



22nd
ANNUAL

POSTER SESSION

11.21.2024

12:30 pm-3:00 pm

Academic Complex
Lobby

A Showcase of City Tech Faculty and Students'
Research and Publications

**BIOLOGY
AND
HEALTH SCIENCES**

BUSINESS

CHEMISTRY

**COMMUNICATION
DESIGN**

**COMPUTER
ENGINEERING
AND
INFORMATION
SYSTEMS
TECHNOLOGY**

**CONSTRUCTION
MANAGEMENT
AND
CIVIL ENGINEERING**

EDUCATION

**HUMANITIES,
SOCIAL SCIENCES
AND ENGLISH**

INTERDISCIPLINARY

MATHEMATICS

PHYSICS

**RADIOLOGIC
TECHNOLOGY
AND MEDICAL
IMAGING**

22nd POSTER SESSION, 2024

12:30 pm–3:00 pm

WELCOME AND GREETINGS

1:00 pm–1:15 pm

Dr. Russell Hotzler

President

Dr. Pamela Brown

Provost

Dr. Reginald Blake

Associate Provost and Dean of Curriculum and Research

Dr. Justin Vazquez-Poritz

Dean of the School of Arts & Sciences

Dr. Hong Li

Dean of the School of Technology & Design

Dr. Maureen Archer

Dean of the School of Professional Studies

AWARDING CEREMONY

1:15 pm–1:30 pm

ONE-MINUTE FACULTY POSTER PRESENTATION

1:30 pm–2:00 pm

2:00 pm–3:00 pm

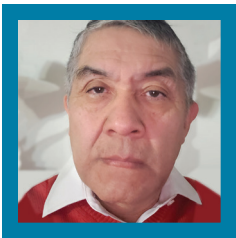
Informal Q&A in the lobby with refreshments.

The program is organized by topics rather than by departments. Frequently the presentations are cross-disciplinary or difficult to assign to the discipline represented by the department with which the presenter is affiliated.

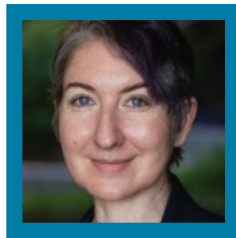
AWARDING CEREMONY

The organizing committee of the 21st Annual Faculty and Student Research Poster Sessions has selected for special recognition the following awardees from among over 40 excellent posters. The names of presenters of the awarded posters are given in bold and identified with an asterisk*.

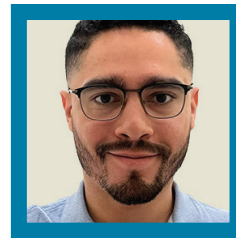
21st POSTER SESSION AWARDEES, 2023



Eric Gadesseh and **Aparicio Carranza***. Comprehensive Study on Cloud Computing Security Threats and Preventive Measures.



Charlotte Olsen* and Charlotte Welker. Finding Fingerprints of Filaments with Galaxy Star Formation Histories.



Juan Rivera-Correa*, Ana Rodriguez and Maria F. Yasnot-Acosta. Investigating the Influence of Co-infection with Soil-Transmitted Helminths (STH) or Epstein-Barr Virus (EBV) on Humoral Autoimmunity in Malaria.

POSTER SESSION

BIOLOGY AND HEALTH SCIENCES

- 1** Dan H. Chen, Abbi Raper and Laura Andreescu. Impact of Dental Genetic Therapies in Dentistry.
- 2** Margaret Rafferty, Ayanna Persue, Mandy Misagal, Elza Coelho Barbosa Cabral and Jose Cruz. Climate Change is Leading to Surging Malaria Rates.
- 3** Efia Serwaa Appiasam, S M Arifuzzaman Akash, Maria F. Yasnot-Acosta and Juan Rivera-Correa. Assessing IgG Autoantibodies Against Smith-ribonucleoprotein (sm-RNP) in *P. vivax* Malaria Patients.
- 4** Margaret Rafferty, Paola Guzman, Elizabeth Santos, Dmytro Stapinskyy and Shuhua Kuang. Wildfires: A Threat to Public Health.

BUSINESS

- 5** Alyssa Dana Adomaitis, Diana Saiki and Audrey Anhalt. Motivating Consumers to Participate in Collaborative Consumption.
- 6** Nazanin Hedayat Munroe. Skilled Immigrants in the Textile and Fashion Industries. Stories from a Globe-Spanning History (Bloomsbury, 2024).

CHEMISTRY

- 7** Alberto Martinez. Synthesis, in Vitro Activity and Molecular Docking of Caffeic Acid Derivatives Against Alzheimer's Disease-related Enzymes.
- 8** Vishwas Joshi. Iodine-protein Nanoparticles for Cancer Imaging and Therapy.

COMMUNICATION DESIGN

- 9** Eli Neugeboren and Jay Neugeboren. Whatever Happened to Frankie King.
- 10** Anita Giraldo. Democracy Spoken Here – Progress of a Typographic Art Print Series.
- 11** A. Noreen Y. Whysel, B. Shari Thurow and C. Bev Corwin. A Visual Language for Communicating Semantic Web Concepts and How it Could Be Applied in AI Applications.

COMPUTER ENGINEERING AND INFORMATION SYSTEM TECHNOLOGY

- 12** Marcos Pinto and Melissa Garcia. Using Blockchain Technology to Safeguard Pharmaceutical Supply Chain.
- 13** Chein-Chang Peter Li, Dover, Cassandra D, Gbondjin, Isaac, Parra Salas, Adalberto Rafael, Thomson, Andre. Exploring Multiple Web Hosting on Virtual Machine and Cloud Environment. Implementing Multiple Web Hosting, Secure HTTP, Primary and Secondary Domain Name System (DNS) Name Servers, Domain Name System Security Extensions (DNSSEC) and Webservers Load Balancing.
- 14** Ahmed Hasebo, Mohamed Tealab. From a Traditional City to a Smart City: The Measurement of Cities' Readiness for Transition, Egypt as a Case Study.

- 15** Yu-Wen Chen. Knowledge Distillation Based Defense for Audio Trigger Backdoor in Federated Learning.
- 16** David B. Smith. Balanced Blended Space (BBS) Model: Developing a Comprehensive Framework for Physical-Digital Communication.
- 17** Jared Bowens, Ivan Guerrero, Benjamin Yusuf, Bharat Dangi and Aparicio Carranza. Reducing E-Waste: Repurposing Old PCs and Laptops into Sustainable NAS Systems.
- 18** Aaron F. Jones, Pavel Karpov, Henry Mejia F., Mir F. Mithila and Aparicio Carranza. Navigating the Digital Sky.
- 19** Bilal Akhtar, Omar Bautista, Dario Vil, Sali Fazlija and Aparicio Carranza. Biometric Authentication for Easier and Faster Secure Access to Websites.
- 20** Ifte Alam, Damian Brathwaite, Jorge Montero, Aramis Vicente and Aparicio Carranza. Cloud Computing: Exploring the Digital Frontier.
- 21** Tony Wang, Zhen Yan Guan, Ruiming Chen, Ricky Lin and Aparicio Carranza. Smart Home Lighting System.
- 22** Randy Mojum, Kahou Puan, Maharin Khondoker and Aparicio Carranza. The Deployment of Virtualized Operating Systems to Reveal Network Vulnerabilities.

23 Adel Mused, Richard Morales, Mickel Cupid and Aparicio Carranza. Networking with Android Systems.

24 Sheyla Criollo, Bryan Rivera, Aaron Libato, Crystal Cruickshank and Aparicio Carranza. Cloud Computing Attendance Management System with Integration of MySQL & PHP.

25 Puya Roy and Aparicio Carranza. Design and Development of a Natural Language Processing (NLP) Based Classification Model for Forum Post Recommendation System.

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ONE-MINUTE FACULTY POSTER PRESENTATION

- 1** Dan H. Chen, Abbi Raper and Laura Andreescu. Impact of Dental Genetic Therapies in Dentistry.
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- 3** Vishwas Joshi. Iodine-protein Nanoparticles for Cancer Imaging and Therapy.
- 4** Anita Giraldo. Democracy Spoken Here – Progress of a Typographic Art Print Series.
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1. Impact of Dental Genetic Therapies in Dentistry

A. Dan H. Chen, B. Abbi Raper and C. Laura Andreescu /
Department Restorative Dentistry

The research on regrowing lost teeth has the potential to revolutionize dental care by providing a permanent solution to tooth loss, reducing reliance on temporary fixes like dentures and implants. This innovation could alleviate discomfort and enhance the quality of life for patients. For dental practitioners, it offers an opportunity to provide advanced treatments and improve patient outcomes, potentially leading to a shift towards more regenerative approaches in dental practices. Additionally, genetic therapies, including regenerative, molecular and targeted therapies, hold promise for treating a wide range of conditions, from genetic disorders to cancer and degenerative diseases.

This poster will present the latest research in this area and what are some of the challenges that the dental industry is facing related to the implementation, accessibility and patients' compliance with the treatment.

2. Climate Change is Leading to Surging Malaria Rates

Margaret Rafferty, Ayanna Persue, Mandy Misagal, Elza Coelho Barbosa Cabral and Jose Cruz / Department of Nursing

Malaria is the deadliest vector-borne disease (WHO, 2023). The WHO reported that in 2022 there were 608,000 malaria deaths worldwide with the death toll disproportionately effecting people from poor countries (WHO, 2024). Vector borne diseases, which are endemic to many parts of the world, are responsive to changes in their environment (Thomson M & Stanberry, 2022). Climate change is altering the habitat of the vectors playing a pivotal role in altering the geographic distribution of vector-borne diseases like malaria. Rising temperatures, changing precipitation patterns and increased humidity create more hospitable environments for *Anopheles* mosquitoes. Increased temperatures can lead to extended mosquito breeding seasons and increased mosquito populations, thereby elevating the risk of malaria transmission (Carlson et al, 2023; Carlson 2024; George et al 2024; Thomson & Stanberry, 2022).

3. Assessing IgG Autoantibodies Against Smith-ribonucleoprotein (sm-RNP) in *P. vivax* Malaria Patients

Efia Serwaa Appiasam¹, S M Arifuzzaman Akash¹, Maria F. Yasnot-Acosta², Juan Rivera-Correa¹

¹ Department of Biological Sciences, NYC College of Technology
² GIMBIC, Universidad de Córdoba, Montería, Córdoba, Colombia

Malaria is one of the major global infectious diseases with 233 million cases and 608,000 deaths in 2022. Malaria exhibits a spectrum of clinical severities ranging from asymptomatic to uncomplicated and complicated malaria, but the factors leading to these different outcomes remain unknown. Malarial anemia is one of the major complications associated with mortality during malaria. Previous research work from the Rivera-Correa Lab characterized the role of autoimmunity in promoting malarial anemia in a mouse model and patients but the factors leading to this phenomenon are incompletely understood. Autoantibodies are antibodies that attack the host's cells and tissues and produce pathology. One of the parasites that causes malaria is *Plasmodium vivax* which historically was considered mild but now is recognized to lead to serious life-threatening complications like anemia. The goal of this project was to characterize additional autoantibodies, specifically IgG autoantibodies against Smith-ribonucleoprotein (smRNP), associated with uncomplicated and complicated Colombian *P. vivax* malaria patients and uninfected endemic controls. Our results showed a non-significant trend of higher levels of anti-smRNP IgG antibodies in *P. vivax* malaria patients compared to uninfected controls regardless of severity. In studying the presence of these autoantibodies, our goal is to understand their pathological roles with implications in bettering diagnostics and finding disease biomarkers of clinical severity during malaria.

4. Wildfires: A Threat to Public Health

Margaret Rafferty, Paola Guzman, Elizabeth Santos, Dmytro Stapinsky and Shuhua Kuang / Department of Nursing

The major increase in climate driven wildfires worldwide poses a severe threat to a sustainable health care system. Wildfires are more frequent and intense due to climate change. These intense wildfires have a shortened warning period, spread very rapidly and overwhelm fire fighters. These intense 2000-degree fires burn everything in their path causing morbidity, mortality and extensive property damage. Near exposure to wildfires can result in death, burns, smoke inhalation and exacerbation of respiratory and cardiac disease. For people who live far from the actual fire, wildfire air pollution still presents health risks. Exposure to wildfire smoke causes increased respiratory morbidity, respiratory infections, asthma, COPD, reduced lung function and all-cause mortality. There is a significant association between increased rates of lung cancer and exposure to smoke (particulate matter). Wildfire smoke may contain carcinogenic pollutants resulting in an increased incidence of lung cancer and brain tumors post-wildfire exposure.

5. Motivating Consumers to Participate in Collaborative Consumption

Alyssa Dana Adomaitis¹, Diana Saiki¹, Audrey Anhalt²

¹ Department of Business, NYC College of Technology

² Ball State University

Collaborative Consumption (CC) refers to consuming resources by swapping, renting and buying second-hand. In today's digital marketplace, CC is becoming a significant alternative to traditional consumption methods. CC of fashion has been outlined on a model based on Ajzen's Model of Planned Behavior whereby sustainability, enjoyment, reputation and economic benefits influence attitudes thus prompting consumption behavior. This study examines the websites of CC fashion retail businesses. Specific research questions were: What strategies do CC businesses use to attract customers? And How is CC marketed to consumers? A content analysis of fifty-one (51) websites of CC companies (e.g. Thrifted, Nully) was completed. Each website was analyzed using a survey that measured consumers' motivations for CC. A survey was developed from Aizen's Model having measures for motivations to CC to rate using a Likert Scale from strongly disagree to agree. The findings indicated that 64% of these brands do not advertise sustainability. Status (e.g. CC allows me to be a member of a peer-style group) was featured as a motivator to CC. CC was used to promote other forms of activism (such as job creation and poverty prevention). These websites featured young adults (18-29 years). The results suggest gaps in promoting CC, which highlights missed opportunities to communicate with the public who are interested in sustainability. For example, these companies can emphasize the environmentally friendly benefits of CC and a broader age group could be targeted. Given the aging population in the U.S., a niche opportunity is available to encourage populations 40+ years to CC.

6. Skilled Immigrants in the Textile and Fashion Industries. Stories from a Globe-Spanning History (Bloomsbury, 2024)

Nazanin Hedayat Munroe /

Department of Business, Business and Technology of Fashion

This new anthology examines how immigrant communities helped create the modern fashion industry. With contributions from leading experts, this collection presents original research on the skills brought by immigrant communities to the textile and fashion industries in Asia and the Islamic World, Europe, Africa and the Americas.

Manufacturing of textiles and apparel is arduous work, which historically depended on skilled artisans, inexpensive labor and the introduction of labor-saving technology. Immigrant communities supplied much of the work force, bringing their own skill sets to new locations, leading to the development of new manufacturing centers and an increase in both production and technical expertise. Examining the cultural identity of migrant populations, the research brings to light ongoing dilemmas and practices of diaspora communities. By analyzing material, mythical and technical aspects of textile and apparel production, a new narrative is created about textile- and garment-making as a collective endeavor, requiring diversity of skill and methodology to thrive.

7. Synthesis, in Vitro Activity and Molecular Docking of Caffeic Acid Derivatives Against Alzheimer's Disease-related Enzymes

Alberto Martinez / Department of Chemistry

Alzheimer's disease (AD), the most common form of dementia, affects over 6 million people in the United States and more than 40 million worldwide. The incidence of AD is expected to rise rapidly due to the lack of effective treatments. Several enzymes, particularly acetylcholinesterase (AChE) and β -secretase (BACE 1), have been implicated in the progression of the disease. Phenolic acids, including caffeic acid, have demonstrated anti-AD properties. Caffeic acid, a phenolic acid abundant in plant tissues, is commonly found in foods such as fruits, spices, vegetables, wine, olive oil and coffee. It has been noted for its antitumor, anti-inflammatory and anti-AD effects. Additionally, quinoline and quinacrine-based compounds have shown promise as potential anti-AD agents.

In this study, the synthesis of three caffeic acid derivatives—AM67, AM68 and AM70— is reported and their ability to inhibit both AChE and BACE 1 enzymes is evaluated. Molecular docking studies were also conducted at the active site of both enzymes. The results were compared to those of the parent compound, caffeic acid and clinically used inhibitors. The experimental IC_{50} values were promising, with AM68 demonstrating low micromolar inhibition against AChE and AM70 showing nanomolar inhibition against BACE 1. All three compounds exhibited strong binding affinity to the active sites of the enzymes, with binding scores generally aligning with the experimental IC_{50} values. Overall, these compounds show potential as promising candidates for the development of new anti-AD therapies.

8. Iodine-protein Nanoparticles for Cancer Imaging and Therapy

Vishwas Joshi^{1,2}

¹ Department of Chemistry, NYC College of Technology

² Anvesha Labs, Inc. New York

Nanoparticles (NPs) have found applications in the areas of imaging, diagnosis and therapy or as theranostic agents. Radioisotopes, photosensitizers and heavy metal label loaded protein, lipid, polymer and metal NPs have been used as theranostic agents.

However, not all materials used to construct NP-based theranostic agents have high biocompatibility and low toxicity. We chose albumin as the delivery agent because of its low cost, biocompatibility, safety and ability to deliver therapeutics and diagnostic agents. Further, iodinated agents are clinically used for contrast-enhanced X-ray imaging. Also, the X-rays absorbed by iodine eject inner shell electrons, that in turn create tissue-damaging free radicals and enhance local radiation dose.

With these advantages in view, we have developed iodine-loaded albumin NPs for X-ray aided imaging and therapy.



9. Whatever Happened to Frankie King

Eli Neugeboren and Jay Neugeboren /
Department of Communication Design and Columbia University

A real-life mystery of books and basketball.

Frankie King was a precocious student and a promising basketball player at Brooklyn's James Madison High School in the early 1950s. Sportswriters were comparing Frankie to the greatest college and professional players of all time and he was recruited as a starting guard at the University of North Carolina. But Frankie dropped out before playing a single game.

This graphic novel follows King's enigmatic life from its auspicious start in the limelight to his very reclusive existence in New York City, where he authored more than forty novels, including a popular series of cozy cat mysteries written under a woman's pseudonym. *Whatever Happened to Frankie King* is the story of a unique and sometimes troubled life as well as a meditation on dreams realized, lost and abandoned.

Eli Neugeboren is an award-winning artist, illustrator, writer and professor whose work has appeared in *Corpus: A Comic Anthology of Bodily Ailments*, *Weapon Echh!* and *COVID Chronicles: A Comics Anthology*, among other publications.

Jay Neugeboren is the award-winning author of twenty-three books, including the novels *The American Sun and Wind* *Moving Picture Company* and *After Camus* and the memoir *Imagining Robert: My Brother, Madness and Survival*, which was adapted into a critically acclaimed documentary film.

10. Democracy Spoken Here – Progress of a Typographic Art Print Series

Anita Giraldo / Department of Communication Design

Democracy Spoken Here, a series of art prints, has evolved from a typographic representation of historic American quotes into a critical examination of the erosion of human rights in the United States. While typography remains central, the works now incorporate illustrations and other graphic elements.

Initially, the project explored the intersection of design, typography, printmaking and historical quotes from the American experience. However, it has since shifted from a purely historical focus to a more pointed critique of how some individuals' rights are prioritized over others.

Added graphic illustrations enhance and deepen the message.

The series has been featured in politically oriented exhibitions at museums, university galleries and juried shows across the U.S., as well as in international publications. Its relevance underscores the acceptance of typography as an art form that bridges the literary and visual arts.

11. A Visual Language for Communicating Semantic Web Concepts and How it Could Be Applied in AI Applications

Noreen Y. Whysel¹, Shari Thurow², Bev Corwin²

¹ Department of Communication Design, NYC College of Technology

² Information Architecture Gateway

Artificial Intelligence experiences can be improved by the addition of knowledge graphs. Theory and applications are being proposed by researchers in the field with some promise, but many questions remain. Information Architecture can help. Large Language Models, which typically learn based on a probabilistic ordering of tokens or strings, to provide more context aware output. In this poster, we review the semiotics of Charles Sanders Peirce's triadic semiotics model for understanding meaning and suggest ways to extend the meaning of LLM output with expert knowledge graphs. Peirce's Object-Sign-Interpreter model (where interpreter is typically the human observer) includes three concept levels, Naming, Quoting and Representing. In Sowa's classic example, Object is a cat, Symbol is the name "Yojo" and the Interpretant is the person parsing the string Y-O-J-O. In the case of generative Artificial Intelligence (genAI), the interpreter is a Large Language Model (LLM). We are adding a fourth triad called "Understanding" which takes the model a step further and applies context for a human interpreter.

12. Using Blockchain Technology to Safeguard Pharmaceutical Supply Chain

Marcos Pinto and Melissa Garcia /
Department of Computer Systems Technology

Drug counterfeiting is a global problem with significant risks to consumers and the general public. The pharmaceutical industry suffers from a lack of transparency, difficulty tracking products, lack of trust and the shipment of expired products. Blockchain technology has been applied to solve several of these problems. This project presents a blockchain-based solution that can protect the end-consumer by providing secure delivery of pharma goods and providing a verifiable decentralized ledger that is traceable by all stakeholders across the supply chain.

13. Exploring Multiple Web Hosting on Virtual Machine and Cloud Environment

Implementing Multiple Web Hosting, Secure HTTP, Primary and Secondary Domain Name System (DNS) Name Servers, Domain Name System Security Extensions (DNSSEC) and Webservers Load Balancing

Chein-Chang Peter Li, et al. / Department of Computer System Technology

The scope of this research focuses on the use of classroom Windows server 2019, Windows 11 Laptop running Virtual machines and Cloud servers. The virtual machine that runs on the Windows 11 laptop acts as a host. The Linux and Windows server 2022 operating systems are installed and configured as guest operating systems. The three operating systems are bridge-networked. We then configured multiple websites hosting on Windows and Linux based operating systems. Using classroom Windows 2019 servers to implement Domain Name System (DNS) Name Server to support web developers. In addition, Domain Name System Security Extensions (DNSSEC) was explored to configure primary and secondary name servers on Cloud. Webservers with load balancing were implemented in the classroom and on the cloud.

Finally, Hypertext Transfer Protocol Secure (HTTPS) protocol was implemented on a Cross-Platform, Apache, MySQL, PHP and Perl (XAMPP) Server as well. Open-source software such as WordPress and its plug-ins were explored to better support front-end and back-end developers. Results and outcomes of the interoperability of portable platforms and Clouds were displayed and communicated. Therefore, the motivation of this project is to expand our knowledge in building a web infrastructure, physically and virtually on portable developmental laptop and Cloud.

14. From a Traditional City to a Smart City: The Measurement of Cities' Readiness for Transition, Egypt as a Case Study

Ahmed Hassebo¹ and Mohamed Tealab²

¹ Department of Electrical Telecommunications and Engineering Technology, NYC College of Technology

² Department of Architecture, Faculty of Engineering, Al Azhar University, Egypt

The transition from traditional cities to smart cities marks a critical point in urban development and governance. As cities around the world face the challenges of rapid urbanization, limited resources and the need to improve citizens' quality of life, the concept of a "smart city" has become increasingly prominent. This paper examines the complex process of urban transformation, highlighting the key criteria and factors that influence a city's transition to becoming smart. To offer a comprehensive approach to this transition, the paper introduces a computer program designed to assess a city's readiness for smart city transformation. The criteria include technological innovation, data-driven decision-making, infrastructure development and effective governance. The paper also discusses the importance of citizen participation, privacy concerns and sustainability in shaping the transformation. Case studies of Egyptian cities ready for smart city development are presented to demonstrate how these criteria are applied in practice. Ultimately, this paper serves as a guide for city planners, policymakers and urban stakeholders, outlining the essential elements needed to navigate this complex transformation. In an era of accelerating urbanization, the move to smart cities is not just a future vision but an urgent need to ensure the sustainability and success of our urban centers.

15. Knowledge Distillation Based Defense for Audio Trigger Backdoor in Federated Learning

Yu-Wen Chen / Department of Computer Systems Technology

The applications of Automatic Speech Recognition (ASR) on Internet-of-Things (IoT) devices have increased significantly in recent years and Federated Learning (FL) is often used to improve ASR performance since its decentralized training mechanism ensures users' data privacy. However, FL is vulnerable to various attacks. The most challenging one to detect and defend against is trigger backdoor attack. Adversaries inject the trigger into the training audio data and participate in the FL training, causing the converged global model to mispredict the poisoned data. Unlike previous defense methods filtering suspicious models during model aggregation, we propose the Knowledge Distillation Defense Framework (KDDF) to detect and remove features of the potential triggers during the inference. KDDF utilizes Knowledge Distillation (KD) to train a validation model on each IoT device, which is used to identify suspicious data. Then, KDDF would try to eliminate the injected trigger during the model inference if the data is suspicious. Experimental results show that KDDF can effectively distinguish between benign and suspicious data and recover the classification results.

16.

Balanced Blended Space (BBS) Model: Developing a Comprehensive Framework for Physical-Digital Communication

David B. Smith / Department of Entertainment Technology

The [Balanced Blended Space \(BBS\)](#) model is a meta-project created to develop a universal framework for integrating physical, virtual and conceptual realities. BBS establishes formal communication pathways between human and AI collaborators within [Combinative Reality](#). A formal syntax is being developed to describe these pathways, offering a systematic approach to structuring interactions in blended environments. BBS theory is then applied to real world activities with projects like the **Blended Reality Performance System (BRPS)** and the [Blended Shadow Puppet \(BSP\)](#) project validate the framework by testing real-time collaboration between human and AI agents. This research explores the evolution of combinative realities and interdisciplinary collaboration, contributing to creative and research-based contexts. We invite collaboration from the entire City Tech research and creative community!

17.

Reducing E-Waste: Repurposing Old PCs and Laptops into Sustainable NAS Systems

Jared Bowens, Ivan Guerrero, Benjamin Yusufov, Bharat Dangi and Aparicio Carranza / Department of Computer Engineering Technology

The global rise in electronic waste has impacted the world's economic state and brought about significant environmental challenges. These challenges have highlighted the necessity for innovative strategies for once thought obsolete technologies into sustainable storage systems. We have explored how outdated hardware can be repurposed into functional, energy-efficient Network-Attached Storage (NAS) systems to help reduce potential e-waste. Using Open-Source software and minimum system requirements, we have created customizable storage solutions that breathe life back into outdated hardware and promote sustainability within the ever-evolving tech industry.

18.

Navigating the Digital Sky

Aaron F. Jones, Pavel Karpov, Henry Mejia F., Mir F. Mithila and Aparicio Carranza / Department of Computer Engineering Technology

In the world of technology and online platforms big players such as Google, Apple, Microsoft and Dropbox hold sway in providing cloud services to users giving them easy access to store and manage files. However, these services come with their downsides; users have limited control over their data stored on these platforms and recurring charges, for exceeding certain storage limits. We overcame these constraints by developing a personal cloud solution that puts users in control at a low cost. Using a limited budget and open-source hardware such as a Raspberry Pi with additional components, we aim to construct a cloud system that eliminates the need for external providers and offers a secure, private solution for file storage. The system was assembled using hardware that costs under \$100 making it accessible to students, hobbyists and technology enthusiasts.

19.

Biometric Authentication for Easier and Faster Secure Access to Websites

Bilal Akhtar, Omar Bautista, Dario Vil, Sali Fazlija and Aparicio Carranza / Department of Computer Engineering Technology

Biometric authentication is an identification and verification method that relies on an individual's physical or behavioural characteristics to grant or deny access to a system, device, or application, due to the high security and convenience it has recently gained popularity as an alternative method for authentication. We have developed a biometric authentication system using Python and Django web development platform with a user-friendly interface that guides users through the authentication process for website login. A website was designed to use Facial Recognition to log in and access the features. As part of the process, the system captures and stores the biometric data of registered users in a secure database. By leveraging Python and Django, we developed and implemented a scalable, reliable and secure biometric authentication system that provides a seamless user experience for website authentication

20.

Cloud Computing: Exploring the Digital Frontier

Ifte Alam, Damian Brathwaite, Jorge Montero, Aramis Vicente and Aparicio Carranza / Department of Computer Engineering Technology

The cloud is everywhere, but what does it represent, how does it exist? That is a question people may ask themselves at this present time. We explore in-depth about how the cloud revolutionizes our realm of technology. We utilize Amazon AWS to display different usages of the cloud such as: storage, applications within the cloud, hosting of websites and usage of virtual machines within a personal cloud server. Using virtual machines, we display how the services are used for cloud computing. Cloud storage allows for the viewing and saving of these applications and software. The cloud allows for the usage of these applications which handles for many different purposes, most famous being AI and Cybersecurity.

21.

Smart Home Lighting System

Tony Wang, Zhen Yan Guan, Ruiming Chen, Ricky Lin and Aparicio Carranza / Department of Computer Engineering Technology

We have designed and implemented a Smart Home Lighting Systems. A Smart Home Lighting System is a network of lighting devices that can be controlled remotely or automated to enhance convenience, energy efficiency and security in a home environment. The system consists of Arduino UNO, breadboard, LED light, resistors and HC-05 Bluetooth module. We upload a basic sketch to the Arduino to test communication with the HC-05 module to ensure the module works properly. Afterward, we write Arduino code to interpret the commands received from the mobile app to control the LEDs accordingly such as turning on/off LED lights. Once the components have been constructed, testing and calibration are done to ensure everything works as intended. Our project emphasizes on user-friendly app development, providing intuitive controls and wireless accessibility.

22.

The Deployment of Virtualized Operating Systems to Reveal Network Vulnerabilities

Randy Mojum, Kahou Puan, Maharin Khondoker and Aparicio Carranza / Department of Computer Engineering Technology

Virtualization has grown as a modular system that allows individuals and companies to perform security tests. Virtualization allows a host or physical device to create partitions that can contain multiple virtual machines. These virtual machines can manage different operating systems that run in isolated environments. Our work deals with hypervisors including Hyper-V, VirtualBox and VMware Workstation to seek vulnerabilities in systems utilizing tools built into Linux-based systems to detect malicious network traffic. The Honeypot tool from Pentbox denies access from potential attackers attempting to access our devices through open ports. Our methodology employs tools inherent to Linux-based systems, such as Nmap for scanning and evaluating network vulnerabilities, alongside analyzing network traffic for malicious activities. We have deployed the Netstat command to log incoming and outgoing network packets.

23.

Networking with Android Systems

Adel Mused, Richard Morales, Mickel Cupid and Aparicio Carranza / Department of Computer Engineering Technology

We explore the world of networking with the Android system, where we discuss the essential security protocols, technologies and other concepts needed to provide monitored, safe, secured and seamless connection between devices. We discuss the integration from top to bottom from assigning the IP Address to subnetting, TCP/IP, Wi-Fi and shedding light on the fine details of data transmission. We go through security layers, touching on SSL/TLS, Firewalls and other network security measures to safeguard communication between Android systems. We also touch base on IPv6 which is a new more complex version of assigning IP addresses to devices.

24.

Cloud Computing Attendance Management System with Integration of MySQL & PHP

Sheyla Criollo, Bryan Rivera, Aaron Libato, Crystal Cruickshank and Aparicio Carranza / Department of Computer Engineering Technology

The Cloud Computing Attendance Management System (CCAMS) project with PHP (*Hypertext Preprocessor*) and MySQL (MP) is a robust and reliable solution for tracking and managing employee attendance in a company. The system utilizes the MP stack and cloud computing technologies to provide real-time access to attendance records from any location with an Internet connection. Utilizing credentials such as usernames and passwords for login and sending information to the database. CCAMS also provides advanced reporting capabilities that enable managers to quickly and easily analyze trends and make informed decisions. The MySQL is set up to collect and store user login information, ID number and name. With CCAMS users can access the attendance system from any operating system. Compared to other systems this provides the user with an overview that is user-friendly and includes a customizable workspace with an open-source system.

25.

Design and Development of a Natural Language Processing (NLP) Based Classification Model for Forum Post Recommendation System

Puya Roy and Aparicio Carranza / Department of Computer Engineering Technology

Recommendation Systems have aided consumers by recommending and selecting alternate features/options of certain products by leveraging big data and predicting ratings based on users input. We have developed and implemented a content-based Forum post recommender system that classifies a post into its designated category. The various components of this project involve AI/Machine Learning, Data Science and Natural Language Processing that aims to summarize text from big data. The data was collected from an educational platform's Discourse Hub Community and Python was used to web scrape several forums. Data was preprocessed and cleaned by programming in Python to conduct Exploratory Data Analysis (EDA). Our system aimed towards calculating the similarity between posts and recommendations by vectorizing data and computing the similarity matrix to recommend posts associated with identical posts. Various Machine Learning models and algorithms were leveraged and trained to classify posts in categories as either positive or negative.

26.

Password Management: The Future of Security

Ameer Shadick and Aparicio Carranza / Department of Computer Engineering Technology

A password manager is a software program or service specifically created to securely store and manage passwords for many online accounts and services. It primarily serves to store passwords, generate new passwords, provide security measures such as encryption and two-factor authentication and provide password auditing tools. Our system operates by securely storing passwords in an encrypted database, necessitating the user to generate and recall just a single master password to retrieve all saved passwords. Our system is built on Kali Linux using Python, which utilizes Advanced Encryption Standard (AES) to securely store and retrieve passwords. The password manager allows users to add, retrieve, change and remove passwords for many services using simple command-line interface (CLI) commands. The system includes a technique for creating encryption keys dynamically, ensuring that unique keys are generated for each session, hence increasing security.

27. The Efficiency of Different Approach for Preventing Data Penetration

Xiaofeng Yu, Junhui Yang, David Diaz, Hong Peng Shiwu and Aparicio Carranza, PhD / Department of Computer Engineering Technology

One of the most prevalent cyber risks that users encounter on a daily basis is data invasion/penetration. There are several ways to avoid these data breaches including device execution of security policies, firewalls, authentication and penetration testing. Penetration testing, or pen-testing for short, quickly rose to fruition due to tech industries realizing that having multiple users on one system, which was a normal thing, posed an inherent risk to the system's security. Pen-testing in a way is the first line of defense against everyday cyber threats. We have demonstrated different types of programs and methods within Kali Linux and Parrot OS that users can use to identify what vulnerabilities are within their device and accordingly act in order to protect their personal information. In accordance with device compatibility and user's preference, Kali Linux and Parrot Operating System are very powerful systems that contain almost the same amount of tools.

CONSTRUCTION
MANAGEMENT
AND
CIVIL ENGINEERING

28. Climate Change Impacts on Bridge Scour Risk in New York State

Samaneh Gholitabar and Alexis Torres /
Department of Construction Management and Civil Engineering

Climate change is occurring at unprecedented rates, with significant implications for infrastructure resilience. This study investigates the potential impacts of climate change-induced higher flood risk, due to future precipitation changes, on bridge scour risk in New York State. Bridge scour is the primary cause of bridge failure in the United States, making this research crucial for infrastructure management.

This study examines the relationship between future precipitation patterns, resulting runoff and streamflow in areas with bridges vulnerable to scour. The research employs a GIS-based risk analysis model, integrating data from the National Bridge Inventory, climate hazard maps and other geospatial sources. This approach allows for the identification and mapping of critical scour-vulnerable bridges across New York State and evaluates how altered hydrological conditions may exacerbate scour risk for these structures.

The study provides valuable insights for infrastructure planning and management in New York State. The findings highlight the need for adaptive strategies to mitigate increased bridge scour risk in a changing climate, contributing to the long-term resilience of transportation networks.

EDUCATION

29. Peeragogy and Teaching

M. Tedeschi¹, S. Belich², P. Ricaurte Quijano³, C. Danoff⁴, J. Corneli⁵, S. Ayloo²

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We are part of a team of collaborators from across the globe working with synchronous and asynchronous technologies to collaboratively explore and develop 'Peeragogy', a collection of practical techniques for collaborative learning and collaborative work. Use cases for these techniques include peer learning and research co-production. Alongside our shared informal learning in the Peeragogy Project, several of us are employed as instructors in formal education settings. Here, we explore the interface between these two worlds. This paper shows how a graduate class was instructed to use Beautiful Soup for a final project in a web assisted course. We started with step-by-step installation instructions for both Windows and Unix systems, and quickly moved into practical applications. The focus was on retrieving data from major educational and economic websites, such as those of the World Bank. We used standard teaching methods to explain the tools and assignments. Students then worked together in groups, teaching each other in a more peeragogical manner. The results of these student collaborations will be described. In addition, we reflect briefly on other examples at the interface between peeragogy and formal teaching. Our conclusions point to the need for more work on refining techniques that can support peeragogy within traditional educational settings.

30.

Aldous Huxley's Short Fiction (Palgrave Macmillan 2024)

Andrija Matic / Department of English

Aldous Huxley's Short Fiction is the first book that analyzes Huxley's short fiction in its entirety. The book explores all stories from Huxley's official collections, together with ten stories published only in magazines during his lifetime. Although the book positions Huxley's short fiction within the modernist context, it also highlights themes that correspond with our time. It illustrates Huxley's views on organized religion and clarifies Huxley's political opinion, which is often misunderstood due to his advocacy of pacifism. Finally, *Aldous Huxley's Short Fiction* reveals Huxley's complex humor and irony, areas he developed more than any other modernist author of short fiction.

More about the book can be found here:

<https://link.springer.com/book/10.1007/978-3-031-55775-0>

31.

Applying Cultural Relativism to Discussions of Multiculturalism: Creating A Space for Empathy and Dialogue

Lisa Pope Fischer / Department of Social Science

This chapter is part of a textbook entitled *Multiculturalism*, edited by Dr. Annie Ngana Mundeke and Dr. Eric Rodriguez-Chan, which uses a self-reflexive approach drawing on personal experience to introduce the topic of cultural relativism and its application to multiculturalism. Understanding cultural relativism necessitates looking at several key anthropological concepts such as culture, ethnocentrism, emic, etic, identity, and "the other." On the one hand, cultural relativism provides a way in which to view different cultures from an unbiased point of view, yet on the other hand, cultural relativism also raises several issues and dilemmas. Cultural relativism draws attention to issues of power and agency, especially concerning hot-button topics such as morality and racism. Yet the aims of cultural relativism also encourage empathy and dialogue to strive toward equity. The benefits and problems of a culturally relative approach draw attention to critical points to understand a multicultural world.

32.

The Impacts of Climate Change on Education: The Cases of Helene Hurricane and Milton Hurricane (2024).

Annie Ngana Mundeke / Department of Social Science

This research project examines the impacts of Climate Change, focusing on economic loss, health, and education. The research examines the effects of three past major hurricanes that hit the Caribbean and the United States over the past 5 years. This research project mostly assesses the damages caused by Hurricane Helene which devastated a few states in the United States from Florida to North Carolina in October 2024.

Statistics show that Hurricane Helene has claimed more than 100 lives. Houses and roads were underwater, and trees fell. Images on social media are scary to watch. Helene took human lives, caused economic loss, impacted education,

This Project is a part of my research project titled: The Impacts of Climate Change, Global Warming, Hurricanes, and Natural Disasters on the Society and the Environments (Family and Social Justice).

INTERDISCIPLINARY

33.

Online Nursing Admission Application

Shi Li-May Li¹, Michelle Gellar¹ and Peter Dinh²

¹ Department of Nursing

² Office of Computing and Information System

The healthcare sector, particularly nursing, has experienced substantial growth following the COVID-19 pandemic, intensifying the demand for nursing professionals in New York. City Tech's Associate in Applied Science Degree Program (AAS) has remained competitive with its high NCLEX-RN pass rates, attracting 160-200 applicants every semester. Traditionally, the application process involved cumbersome hard copy submissions, leading to inefficiencies and administrative burdens for faculty and staff.

In response, the Nursing Admission Committee has collaborated with the Office of Computing and Information System (OCIS) Department to develop and launch the Online Nursing Admission Application last Fall, 2023. This innovative application streamlines the admissions process by centralizing the application management through a sophisticated digital platform. The system features advanced tools for scoring applicants based on customizable criteria, GPA calculation, and comprehensive communication tracking. Additionally, it enables applicants to upload essential documents, such as transcripts and references, directly online.

Since its implementation, the platform has been utilized by an average of 180 applicants each semester, yielding positive feedback from all stakeholders. The Online Nursing Admission Application has not only optimized the admissions workflow but also holds potential for integration with other institutional departments such as advisement, registration, and financial services. This application stands as a pioneering model that could be extended to other CUNY departments, further enhancing operational efficiency across the college system.

34. Medical Interpretation: Student Survey for Workforce Development in Health and Helping Professions with a Foundation in the Humanities

N. Rodríguez¹, D. Sánchez Jiménez², M. Pérezc³, J. Harnandan¹ and M. García⁴

¹ Department of Health Sciences

² Department of Humanities

³ Department of Biological Sciences

⁴ Department of Computer Systems Technology

By 2022, nearly 25% of NYC's population was limited English proficient (LEP). Recognizing this, an interdisciplinary team of City Tech faculty and students disseminated a pilot survey to a convenience sample of 105 students in April 2024 to gauge students' interests in medical interpretation learning opportunities. The response rate was 28.6% (n = 30). Disciplines represented included health sciences, social sciences, humanities, technology, engineering, and law. Nearly all respondents had or knew someone who encountered a language barrier in a health setting and believed medical interpretation should be available across all health services. Seventy percent (n = 21) were highly interested in a medical interpretation certificate, and 60% (n = 18) were highly interested in obtaining a medical interpretation job. This indicated a high recognition for language access in health settings and a firm interest in medical interpretation. The goal of the survey was to inform a new proposal for medical interpretation education at City Tech.

35. Microbial Diversity of Newtown Creek

Daler Djuraev¹, Adriana Galvan¹, Peter Spellane¹, Anna Feitzinger²

¹ Department of Chemistry, NYC College of Technology

² DNA Learning Center, Cold Spring Harbor Laboratory

Newtown Creek, a tributary of the East River, is one of the most polluted industrial sites in the United States. A major source of pollution is the 22 combined sewer overflows that line the creek and can send untreated sewage into the waterway. This research aims to explore the biodiversity and microbial dynamics along the creek using 16S metabarcoding to survey the abundance and distribution of bacteria. We collected water samples from 7 locations along Newtown Creek with varying distances from Combined Sewage Overflows (CSOs) days after a major flooding event in NYC. DNA extraction, Nanopore sequencing, and bioinformatics analysis unveiled differences in taxa distribution along the creek. Additionally, the abundance of specific genera increased or decreased with distance from CSOs. These findings contribute insights into the microbial ecology of an understudied urban waterway.

36. Sentiment Analysis of Instagram Comments: Exploring Body Image Perceptions

Hannah Bloomfield¹, Qing Chen (Charlotte)², Mark Hughes¹, Patricia Medina²

¹ Department of Mathematics, Brigham Young University

² Department of Mathematics, NYC College of Technology

In this study, we conducted a sentiment analysis of Instagram comments to examine the treatment of plus-size versus non-plus-size influencers. We collected a dataset of over 10,000 comments, which were categorized into two groups: comments directed at plus-size influencers and those aimed at non-plus-size influencers. By analyzing the sentiment of each comment—whether positive or negative—we found no significant difference in the way the two groups of influencers are treated on Instagram. Our methodology included term frequency-inverse document frequency (TF-IDF) and logistic regression to draw conclusions. Additionally, we used the Python package Flair to assess sentiment confidence levels, further supporting our analysis.

37. How to Perform Feature Engineering in ML Classification Algorithms with Mathematical Quantities in Remote Sensing Data

Patricia Medina / Department of Mathematics

Product coefficients are quantities that arise in analysis with the goal of representing measures. In this poster, we present the definition of product coefficients and demonstrate their application in feature engineering for the classification of remote sensing data, specifically 3D LiDAR point clouds. We explore how product coefficients can be used to enhance the classification accuracy and provide insights into their practical implementation in real-world scenarios.

38.

Comprehensive Crime Analysis: Integrating Classification, Regression, and Spatial-Temporal Insights

Patricia Medina¹, Justin Mejia¹, Bledar Ndoni²

¹ Department of Mathematics, NYC College of Technology

² Department of Computer Systems Technology, NYC College of Technology

This study focuses on developing a comprehensive framework for analyzing crime data through classification and regression models. We aim to predict the type of crime based on various features, including location, time, and victim demographics. In addition to classification, we are exploring regression techniques to forecast the number of crimes within specific areas and time periods, as well as the potential future impact of crime on the economy. To enhance our analysis, we utilize geospatial visualization tools, such as Folium and GeoPandas, to map crime locations and visualize hotspots. This spatial analysis allows us to identify areas with elevated crime rates and investigate underlying factors contributing to these patterns. Furthermore, we are examining temporal patterns, including seasonal variations in crime rates, to better understand fluctuations in criminal activity. Our multidisciplinary approach aims to provide valuable insights for policymakers and law enforcement agencies in addressing crime effectively.

PHYSICS

39.

Superfluidity of Indirect Momentum Space Dark Dipolar Excitons in a Double Layer with Anisotropic Tilted Semi-Dirac Bands

A. Nafis Arafat^{1,2}, Oleg L. Berman^{1,3}, Godfrey Gumbs^{1,2,4}

¹ The Graduate School and University Center, CUNY

² Department of Physics and Astronomy, Hunter College, CUNY

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We theoretically investigate the spin- and valley-dependent superfluid properties of indirect momentum space dark dipolar excitons in double layers with massive anisotropic tilted semi-Dirac energy bands under circularly polarized irradiation [1]. Using parameters for a double layer of $1T' - \text{MoS}_2$, we derive analytical expressions for exciton energy spectra, wave functions, and binding energies. We explore how varying the intensity and frequency of the irradiation affects the exciton effective mass, binding energy, and critical temperature for superfluidity. Our calculations of

the sound velocity and critical velocity reveal anisotropic superfluid behavior formed by a two-component system of dipolar dark excitons. We find that increasing exciton concentration and interlayer separation raises the critical temperature for superfluidity. We propose phonon-assisted photoluminescence experiments to confirm directional superfluidity of these excitons in such double-layer systems.

[1] A. N. Arafat, O. L. Berman, and G. Gumbs, Phys. Rev. B **109**, 224506 (2024).

40.

Controllable Trions in Buckled Two-Dimensional Materials

Anastasia Spiridonova / Department of Physics

The results published in Refs. [1, 2] are reported. The formation of intravalley and intervalley controllable trions in buckled two-dimensional (2D) materials such as silicene, germanene, and stanene monolayers in an external electric field is predicted. The solution of the three-body Schrödinger equation with the Rytova-Keldysh potential by expanding the wave functions of a trion in terms of the hyperspherical harmonics (HH) within the framework of a nonrelativistic potential model is presented. The resultant system of coupled differential equations is solved numerically. Controllable ground-state energies of intravalley and intervalley trions by the external electric field are presented. We demonstrate that trion BEs can be controlled by the external electric field, and the dielectric environment has a significant effect on the trion BE.

1. R. Ya. Kezerashvili, S. M. Tsiklauri, and A. Spiridonova, Electric-field-tuned binding energies of trions in silicene, germanene, and stanene monolayers, International Journal of Physics **12**(5), 225-231, 2024.

2. R. Ya. Kezerashvili, S. M. Tsiklauri, and A. Spiridonova, Trions in buckled two-dimensional materials, Phys. Rev. B **110**, 035425 (2024).

41.

It's What's Inside That Counts. Looking at Galaxy Evolution Through Spatially Resolved Star Formation in Milky Way Type Galaxies

Ena Chia, Charlotte Olsen, Charlotte Welker / Department of Physics

Star formation is an important physical observable that traces the complex processes involved in galaxy evolution. In order to form stars in a galaxy, gas must first cool and collapse, but the radiation from newborn stars can heat nearby gas and halt star formation. Likewise feedback from supernovae or jets from a supermassive black hole at the galactic center can heat or eject gas from a galaxy, quenching star formation. These processes that drive star formation and quenching as well as the timescales upon which they act are an active area of study. Studying areas within a galaxy allows us to infer when and where these processes are at play. We use a Milky Way type galaxy from hydrodynamical simulation to see how star formation rate (SFR) and stellar mass at the time of observation vary within regions of the galaxy. We then trace these stars back in time to see how accurately we can infer past SFR and stellar mass from the time of observation. We compare with similar results using observations from the UVCANDELS survey that maps the relationship between stellar mass and SFR for regions within Milky Way mass galaxies.

42. Quantum Entanglement of Multiple Excitons in Strained Graphene Embedded in an Optical Microcavity

G. P. Matins^{1,2}, O. L. Berman^{1,3}, G. Gumbsa² and Yu. E. Lozovik⁴

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We studied the effects arising from a coherent source of photons on the entanglement between three and more excitons in a strained graphene monolayer [1]. We consider systems of up to five excitons, inside a leaky optical microcavity subject to a coherent source of photons. We have shown that interacting with coherent photons can create long-lasting entanglement between the excitons. We calculated the time evolution of multiple entanglement witnesses for this system. We have devised a way to estimate the total amount of entanglement within a multi-particle system. We have reached the counter-intuitive conclusion that freely increasing the number of excitons in the system does not, in general, increase the amount of entanglement created by the dynamics. There exists an optimal number of excitons that depends on the systems physical parameters.

[1] G. P. Martins, O. L. Berman, G. Gumbs, and Yu. E. Lozovik, arXiv:2405.16024 [cond-mat.mes-hall] (2024).

43. Fully Differential Semileptonic Decay of the Bottom Quark at Next-to-Next-to-Leading Order

A. Ferroglia / Department of Physics

This project aims at obtaining a fully differential numerical code for the evaluation of next-to-next-to-leading order QCD corrections to the decay of the bottom quark in a massless up quark and a charged lepton neutrino pair. For this purpose, a public code written some years ago by Gao, Li, and Zhu for the calculation of the top quark decay in a (massless) bottom quark and an on-shell W boson was suitably modified.

The corrections to the partonic process can then be employed to improve predictions for the semileptonic decay of the B -meson. In order to achieve this goal, the contribution of the corrections to three form factors needs to be extracted: A method to achieve this goal was developed. Better predictions for the semileptonic decay of the B -meson will be useful in extracting the Cabibbo–Kobayashi–Maskawa matrix element V_{ub} from data.

44. Graph Theory in Physics: From Kirchhoff's Laws to Feynman Diagrams

Ray D. Sameshima / Department of Physics

Graph theory has found its numerous applications in physics, from its early use in solving puzzle problems to its essential role in circuit analysis, modeling state transitions, representing quantum interactions among fields and particles. This poster presents key insights from the forthcoming Springer publication "Lectures on Feynman Diagrams: A Graph Theoretical Perspective." It highlights

how graph-theoretical methods, alongside linear algebra, provide a unified framework for understanding Feynman diagrams, with applications on quantum field theory. The poster also explores classical applications such as Kirchhoff's laws, as well as their modern implications in fundamental physics.

45. Momentech - Modern Explorations of the Impulse-Momentum Theorem

Todd Gelbord / Department of Physics

Herein we outline the design and construction of an instructional laboratory demonstration of the conservation of linear momentum, by way of the Impulse-Momentum Theorem, utilizing small, commercially available accelerometers attached to microcontrollers. The set-up is equipped with small, OLED screens which are able to display real-time acceleration graphs. Furthermore, a template for an experiment involving this set-up is provided. We also explore various data analysis options for different levels of student sophistication.

46. Properties of Water in Extreme Space Environments: A Computer Study

Vasily Znamenskiy / Department of Physics

Water, one of the most abundant and important molecules in the Universe, exhibits unique behavior in extreme space environments that challenge our current understanding of its properties. In this study, we examine the structural, thermodynamic, and dynamic properties of water in environments such as distant exoplanets, comets, interstellar voids, interstellar dust clouds, and black hole close environments, where temperatures, pressures, and radiation reach extreme values. Using advanced molecular dynamics and quantum mechanical calculations, we analyze how water molecules group, interact, and adapt to these abnormal conditions. We explore the 1D, 2D, and 3D states of water in a vacuum and within other structures. The results provide insights into phase transitions, hydrogen bond stability, and the possibility of unique water phases in unexpected space environments. This research not only expands our knowledge of how water behaves in space but also opens up new avenues for understanding the role of water in astrobiology and planetary science.

47. Fabrication and Characterization of Monolayered Transition-Metal Dichalcogenides

V. Dorogan¹, K. Cruza², M. Vardoshvili^{1,2}, P. Sotomayor¹, S. Rivera¹, T. Gonzalez¹

¹ Department of Physics, NYC College of Technology

² Chemistry Department of Brooklyn College

To make devices for quantum networking one must use materials of the highest quality. A quantum transducer, a device that is designed to convert the radio-frequency signal from quantum computers into an optical signal, can be built using a two-dimensional semiconductor material. Such materials are transition metal dichalcogenides (TMDs). In this research, we use the exfoliation method to produce thin layers of WS_2 and $MoSe_2$. It is known

from the literature that for TMDs only monolayers (several atoms thick) manifest a strong photoluminescence (PL) emission at room temperature. So, PL at room temperature indicates a monolayer thickness for TMDs. Most of the flakes turned out to be thicker than a monolayer and did not yield any PL signal, except one flake of WS₂. It showed strong PL emission with two peaks around 710 nm and 820 nm. We also studied the PL intensity dependence, showing that the two peaks quench at different rates. The future electrical characterization of the flakes requires nanofabrication of metal contacts. The contacts were made using Electron-Beam Lithography followed by metal deposition and lift-off procedure.

48. Electric and Magnetic Fields Controllable Energy Levels of Trions in Xenes Monolayers

Roman Ya. Kezerashvili / Department of Physics

A three-particle system in quantum physics can be described in the framework of a few-body physics approaches such as Faddeev equations [1] and the method of hyperspherical functions [2,3]. We predict the formation of interavalley trions in buckled two-dimensional materials, such as silicene, germanene, and stanene monolayers, controllable by external electric and magnetic fields perpendicular to the monolayer. Using a coordinate transformation, a trion Hamiltonian is split into the sum of a translational term describing Landau quantizations for the trion center-of-mass motion, and a term describing three-particle relative motion. The trion eigenenergy and wavefunction are calculated efficiently within the formalism developed in [2-4]. The three-body Schrödinger equation is solved with the Rytova-Keldysh potential by expanding the wave functions of a trion in terms of the hyperspherical harmonics and then a numerical solution of a resultant system of coupled differential equations. We investigate the dependence of energy levels and binding energies of trions on the electric and magnetic fields strength and present trions' binding energies (BE). The dependencies of the BEs of trions in silicene, germanene, and stanene as a function of the electric and magnetic fields are qualitatively similar.

1. I. Filikhin, R. Ya. Kezerashvili, B. Vlacovic, Phys. Rev. D **110**, L031502 (2024).

2. R. Ya. Kezerashvili, S. M. Tsiklauri, A. Dublin, Phys. Rev. B **109**, 085406 (2024).

3. R. Ya. Kezerashvili, S. M. Tsiklauri, A. Spiridonova, Phys. Rev. B **110**, 035425 (2024).

4. R. Ya. Kezerashvili, S. M. Tsiklauri, and A. Spiridonova, Inter. J. Phys. **12**(5), 225 (2024).

49. Ethnic and Race Disparity in Multiple Sclerosis: Trends and High Prevalence in the US

Evans Lespinasse and Subhendra Sarkar /
Department of Radiologic Technology and Medical Imaging

The prevalence and incidence of Multiple Sclerosis (MS) in relation to race and ethnicity in the United States reveal significant disparities and controversies that warrant close attention. Recent studies indicate that MS affects various racial and ethnic groups differently with notable variability in prevalence rates, disease onset and mortality. African Americans and Hispanic people are increasingly diagnosed with MS at higher rates than white counterparts and often experience more severe disease manifestations. These disparities can be attributed to a complex interaction that may involve genetic susceptibility, environmental factors and socio-economic barriers to healthcare access. Cultural stigma and lack of awareness also exacerbate early diagnosis and disease management. Addressing these disparities is essential to achieving health equity and improve health outcomes for marginalized populations. By understanding the intricacies of how race and ethnicity intersect with MS, one may achieve a more inclusive and effective healthcare system. A critical review of plausible sources of disparity is undertaken in this work.

50. The Inside Story of Poultry DNA Disc that Gets Food from Fresh Yolk while in Neutered Store Eggs the DNA Disc Dies Hungry

Subhendra Sarkar¹, Zoya Vinokur¹, Fahameda Hassan¹, Jasper Cheung¹ and Stacey Hernandez²

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Poultry is a valuable ex-ova model for research. Our laboratory has observed structural differences between fresh and shelf stabilized chicken eggs in recent years. Currently we have imaged physiology and function of early stages of hatching of poultry that seems to be the first radiological demonstration of DNA activity in such species. So far, we have adequate evidence that fresh, untreated chicken eggs are more susceptible to toxic medical contrast agents indicating safety concerns about MR and CT procedures on neonates and pregnant patients. In addition, we observed a longer and robust viability of DNA disc and yolk protein communication fibers for first several months for fresh, untreated chicken eggs while the connectivity is short-lived, weaker and broken in neutered shelf stable ones.

51.

Manipulating Harmful Compton Radiation in Composite Filters to Generate Variable X-ray Flux for Imaging Soft Biomaterials: Let Devil Do Some Good

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In our laboratory we are exploring how to benefit from the harmful Compton scattering that produce a large number of secondary electrons with no known utility. In this approach we regenerate weak photon streams from higher energy incident photons by thin cellulose or organic filters and a second composite layer of crystalline salts or salt solutions embedded in porous matrix. Alkali halides in porous matrix offer many nanomaterial advantages including Auger electrons and phonon assisted harmonic generation. These new photon streams have weaker energy and variable flux density due to standing waves depending on composite crystallinity and may be useful for low-dose photon therapy of superficial tumors.



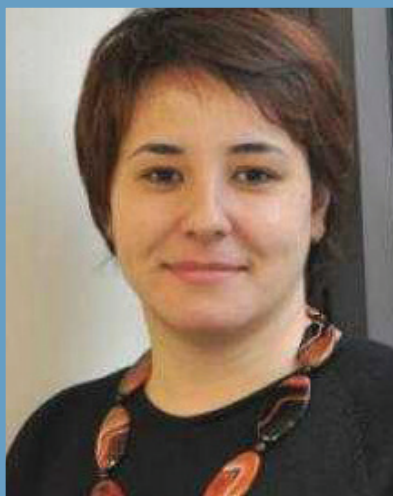
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