. Research Presentation Abstracts, and D. Workshop Schedules for further information

1:30 - 2:10	Workshop Session I Research Talks I
2:20 - 3:00	Workshop Session II Research Talks II
3:10 - 3:50	Workshop Session III Research Talks III

4:00-5:00 **Symphonies in Space: 'Listening' to the Universe with Gravitational Waves**
Location: Room MR3
Introduction by Amii Matamoros Delgado and Matthew Gootman
Rob Coyne

Abstract: Since the first days that humans gazed up into the night sky, we've mostly used light to learn about the universe. But that changed in 2015 when, on September 14th, the Laser Interferometer Gravitational-wave Observatory (LIGO) made the first direct observation of gravitational waves from a pair of black holes that spiraled into each other and merged. Since then, we have observed gravitational waves from numerous black holes and neutron stars, opening up a new era in astronomy. In this talk, we'll learn about gravitational waves, how we detect them, and how they offer us a whole new way of observing the universe. In a way, if light allows us to 'see' the cosmos, gravitational waves allow us to 'listen' to it, enabling new discoveries that early astronomers could have only dreamed of.

B. Research Presentation Sessions (1:30pm-4:10pm)

This session is sponsored by Rochester Symposium for Physics Students

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

Session 1A (Room MR408) – Renewable Energy (AA-10)
Chair: Prof. Jerome Fung, Ithaca College
1:30-2:10pm

Exploring Wind Turbine and Solar Panel for a Better Environment
Adam Choudhry, St. John University

In-Depth Look at Solar Panels and Windmills for Energy Production
Joshua Rivera, St. John University

In-depth characterization of certain wind turbines and solar panels for the future of renewable energy
Alexander Ram-Singh, St. John University

Session 1B (Room MR410) – Astronomy & Astrophysics (AA-11)
Chair: Prof Kelly Douglass, University of Rochester
1:30-2:10pm

Investigating Radiative Levitation in White Dwarf Stars by Large-Scale Molecular-Dynamics Simulations
Annie L. Maloney, University of Rochester

Searching for Pulsation in Low Mass Stars using Unsupervised Learning Techniques
Waly M Z Karim, University of Rochester

Analysis of pion field EFT parameters for large-scale structure
David Muqattash, Manhattan University

Session 1C (Room MR417N) – Physics Education (AA-12)
Chair: Prof. Michael Pfenning, United States Military Academy
1:30-2:10pm

Bringing Experiment into the Classroom Using a Quantum Interference Effect in Rubidium
Christian Custodio, United States Military Academy

Atom-based RF Quantum Sensors: Establishment of an Undergraduate QIS Research Laboratory
Tyler Catapano & Michael Speer, United States Military Academy

Pulsed Power Inertial Fusion
Eleanor Gautsch & Faith Garrett, University of Rochester

Session 2A (Room MR408) – Condensed Matter (BB-13)
Chair: Prof. Bart Horn, Manhattan College
2:20-3:00pm

Characterizing the three-body chaotic motion of vortices in a Bose-Einstein condensate
Juan Pelaez, University of Rochester

Machine Learning Prediction and Experimental Synthesis of New High-Temperature Superconductors
Edward Jansen, Adelphi University

The Continuing Story of Perovskite Titanates: Connecting Electrical and Optical Properties to Structural Modification
Ethan Haley, Manhattan University

Session 2B (Room MR410) – Particle Physics (BB-14)
Chair: Prof Kelly Douglass, University of Rochester
2:20-3:00pm

The Study of Quantum Entanglement in the HZZ System in The Standard Model and Beyond
Jack Simoni, Manhattan University

Parametrizations of Electron Scattering Form Factors for Elastic Scattering and Electron-Excitation of Nuclear States for AL-27 and Ca-40
Amii Matamoros Delgado, University of Rochester

A Multi-Messenger Exploration of Neutrino-Emitting Blazars, the Most Energetic Persistent Particle Accelerators in the Universe
Mina Mori, Hunter College High School

Session 2C (Room MR417N) – Plasma Physics (BB-15)
Chair: Prof. Michael Pfenning, United States Military Academy
2:20-3:00pm

THOR: Towards Precise Plasma Diagnostics
Cole Jerum, University of Rochester & Timothy Seo, Pittsford High School

Distributed CASES Array for Mid-Latitude Ionospheric Characterization
Sidharth Hedge, United States Military Academy

Identifying Runaway Supermassive Black Holes Via Broad Emission Line Shapes
Kaya Miller, Rochester Institute of Technology

Session 3A (Room MR408) – Medical & Biological Physics (CC-16)
Chair: Prof. Merideth Frey, Sarah Lawrence College
3:10-3:50pm

Using an Infrared Laser to Draw Elastin Microstructures
Marlene M. McKinney, CUNY City College

Creating a Diagnostic Tool for Parkinson's Disease Using a KNN Algorithm
Kylie Goldade, Adelphi University

Rhizobium Tropici-Produced Biopolymer: Analyzing Its Impact on the Phenotype and Genotype of Arabidopsis Thaliana
Christian Chan, South Side High School

Session 3B (Room MR410) – From Mechanics to Dynamics (CC-17)
Chair: Prof. Bart Horn, Manhattan College
3:10-3:50pm

On Noether's Theorem and Its Applications in Classical Mechanics and Quantum Field Theory
Hasin A. Shaykat, The KewForest School

Investigating the stability of trojan and horseshoe co-orbitals in extrasolar multi-planet systems
Mariah C. Jones, Vassar College

Flight Dynamics: Exploring the Impact of Wing Design on Fighter Jet Speed -From Skies to the Tracks
Armina Yetimoglu, Lindenhurst High School

C. Research Presentation Abstracts (1:30pm-4:10pm)

This session is sponsored by Rochester Symposium for Physics Students

Session 1A (Room MR408) – Renewable Energy

Exploring Wind Turbine and Solar Panel for a Better Environment

Adam Choudhry & Dr. Malek Abunaemeh, St. John University

This research focuses on creating wind turbine and solar panel for a better environment. Having both wind turbines and solar panel have a lot of benefits for a healthy environment in which cuts down the amount of carbon dioxide (greenhouse gases) in polluting the atmosphere. It is important that we have renewable energy in our society and for the whole world because the amount greenhouse gases (pollutants) in the environment can lead to unhealthy life. The benefits of having wind turbine and solar panel is that it helps make everyone's life and job easier, having enough power for their houses especially workplaces, and the most important part of renewable energy is that it helps us save money and not wasting them on paying electricity bills. The similarity between wind turbine and solar panel is that they both produce electric current to flow, but the difference is that the solar panel takes the amount of energy from the sun when it hits to PV (photovoltaic cell) it converts electricity while wind turbine takes it from the wind. One of the benefits of having solar energy is that it reduces electricity bills and one of the disadvantages of having solar panels is the energy storage is expensive. For wind turbine, one of the advantages is that it is clean, sustainable and abundant. One of the disadvantages is that it needs wind to work in order to produce electricity bills. It is strongly encouraging and important that we need keep the environment clean.

In-Depth Look at Solar Panels and Windmills for Energy Production

Joshua Rivera & Dr. Malek Abunaemeh, St. John University

Renewable energy sources such as solar panels and windmills are a valuable asset for the environment as well as our own future. Solar panels, over the last few decades, have made incredible advancements, allowing for them to be introduced as an alternative source of energy for homes and communities across America. Windmills have seen similar technological advancements, allowing for an increasing popularity in the use of wind farms as a source of energy as well. Through a closer look at how these devices function, it is possible to create more effective and efficient methods of producing energy. We will begin to do this through analyzing two types of solar panels along with several windmill designs.

In-depth characterization of certain wind turbines and solar panels for the future of renewable energy

Alexander Ram-Singh, St. John University

As cities and countries further develop and the need for energy grows, efforts to reduce climate change and move away from fossil fuels become more common. As a result of these efforts windmills and solar panels have become promising solutions to the need for renewable energy. Wind turbines convert kinetic energy from the wind into electrical power, as the turbine spins a rotor linked to a generator produces electrical energy. Solar panels convert sunlight into electricity through the Photovoltaic effect. When sunlight hits the panels it excites the electrons causing them to flow creating an electric current. Both methods rely on environmental factors such as weather and location which can impact their overall performance. The goal of this research project is to analyze the function and efficiency of different types of solar panels and windmills with varying outputs to provide insights that can enhance their future applications and support the transition toward sustainable energy methods.

Session 1B (Room MR410) – Astronomy & Astrophysics

Investigating Radiative Levitation in White Dwarf Stars by Large-Scale Molecular-Dynamics Simulations

Annie L. Maloney, Brennan Arnold, Eric Blackman, Suxing Hu, University of Rochester & LLE

It has been observed that the abundance of heavy elements in the atmospheres of white dwarf stars does not match exactly with prevailing stellar models. The phenomenon of radiative levitation is one possible explanation, wherein due to the high opacity of heavy elements such as C, Si, and Fe, these elements are "levitated" against the force of gravity within a plasma of Hydrogen and/or Helium. This mechanism is not entirely understood at the microscopic level; the effect of plasma density and temperature conditions is particularly uncertain. To clarify these effects we use large-scale molecular dynamics simulations to model interparticle interactions and radiative force. By scanning different density/temperature conditions of the white dwarf atmosphere, this study will reveal where radiation levitation may play a role to redistribute heavy elements in white dwarf stars.

Searching for Pulsation in Low Mass Stars using Unsupervised Learning Techniques

Waly M Z Karim, University of Rochester

M-dwarfs, the most prevalent stars in our solar neighborhood, remain poorly understood, in part due to inconsistencies between theoretical models and observational data regarding their radii and effective temperatures. Asteroseismology, the study of stellar oscillations, offers a promising solution. Despite previous challenges in detecting pulsations in low-mass stars, TESS light curves provide new opportunities with their red sensitivity and rapid observing cadence. We have developed an unsupervised algorithm to classify light curves and identify pulsations by retraining a convolutional autoencoder on a labeled catalog of variable stars using TESS 2-minute cadence data. Dimensionality reduction was achieved through the neural network, followed by clustering the latent space using K-Means and visualizing it with UMAP. Our model has reached 87% accuracy in classifying pulsators. We are currently analyzing an unlabeled sample of stars within 100 pc from Gaia DR3, and have already found a few F and A type pulsators. This work will present our clustering results based on the sources of variability, and potential detection of new pulsating stars.

Analysis of pion field EFT parameters for large-scale structure

David Muqattash, Manhattan University

We consider a model of large scale structure in the Universe as a scalar pion field, corresponding to the scalar potential of the smoothed velocity field of pressureless matter. We compare data from N-body simulations at different length scales and redshifts to the data from a top-down pion field simulation, and we use software packages GADGET-4 and PyLiANS to analyze the data and to find effective field theory parameters such as the sound speed and viscosity of our cosmic pion fluid.

Session 1C (Room MR417N) – Physics Education

Bringing Experiment into the Classroom Using a Quantum Interference Effect in Rubidium

Christian Custodio, United States Miliary Academy

Bringing an experimental component into the quantum curriculum can help students gain a better understanding of a wide range of principles including atomic state structure, doppler broadening, and selection rules. Starting with Saturated Absorption Spectroscopy and then building into Electromagnetically Induced Transparency (EIT) on Rb provides coverage of this range of important concepts. EIT is a quantum interference phenomenon allowing for the Doppler-free spectroscopy of the hyperfine electronic structure in an atomic gas. Our experimental team recently reproduced experiments by Badger et al.[1] in which EIT is used to resolve the hyperfine structure of the ground to first excited state in Rb-85. Our work uses counter propagating 'Probe' and 'Coupling' lasers at 780nm and 776nm respectively. The methodology for this experiment and its potential value as a laboratory experience to supplement a quantum information science curriculum will be presented at the meeting.

1 Badger et al. 2001 J. Phys. B: At. Mol. Opt. Phys. 34 L749

Atom-based RF Quantum Sensors: Establishment of an Undergraduate QIS Research Laboratory

Tyler Catapano & Michael Speer, United States Military Academy

Electromagnetically Induced Transparency (EIT) is a quantum interference phenomenon allowing for the Doppler-free spectroscopy of the hyperfine electronic structure in a classical atomic gas. Our experimental team recently reproduced experiments by Badger et al.[1] in which EIT is used to resolve the hyperfine structure of the ground to first excited state in Rb-85. Our work uses counter propagating 'Probe' and 'Coupling' lasers at 780nm and 776nm respectively. The effects of polarization and relative beam powers on the EIT-resolved hyperfine structure of the Rb-85 D2 transition is in progress. This work served to establish the methodology needed for our current EIT-based atomic experiments in valence-to-Rydberg electronic transitions. A recap of our previous work and the status of our current efforts to achieve Rydberg EIT will be presented at the meeting.

1 Badger et al. 2001 J. Phys. B: At. Mol. Opt. Phys. 34 L749

Pulsed Power Inertial Fusion

Eleanor Gautsch & Faith Garrett, University of Rochester

Current fusion methods use more energy than the reactions produce. However, it is possible that inertial fusion can be achieved in a financially viable reactor. Spherical laser compression has a stronger compression ratio (ratio of initial and final target volume) than cylindrical magnetic compression (spherical: 1/r^3, cylindrical: 1/r^2). However, lasers are more expensive to build than pulsed-power drivers and more difficult to implement in a lab. This project searches for a fusion method that increases magnetic compression ratio (~ 1/r^2.5) by optimizing the geometry of the load. The traditional method involves a current-carrying cylinder that collapses under a self-induced magnetic force. To improve the design's compression ratio, it is possible to use a Gaussian profile with hyperbolic ends, forming a flared tube with a central bulge. Computational methods will show the validity of this approach, which can be executed on existing machines, such as the Z machine.

Session 2A (Room MR408) – Condensed Matter

Characterizing the three-body chaotic motion of vortices in a Bose-Einstein condensate
Juan Pelaez, Elisha Haber, Nicholas Bigelow, University of Rochester

Quantum chaos studies quantum systems that reveal classical chaotic behavior. The exact relationship between quantum and classical is widely debated and unsolved. The three masses interacting is a standard example of a chaotic system. The quantum counterpart considers three vortices imprinted in a Bose-Einstein Condensate (BEC). A BEC is an ultracold gas of bosons that occupy the same quantum ground state. The simulations are situated in a harmonic potential trap with Rubidium 87 atoms. Previous works in the literature have ignored the vortices and BEC. We have solved the mean-field Gross-Pitaevskii equation to accurately model the dynamics of the vortices. To measure chaos in the system, the vortices are initialized in slightly different configurations to compute the maximal Lyapunov exponent (MLE). The MLE converges to a positive value indicating that vortices with slightly different configurations will diverge in phase space quickly. Future efforts will include more analysis such as bifurcations diagrams.

Machine Learning Prediction and Experimental Synthesis of New High-Temperature Superconductors
Edward Jansen & Dr. Ivan Hyatt, Adelphi University

Data-driven machine learning, informed by structural crystallographic data, offers a powerful tool for designing improved materials. In this study, we leverage this approach to synthesize and experimentally evaluate new high temperature superconductors. We employ the Crystal Diffusion Variational Autoencoder (CDVAE) model to train and generate stable superconductors optimized for high critical temperatures. Candidate materials are screened using the Atomistic Line Graph Neural Network (ALIGNN) model to estimate key properties, including formation energy, critical temperature, and band gap. We then experimentally test the most promising, high-temperature, stable candidates. This research demonstrates a successful workflow for materials discovery, drawing on established methodologies and available tools to gather data, curate training datasets, and train graph neural networks to learn patterns between structural and material properties. Our approach enables the generation of novel materials through a physics-informed variational autoencoder, followed by screening for stability and other desired properties, and ultimately, experimental validation of these materials.

The Continuing Story of Perovskite Titanates: Connecting Electrical and Optical Properties to Structural Modification
Ethan Haley, Manhattan University

Perovskite structured titanates have attracted immense attention in research after decades of use in electronic components as they have emerged as strong candidates for other applications including semiconductors, superconductors, photocatalysis, and gas sensing. Advancements in structural modification strategies, including induced impurities through doping, have opened up opportunities for tuning the properties of these materials for specific applications, including a band gap narrowing effect known to improve the performance of perovskite titanates as semiconductors. In this study, we used doped and undoped samples of strontium titanate and barium titanate synthesized by solid-state reaction as model systems to investigate how the dopant type, concentration, site, and calcination atmosphere affected the structures that are related to the optical and electrical properties of these materials. Site-specific doping was guided by stoichiometric deficiencies on the A or B site during synthesis. The morphology and chemical composition of each sample was measured using a scanning electron microscope (SEM) with energy dispersive spectroscopy (EDS). Raman spectroscopy was performed to characterize the local symmetry, structure, and possible defects. A notable phase change was observed in the Raman spectra of doped barium titanate samples. UV-Visible diffuse reflectance spectroscopy showed a red-shift in doped samples with respect to pure samples, indicating a reduction of the electronic band gap with increasing concentrations of dopant. These results will help future examination of the connections between doped perovskite titanate structures and their optical, electrical, and photocalalytic properties.

Session 2B (Room MR410) – Particle Physics

The Study of Quantum Entanglement in the HZZ System in The Standard Model and Beyond
Jack Simoni, Manhattan University

Quantum entanglement (QE) is an extremely prevalent phenomenon in quantum physics. In recent years, efforts have been made to probe for QE in higher-energy experiments, namely at the Large Hadron Collider (LHC). In particular, one process observed at the LHC of interest is the Higgs boson decaying into two Z-Bosons (HZZ). The pair of Z-Bosons are expected to be qutrit entangled (the Z-Bosons have 3 possible states rather than two). It will be the first measurement of quantum qutrit entanglement at high energies. This process is produced by a proton-proton collision at an energy of 13 TeV. This research study offers insight into testing for the existence of entanglement within the HZZ system using simulated data. The simulations not only take into account the HZZ system within the Standard Model, but also consider Beyond Standard Model (BSM) effects. The methodology of probing for entanglement relies on representing the differential cross section of the system as a combination of spherical harmonics. Within this representation, the angular coefficients are embedded. It is these angular coefficients that can be calculated through simulations that allow for a test on the existence of entanglement. By acquiring the angular coefficients of the system, the Peres-Horodecki criterion and the CGLMP Inequality can be used as tests for QE. It has been observed that QE does occur within the HZZ level at the Standard Model, and additionally, that the QE angular coefficients change with BSM effects, allowing for a sensitive test towards the existence of BSM theories in the future.

Parametrizations of Electron Scattering Form Factors for Elastic Scattering and Electron-Excitation of Nuclear States for AL-27 and Ca-40
Amii Matamoros Delgado, University of Rochester

We report on empirical parameterizations of longitudinal and transverse nuclear electromagnetic form factors for elastic scattering and the excitations of nuclear states in AL-27 and Ca-40. The parameterizations are needed for the calculations of radiative corrections in measurements of electron scattering cross sections on AL-27 and Ca-40 in the quasi-elastic, resonance and inelastic continuum regions. In addition, they provide the contribution of nuclear excitations to the longitudinal and transverse electromagnetic response functions RL and RT therefore complement measurements of RL and RT in the QE region for comparisons with theoretical models and investigations of the Coulomb Sum Rule. In general, the complete extractions of the response functions RL and RT over a large kinematic range can be readily used for comparison to theoretical predictions as well as validating and tuning Monte Carlo generators for future electron and neutrino scattering experiments.

A Multi-Messenger Exploration of Neutrino-Emitting Blazars, the Most Energetic Persistent Particle Accelerators in the Universe

Mina Mori, Hunter College High School

Recently, the IceCube Neutrino Observatory made the groundbreaking discovery of associating significant high-energy neutrinos with gamma-rays from blazars – active galactic nuclei (AGN) powered by a supermassive black hole, with relativistic jets oriented very nearly towards Earth. Neutrinos are charge-neutral elementary particles produced by hadronic interactions when relativistic protons hit surrounding molecular clouds and torus around the supermassive blackhole. However, the mechanisms and locations of neutrino and gamma-ray emission are poorly understood. By cross-matching 8 years of IceCube neutrino data and the Fermi-4LAC gamma-ray AGN catalog, I identified 25 neutrino-emitting blazar candidates. Then, based on the gamma-ray and X-ray lightcurve data obtained by NASA’s Fermi Large Area Telescope and Swift X-ray Telescope, I investigated whether the neutrino emission time Intervals coincided with gamma-ray and X-ray flares for the purpose of testing the most recent model predictions about the neutrino and high energy emission mechanisms.

Session 2C (Room MR417N) – Plasma Physics

THOR: Towards Precise Plasma Diagnostics

Cole Jerum, University of Rochester & Timothy Seo, Pittsford Mendon High School

Accurate alignment of diagnostic lasers is crucial in plasma research, yet traditional manual optics calibration can be slow and prone to human error, while motorized systems are prohibitively expensive. To address this challenge, we developed the Teleoperated High-Precision Optics Repositioner (THOR); THOR significantly reduces implementation costs by integrating motorized controls directly onto standard kinematic mounts, allowing each adjustment screw to be precisely tuned via a computer interface. To evaluate its performance, we first performed a standard manual calibration of a laser beamline. Next, we integrated a real-time optimization algorithm with THOR to maximize beam intensity using live signal feedback. THOR achieved comparable or improved alignment outcomes with greater ease and consistency. These results highlight THOR’s potential as an affordable and adaptable alternative to enhance laser alignment in plasma diagnostics.

Distributed CASES Array for Mid-Latitude Ionospheric Characterization
Sidharth Hegde, United States Military Academy

This research studies the characteristics of Traveling Ionospheric Disturbances (TIDs) as they influence GPS signals. The data used in this study is obtained using CASES GPS receivers that measure scintillations in total electron content (TEC), signal phase, and signal amplitude. These fluctuations can be used to calculate the characteristics of the ionospheric plasma within the TIDs, allowing for greater understanding of their composition and nature.

Identifying Runaway Supermassive Black Holes Via Broad Emission Line Shapes
Kaya Miller, Rochester Institute of Technology

Current galaxy evolution theories propose that galaxy mergers result in binary supermassive black holes (SMBHs), whose eventual coalescence emits gravitational waves. Distinguishing recoiling SMBHs (RSMBHs) from normal active galactic nuclei (AGN) processes like AGN winds is critical. RSMBHs produce distinct signatures in broad emission lines (BELs), including larger Doppler shifts, low kurtosis, and asymmetric peaks due to gravitational wave recoil. However, similar BEL characteristics can arise from AGN winds and other intrinsic AGN properties, complicating RSMBH identification. To address this, a simulation code will be used to model BEL profiles of AGN under various conditions. This will create a library of BEL profiles for comparison with real spectra, aiding in accurate RSMBH identification. This research is pivotal for advancing our understanding of galaxy evolution, as correctly identifying RSMBHs is essential for comprehending their impact on galaxy structure and evolution.

Session 3A (Room MR408) – Medical & Biological Physics

Using an Infrared Laser to Draw Elastin Microstructures
Marlene M. McKinney, CUNY City College

Tropoelastin is a connective tissue protein that makes up elastic fibers across the body. We have previously reported on the design of artificial mini tropoelastin that mimics the behavior of the natural protein. Specifically, the mini tropoelastin undergoes reversible, heat-induced phase-phase separation known as coacervation. If heated sufficiently, the protein undergoes domain crosslinking and irreversibly forms elastic fibers without enzymatic activity. We aim to guide the formation of elastic microstructures using an infrared laser as a heat source. Protein samples of 25, 50, and 100 μM were exposed to several wavelengths in the near-infrared spectrum. Nonlinear photonic transmission quantified elastic fiber formation, and matured structures were extracted after exposure. This data will be used to create more complex, tubular microstructures that can be used to replace degenerated or necrotic arteries after traumatic events.

Creating a Diagnostic Tool for Parkinson's Disease Using a KNN Algorithm
Kylie Goldade, Adelphi University

We built a machine learning algorithm (kNN) to take in audio samples from a person's voice and classify them with or without Parkinson's. Current screening for Parkinson's disease includes studying extensive medical history, blood tests, and neurological tests. Our goals were to develop a cost effective screening tool for Parkinson's using voice data rather than some more costly options like blood tests. We used the Oxford Parkinson's Disease Detection Data Set that included 6-7 audio samples from 32 different people; 23 with Parkinsons and 9 without. This data set was analyzed for numerical data from the voices. We created an effective machine learning algorithm and determined which variables are unnecessary in the testing dataset. These goals were met with 87% accuracy, and 7 columns of unnecessary data removed.

Rhizobium Tropici-Produced Biopolymer: Analyzing Its Impact on the Phenotype and Genotype of Arabidopsis Thaliana

Christian Chan, South Side High School

Increasing soil stability is important for addressing increased stream and river turbidity, eutrophication, decreased biodiversity, and desertification of farmland. A potential solution is the use of extracellular polymeric substances (EPS) produced by the bacteria Rhizobium Tropici, which offers a low-cost and environmentally friendly solution to soil erosion. The form of RT-EPS used in this research is Ethanol Precipitable Material (EPM). Characterized by its ability to retain water and nutrients and enhance subterranean root structure, EPM offers applications in sustainable agriculture and environmental preservation in the face of intense weather patterns. This study aims to investigate how EPM influences the mechanical properties of sand and promotes growth in Bermuda Grass and Bush Bean Plants. To study EPM's adhesive properties, an experiment was conducted to measure the angle of repose for sand samples mixed with varying concentrations of EPM. The angle of repose reflects the stability of a granular material, and it was used to indirectly measure the adhesive interactions between the sand particles mixed in with EPM. Different concentrations of EPM (0 mg/kg, 12.5 mg/kg, 50 mg/kg, and 125 mg/kg) were mixed with sand, and these mixtures were then molded into cones using a funnel. The measurements were then recorded at different time points for a prolonged period of time. A significant difference in the angle of repose was noted between 125 mg/kg and control samples, indicating that greater amounts of EPM imparted the sand with improved stability. Bermuda Grass samples germinated and matured over a 2 month period. On average, the shoot count and root mass increased with higher EPM concentrations of 25 mg/kg and 125 mg/kg. This promotion of shoot and root development led to the hypothesis that the EPM may also be promoting nutrient availability and uptake for the plants. This was investigated with the Bush Bean Plants, as the main focus was on the number of bean pods produced and the mineral content in those pods. Samples grown with 25 mg/kg EPM in sand produced the greatest number of bean pods and had the highest root mass and root-shoot mass ratio. XRF analysis was then performed to quantify the presence of important minerals in the pods, and a significant increase in the amount of potassium and chlorine with higher amounts of EPM was noted. At the higher concentration of 125 mg/kg, though XRF analysis delivered results that followed the trend of increased mineral content, the bean pod count was lower than the 25 mg/kg samples and equivalent to the control. In conclusion, it was observed that sand samples treated with EPM maintained a higher angle of repose over longer periods of time, demonstrating its ability to enhance adhesive properties between the granules. This suggests its potential to effectively reduce soil erosion in vulnerable areas. In addition, the results showcase EPM's ability to increase shoot count and root mass in Bermuda Grass, highlighting its ability to influence both above and below-ground development. This is further supported by XRF analysis in Bush Bean pods, as EPM treated samples display an increase in important minerals for growth and metabolism. Angle of repose will continue to be measured to observe the long-term impact on adhesive properties. The scope of the XRF studies may also be broadened to include the observations of toxic metals: different studies showed that just as the EPM assists in delivering minerals to the plants in controlled amounts it can also sequester toxic and non-essential metals. The authors would like to thank the US Army Corps of Engineers (ERDC) and the Louis Morin Charitable Trust for their support (W912HZ-20-2-0054) in this research.

Session 3B (Room MR410) – From Mechanics to Dynamics

Flight Dynamics: Exploring the Impact of Wing Design on Fighter Jet Speed -From Skies to the Tracks

Armina Yetimoglu, Lindenhurst High School

The purpose of this research is to determine the most beneficial wing design in terms of greatest velocity of a fighter jet, and then hypothetically relate these findings to a Formula 1 car. The fighter jets used around the world are constantly evolving to establish a military advantage superior to other countries. Formula 1 cars are always being redesigned or upgraded to become the fastest among to become the fastest of the ten teams in the Formula 1 grid of racing in order to acquire the most points to achieve the Drivers Championship and the Constructor Championship. The hypothesis for this experiment is that if the most beneficial designs could be found of the variables of the fighter jets that are being experimented on (wings) and create a new and unique design, then the design should be able to increase the velocity of the plane. And given the correlation inverse relationship between a fighter jet and a Formula 1 car, the findings regarding the aerodynamic variables discussed above should have a similar, if not the same effect on the increase of velocity. By creating small fighter jet models (to scale) and using a motion sensor to acquire the position, velocity, and acceleration, it would be possible to compare and contrast the control group (F-16 fighter jet) with the three experimental groups (Sukhoi Su 47 wing design, TAI TF KAAN wing design, and the original wing design created for this experiment, nicknamed the 'Yeti'), and conduct statistical analysis among them using the One-Way Analysis of Variance Test.After conducting three trials the conclusion of my research is that the original and unique design, 'Yeti', has the most velocity of an average of 21 m/s. To the relationship between the 'Yeti' and a Formula 1 car is through the floor of the car, meaning that the floor of the Formula 1 car would need to have a similar and inverted design to generate the most downforce by increasing the vortices and creating a steep air flow of the high and low pressure between the floor of the car and the track it is racing on. The increased downforce will then increase the car's grip which effectively allows the Formula 1 car to race at a faster velocity. The future of this research is to allow this to be done at a larger scale and with a few minor modifications in the 'Yeti' design to achieve the design in which it will acquire the highest velocity and again make the connections to a Formula 1 car's floor. Even further, there would be a goal to create smaller displays (to scale) of the floor of Formula 1 cars and test the similar yet inverted designs to the 'Yeti' fighter jet wing design and test the velocity to understand the estimated downforce generated.

On Noether's Theorem and Its Applications in Classical Mechanics and Quantum Field Theory

Hasin A. Shaykat, The KewForest School

The role of symmetry within the laws of physics is explored in this paper. It encompasses systems from Newtonian mechanics to modern theories such as the Standard Model. The focus is placed on Lagrangian mechanics and the calculus of variations, which are foundational for understanding Noether's theorem. This paper uses the theorem to demonstrate how continuous symmetries lead to conservation laws, including those of momentum, angular momentum, and energy. These principles simplify complex physical problems and extend to advanced topics, such as gauge symmetry, complex scalar fields, and scalar quantum electrodynamics (QED). The unifying framework provided by symmetry is highlighted, showing its appl classical and modern physics.

Investigating the stability of trojan and horseshoe co-orbitals in extrasolar multi-planet systems
Mariah C. Jones, Vassar College & Matija Cuk, SETI Institute

Trojans and horseshoes are specific types of co-orbital bodies in planetary systems. Trojans share an orbit with a planet, positioned at the stable Lagrange points L4 and L5 (60 degrees ahead or behind the planet), while horseshoes oscillate around the planet's path in a more complex manner. At least three Solar System planets—Mars, Jupiter, and Neptune—host stable co-orbital asteroids that have shared their orbits since the early formation of the system. In contrast, Saturn and Uranus lack stable co-orbital asteroids due to their proximity to orbital resonances with Jupiter and Neptune, respectively. According to Nesvorny and Dones (2002), Saturn lacks stable Trojans because it is near 5:2 period ratio with Jupiter which results in strong gravitational perturbations that destabilize potential co-orbitals. Transiting extrasolar multi-planet systems frequently contain planets in resonance or near-resonance. In this talk, I present numerical simulations of the stability of co-orbitals in TRAPPIST-1, Kepler-11, Kepler-80, Kepler-90/KOI-351, and HD 110067 using the TRACE integrator from the REBOUND package. We place 20 hypothetical particles for each planet 60 degrees ahead of the planet, with semi-major axes varying from that equal to the planet's to one that is one Hill radius larger. Our simulations are limited to initially circular and planar orbits. Preliminary results indicate that co-orbitals in resonant systems, such as TRAPPIST-1, exhibit less stability compared to those in non-resonant systems. This suggests that orbital resonances play a significant role in the stability of co-orbital bodies. Full results will be presented at the conference, shedding light on the dynamics and the implications for the existence of co-orbitals in extrasolar planetary systems.

D. Workshop Schedules (1:30pm-4:10pm)

Student Presentations (See B. Research Presentation Sessions, C. Research Presentation Abstracts)
Location: MR408
MR410
MR417N

Capturing Physics with Python (AA-1 & BB-1)
Location: MR409S Double Session: 1:30pm – 3:00
Dave Biersach
Title: Capturing Physics with Python

Abstract: In this 1 hr. and 35-minute workshop, students will connect an RP2350 microcontroller to several sensor types to perform several undergraduate-level physics experiments. In addition to wiring the circuits, students will run Python code on their laptops and the microcontroller to measure and plot circuit responses. Students will analyze passive and active electronic circuits, including bipolar junction transistors and operational amplifiers. By completing these hands-on labs, students will understand how oscilloscopes and signal generators capture and display small signal waveforms. They will also gain new sensitivity to sampling rates as they design future experiments in their academic and professional career.

The specific experiments the students will complete include:

- Resistor-Capacitor Charge/Discharge Circuit Response (Kirchoff and Maxwell Laws)
- Bipolar Junction Transistor Amplification and Regions (Cutoff, Active, Saturation)
- Blue LED Band Gap Energy (Einstein's Photon Energy Equation)
- Signal Generators and Operational Amplifiers (Negative Feedback Loops)
- Nyquist Limit and Sample Aliasing (Pulse Counting, Parasitic Capacitance)

CCNY Lab Tours (AA-2 & BB-2)
Location: Outside of Room MR3 Double Session: 1:30 – 3:00
Abstract: Explore CCNY research laboratories! During this period students will get to see many of the physics research facilities at CCNY.

Graduate Student Panels (BB-3 & CC-3)
Location: MR-3 (1st floor)
Session BB-3 2:20 – 3:00
Session CC-3 3:10 – 3:50
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

The relevance of angular measurement in the control of robotic arms (CC-49)

Location: MR409S 3:10 – 3:50

Ben Ovryn

Abstract: Research Assistants from the Ovryn Laboratory at the New York Institute of Technology will demonstrate the intricacies of a multi-arm articulating robot and discuss the details of angular displacement, measurement and control. Since ancient times, angular measure has been required to represent the size of astronomical objects as they appear in the night sky. Leonhard Euler introduced a convention with three angles to specify the orientation of a rigid body in a fixed coordinate system. Although interferometric phase measurements can provide an extremely high precision, they are not typically suitable for real-time needs of industrial robotics. Instead, the rotation of coding disks or masks provides a reasonable compromise that balances speed and precision. In addition to demonstrating the approach used on an industrial robot, a separate setup will present the approach and required signal processing.

* Note CC-49 is a mixed session.

Demonstration of a commercial instrument that implements a Shack-Hartmann wavefront sensor and an adaptive optics device for measurement and characterization of wavefront aberrations (CC-49)

Location: MR409S 3:10 – 3:50

Ben Ovryn, Ph.D.[1], Jerôme Ballesta[2], and Bérénice Renard[3]

1 Department of Physics, New York Institute Of Technology, Old Westbury, NY, bovryn@nyit.edu;

2 Imagine-Optic 18, rue Charles de Gaulle, 91400 Orsay, France, jballesta@imagine-optic.com;

3 Imagine-Optic, 444 Somerville Ave, Somerville, MA, 02143; brenard@imagine-optic.com

Abstract: In this presentation, Research Assistants from the Ovryn Laboratory at the New York Institute of Technology will be joined by representatives of Imagine Optic in a demonstration of a commercial instrument that implements an adaptive optics (AO) system based on a Shack-Hartmann wavefront sensor (SHWFS) and an electromagnetic deformable mirror which can characterize, correct and produce aberrations. This approach offer the ability to correct aberrations in order to improve image quality. The presentation of the AO system will be combined with a discussion of Zernike polynomials, a series of orthogonal polynomials that form a basis over a circular aperture. These polynomials can be used to characterize wavefront aberrations with demonstrable applications in astrophysics, particle physics, ophthalmology, microscopy. The details of the AO system and the approach to fitting and studying Zernike polynomials will be presented.

* Note CC-49 is a mixed session.

Live Space Show: Take an immersive tour of the visible (and invisible) universe in the CCNY Planetarium. (CC-5) 3:10 – 3:50
Location: Planetarium First Floor
James Hedberg

Productive Physics (AA-6 & CC-6)
Location: MR 417S
Session AA-6 1:30 – 2:10
Session CC-6 3:10 – 3:50
Rob Krakehi
Creating and being part of a productive physics classroom designed around student-centered learning can be challenging. Whether you're a novice or seasoned teacher, a freshman or a graduate student this workshop will demonstrate guiding principles to get active learning happening. From making it visible to fostering a thinking classroom, we'll help your students (and you) learn how to ask the right questions.

Gain practical strategies to transform your classroom into an engaging learning environment. Explore techniques to foster critical thinking, creativity, and collaboration. Learn to design inquiry-based projects that connect scientific concepts to everyday life. Create a culture of curiosity, inspiring students to take ownership of their learning.

Stepping into Your Career with Confidence: An SPS Workshop (AA-18, CC-7)
Session AA-18 Location: MR4 1:30 – 2:10
Session CC-7 Location: MR 418N 3:10 – 3:50
Kayla Stephens
Abstract: The Society of Physics Students (SPS) is here to help you navigate your path in physics, astronomy, and related fields. In this interactive workshop, explore how SPS can support your academic and career journey with valuable resources and opportunities. We'll dive into the Careers Toolbox and practice crafting effective elevator speeches to help you stand out in networking, applications, and interviews. You'll also learn about internship opportunities, discover tips for career planning, and get a sneak peek at the 2025 Physics and Astronomy Congress—an event bringing together students just like you. Join us to gain the tools you need to build your future with confidence!

Resume Workshop (AA-8 & BB-8)
Location: MR 418N
Session AA-8 1:30 – 2:10
Session BB-8 2:20 – 3:00
Tracy Paltoo
Abstract: Join Turner and Townsend's team to learn how to shape your resume for your career. Work with professionals to learn how to build your resume and get insightful interview tips!

E. Poster Abstracts (1:30pm-4:10pm)

This session is sponsored by Rochester Symposium for Physics Students

Location: MR 418S (4th floor)

Poster 1

Viable innovations in overcoming limitations in quantum entanglement technology

Maia Savich, St. John's University

Quantum entanglement has been shown in recent studies to have practical use apart from completing the unified field theory, including use within the fields of material science and cybersecurity. Theories concerning the use of quantum entanglement in technology have been circulated since its inception, with quantum computing becoming increasingly popular. Quantum computing promises an ultra-encrypted, unhackable, and incredibly accelerated system that could bring about a second technical revolution. This research also includes complex problems, due to their heat-sensitive nature and the effect of the observer. Discrete time crystals may be applied as a potential method to skirt these limitations. We use data from Zhang et al.'s paper "Observation of a discrete time crystal" to extrapolate on the possibility of discrete crystalline structures as viable translators for quantum information. Additionally, cybersecurity has recently shown to be improved through quantum entanglement with a recent breakthrough study "Detecting and quantifying entanglement on near-term quantum devices" (Wang, et al.) wherein experimental data may prove to be a quantifiable method to directly observe quantum information transfer, as well.

Poster 2

Fabricating Qubits: Junctions and Resonators

Anagha Ramnath, University of Rochester

Classical computers have taken us far, but there are still tasks that even the most powerful supercomputers cannot simulate. Quantum computers, on the other hand, can harness the properties of quantum mechanics to elevate our current computational abilities. This project focuses on the fabrication of qubits, which are two-level systems that serve as the quantum equivalent of classical bits (0 and 1). Specifically, the project targets the development of a type of qubit known as the transmon, which utilizes two components of a quantum circuit to form the qubit. The goal of this project was to determine whether we can reproduce these two components—the Josephson Junction and the resonator—in the URNano cleanroom, ultimately optimizing the conditions for creating a qubit.

Poster 3

Analysis of Extreme Light Infrastructure (ELI) Compton spectra

Anne Campbell, University at Buffalo

This project explores the energy spectra of Compton scattering, a phenomenon that produces X-rays or gamma rays as a result of a wavelength shift. As high-energy photons collide with electrons, the photons scatter with different energies and wavelengths, in a tunable fashion. The goal of this project was to calculate and verify the spectral distributions near the Compton edge. Using advanced simulations, we reproduced and expanded on a simulation run by the Extreme

Light Infrastructure (ELI) group for their preparation of the Variable Energy GAmma (VEGA) system. By fitting analytic expressions to their spectral data of varying aperture sizes, we validated our theoretical predictions. Our results demonstrate that as aperture size decreases, the curve of the energy spectra becomes steeper and approaches a linear slope on the log scale. This study supports the usage of our code and theory to simulate the energy of Compton scattering.

Poster 4

Quantum Experiments for Upper Level Physics Courses

Dominick Guadagno, Adelphi University

Recent developments in quantum technologies have shown that there is a need for a strong quantum workforce. At the same, there are a limited number of quantum experiments that can be done in a classroom environment. Two have recently developed two quantum experiments for undergraduates that can be accomplished with a modest budget, the two experiments are exploring the operation of an acousto-optical modulator and quantum-beating in the fluorescence of a dilute atomic gas with a pulsed diode laser. Details about the experiments will be given.

Poster 5

Controlling Pulse-Shaped Electronics in the Presence of Dissipation Through Direct Alteration of Fourier Series

Graham Lippert, North Shore High School

The ability to control the physical world is often limited by frequency limiting electronics. This project attempts to correct for this by altering the harmonics of the input signal, using what we know about the frequency dependence and the Fourier series of the desired signal. I used a toy model that consists of a Digital to Analog Converter (DAC), a low-pass filter, and an Analog to Digital Converter (ADC) to demonstrate this concept. I determined the response of the system by sending cosine waves at varying frequencies through the system, and finding the gain and phase shift. Using this data, I adjusted each harmonic in the Fourier series of the pulse to correct for the dissipation. Our goal was to generate an appropriately corrected pulse that retains its intended shape after passing through the low-pass filter. Ultimately, this project aimed to demonstrate a cost-effective method for controlling pulses using computational techniques, allowing researchers to achieve precise pulse shaping without the need for high-speed, expensive electronics.

Poster 6

Optimization of Heavily Filtered Signals Using a Genetic Algorithm

Natalie Ion, North Shore High School

We are interested in controlling how atoms dissipate light. As a start on this project, I was tasked with exploring how one might use optimization tools to control a system with extreme dissipation. To do this, we built a toy model of such a system using a microprocessor as an arbitrary waveform generator, and frequency sensitive electronics. We used a low-pass filter to deliberately distort a signal from an arbitrary waveform generator and attempted to control the filtered system using a homebuilt genetic algorithm. We found that waveforms could only approach the generalized shape of the desired signal, because high frequency noise affected the output signal in an initially unexpected way.

Poster 7

Developing an algorithm for arc length-weighted anti-aliasing propagation of beams with 1D Fourier spectra

Matthew Gootman, Adelphi University

Optical beams with one-dimensional Fourier spectra (ODFS) exhibit unique properties that are non-intuitive and absent in convention beams [1 - 4]: Non-diffracting: Bessel beams do not spread (diffract) as they propagate. Self-healing: Bessel, Airy, and Pearcey beams are capable of self-reconstructing their original intensity distribution after encountering an obstacle during propagation. Auto-focusing: Several ODFS beams exhibit an automatic focusing effect upon propagation. Our present research efforts serve to best-simulate these beams using numerical software (MATLAB).

Poster 8

Exploring The Polarization Dependence of a Phase Modulator

Mariane Diby, Adelphi University

We use an electro-optic phase modulator to generate 6.5 GHz frequency sidebands for a repump transition in our magneto-optical trap. We explore how the modulation strength depends on input polarization. The modulation strength is 2.7 times as strong for the fast vs slow axis.

Poster 9

Spherical Defects in Holography

Asad Imam, SUNY Old Westbury

In our research we will consider a spherical defect, playing the role of the Graphene system. Since there is strong coupling on the QFT side (the boundary) we will study the effects in the bulk by constructing a D3-D5 model which are 3- and 5-dimensional D-branes respectively. Making use of symmetries we reduce the equations of motion to Ordinary Differential Equations for two variables.

Poster 10

Characterization of pre-irradiated glassy polymeric carbon GPC) for use in nuclear applications

Daniel Orozco, St. John's University

TRISO fuel has been used in some of the Generation IV nuclear reactor designs for many years. It is a fuel kernel of UO x coated with several layers of materials with distinct functions. These layers consist of a low-density pyrolytic carbon buffer, an inner high-density pyrolytic carbon layer, silicon carbide (SiC), and an outer pyrolytic carbon shell. Pyrolytic carbon (PyC) is a form of carbon that is synthesized using the pyrolysis of hydrocarbons. However, this material does not offer a perfect barrier due to its inherent crystalline structure. It is impossible to mold in one continuous sheet around the spherical fuel bead. As an alternative, we are exploring another possibility: Glassy Polymeric Carbon (GPC). We aim to explore design, development, and characterization of pre-irradiated GPC samples to determine its physical and mechanical properties for its potential use in future ion irradiation for nuclear application.

Poster 11

Unexpectedly Asymmetric Granular Media

Ayantu Uli, Ithaca College

We study the flow of disks through a symmetric channel. The experiment uses a 2D setup with hard plastic disks on a flat surface, compressed by plungers. Even when the initial state is nominally symmetric, we find the flow is asymmetric: more disks move to one side than to the other. We confirm that intentionally asymmetric initial states result in asymmetric flows: particles move toward areas of lower resistance. In particular, we examine two types of asymmetric initial states: one with more disks on one side than the other; and one with larger disks on one side than the other. We find the location of the large disks to be most significant in determining the flow pattern. We conjecture that even in nominally symmetric initial states, there is a subtle asymmetry in the locations of the large disks. Understanding granular material science is vital for industries such as agriculture, pharmaceuticals, and construction and for natural processes like landslides and avalanches. This research aims to improve the predictability of granular flow events and optimize industrial processes by identifying key parameters influencing shearing behavior in polydisperse systems.

Poster 12

Mapping the Universe's Growth: Pion Description in Cosmological Simulations and Modeling Large-Scale Structure Evolution

Bhavya Mishra, Manhattan College

We simulate the evolution of Large Scale Structure in the Universe described as an effective pion fluid using different numerical and computational simulation techniques to reduce the runtime and algorithmic complexity while also limiting the reliance on hardware resources. We minimize the technical resource dependence for the simulation by employing methods like parallel processing and other efficient programming techniques. The pion description of effective field theory is inspired by soft-pion theorems from high energy physics and is used to solve for the evolution of the cosmic pion fluid leveraging Fast Fourier Transformation and other methods while also generating and analyzing the evolution of the power spectrum over time. We also discuss work in progress related to more efficient simulation techniques for LSS using parallel processing algorithms.

Poster 13

Testing Near Space Effects on Cucumbers and Alaskan Shasta Daisy Seeds Using a High Altitude Balloon

Tara Dolack, Siena College

High altitude balloons are used for near-space research, the use of the payload benefitting scientists by assisting in bringing materials to space, especially plants. However, our understanding on how soil or seeds are affected by near-space conditions remains unclear. In this study, for phase one and two we used a high altitude balloon to first send soil, and then the seeds of cucumbers and shasta daisies into near-space. Soil and seeds were taken to near space conditions using a high altitude balloon and then were used to grow shasta daisies for 42 days while another group of shasta daisy seeds were grown in soil not taken to near space. Their stem and root growth were compared. The same test was run again for phase two but with only the seeds of the shasta daisies and garden bush cucumbers, and then were measured for an extended period of time of about three months. Although near-space conditions had no significant effect on the stem growth of the plants, root systems' lengths within the near-space soil were significantly shorter than the roots in the earth soil. Similar results were shown with the seed affected but not significantly less after being exposed to near space conditions. Chances of having an abundant amount of plants to cultivate on a different planet, as shown in this research, would be unlikely without accounting for how they grow in space-affected soil, as well as the seeds being affected themselves.

Poster 14

Streamer rules disk formation in young binary system

Erica Sundermeyer, University of Rochester

Protostellar disk formation has historically been modeled as an isolated and axisymmetric process. However, observations of young disks often feature more complex asymmetric structures that cannot be explained by simplified models. Recent radio observations have revealed the presence of streamers: large, asymmetric accretion flows from envelope to disk scales. Here we use radio data from the NOEMA interferometer to study a large streamer and surrounding envelope feeding young (Class 0) protostellar system Per-emb-2, located in the Perseus Molecular Cloud. By transporting mass and angular momentum from the outer envelope to the disk, streamers (and therefore envelopes) have direct influence on maximum possible disk size and probability of disk fragmentation. We determine the specific angular momentum profile of the Per-emb-2 envelope and streamer in order to place constraints on disk formation, and further investigate how this system's evolution is affected by its larger environment.

Poster 15

Ion Irradiation

Tadhg Sullivan, St. John's University

TRISO fuel has been used in some of the Generation IV nuclear reactor designs. It's a fuel kernel of UOx coated with several layers of materials with different functions. One of these layers is Pyrolytic carbon (PyC). This material does not offer a perfect barrier due to its inherent crystalline structure. It is impossible to mold in one continuous sheet around the spherical fuel bead. We aim to explore design, development and characterization of pre-irradiated GPC samples to determine its physical and mechanical properties to determine its use for future ion irradiation for nuclear applications.

Poster 16

THOR: Towards Precise Plasma Diagnostics

Cole Jerum, University of Rochester & Timothy Seo, Pittsford Mendon High School

Accurate alignment of diagnostic lasers is crucial in plasma research, yet traditional manual optics calibration can be slow and prone to human error, while motorized systems are prohibitively expensive. To address this challenge, we developed the Teleoperated High-Precision Optics Repositioner (THOR); THOR significantly reduces implementation costs by integrating motorized controls directly onto standard kinematic mounts, allowing each adjustment screw to be precisely tuned via a computer interface. To evaluate its performance, we first performed a standard manual calibration of a laser beamline. Next, we integrated a real-time optimization algorithm with THOR to maximize beam intensity using live signal feedback. THOR achieved comparable or improved alignment outcomes with greater ease and consistency. These results highlight THOR’s potential as an affordable and adaptable alternative to enhance laser alignment in plasma diagnostics.

Poster 17

Modeling Quantum Tunneling and the Double-Slit Experiment in GeoGebra

Sherzod Ravshanov, Ithaca College

This research explores the application of GeoGebra, an interactive mathematical software, to model some of the key quantum mechanical phenomena, quantum tunneling and the double-slit experiment. The project aims to address the mathematically complex nature of quantum mechanics by developing user-friendly interactive simulations that can help enhance comprehension for undergraduate physics students. Through iterative development, I created a double-slit simulation visualizing interference patterns, with adjustable parameters like slit width, slit separation, and wavelength. Additionally, I modeled quantum tunneling by simulating particle-wave interactions with potential barriers, incorporating sinusoidal and exponential functions to represent wave behavior across regions. Despite GeoGebra's computational limitations, optimizations needed such as simplifying equations, animating variables, and enhancing user interfaces helped improve the accessibility and clarity of these tools. The simulations on GeoGebra have a potential to bridge the gap between theoretical equations and conceptual understanding that can offer an engaging and educational resource for students. This project demonstrates GeoGebra's potential in visualizing complex quantum systems and lays the groundwork for future advancements in interactive physics education.

Poster 18

Enhancing Physics Education Through Immersive XR Environments

Suryash Malviya, Ithaca College

Traditional two-dimensional physics representations often fail to encompass the spatial intuition and interactive nature of fundamental physics. This often leads to gaps in understanding of the basic physics concepts. To address this issue, we are developing extended reality (XR)-based tools to offer a more intuitive and engaging experience for topics such as those covered in introductory electromagnetism courses. By leveraging 3D technologies, we want to bring concepts into students’ learning environments where they can dynamically explore them. We emphasize accessibility and adaptability integration in these tools to ensure compatibility with mobile devices and mixed-reality headsets. We are also developing this as an open-ended framework to allow future educators to diversify these tools and adapt to achieve their learning objectives. This presentation outlines our ongoing development process, detailing the technical challenges encountered and the progress we have made. We will also use this opportunity to share our current progress and welcome feedback from educators and students attending the event. Looking forward, we will continue to refine these immersive environments, broaden their impact, and integrate them into the physics education community.

Poster 19

The design and use of a Peltier-powered cloud chamber for outreach and classroom laboratory measurements

Jillian Cola, Siena College

One challenge facing the scientist who studies anything at the nuclear level is convincing both the general public and students that what they are studying is real. Astronomers are able to show beautiful images of stars and galaxies, geologists let you hold a 3 billion year-old rock in your hand, but the nuclear physicist must come up with other methods to demonstrate the equally fascinating science that they engage with. At Siena College, we have worked for almost 10 years to improve upon a design for a Peltier-powered cloud chamber that does not require dry ice and is very portable. The design has been driven primarily by students in our Applied Physics program who have used their general design skills and 3D printing acumen to make the device easier to build and transport. This makes it ideal for both outreach activities and in-classroom demonstrations, usually in a Modern Physics class. In addition, Siena students have worked hard to document the construction process on the popular website, Instructables, so that others can build their own. Recently, we have developed a lab in which students use the device to extract scientific data. This involves a video analysis of a radioactive sample placed in the cloud chamber and the lengths of tracks are measured from a video analysis program. These lengths are used as an analog of the energy of the emitted particles and a spectrum is produced and compared to literature. A similar study can be done with cosmic rays where the lengths of the tracks map onto the angle of entry. The current status of both the cloud chamber design and the efforts to turn this into a classroom lab will be presented.

Poster 20

Creating a Diagnostic Tool for Parkinson’s Disease Using a KNN Algorithm

Kylie Goldade, Adelphi University

We built a machine learning algorithm (kNN) to take in audio samples from a person’s voice and classify them with or without Parkinson’s. Current screening for Parkinson’s disease includes studying extensive medical history, blood tests, and neurological tests. Our goals were to develop a cost effective screening tool for Parkinson’s using voice data rather than some more costly options like blood tests. We used the Oxford Parkinson’s Disease Detection Data Set that included 6-7 audio samples from 32 different people; 23 with Parkinsons and 9 without. This data set was analyzed for numerical data from the voices. We created an effective machine learning algorithm and determined which variables are unnecessary in the testing dataset. These goals were met with 87% accuracy, and 7 columns of unnecessary data removed.

Poster 21

What Can Nuclear Magnetic Resonance Teach Students about the Quantum Realm?

Katyanna Sciorra, Sarah Lawrence College

Many new Quantum Information Science and Engineering (QISE) programs are being developed to address the growing need for quantum awareness and training in quantum technologies to expand the future STEM workforce. Nuclear magnetic resonance (NMR) is a widely used quantum mechanical tool with many classical analogs that can provide a valuable entryway to quantum technology and research. This poster presents two research-based active-learning lab modules that were developed as part of an NSF-IUSE grant to make the quantum realm more accessible to undergraduate students by introducing the basic physics behind NMR earlier in the undergraduate science curriculum. All the developed materials have been designed and tested to be used in introductory science courses without the expectation of prior physics or chemistry knowledge. These two lab modules utilize the NMR basics introduced in previous modules, connect them directly to fundamental quantum principles, and relate them to important aspects of quantum computing - for example, visualizing qubit states using the Bloch sphere and identifying NMR pulses that can serve as quantum gates. We are currently refining these modules and would value feedback regarding additional topics to cover or ways these modules could be implemented into QISE programs.

Poster 22

Applications of wind and solar for renewable energy

Caden Wilkinson, St. John's University

Our modern world requires massive amounts of energy to run. Currently, we rely on finite resources that contribute to climate change and will eventually be depleted. Because energy sources like coal and natural gas are limited, prices fluctuate with demand, causing most Americans to pay around $2,000 a year for energy. This dependence come with both a financial and environmental cost that is burdening average Americans and the planet. Wind and solar energy provide a way to reduce reliance on fossil fuels, helping to stabilize prices and give the Earth a chance to provide for a way of life that unburdens Americans wallets and the Earth's ozone.

Poster 23

Energy, Wealth, and Virtual Wealth: A Data Analytics Approach

Eddie Pearce, Siena College

This project explores Econophysics, applying data analytics to examine the principles of Cartesian Economics as introduced by Nobel laureate Frederick Soddy. Soddy argued that economic systems, like physical systems, obey the laws of thermodynamics. A key focus is Virtual Wealth (VW), representing the physical wealth expected in return for money. This study quantifies VW for major economies (USA, UK, Europe, China) and analyzes its correlation with socio-economic factors such as GDP, energy consumption, unemployment, and pollution. Using economic datasets from FRED and Python-based analytical techniques—including time-series synchronization, inflation adjustments, and multivariate analysis—this research bridges physics and economics, offering insights into monetary policy and resource distribution.

Poster 24

Visual Spatial Processing Patterns When Analyzing 3-D Models

Nazneen Hassan, South Side High School

Many tests have been developed to assess one's visual intelligence, however it is unclear how exactly people observe, interpret, and analyze visual models. By using an eye tracker to see where participants look when solving visual problems, this allowed for the study to analyze the differences in focus areas between those with high visual spatial intelligence and low visual spatial intelligence to identify correlations between mistakes and certain gaze fixations. The widely known Gazepoint eye tracker in this study examines various variables affecting spatial processing: how long individuals focus on specific areas of the puzzle to assess attention and interest, how quickly individuals locate pieces or features within the puzzle which reflects spatial awareness and cognitive efficiency. This study analyses gaze behavior during critical decision points to understand reasoning and strategic planning, the time spent on different stages of the puzzle-solving process to infer cognitive speed and efficiency, where and how often users make mistakes to see if errors correlate with specific gaze patterns or attention lapses, and compare eye-tracking data across different individuals to assess variations in cognitive abilities, strategies, and problem-solving approach.

Poster 25

Fabrication and Testing of a Solar Tracking System

Traevon Ruddock, Siena College

Solar energy is a promising renewable energy source, however its efficiency is heavily dependent on the angle of incidence between the sunlight and solar panels. To maximize energy capture, solar panels need to be reoriented towards the sun throughout the day. This project aims to fabricate and test a novel solar tracking system aimed at enhancing solar panel efficiency. The solar tracking system will use a combination of sensors, actuators, and control algorithms to dynamically adjust the orientation of solar panels in real-time, ensuring optimal alignment with the sun's position. To analyze the effectiveness of this tracking system, performance metrics such as energy yield, tracking accuracy, and system reliability will be assessed under a variety of environmental conditions.

Poster 26

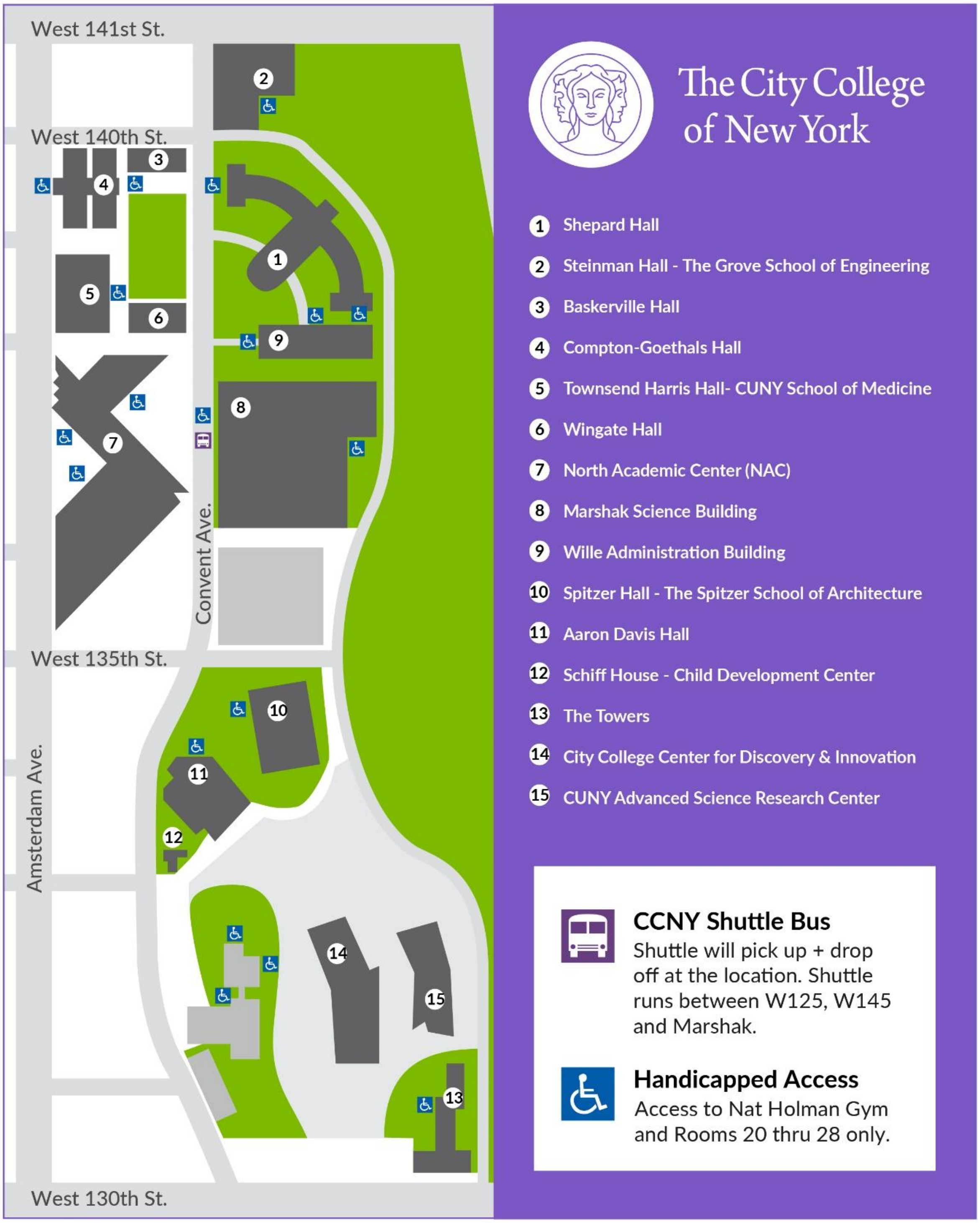
Creating a Diagnostic Tool for Parkinson’s Disease Using a KNN Algorithm

Eric Greene, South Side High School

Parkinson’s Disease (PD) is a degenerative disease which affects the nervous system and progressively decreases muscle control while simultaneously causing neurological issues. Considering the gravity of PD, a lack of conclusive testing could be detrimental for a person suffering from the disease. Using the Oxford Parkinson’s Disease Detection Dataset, a kNN algorithm to aid in diagnosing individuals with PD was created. The algorithm utilizes voice data to classify individuals as either healthy or afflicted with PD based on neighboring data points. The dataset contained multiple recordings from a set of 32 individuals, with a total of 195 voice samples. These samples were aggregated by their means leaving 32 data points for analysis, one per person. Maximum absolute scaling was used to normalize the remaining data. For learning, a 70:30 train:test split was used, leaving 10 testing data points and 22 for training. Of 22 initial variables excluding those used for identification, 7 remained after simplifying the dataset. These variables were chosen by removing correlated variables which showed redundancy and by removing those which did not result in improved accuracy. After classification of a testing data point, the result was checked against the person’s actual status in order to determine the accuracy of the machine learning algorithm. The final accuracy of the classification tool remains at approximately 97.1% $\mp$ 5.38% overall.

F. City of College New York Map

The conference is held at 8 Marshak Science Building



Conference Site

Marshak Science Building 160 Convent Ave, New York, NY 10031 – Registration is on the first floor

Getting Here

Getting to New York City is rather straightforward. It is a major transportation hub. Travel by rail is probably the easiest for most attendees. Everything is connected via the subway, and you won't have to worry about parking, which can be completely awful in January if there is some snow piled up.

By Subway

Take the IRT #1 local to 137th Street and Broadway.Walk up 138th Street three blocks to Convent Avenue.

-OR-

Take the IND "A" or "D" express, or the "B" or "C" local to 145th Street and St. Nicholas Avenue, walk west one block to 145th Street and Convent Avenue, then south to 138th Street.The CCNY shuttle bus makes regular stops to this subway during the day.

-OR-

Take the IRT #4 or#5 express or #6 local to 125th Street and Lexington Avenue.Change there for the M-100 or M-101 bus to Amsterdam Avenue and 138th Street.Walk east one block to Convent Avenue.

-OR-

Take the Metro North to 125th Street and Park Avenue.Change there for the M-100 or M-101 bus to Amsterdam Avenue and 138th Street, walk east one block to Convent Avenue.

(Note Subway information from https://www.ccny.cuny.edu/)

By Train

New York City has two main rail stations in Midtown: Grand Central Terminal (on the east side) and Penn Station (on the west side). Each is also served by numerous bus and subway lines. Grand Central is served by Metro-North Railroad, which goes to NYC suburbs in New York and Connecticut. Penn Station is served by the following: Long Island Rail Road, a commuter railroad serving Long Island; Amtrak, the US national passenger railroad, serving many points throughout the country; and NJ Transit, a commuter line serving points in New Jersey. You'll arrive in NY at either Grand Central, or Penn Station:

Grand Central Terminal – Park Avenue and East 42nd Street (between Lexington and Vanderbilt Avenues). Grand Central is the main terminal for Metro-North Railroad services. Subway lines here include the 4, 5, 6, 7 and S (shuttle between Grand Central and Times Square). For MTA bus details, visit tripplanner.mta.info.

Penn Station – Seventh to Eighth Avenues, between West 31st and West 33rd Streets Penn Station is the main terminal for Long Island Rail Road, and a terminal for Amtrak and NJ Transit. Subway lines here include the 1, 2, 3, A, C and E. For MTA bus details, visit tripplanner.mta.info.

Rail Services

Amtrak

Amtrak is the national passenger railroad of the United States. New York City's Penn Station is their busiest station in the nation, serving hundreds of thousands of passengers each year. The company offers numerous packages and deals, including special passes allowing international visitors to make multiple stops throughout the country. 800-872-7245, 212-630-6400

Long Island Rail Road (LIRR)

The LIRR commuter railroad operates out of Penn Station and serves 124 stations in Nassau County, Suffolk County, Queens, Brooklyn and Manhattan, transporting some 81 million customers each year. Destinations include the Belmont Park racetrack, Citi Field, Jones Beach, the Hamptons and Montauk. 718-217-5477

Metro-North Railroad

The second-largest commuter train line in the United States, Metro-North operates out of Grand Central Terminal. The historic roots of the operation go back to 1832, when the enterprise was known as the New York & Harlem Railroad, a horsecar line in Lower Manhattan. Today, with 775 miles of track, Metro-North goes to 121 stations (in seven New York State counties—Dutchess, Putnam, Westchester, Rockland, Orange, Bronx and New York (Manhattan)—and Connecticut's New Haven and Fairfield counties). 212-532-4900, 877-690-5114

NJ Transit

NJ transit features 12 lines in three divisions (Hoboken, Newark and the Atlantic City Rail Line) with frequent service throughout New Jersey (Atlantic City and the Jersey Shore are popular stops) and New York (Rockland and Orange counties)—and, of course, into and out of New York City via Penn Station. For schedules and fares, visit the NJ Transit website. 973-275-5555, TTY 800-772-2287

PATH (Port Authority Trans Hudson)

The PATH provides rapid transit between several stops in New York City, along with locations in Newark, Harrison, Jersey City and Hoboken in New Jersey. Air travelers can connect to the PATH from Newark Liberty International Airport. The service operates from the Penn Station in Newark (not the same as Manhattan's Penn Station) to Lower and Midtown Manhattan. The PATH's 33rd Street station (on Sixth Avenue, in Herald Square) in Manhattan is one avenue from Amtrak, Long Island Rail Road and NJ Transit trains at Penn Station. 800-234-PATH

By Bus

There are a number of affordable, convenient bus lines that travel to New York City from around the United States. These include BoltBus, Megabus and Greyhound.

By Car

Use Google Maps for driving directions to New York City. Also, make sure you know where to park: you may want to use an app like SpotHero to find and compare parking spots and locations.

G. Speaker Bios

Conference introduction and Be a Shark

Kyle Cash

Kyle Cash is an aspiring mechanical engineer and physics enthusiast completing my final semester of a 3-2 program at Adelphi University and Columbia University. He is driven by curiosity and a love for learning, always seeking new challenges and opportunities to grow.

Zahin Ritee

Zahin Ritee is the Associate Zone counselor for Zone 2 for the Society of Physics Students. She is currently a senior double majoring in Mechanical Engineering and Physics from both Columbia University and Adelphi University. She has done research in theoretical and experimental optical Physics, and Condensed matter Physics.

Matthew Wright

Matthew Wright, Ph.D. is the chair of the physics department at Adelphi University, where he holds the rank of Associate 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. He has written over 19 op-eds on this topic and many others.

Graduate School in Physical Sciences

Brittney Hauke

Brittney Hauke is finishing up her PhD in Materials Science and Engineering at Penn State University and will be graduating in May. Her research involves studying the structure and properties of glass, specifically the process of glass relaxation using a thermal analysis technique called modulated differential scanning calorimetry. She graduated with a dual B.A. in physics and studio art from Coe College in 2017 and a M.S. in Materials Science and Engineering from Arizona State University in 2019. Brittney is very involved with the Society of Physics Students and American Institute of Physics, serving various roles on the planning committees for the 2016, 2019, 2022, and 2025 Physics and Astronomy Congresses. She is also the co-chair for the 2028 Physics and Astronomy Congress. While at Penn State, she has been involved with the American Ceramic Society, serving on the President’s Council of Student Advisors from 2021-2025, serving as the Communications Chair from 2023-2024. Due to her extensive volunteer work with SPS and Congress, Brittney was awarded the Sigma Pi Sigma Outstanding Service Award in 2021. Within the Materials Science Department at Penn State, she received the Coppola Graduate Student Excellence Award for Service and Leadership in 2024 and is the Carlo Pantano Fellow for 2025.

Molly Mcdonough

Molly Mcdonough is a 3rd year PhD student at Pennsylvania State University in the Department of Materials Science and Engineering. Before she came to Penn State, she worked as an Associate Research Physicist at Air Force Research Lab. She received her Bachelor of Science in Physics from Suffolk University. Her current research is focused on synthesis of semiconductor materials for applications in infrared light emission and detection. Outside of research, Molly is the co-chair for 2025 Sigma Pi Sigma Physics and Astronomy Congress.

James St. John

James St. John is a PhD Student in Materials Science at Stony Brook University and has a BS in Physics from Adelphi University. He is researching Electrodynamic Dust Shield (EDS) technology for applications on self-cleaning solar panels. James has experience working as an R&D Laser Engineer for Photonincs Industries in Ronkonkoma, NY and as the Physics Laboratory Coordinator and Adjunct Faculty at Adelphi University. James is passionate about teaching physics and research topics related to environmentally sustainable devices and manufacturing methods.

Physical Science Career Panel

Brad Conrad

Brad R. Conrad, Ph.D. is the Education and 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 and a B.S. in physics with a minor in history from the Rochester Institute of Technology (RIT).

Prior to NIST, Brad served as the Director of two membership societies for the American Institute of Physics: the Society of Physics Students and Sigma Pi Sigma, the Physics and Astronomy Honor Society. There he supported a network of over 800 undergraduate physics and astronomy student groups at two-year/four-year institutions and +80,000 lifetime members. Earlier he was a tenured Associate Professor of Physics and Astronomy at Appalachian State University, where his research focused on nanoelectronics, acoustics, and microscopy. Before becoming a professor, he was a National Research Council (NRC) Fellow at NIST in the Electronics and Electrical Engineering Laboratory where he studied the electrical properties of organic single crystals.

Brad has given over 200 talks at national conferences or universities and published articles on workforce skills and technical careers for undergraduates. In addition, he has served as Director/Chair for many large U.S.-based education and workforce-based conferences, served as Executive Editor for several physical science education publications, mentored over 50 research students, and served/chaired several committees for various associations. Brad has served as a committee member on the U.S. Liaison Committee for the International Union of Pure and Applied Physics.

At OAM, Brad strengthens collaboration across education and workforce development initiatives for Manufacturing USA and participating U.S. government agencies and leads advanced manufacturing education and workforce development partnerships and outreach opportunities to expand awareness and engagement with industry stakeholders, educators, workers, and students.

Fabian Chacon

Dr. Fabian Chacon graduated with his doctorate in aerospace engineering from the University of Michigan in 2020. His doctoral work focused on non ideal phenomena in rotating detonation combustors. He is currently a Senior Advanced Propulsion Engineer at Innoveering/ GE Aerospace, working on high speed air breathing propulsion of various forms and applications.

Mickey Chiu

Dr. Mickey Chiu is a Sr. Scientist at Brookhaven National Laboratory, where he smashes heavy nuclei together at the Relativistic Heavy Ion Collider in order to study the physics of the quark-gluon plasma, the ultra-hot state of matter that existed one-millionth of a second after the Big Bang. His daily life consists of dreaming up and testing new exquisitely sensitive detector ideas, writing analysis code to discover the effects of physical laws from the big data collected at RHIC, and striving to apply the use of physics for the common good. He grew up in NYC, including time at CCNY as an undergrad, and received his PhD in Physics from Columbia University. When not grinding away in the lab, he enjoys the majesty of nature by sailing the Atlantic Ocean south of Long Island with his son.

Navjot Kaur

Navjot Kaur is an Engineer with Turner Construction Company, a Construction Management firm based in New York City, where she has worked for the past 10 years. Navjot has worked on The David Koch Center for Cancer Care (Memorial Sloan Kettering) on the Upper East Side, The Penn 2 Redevelopment Project above Penn Station, and is currently working on the New York City Football Club's Etihad Park Soccer Stadium in Queens. Navjot obtained a Bachelor of Science degree in Physics from Adelphi University, a Bachelor of Science degree in Civil Engineering from Columbia University, and a Master of Science degree in Forensic Structural Engineering, also from Columbia University. Navjot loves to read and travel in her spare time.

LIGO

Rob Coyne

Bio: Rob Coyne is an Associate Teaching Professor of Physics at the University of Rhode Island. He earned his PhD at the George Washington University in 2015 for work on searches for gravitational waves associated with gamma-ray bursts. He has been a member of the LIGO Scientific Collaboration since 2013, and has contributed to numerous publications in the field of gravitational wave astronomy. He is passionate about physics education and communicating science to the public, and has been serving as the Chair of the Communication and Education Division of the LIGO Scientific Collaboration since 2023.

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

Turner & Townsend – Donor

Thorlabs

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National Institute of standards and Technology

Imagine Optic

Frequency Electronics, Inc.

Step Up - American Physical Society

Colleges

Adelphi University

The City College of New York

Sarah Lawrence College

Stony Brook University

University of Rochester

High Schools
Manhasset School District

Mineola School District

Westbury School District

I. Cosmic Pathways Organizing Team

Jason Bier, Adelphi University

Brad Conrad, National Institute of Standards and Technology

Alejandro De La Puente, American Physical Society

Kelly Douglass, University of Rochester

Merideth Frey, Sarah Lawrence College

Carissa Giuliano, Mineola High School

Kylie Goldade, Adelphi University

James Hedberg, City College of New York

Angela Kelly, Stony Brook University

Rob Krakehl, Manhasset High School

Dana Molloy, Dobbs Ferry High School

Zahin Ritee, Columbia University

Luis Rodriguez, Adelphi University

James St John, Stony Brook University

Zoya Shafique, City College of New York

Lysa Wade, University of Rochester

Matthew Wright, Adelphi University

Alyssa Zambuto, Adelphi University

J. Two Really Big Thank Yous

Matthew Wright, Adelphi University

I am going to be honest with you, I was not prepared for many of the different exciting things that happened once we started putting this conference together. The outpouring of support from the community was amazing! I had to stop taking people who wanted to help because there were so many volunteers and big ideas out there. The second thing that surprised me was how much work was involved in this thing. There are so many visible parts of this summit where you can see how much work everyone is doing. Like you're going to see and hear me – all six foot 300 lbs of me yelling about physics in a full body shark outfit. And then there are things that are not so visible.

I want to take a moment and acknowledge two amazing people who have been working behind the scenes to make this summit a reality.

Grace Aragona-Hernandez – Grace was the physics office administrative assistant for a short time in the end of 2024 and the beginning of 2025. She was the right person at the right time. Grace was one of those people that made things better. She took a hidden leadership role on this very program helping Kylie Goldade, Lysa Wade, and myself put it all together. (There are some many hidden leaders on this project, it is impossible to name them all.) Grace had a way of bringing the team together and making the project happen that really impressed me. She brought a number of amazing project management skills at a critical juncture for the conference. This all came together because of Grace's hard work and I want to take a moment and acknowledge that.

Professor James Hedberg (CCNY) – Professor Hedberg is a professor of physics at CCNY. This past summer right after we kicked off the Cosmic Pathways mission (then called NYC PhysSummit), we began searching for a venue for this event. We were considering all the colleges and museums in the city at the time. Its then when I had a candid conversation with Luis Rodriguez, a former physics student at CCNY and current Physics Laboratory Coordinator at Adelphi University. Luis said, Professor Hedberg is the best. And just like that I was sold.

Since then, Professor Hedberg and I have been working behind the scenes to make this conference a reality. He has been in charge of negotiating with CCNY facilities staff. There have been some big hurtles with putting this conference together and hopefully no one will even notice. A large part of that is the effort that Professor Hedberg has put in behind the scenes.