University at Buffalo
Louis Stokes Alliance for Minority Participation

LSAMP Summer Program Newsletter, Summer 2024


UB Louis Stokes Alliance for Minority Participation (LSAMP) 2024 Summer Research Interns during the Research Poster Symposium in Davis Hall

The University at Buffalo (UB) School of Engineering and Applied Sciences (SEAS) is pleased to highlight the accomplishments of our **2024 Louis Stokes Alliance for Minority Participation (LSAMP) Summer Research Internship Program**.

LSAMP is funded by the National Science Foundation (NSF) and seeks to increase the number of underrepresented students pursuing degrees in science, technology, engineering, and mathematics (STEM) disciplines. The program funded 12 undergraduates who participated in research internships during a 10-week summer program.

Students spent a minimum of 30 hours per week in the lab under the direction of a UB faculty member. Additional time was spent on “professional skills” and community service activities. Professional skills workshops included *Lab Safety, Dress for Success, Building Your Brand, Graduate School Funding Workshop, Budgeting Your Money, LinkedIn and Resumes, Abstract Bootcamp, Communicating Your Science* and *DISC Training*. The students also toured the Buffalo Niagara Medical Campus, where they participated in a medical device design project and a “Brain Bootcamp.” They also toured the Strong Museum of Play, UB Sustainability GRoW home, and UB Solar Strand. Community Service projects included the Adopt-a-Beach cleanup of Woodlawn Beach State Park, building science kits with young people at the annual Buffalo Juneteenth Celebration, and getting rid of invasive species at Tifft Nature Preserve.

The interns gave oral presentations in front of a national audience at the UCLA McNair *Conference* in Los Angeles, CA. The summer ended with the *UB SEAS Summer Research Symposium*, featuring LSAMP and Research Experiences for Undergraduates (REU) students. All students presented research posters and two LSAMP students joined REU teams for spotlight oral presentations. It was a busy summer filled with exciting research projects, new friends and colleagues, and fun times!

Words from the Director, Dr. Letitia Thomas

It was another wonderful summer! The 2024 LSAMP Summer Research Interns were true to our motto, #WeDoScienceandEngineering!

As a flagship institution in the State University of New York, and member of the Association of American Universities -where much of the federally funded university research that contributes to our economic competitiveness, health, well-being, and national security takes place- it is in our DNA to prepare the next generation of scientists and engineers for global leadership.

Letitia Thomas, PhD
Project Director, LSAMP

LSAMP students are proud to be a part of UB's research legacy, and their research mentors are some of the finest scholars in the country. We are always happy to welcome students from the University of Puerto Rico Cayey to join our summer program, in partnership with Dr. Luis Colon in the UB Department of Chemistry. Through a Sloan Foundation Grant, the students were able to travel to Buffalo for paid research opportunities with UB Faculty.

Students researched a wide variety of topics, including PFAS, radar technology, microplastics, nanofluids, systems engineering, project-based STEM education, and neuromorphic materials. During these ten weeks, we did science, performed service, and gained professional skills. We learned about sustainability, took a nautical science boat tour, and participated in an engineering design project. We traveled to Los Angeles for the UCLA McNair Conference and presented our research in front of a national audience. It was an intense 10 weeks, but the students came, saw, and conquered.

We hope you enjoy our summer program review as much as we enjoyed creating these moments.

2024 LSAMP Summer Research Interns

Student	Major
Nelson Colon Delgado+	Chemistry
Grecia Fabre-Latorre*	Chemistry
Ndeye Fall	Chemical Engineering
Karla García-González*	Chemistry
J'Louis Rafael Gutierrez	Mechanical Engineering
Georges Merisier	Computer Engineering
Natalie Morales Báez*	Chemistry
Kaden Ostrander	Mechanical Engineering
Michael Rodriguez	Electrical Engineering
Amie Sallah	Computer Engineering
Alexis Sill-Ruiz	Chemical Engineering
Khalil Suleman	Mechanical Engineering

+University of Puerto Rico at Mayaguez student
**University of Puerto Rico at Cayey student*

Meet the LSAMP Graduate Assistants

Meet our Research Methods Instructor, Ms. G. Stephanie Otémé

G. Stephanie Otémé, was born and raised in Côte d'Ivoire (Ivory Coast) West Africa. She began her academic journey by earning a BS in Biology with a minor in Toxicology from Nazareth University in 2016. Driven by a passion for science and innovation, she earned an MS in Pharmaceutical Sciences from the University at Buffalo in 2019. Continuing her academic journey, she returned to the University at Buffalo, where she is currently pursuing a doctorate in Materials Design and Innovation (MDI) under the guidance of Dr. Nalam and Dr. Dai in the Department of Chemical, Structural, and Environmental Engineering (CSEE). Now in her fourth year of the program, her research combines experimental techniques like Quartz Crystal Microbalance (QCM) and Atomic Force Microscopy (AFM) with molecular dynamics (MD) simulations to investigate the near-surface interactions between Per-and-polyfluoroalkyl (PFAS) molecules and chemically engineered model surfaces.

Stephanie Otémé, PhD Candidate
Research Methods Instructor

In addition to her research, she is passionate about working with high school students interested in pursuing a STEM degree and undergraduate students considering graduate school. This year marked her first time as an instructor for the Louis Stokes Alliance for Minority Participation (LSAMP) Program's research methods course. Through this program, she helped undergraduate students refine their technical presentation skills and provided insights into the life of a graduate student. An avid crafter and baker, she is often found working on handmade trinkets or testing recipes for delicious holiday treats when not engaged in research or academics.

Meet our Research Methods Instructor, Mr. Alec Pitter

Alec Pitter, PhD Candidate
Research Methods Instructor

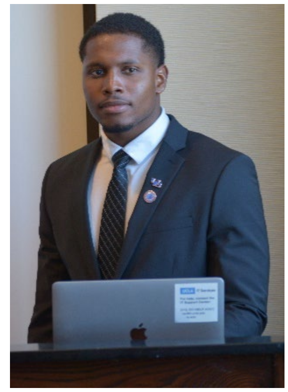
Alec Pitter, born and raised in the Bronx, earned his BS in Chemistry from the University at Buffalo in 2021. Alex is a proud LSAMP Alum and participated in the summer program in 2020. Continuing his academic journey, he is currently pursuing a Chemistry doctorate under the guidance of Dr. Martin Trebbin and Dr. Janet Morrow. He is now in his third year of the doctoral program focusing on synthesizing enhanced nanoparticles for Magnetic Resonance Imaging (MRI) using microfluidics and microwave heating. His research also includes an emerging proficiency in characterizing Small-Angle X-ray Scattering (SAXS) materials.

In addition to Alec's research experiments, he is passionate about working with underrepresented undergraduate groups. This past summer marked his third time as an instructor for the LSAMP research methods course. During this experience, he had the opportunity to guide undergraduates in crafting research posters and PowerPoint presentations while providing valuable insights into graduate school. You will often find him on the basketball court when he is not engaged in the lab or classroom.

Meet our LSAMP Student Assistant, Mr. Georges Merisier

Georges Mersier was born in Boston, MA, and raised in Haiti. He returned to the United States to complete high school and pursue higher education. He will graduate with a bachelor's degree in computer engineering in December 2024 and plans to immediately begin a master's program in electrical engineering, focusing on the Internet of Things (IoT).

Georges is actively engaged in campus activities and has participated in research through the LSAMP program on two occasions. His first research experience was with CHREST, where he led a project to improve combustion simulation using PyKokkos and TChem. This past summer, he conducted research with the Drones Lab, working on a PCB board for a low-frequency radar device designed to detect internal structural damage without the need for physical intervention. These experiences were not only intellectually stimulating but also provided opportunities to collaborate with individuals from diverse backgrounds and cultures. Georges is an avid soccer (football) fan and enjoys working out at the gym.



Georges Merisier, BS Candidate
LSAMP Student Assistant

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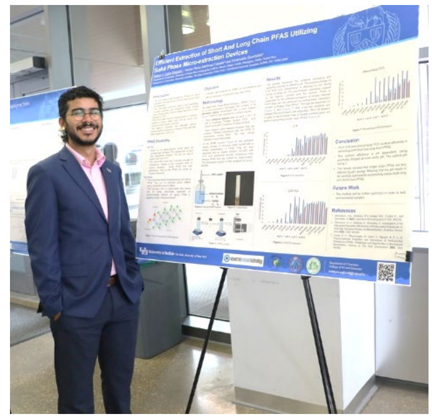
UCLA McNair Conference

Buffalo Museum of Science

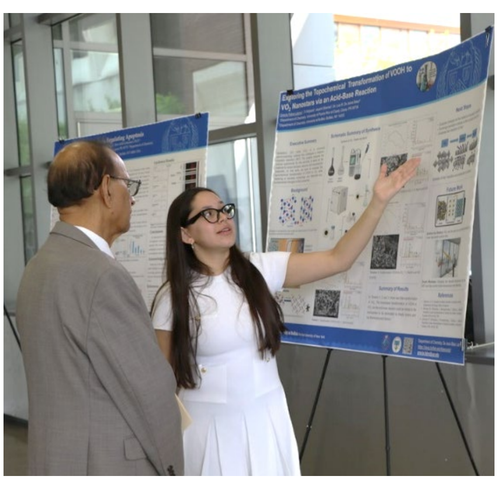
Efficient Extraction of Short and Long Chain Perfluoroalkyl Substances (PFAS) Using Cationic Sorbents Immobilized on Solid Phase Microextraction Devices

Nelson Delgado
***Major**: Chemistry*
***Mentors:** Dr. Emanuela Gionfriddo & Hector Martinez Perez Cejuela*



Per- and polyfluoroalkyl substances (PFAS) are highly persistent chemicals known for their resistance to heat and degradation. This persistence is due to their strong carbon-fluorine bonds, which are also symmetrically arranged, making them hydrophobic. Many PFAS are negatively ionized at environmental pH due to their hydrophilic moiety. PFAS are found to bioaccumulate in humans, leading to health risks such as cancer and reduced immune system function, among others. Despite their numerous health effects PFAS are commonly used in food packaging, non-stick cookware, firefighting foams, etc., resulting in daily human exposure. In this research three sorbents' particles with cationic properties are evaluated for their efficiency in extracting 15 anionic PFAS with alkyl chain length from C4 to C14. The sorbents are based on silica functionalized with C18, PCS (Positively Charged Sorbent) C18 and phenyl-hexyl PCS and have a diameter of 2.7 µm. These functional groups can establish different interactions with PFAS through their hydrophobic tail and hydrophilic heads. Electrostatic interactions are the main drivers of the extraction process. The method utilized for extraction is called solid phase microextraction (SPME), a preconcentration technique which allows the separation of PFAS from complex environmental samples and biofluids. After extraction, chromatographic separation and detection is performed with liquid chromatography tandem mass spectrometry. Our aim is to develop an efficient extraction method for both long and shorter chain PFAS, since environmental samples are often contaminated with mixtures of PFAS, and it is necessary to simultaneously extract them with one quick, fast, and environmentally friendly method.

Grecia Fabre Latorre
***Major**: Chemistry*
***Mentors:** Dr. Luis De Jesús Báez & Jayanti Sharma*



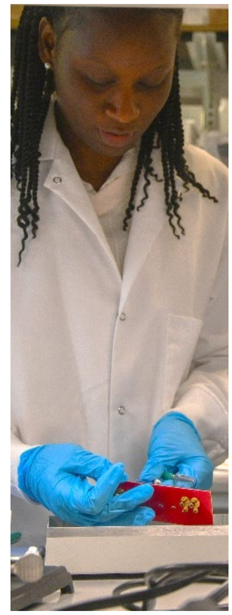
Exploring The Topochemical Transformation of VOOH to VO2 Nanostars via an Acid-Base Reaction

Abstract: Vanadium (IV) oxide (VO_2) is a canonical semiconducting material that undergoes a metal-to-insulator transition (MIT). This property presents the unique opportunity for this structure to serve as the material for smart windows, sensors, and neuromorphic materials. For this, control over the temperature range and hysteresis width where the MIT occurs is of great interest due to its direct relationship to the application. Approaches that include substitutional doping with several transition-metals, stabilizing ultrasmall particles (1-2 nm of width), and morphology changes have demonstrated to serve as a synthetic knob to tailor the MIT. The De Jesús Báez lab has recently developed a synthetic route for non-conventional morphologies (clustered rods and nanostars) of VOOH, a protonated structure of VO_2. In this work, we seek to elucidate the mechanism of transformation of VOOH to VO_2 by reacting VOOH with a base. We hypothesize that by exposing VOOH to a base, we are able to retain the morphology from VOOH and effectively transform the material to VO_2.

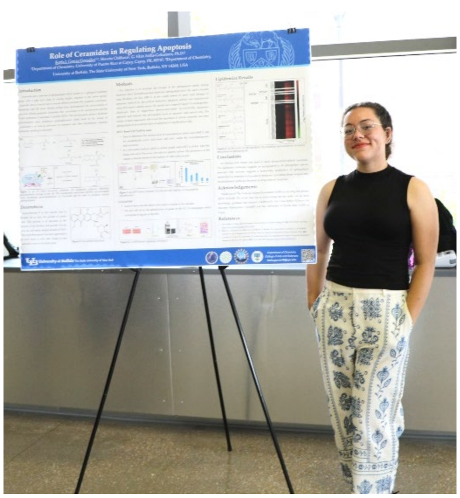
Dielectrophoretic enrichment and electrochemical detection of microplastics in drinking water

Ndeye Fall
***Major**: Chemical Engineering*
***Mentors:** Dr. Thomas Thundat & Gayatri Ranade*

Microplastics pose multiple health and environmental risks due to their presence in resources such as drinking water. In addition, the increasing amount of plastic waste entering the oceans is resulting in adverse effects such as climate change. Selectively detecting and sorting microplastics still remains a challenge. Here, we aim to conduct studies using Dielectrophoresis (DEP) enrichment and Electrochemical sensing towards the development of a sensor system for detecting microplastics in drinking water. Dielectrophoresis experiments function as a pre-concentrator to manipulate the presence of microplastics in water based on their response to a non-uniform electric field. We will also explore the use of different electrode geometries and dielectric properties for the pre-concentration studies. Electrochemical detection using spectroscopic techniques like Electrochemical Impedance Spectroscopy (EIS) will be conducted based on the pre-concentration studies leading towards the development of label-free detection of microplastics. This novel method of combining two different techniques can lead to the development of a unique sensor platform using various electrode configurations to detect presence of microplastics selectively. In addition, this sensing technique can also be used as a bio-sensor platform for detecting microplastics beyond just drinking water but also presence of microplastics and other harmful bio-particles in human blood.



Karla García-González
***Major**: Chemistry*
***Mentors:** Dr. G. Ekin Atilla-Gokcumen & Shweta Chitkara*



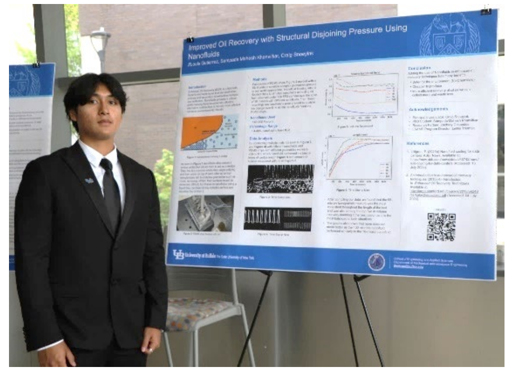
Role of Ceramide in Regulating Apoptosis

Ceramides are a subclass of sphingolipids which consist of a sphingoid backbone along with a fatty acid chain of varying lengths, attached at the amino group. Ceramides serve a crucial role in various cellular processes like apoptosis, senescence, autophagy, and ER stress. Several studies have demonstrated the accumulation of ceramide during apoptosis. Ceramides that accumulate at the mitochondria activate B-cell lymphoma 2 associated X protein (BAX). This pro-apoptotic protein facilitates mitochondrial outer membrane permeabilization which leads to the release of cytochrome c as well as activation of caspase-9 and other downstream caspases, ultimately resulting in cell death. Our objective is to elucidate the changes in the sphingolipid family during apoptosis. We will use a human lung fibroblast cell line, MRC-5, as the model system to study lipid changes in apoptosis, induced by doxorubicin treatment. Apoptotic activity will be characterized using MTT-based viability assays and Western blotting. We will conduct a targeted Liquid Chromatography-Quadruple Time of Flight-Mass Spectrometry-based (LC-QToF-MS) lipidomics approach and compare the sphingolipid levels in apoptotic and control cells. The results of these experiments will reveal the regulation of cellular ceramide and other sphingolipids in doxorubicin-induced apoptosis in lung fibroblast cells.

Improved Oil Recovery with Structural Disjoining Pressure Using Nanofluids

J'Louis Gutierrez
***Major**: Mechanical Engineering*
***Mentors:** Dr. Craig Snoeyink & Sampada Mahesh Khanvilkar*

Current enhanced oil recovery methods lack effectiveness in retrieving oil and care for the environment. Despite this, the development of a cleaner, more efficient alternative has been limited. Currently, enhanced oil recovery methods include thermal recovery methods that involve the flowing of heated gas typically CO_2 into an oil reservoir to lower the viscosity and increase its flow or a chemical approach that uses surfactants and polymers to reduce surface tension. Both these methods involve the usage of a brine that can contaminate the environment such as contaminating drinking water supplies with heavy metals. Nanofluids are an effective method for oil removal in porous media that can improve enhanced oil recovery or remediation with significantly less environmental damage. Nanofluids possess a unique ability to concentrate at contact lines and produce pressure called structural disjoining pressure that allows for oil to be removed from complex low permeability geometries that cannot be reached with current Enhanced Oil Recovery (EOR) methods. By enhancing the structural disjoining pressure created by nanofluids, nanofluid efficiency for oil recovery can be drastically improved offering a cleaner more efficient EOR method. Beyond this, due to its efficiency in complex geometries, its application can be expanded to clean deep intricate three-dimensional designs.



Georges Merisier
***Major**: Computer Engineering*
***Mentors:** Dr. Karthik Dantu & Dr. Roshan Ayyalasomayajula*

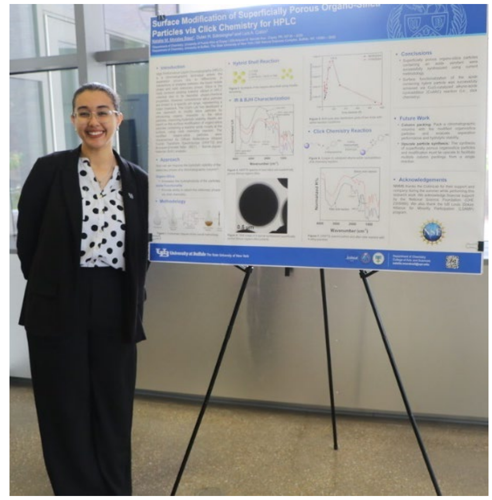
Radar device capable of detecting internal wall damage

Earthquakes can cause severe damage to the general configuration of various buildings, including their inner framework. Being that such a reality may or may not be apparent from the outside, when concealed the damages can lead to injuries or even fatalities if not properly identified and repaired. This research project aims to develop a radar device capable of scanning the interior of walls to detect hidden structural damage without causing any physical harm to the walls. The inspiration for this research comes from Vital-Radio, a device that tracks breathing and heartbeats without physical contact using FMCW (Frequency Modulated Carrier Waves) radar technology. Vital-Radio transmits a low-power wireless signal and measures the reflection time to monitor minute movements. Similarly, this new radar system will transmit wireless signals and analyze the reflected signals to identify structural anomalies within walls. This innovative device will be particularly beneficial during the construction and inspection of houses, ensuring that all walls are intact and structurally sound. By providing a non-invasive method for internal wall inspection, this radar device will enhance safety and efficiency in building maintenance and construction.

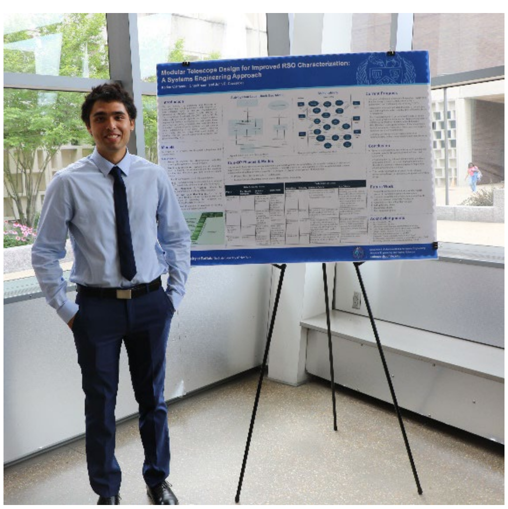
Surface Modification of Superficially Porous Organo-Silica Particles via Click Chemistry for HPLC

Natalie Morales Báez
***Major**: Chemistry*
***Mentors:** Dr. Luis Colon & Dulan H. Edirisinghe*

Silica is one of the most investigated packing materials in High-Performance Liquid Chromatography (HPLC) column technology due to its favorable chemical and physical properties. Traditionally, the inorganic silica support is chemically modified at the surface to introduce chemistries for chromatographic applications. However, the application of stationary phases attached with siloxane bonds to inorganic silica for chromatographic separations is limited due to poor hydrolytic stability at low (< pH 2) and high (> pH 8) pH levels. Superficially porous silica is ideal for analytical separations because it has adequate loading capacity and a shorter flow path through the particle. The incorporation of radially oriented pores (ROP) further improves separation efficiency. In this study, the development of superficially porous silica with an organo-silica shell and ROP was investigated as a potentially highly hydrolytically stable packing material. This was achieved by incorporating propyl azide functionalities into the otherwise inorganic silica shell to add organic character. Additionally, the azide groups on the surface could be used to attach a stationary phase to the particle surface using the well-established Cu(I)-catalyzed azide−alkyne cycloaddition (CuAAC) reaction, commonly known as click chemistry, instead of conventional salinization to obtain improved hydrolytic stability. These particles will be packed into stainless steel columns and studied for their hydrolytic stability under extreme pH conditions.



Kaden Ostrander
***Major**: Mechanical Engineering*
***Mentors:** Dr. John Crassidis & Chet Knoer*



Modular Telescope Design for Improved RSO Characterization: A Systems Engineering Approach

Light curves, which represent the time-history of photometric brightness, have been shown to enable the estimation of various characteristics of spacecraft, Resident Space Objects (RSOs), and debris. Light curves can be used to characterize attitude, shape, surface roughness, size, surface materials, and angular rate. The primary objective of this research is to enhance the characterization of RSOs using both polarized and unpolarized light data. Despite the potential benefits, few studies have tackled the comprehensive challenge of simultaneously estimating multiple attributes of an RSO without relying on a priori information, such as an initial estimate or complete material composition. This study aims to utilize the systems engineering model to design, develop, and fabricate a telescope capable of tracking space objects with known characteristics to use as a scientific control to improve estimation methods. Both polarized and unpolarized light data will be collected to estimate characteristics. This research outlines the preliminary design of a modular polarized and unpolarized light collection telescope.

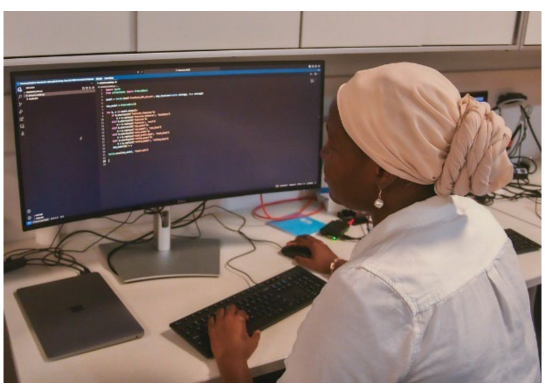
Racing Towards Autonomy: How scaled autonomous racecars are a testbed for autonomous vehicle technology

Michael Rodriguez
Major: *Electrical Engineering*
Mentors**: **Dr. Karthik Dantu & Charuvarahan Adhivarahan

The development of self-driving vehicles can be accelerated through autonomous vehicle racing competitions, which will yield new strategies and algorithms for operating a vehicle in high performance, racetrack settings. This will translate into better performance for autonomous vehicles on the road – for instance, when evasive maneuvers must be used to avoid a collision due to other drivers, or road conditions. The F1Tenth race is one example of such autonomous racing competitions and is the focus of this presentation.

How can Object Tracking be Optimized for Fast and Reliable Performance on Power-Constrained Devices?

Amie J. Sallah
Major: *Computer Engineering*
Mentor: Dr. Jinjun Xiong & Amir Nassereldine



In recent years, the demand for efficient and reliable object tracking on power-constrained devices has significantly increased, driven by the proliferation of applications in surveillance, autonomous vehicles, and robotics. This research investigates methods to enhance object tracking performance on low-power devices, such as the Raspberry Pi and Jetson Nano, which are commonly used in edge computing environments. The study explores the implementation and optimization of various tracking algorithms and models, including Kernelized Correlation Filters and Siamese Neural Networks, with a focus on balancing accuracy, speed, and power consumption. This research is identifying critical factors that influence tracking performance while exploring both novel and established strategies for algorithmic or model adjustments and efficient hardware utilization. The aim is to enable efficient tracking while conserving power. This work aims to contribute to the development of robust and scalable object tracking solutions tailored for resource-constrained platforms, with the ultimate goal of facilitating their broader adoption in various real-world applications.

Title: Detection of PFAS in Microplastic Carriers Using Stand-Off PCDS

Alexis Sill-Ruiz
***Major**: Chemical Engineering*
***Mentors:** Dr. Thomas Thundat & Dr. Yaoli Zhao*

As our society becomes ever more dependent on disposable plastic products, plastic pollution has become one of the most prioritized challenges humanity has ever been forced to address. Over the course of 75 years from 1950 to 2015, plastic production increased by almost 19,000 percent from 2.3 million to 448 million tons. It is projected that plastic production will continue to increase to an estimated 896 million tons by 2050, with only an 8.7 percent recycling rate as of 2023. The remaining unrecycled plastic finds its way into landfills and water bodies, breaking down into tiny particles known as microplastics. Because plastics are highly resistance to decomposition, microplastics build up in soil, local water bodies, and inside the bodies of living things. Microplastics also serve as pre-concentrator carriers for even more toxic chemicals, such as per- and polyfluoroalkyl substances (PFAS). PFAS exposure has been linked to cancer, immune system defects, and child developmental problems. In recent years, chemical sensing using photothermal cantilever deflection spectroscopy (PCDS) has gained traction because of its high sensitivity and high chemoselectivity. PCDS exploits the nonradioactive decay process of infrared light adsorption of matter, providing the ability to molecularly identify unknown target analytes. This work will demonstrate the ability of stand-off PCDS to chemically identify PFAS being carried in micro- and nanoplastics in solution.

Khalil Suleman
***Major**: Mechanical Engineering*
***Mentors:** Dr. John Crassidis & Chet Knoer*

Utilizing High-Altitude Balloons to Enhance STEM Education and Near-Space Research

The University at Buffalo Nanosatellite Laboratory (UBNL), established in 2011 under Dr. John Crassidis, is a collaborative group led by volunteer graduate and undergraduate students. UBNL focuses on building small satellites from concept to launch. To train undergraduates for these missions, they go through a program called the Short Cycle Lab (SCL). In the SCL students engage in projects including mobile ground stations and high-altitude balloons with a variety of scientific payloads. Through hands-on experiences with hardware and software, students are introduced to systems engineering and the basics of every subsystem in nanosat missions. The context of this research lies in the challenge of engaging high school students in STEM, particularly in systems engineering and nanosatellite technology. UBNL's program addresses this by providing constructive, hands-on learning experiences that bridge classroom knowledge with practical application. The motivation behind this program is to both identify effective educational strategies for increasing high school students' interest in CubeSat technology and to equip them with the skills and knowledge necessary for success in this field. By offering practical experience in systems engineering, the program aims to inspire genuine passion for STEM and to enhance collaborative and technical abilities. The hypothesis assumes that hands-on, project-based learning will lead to higher engagement levels and a deeper understanding of systems engineering. To explore this, the research employs a mixed-method approach, combining quantitative and qualitative methods. Data collection includes surveys and project/workshop evaluations to measure student engagement, understanding, and overall effectiveness of the educational strategies utilized within the program.

LSAMP Summer Research Program Events

LSAMP Students visit UB's GRoW Home & Solar Strand to learn more about sustainability issues

LSAMP Summer Research Program Events



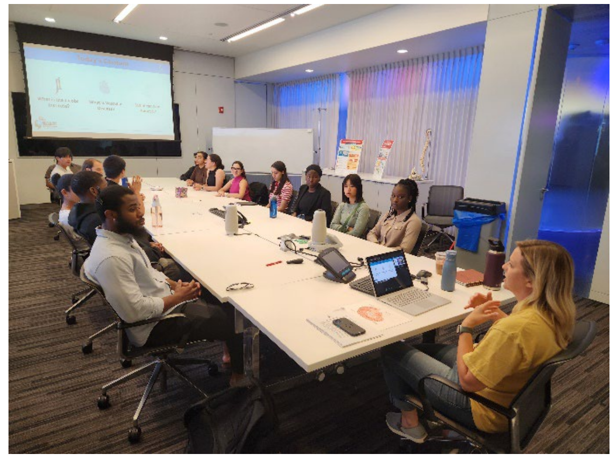
Taking Public Transportation to Canalside



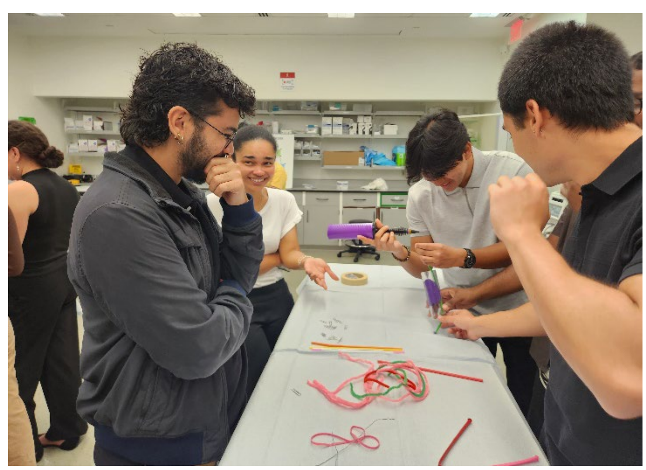


Nautical Science Tour on the Buffalo River

Buffalo Niagara Medical Campus Tour



Jacobs Institute Brain Bootcamp



Tifft Nature Preserve Community Service

LSAMP clear cattails invasive species at Tifft Nature Preserve

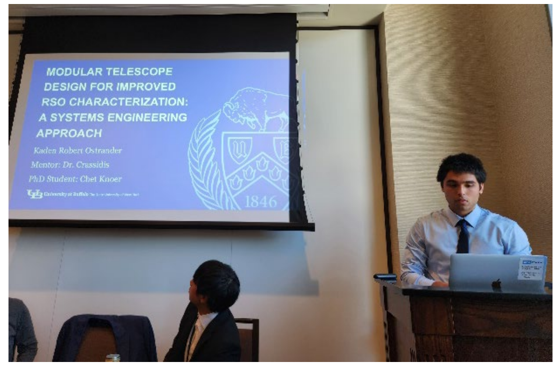
Professional Skills Retreat, Buffalo Museum of Science

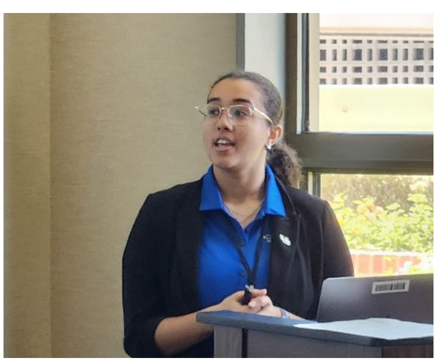
Juneteenth Community Service

Strong National Museum of Play

UCLA McNair Research Conference

UCLA McNair Research Conference





Adopt-a-Beach Cleanup at Woodlawn Beach

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