LaSPACE Fall 2022 Council Meeting Student Poster Abstracts

"Undertaking Heliophysics & Python as an Absolute Beginner"

Jabriel Alshehabi | Delgado Community College | MUREP, MISTC, NASA-GSFC | Poster # 29

Knowledge in the methods, procedures, and tools that contractors and civil servants use in conducting research can greatly contribute to the innovation process. In science, technology, engineering and math, the rapid advancements have created a wide range of disciplines and fields of study. In relatable fields, co-ops can create opportunities to propel scientific research. A quality contributor will continually learn about all the tools available to maximize the potential results. In return, the ability to educate and engage others with these tools creates more routes for growth. Selected for Goddard Space Flight Center of the National Aeronautics and Space Administration as part of the Heliophysics Mission Directorate, studying the sun, its atmospheric effects on earth and the universe. That's not even scratching the corona. Data science is a significant factor in the research, and can be outputted in models to investigate solar behavior. Within the division, the Heliophysics Innovation Lab at Goddard provides in-reach and access to state-of-the-art tools. Technologies for 3D printing and circuits and systems to create models with virtual or augmented reality are available. Accessibility to the lab for all can dynamically improve the creative approach. For my internship I was constrained to the principles of data science and learning about instrumentation. To contribute and investigate solar data I needed to learn how to use Python and what Heliophysics entailed. I was an absolute beginner but prepared to undertake this challenge. I enlisted in an extensive bootcamp and successfully managed to progress my skills to manipulate datasets with Pandas and generate simple executable code. Then creating visual models in two- and three-dimensional planes using Jupyter Notebook, Visual Python, Matplotlib, and Plotly. Next, instrumentation onboard various satellites were studied, and I filtered among the indices provided by the Space Weather Portal. Of those, the Advanced Composite Explorer carries a plethora of instruments and the Solar Wind Electron Proton Alpha Monitor provides suitable data to work within Python. I wanted to capture data locally and create the same results with methods learned in the first half of the internship, so I prototyped a weather station. I focused on getting a wide perspective on everything that Heliophysics and data science encompasses.

"NASA STUDENT LAUNCH DESIGN TEAM (USLI): Designing a High-Power Rocket for Space Exploration"

Zachary Bastian | Dillard University | LaSPACE SAFOS | Poster # 30

The design and building of high-power rockets offer excellent opportunities for undergraduate students to have hands-on experience in aerospace science and research. NASA is interested in this newest generation of undergraduate "space explorers," notably the Artemis Generation. This project involves our team participating in the NASA Student Launch Design Division, one of seven Artemis Student Challenges whose mission is to build foundational knowledge and introduce students to topics, techniques, and technologies critical to the success of the agency's Artemis program. For this challenge, we designed and simulated a high-powered rocket with three different scientific payloads.

The design of the rocket "Blue Devil" is presented, and the results of the launch vehicle were made through advanced simulation runs that allowed the team to gain data without having to launch a live flight. The results for the measured targeted apogee of 6,000 ft. come directly from "RockSim," a computer program that lets the user construct any size rocket and then simulate its flight to see how high and fast it can go. Furthermore, the impact of the lightweight fiberglass material versus other materials on the rocket design presents a tremendous advantage.

"NASA STUDENT LAUNCH DESIGN TEAM (USLI): High-Powered Launch Vehicle Payload Specifics"

Alana Bell | Dillard University | LaSPACE SAFOS | Poster # 31

The design and building of high-power rockets offer excellent opportunities for undergraduate students to have hands-on experience in aerospace science and research. NASA is interested in this newest generation of undergraduate "space explorers," notably the Artemis Generation. This project involves our team participating in the NASA Student Launch Design Division, one of seven Artemis Student Challenges whose mission is to build foundational knowledge and introduce students to topics, techniques,

and technologies critical to the success of the agency's Artemis program. For this challenge, we designed and simulated a high-powered rocket with three different scientific payloads.

"Development of Electromagnetic Levitation System for Containerless Thermophysical Property Data Collection of Metallic Samples"

Kane Bergeron | UL Lafayette | LaSPACE REA| Poster # 18

As the first launch of NASA's Artemis program nears the need for in-situ material manufacturing and testing methods is of growing need. Materials testing that utilizes the benefits of the lower gravity associated with an in-space environment should be utilized as the path toward the advancement of material technologies. Electromagnetic levitation provides such a method that can be utilized to characterize materials that can be derived from lunar regolith in support of NASA's "make it don't take it" initiative. The development of these capabilities accompanied by the potential of 3D printed coil designs can improve the overall efficiency and sizing of the coils associated with electromagnetic levitation and induction heating of materials. Literature review and results from testing of preliminary coil designs have shown promise in obtaining an optimal shape for the levitation and heating of metallic samples.

"Construction of a small dissolved methane sensor for rapid measurements in bioreactor systems"

Robert Bertrand | UL Lafayette | LaSPACE GSRA | Poster # 6

Currently, the International Space Station (ISS) recycles human gas, liquid, and solid waste via the Environmental Control and Life Support System (ECLSS). A Sabatier reaction is used to produce water and methane from hydrogen and carbon dioxide, and vents produced methane overboard. In the interest of a truly closed-loop recovery system for the ECLSS, methane-consuming bacteria have been investigated as a method of fixing and recycling the much-needed carbon, especially for long-haul space flights to Mars or beyond. Dissolved methane is a critical parameter for these bioreactors, yet commercially available sensors are large and designed for deep-sea measurements. Since every inch and every ounce is precious in space travel, a sensor was developed to measure dissolved methane which resulted in a sensor which could be made as small as 4 inches long and 1 inch in diameter, requiring only detection circuits and on-board systems beyond the physical construction. The sensor used a thin silicone membrane which dissolved methane dissolves through, where it is then flushed with nitrogen. The semiconductor sensor is highly selective for methane, and data collection was performed with an Arduino. Changing gas conditions resulted in detailed sensor responsiveness, with an accuracy of 0.088 mmol/L dissolved methane in a bubble column. Mass transfer studies were performed to measure volumetric mass transfer coefficient (kLa), which resulted in a value of 37.8±2.2 hr-1, which is similar to other results from bubble column mass transfer studies. The sensor as built is accurate, small, and rapid; given further development it could be useful in long-haul space flight as a component of a methanotrophic bioreactor system.

"Development of Scintillation Materials Based on Metal-Organic Compounds"

Deepthi Chappidi |Treylan Steveson | LaTech | LaSPACE REA | Poster # 10

As NASA begins focusing on missions into deep space, the presence of ionizing radiation is a hazard to both instrumentation and to the health of the crew. In order to detect the different radiation types while in space-flight, scintillation detectors must be used to detect and measure the amount of ionizing radiation. Using plastic scintillators is ideal because of their low-cost, low mass, and ability to be fabricated into a variety of shapes. We have developed luminescent lanthanide complexes that can be doped into these polymers (~1%wt/wt) of polymethyl methacrylate (PMMA). These lanthanide complexes contain organic ligands that have two roles: 1) to act as an antenna to harvest light for emission and 2) to allow for solubility in the monomer methyl methacrylate (MMA). All complexes doped into polymers are characterized by Fourier Transform Infrared Spectroscopy (FTIR), nuclear magnetic spectroscopy (NMR), and powder and single crystal x-ray diffraction (XRD), and differential scanning calorimetry (DSC) to determine thermal properties. These complexes have high decomposition temperatures allowing for facile curing in MMA. Much of our work has focused on europium and terbium complexes. However, for coupling to photomultiplier tubes (PMTs), an emission wavelength of 420 nm is optimal (blue-cyan), we have developed several yttrium-based complexes that luminesce at the optimal emission

wavelength. More recently, we have focused on complexes with short emission lifetimes and have begun preparing blue-green emitting cerium complexes. Our progress in preparing these compounds and their optical properties will be presented.

"Measuring the Air Quality of the Atmosphere via a Balloon Payload"

Jailyn Davis | Brandon Grayol | Damion Harrison | Dillard | LaSPACE SAFOS | Poster # 12

Air Pollutants are the contaminants in the atmosphere that are harmful to either the environment, humans or both. According to the Environmental Protection Agency(EPA) the five major air pollutants are listed as: ground level ozone, particulate matter, carbon monoxide, sulfur dioxide, and nitrogen dioxide. To measure the amounts of these pollutants in the air as well as the safety of the air for humans to breathe, government agencies use the air quality index(AQI). The AQI has an index of 0 to 500, and as more contaminants enter the atmosphere, the number rises. In order to test the air quality in different areas, a balloon payload will be created with a air quality monitor inside to determine the amount and types of particulates in the area. Using this information, we will be able to discern the type of particulates in the air as well as how severe the issue of air pollution is.

"In vitro Biocompatibility of Chitosan-Genipin Hydrogels for Wound Healing"

Reagan Edwards | LaTech | LaSPACE LURA | Poster # 2

Chronic wounds such as radiation burns are likely to occur to astronauts in a vacuum space. If these wounds are not treated properly, it could lead to microbial growth causing infections that would yield unnecessary costs for NASA. The purpose of this project is to improve astronaut care by creating a proactive, antibacterial, wound-healing scaffold by using hydrogel networks - specifically chitosan-genipin hydrogels. Chitosan hydrogels combine the natural polymer, chitosan, which is biocompatible and has beneficial hemostatic and antibacterial properties, with the superabsorbent nature of hydrogels, creating a multifunctional wound dressing platform. Previously, our group has worked on synthesis and characterization of hydrogel biomaterials capable of promoting cell attachment and growth as well as controlled release of anti-bacterial agents. Building upon this research, we seek to optimize a proactive biomaterial capable of inhibiting bacterial growth while also promoting wound healing. We looked at two differently synthesized chitosan-genipin hydrogels: a super-absorbent slow frozen, lyophilized hydrogel and an injectable in situ crosslinking hydrogel. Slow frozen chitosan-genipin hydrogels have large and densely populated pores which are ideal for absorbing wound exudate and enable cell infiltration for cell attachment and re-growth at the wound site. The injectable hydrogels will allow for a faster and seamless application of the hydrogel into the wound site, decreasing the opportunity for bacterial infection. For both hydrogel types we evaluated the in vitro antibacterial and biocompatibility activity. Overall, these hydrogel scaffolds will help develop more efficient and cost-effective wound healing applications to treat chronic wounds in space.

"Ligand and optical spectra from InP-ZnS quantum dots"

Hillary English | Grambling | LaSPACE HIS | Poster # 3

In bio-medical applications, colloidal quantum dots (QDs) have many useful properties such as high brightness, relative stability, and color turnability compared to conventional bio-marker such as dye molecules. Typical colloidal QDs consist of core, shell, and the outermost layer of ligands. In our experiments, we obtained spectral data from QDs of two different types of ligands: Oleylamine and Oleic Acid. The spectra data from InP/ZnS QDs indicates that the ligand has impacts on the shape of spectra. Furthermore, our results show that the different ligands have different intensity degradation of the QD fluorescence. In the presentation, we will discuss how the ligands affect the emission spectra from InP/ZnS QDs along with the dependence of intensity degradation of the fluorescent spectra on the type of ligand. This project is funded by NASA LaSPACE, NSF PREM program and NSF-CIMM seed grants.

"Hardware System for Tracking Head Kinematics using UHF RFID"

Guilherme Figueiredo | LaTech | NASA EPSCoR RID RAP / R3 | Poster # 25

There is a need to improve astronauts space suits, to better monitor their performance, safety, and health. Issues such as the wired nature of sensor/central suit avionics system communication, the irritation during extra vehicular activity (EVA) and head or neck injuries due to stress need to be addressed. We developed a sensor based on Radio Frequency Identification (RFID) that is wireless and battery free, to measure head kinematics. A backpack metal frame was constructed to hold the antenna setup, to simulate an

astronaut's portable life support system. The system uses two linear polarized antennas, three orthogonally placed commercial RFID tags, a reader, an inertial measurement unit (IMU), and software for data extraction. The setup shows how the rotation and change in the position of the tags affects the received signal strength indicator (RSSI). Head, pitch, and roll were measured including both extremes for each position, as well as control. The RFID sensor proved to be valid for static positions, but the predictability declined when full head motions were tested.

"Evaluation of Zirconium Additives to the Mechanical Properties of NASA GRCop-42 using Open-Source Elevated Temperature Digital Image Correlation"

Abdel Garbie | UL Lafayette| LaSPACE REA | Poster # 21

As the Artemis Program commences with NASA's Space Launch System at its core, the utilization of the RS-25 engines to power NASA's new exploration class rocket will be greatly expanded since its last use in 2011 with the last space shuttle launch. High-heat-flux copper alloys such as NASA-developed GRCop, a copper-chrome-niobium alloy, are developed for the harsh environments expected inside the combustion chamber of the vigorous engine. However, the enabling of wall thinning and in-built cooling channels because of metal additive manufacturing would require materials with stronger mechanical properties than the currently available with NARLoy-Z and NASA GRCop. Furthermore, GRCop, while sufficient at room temperatures, would thoroughly require an increase in the mechanical performance at elevated temperatures to meet future demands. As such, in this study, elevated temperature tensile behavior was the focus of improvement, by the introduction of major zirconium additives into the composition of GRCop-42. ULCop-42Z were evaluated using a high-temperature digital image correlation technique that was developed from the ground up to be flexible, modular and open-source. Using off the shelf components, a Blue-Light DIC apparatus was assembled and evaluated. With the use of monochromatic light illumination and bandpass filters, the thermal radiation emitted from the heated specimen were accounted for, keeping the grey level of the image acquisition constant throughout the procedure. Due to the elevated temperature testing protocol of ULCop-42Z, high temperature high emissivity coatings were employed to provide for an artificial speckle pattern, where the patterns' grayscale were evaluated to ensure continuous deformation tracking throughout the experimental procedure.

"Printability and Performance Evaluation of Sulfur Concrete for Planetary Construction 3D Printing (C3DP)"

Ilerioluwa Giwa | LSU | LaSPACE REA | Poster # 13

To establish a sustained presence of humans on Moon and Mars, supporting infrastructures (i.e., base, hangers, landing/launch pads, protective shields, etc.) are needed for protection against extreme conditions prevalent on these celestial bodies. Through the Artemis missions, NASA will be testing technologies on the Moon in preparation for other complex missions to Mars and deep space. Construction 3D printing (C3DP) which was originally conceived for terrestrial application has been identified as a key construction technology which can eliminate safety risks associated with laborious manned construction operations in deep space. Furthermore, traditional terrestrial construction materials like concrete which are well understood are infeasible for planetary construction since the major ingredients are difficult to obtain and water is considered a precious material that should be utilized for other life-supporting processes. Sulfur concrete presents an attractive choice given that it is waterless and can be recycled. As a basis to gain more insights into the performance of sulfur concrete printed using extrusion-based C3DP, this study evaluates the printability and properties of 3D-printed sulfur concrete. Early experimental results show that sulfur concrete can be successfully 3D printed by carefully tailoring the mixture proportions and extrusion process parameters. Experimental results on the effect of various factors i.e., temperature, cooling rate, interlayer printing time gap, and fiber addition, on the printability and properties of 3D-printed sulfur concrete will be presented and discussed.

"Ultrasonically determined elastic constants of additively manufactured 316L stainless steel"

Mason Hayward | UL Lafayette | LaSPACE GSRA | Poster # 28

We determined the effect of laser speed on the elastic constants of additively manufactured (AM) 316L stainless steel using resonant ultrasound spectroscopy (RUS). The alloy (316L) has biomechanical applications, such as medical implants. AM disks were manufactured at a constant power of 100 W and varying laser speeds of 800, 1000, and 1200 mm/s. RUS samples were extracted

from the disks to determine the effects of fabrication parameters on elastic constants, as well as variations in properties across a single disk. As laser speed increases, the longitudinal (c) moduli decreases from 284.74 GPa to 226.84 GPa, while the shear (c) moduli exhibits minimal change. The measurement error in both moduli increases as laser speed decreases, which is attributed to the textured polycrystal nature of the samples built at lower speed. At lower speed, a greater amount of energy is deposited within the volume, allowing grains more time to grow. The grain structure determined by electron backscatter diffraction shows large crystallite formations in the 800 mm/s sample while the 1200 mm/s sample shows more homogenous small-grain distribution, which is expected of an ideal polycrystal. Variations of properties across the disk will also be presented.

"Automatic spectroscopic data collection via LabVIEW coding"

Nicholas Hornsby | Grambling | LaSPACE HIS| Poster # 16

Automatic data collection is vital for today's cutting-edge research. We have successfully developed and implemented LabVIEW based coding to operate spectrometer and Lock-In amplifier as well as to collect data from the amplifier. Our LabVIEW VI produces a graph of spectra in real-time so that the intensity of detected light over the change wavelength can be obtained automatically when the parameters are typed in to the program. In addition, the VI enables us to export the collected data to an excel file for the further analysis. Spectra from quantum dots have been routinely obtained from the VI. Furthermore, additional coding to operate another spectrometer from other company is under progress. This project is funded by NASA LaSPACE, NSF PREM program and NSF-CIMM seed grants.

"Simulating Seismoacoustic Wave Propagations on Venus for Atmospheric Detection"

Reyna Houston | UL Lafayette | LaSPACE LURA| Poster # 32

Most earthquakes occur around plate boundaries. While Venus is believed to not have the same plate tectonic activity as Earth, Venus may have local or regional plate tectonics. It has been postulated that Venus may have a different form of tectonic movement than Earth, called block tectonics, which can be supported by various areas of noticeable deformation and possible faulting. The seismic waves generated from the venusquake could be coupled into acoustical waves that could travel through Venus's atmosphere. These acoustical waves could be detected by seismometers held in balloons that float in the atmosphere. The results indicate Venus is efficient in coupling seismic waves to acoustic waves as well as propagating acoustic waves in the lower atmosphere. Better understanding of the movement of Venus's crust may help predict where and what kind of quakes might occur, which may enhance simulation and aid in the detection of venusquakes in the future.

"Software Development for Head Tracking using UHF RFID"

Brandon Hubbs | LaTech | NASA EPSCoR RID RAP / R3 | Poster # 24

Neck injuries are fairly common among those living in low and zero-g environments due to otolith dysfunction. An early-warning system would allow for the monitoring of dangerous accelerations and the prevention of such injuries. Wired or battery-based monitoring of the motion of astronauts' heads can be difficult due to the high oxygen environment of their suits. A passive system that would allow for wireless tracking of an astronaut's head motion was devised using ultra-high frequency radio-frequency identification tags as indicators of motion. The received signal strength indicator values between four radio-frequency identification tags and two linearly polarized antennas were correlated with Euler angle measurements from an inertial measurement unit to track head kinematics. Kalman filtering, a common filtering method in location tracking, was paired with interpolation and regression to some success using python. Kalman filtering was implemented using the Filterpy library. Regression was implemented using the statsmodels and sklearn packages. The application of such correlations to predict real-time motion was achieved with limited success and presents potential avenues for improvement.

"On the Manufacturing Process and Tensile Behavior of a Hydrogel"

Walter Loop | UNO | LaSPACE GSRA | Poster # 19

The purpose of this research was to explore the tensile strength of Ecoflex 00-03 by Smooth-On Inc. Ecoflex is a platinum-catalyzed silicone material that is soft, has a high resistance to plastic deformation, and stretches many times its original size. In order to test

this material, the Ecoflex needed to be molded into an ASTM Dog bone shape, more specifically, the ASTM dog bone IV. The manufacturing process required a 3D printed mold of the dog bone shape, a planetary mixer, and a vacuum degassing chamber.

The dog bone mold was designed in Solidworks and 3D printed using the Markforged Mark Two Printer and the material used was Onyx, a carbon fiber infused nylon. Before Ecoflex is in its final form it comes from the manufacture in two precursor materials labeled A and B. These materials were mixed using the planetary mixer, then applied to the mold, degassed, and finally left to cure for 4 hours at room temperature. Once cured the dog bone specimens were tested using a Tinius Olsen tensile machine. Each specimen was pulled until failure. The force, displacement, stress and strain were all recorded in real time while the tests were performed. Using this live data, the stress vs strain and force vs displacement relationships were graphed in Excel and analyzed.

After the analytical data was collected, a finite element study was performed using the ANSYS 2022 software using the explicit dynamics tool on the workbench. The dog bone shape was once again modeled in Solidworks but this time as a solid object. Once completed, the model was moved to ANSYS 2022 and the tensile tests were simulated using the Young's Modulus and Poisson's Ratio acquired from the analytical data. These simulated data were then compared with the analytical data.

"Performance Evaluation of an RL-Aided Dual Active Bridge Converter Based EV Charger"

Maliha Mahazabeen | UL Lafayette | LaSPACE LURA | Poster # 14

Dual Active Bridge (DAB) dc-dc Converter has drawn attention for electric vehicle charging applications due to its ascendancy such as higher power density, bidirectional mode of operation, high efficiency and many more. Different approaches has been taken so far to boost its performance. This study conducts a performance analysis of a single phase shifted DAB converter to achieve desired output current for electric vehicle (EV) charging applications. The applied DAB converter has a proportional integral (PI) controller unit tuned by reinforcement learning (RL) based Deep Deterministic Policy Gradient (DDPG) algorithm. The results show that, the conventionally tuned PI controller has higher rate of overshoot under short circuit fault condition comparing to the RL-aided PI controller. The method and results are validated through simulations in MATLAB/Simulink.

"Controlled fabrication of solid-state in-plane dual nanopore sensors for deployable sequencing applications"

Corinne Martin | LSU | LASPACE LURA | Poster # 1

As space missions go beyond low Earth orbit, there is a present need for adaptable and autonomous biosensors that can supplement chief medical officers once the spacecraft is out of communication range. Novel research into aerospace biosensors highlights the integration of micro and nanofluidic devices. Nanofluidic devices can separate biomolecules and nucleotides, utilizing the electrical signatures of nucleobases to obtain genetic information and thus do not require the reagents and equipment needed for fluorescence labeling. While photolithography is the most prominent and accurate nanofluidic fabrication currently available, it is difficult to precisely fabricate a specific nanopore size. The goal of this study was to design a method to systematically reduce pore size so as to create a more accurate pore size for measuring mononucleotides. Nanofluidic chips were fabricated using a UV resin mold which was then imprinted into a PEGDA polymer substrate. The chips were then inserted into a pressure jig where the electric current was measured after a series of applied forces. As force was applied, the electric transient current was reduced, correlating to reduced pore size. Higher control over nanopore sizes was found when the initial pore was measured at a current less than 10nA, while the chips with the initial pore transient currents higher than 10nA displayed a greater reduction in size with the applied force. However, the nanochips did not maintain the smaller pore size after being relieved of force. Future directions include testing the method alongside nanopore sequencing for the detection of methylated DNA.

"Role of Notch3 in Adipose Stem Cell Fate"

Sydney Mashaw | Kate Horton | Suraj Patel | LaTech | LaSPACE GSRA| Poster # 4

Stem cell research is a new and exciting field, holding implications for human health that could revolutionize medicine forever by allowing for specialized treatments of previously incurable degenerative diseases. There are many factors that can have an impact on stem cell fate, including environmental stimuli, transcription factors, chromatin modifiers, and signal transduction pathways. The Notch signaling pathway is a conserved signal transduction pathway within stem cells and is known to regulate cell proliferation,

differentiation, fate, and death in all animals. The goal of my research is to understand the mechanisms that control adult stem cell fate by specifically examining the Notch signaling pathway. As this pathway is complex, I have narrowed my research specifically to Notch3, one of the more widely researched receptors known to have a role in early embryonic development and cell fate determination. I would like to determine what role, if any, Notch3 plays in a stem cell's ability to self-renew, proliferate, and differentiate. Having a strong understanding of this receptor's role in the Notch signaling pathway and within a stem cell as a whole will lead to targeted approaches for stem cell-based therapies to treat degenerative diseases through the inhibition, activation, or modulation of signaling activity.

"A Study on the Tensile and Fatigue Properties of Ti-6Al-4V Alloy"

Ciara Morse | UNO | LaSPACE LURA | Poster # 20

Laser powder bed fusion processed Ti-6Al-4V is investigated to continue improving the aerospace industry. To mechanically characterize Ti-6Al-4V, tensile and fatigue tests were performed in ANSYS Workbench 2022 R2 using two dog bone models created in SolidWorks 2022. One dog bone is a custom, small-scale specimen proportional to the flat dog bone standard while the other is an ASTM E8M round specimen. Using structural analysis at room temperature, tests were run to show the von mises stress, total deformation, fatigue life, and fatigue factor of safety. For each specimen, a constant amplitude load graph at a ratio of 0.1 and a S-N curve is supplied to present the behavior of Ti-6Al-4V under alternating stress. The provided stress vs. strain graphs made in Excel from the ANSYS data, characterizes the ductility, strength, and yielding behavior of the titanium alloy. The ANSYS Workbench program allows for sufficient mechanical characterization of Ti-6Al-4V while still being cost effective. It is well known that Ti-6Al-4V is versatile with very useful mechanical properties. As additive manufacturing is becoming an integral part of aerospace technology, Ti-6Al-4V is a prime candidate for research because it is compatible with laser power bed fusion which can make complex, customized, thin, and light-weight parts.

"The Influence of Microgravity on Notch Signaling and Adult Stem Cell Osteogenesis"

Lucas Norris | Calla Bunting | LaTech | LaSPACE LURA | Poster # 5

For astronauts who have spent long periods of time on the International Space Station, a loss in bone density of 1-2% per month is common. This becomes problematic upon return to Earth's atmosphere because the loss in bone density has increased the fragility of the bones, therefore, increasing the risk of bone fractures. Human adipose-derived stem cells (hASCs) are multipotent stem cells that hold the potential to combat this significant challenge. Adipose-derived stem cells are critical in the advancement of regenerative medicine because they are easily obtained from adipose tissue and are able to both self-renew and differentiate. In order to maximize the efficiency of hASC therapies, we must first understand how their cell state is maintained and altered. The Notch signaling pathway is a contact dependent cell signaling pathway that plays a major role in hASC osteogenesis. In this project, we investigate the Notch pathway in hASCs undergoing osteogenic differentiation under conditions of both simulated microgravity and normal cell culture conditions. Through this work we will begin to better understand how the pathway's ability to regulate and determine cell fate is affected in space. Once we fully understand the role of the Notch pathway, we will be able to manipulate it in order to selectively differentiate cells to combat the loss in bone density due to microgravity.

"Fluorescent Colloidal Carbon Particles by Laser Ablation in Liquid"

Ke-Sean Peter | Grambling | LaSPACE HIS | Poster # 33

Nanoparticles (NPs) typically synthesized by chemical method which often requires expertise and heavy use of toxic and hazardous chemicals, which sometime becomes expensive due to the cost related with chemical hazards. Laser ablation in liquid (LAL) is a relatively new method to synthesize NPs. We have successfully synthesized carbon particles by LAL method. This presentation discusses the properties of carbon NPs synthesized by LAL. This project is funded by NASA LaSPACE, NSF PREM program and NSF-CIMM seed grants.

"The Photocatalytic Degradation of PFAS using Iron Oxide Modified Carbon Nanotubes"

Elisha Scott (Anna Dugas) | NSULA | LaSPACE LaSSO | Poster # 27

Per- and polyfluoroalkyl substances (PFAS) are emerging organic pollutants found in aquatic ecosystems around the world. The presence of PFAS in drinking water is a serious threat to the environment and human health since studies suggest they bioaccumulate and have potential toxic effects. Moreover, the highly stable structure of PFAS makes their destruction challenging. One of the main sources of PFAS are firefighting training and military facilities. NASA confirmed the presence of PFAS at NASA Wallops Flight Facility, among others. Consequently, the water quality of nearby areas, such as Chincoteague town and Wallops Island, has been impacted. In response, NASA/LaSPACE and NOAA/Louisiana Sea Grant funded our project through the LaSSO program to develop photocatalysts with the potential of converting PFAS into benign substances, such as CO2 and F-.

Iron oxide nanoparticles (IONs) were synthesized, and carbon nanotubes (CNTs) were modified with IONs (Fe-CNTs) by coprecipitation to study their photocatalytic activity in the decomposition of PFAS. The formation of a black precipitate with magnetic properties in the IONs synthesis suggests the presence of magnetite. After heating treatment in an oven, the precipitate changed to brown suggesting the formation of maghemite. Pristine CNTs, IONs and Fe-CNTs were characterized using Fourier-transform infrared spectroscopy (FTIR). The FTIR results of IONs suggest the possible presence of an adsorption band at frequencies lower than 650 cm-1, which is characteristic of Fe-O/Fe-O-Fe bindings. A band in the region of 1116-1129 cm-1 was observed for some samples with IONs suggesting the formation of hydroxo complexes (-FeOH/-Fe-OH-Fe).

"Resilient Charge Control for Battery Operated Rovers"

Savion Siner | UL Lafayette | LaSPACE LURA| Poster # 15

Rovers play an important role in different exploration missions by different NASA research centers. This project investigates adaptive control schemes to enhance the resilience of the charger unit for battery-operated rovers. A buck converter-based charger will be modeled in Matlab/SIMULINK and the performance of the converter's controller will be evaluated under four disturbances. Our tests include constant power load, short circuit at the load side, switching fault, and severe fluctuations in the input voltage of charger. A reinforcement learning based method will be applied to adjust the control parameters in real-time making it adaptive. The performance of the adaptive charger will be evaluated using resilience metrics proposed in different sets of literature.

"NASA STUDENT LAUNCH DESIGN TEAM (USLI): Electrical and Recovery of a High-Powered Launch Vehicle"

Demarco Smith | Dillard | LaSPACE SAFOS | Poster # 11

The design and building of high-power rockets offer excellent opportunities for undergraduate students to have hands-on experience in aerospace science and research. NASA is interested in this newest generation of undergraduate "space explorers," notably the Artemis Generation. This project involves our team participating in the NASA Student Launch Design Division, one of seven Artemis Student Challenges whose mission is to build foundational knowledge and introduce students to topics, techniques, and technologies critical to the success of the agency's Artemis program. For this challenge, we designed and simulated a high-powered rocket with three different scientific payloads.

"Design and Performance Evaluation of Pulsating Heat Pipe Using Metallic Nanoparticles Based Hybrid Nanofluids"

Araf Mim Ahmed Smrity| UL Lafayette | LaSPACE Senior Design | Poster # 22

Pulsating heat pipes (PHP) use two-phase flows to transport heat between evaporators and condensers. The performance of PHP largely depends on the thermal conductivity of the working fluid. Although hybrid nanofluids (HNF) have shown higher thermal conductivities compared to mono nanofluids, only few studies have investigated the impact of PHP with HNF on heat transfer enhancement. In addition, metallic nanoparticles have higher thermal conductivities compared with metallic oxide nanoparticles, but metallic nanoparticles are rarely used in nanofluids due to their poor stability in water and potential sedimentation and clogging in the PHP. Therefore, the research objective of this study is to investigate PHP performance enhancement with HNF consisting of metallic and metallic oxide nanoparticles and compare the PHP performance with different working fluids. A three-turn PHP made

from copper tubing was fabricated and charged with Al2O3-Cu HNF, Al2O3 mono nanofluid, Cu mono nanofluid, and pure water for performance evaluation. A total of ninety-eight (98) experiments were conducted with four working fluids over a range of operating conditions, including nanoparticle weight concentration (0.1% and 0.2%), filling ratio (50% and 60%) and heat input (30-90 W). Results showed that the Al2O3-Cu HNF demonstrated 30-54% lower thermal resistance than water, and even 17-43% lower than Al2O3 mono nanofluid and Cu mono nanofluid at the same filling ratio (FR), weight concentration (wt%), and heat input, which indicates superior heat transfer enhancement. A PHP heat transfer model was also developed and validated using the experimental data. It should be noted that it is challenging to achieve and maintain the stability of Al2O3-Cu HNF due to the hydrophobic nature of Cu nanoparticles. Future studies are planned to use molecular dynamics simulation to investigate factors influencing the stability of metallic nanoparticles based mono and hybrid nanofluids.

"Influence of Interface in Electrical Properties of 3D Printed Structures"

Jonathan Tairov | LaTech | LaSPACE LURA | Poster # 26

3D printing in zero-G has enabled the on-demand manufacturing of essential tools aboard the International Space Station for critical maintenance. This overcomes many months or years of wait times associated with cargo resupply missions to ferry parts and tools from Earth. These resupply missions will become sparse as we venture further into the solar system due to cost and complexity. The first 3D printer in space uses Material Extrusion-based Additive Manufacturing (MEAM), a type of additive manufacturing that involves feeding a filament made of a thermoplastic or a thermoplastic composite through a heated nozzle to partially melt the filament and extrude a thinner strand, which then binds to the surface and hardens. The printer nozzle is moved following a specific path defined usually by a g-code. This way the nozzle builds layers of filaments on top of one another to reconstruct a 3D model. With the development of electrically conductive thermoplastic composites, there has been an expanding desire to fully 3D print electronic components. Our research group is interested in the production of fully 3D printed sensors and actuators. One of the struggles with printing such components is the characterization of electrical properties before they are printed. Because of this, our research has focused on predicting electrical impedance based on different print parameters, such as layer width and layer height.

"Enhanced Antimicrobial Activity of AMPs Modified with Cationic Amino Acid Residues"

Samantha Townsend | LaTech | LaSPACE LURA | Poster # 9

The recent increase of multidrug resistant bacteria poses a serious threat to public health. A promising alternative to combat antibiotic resistance is antimicrobial peptides (AMPs). AMPs are relatively short peptide chains that typically range from 10 to 70 amino acid residues and show antimicrobial activity. Although AMPs tend to have less toxicity than antibiotic therapeutics, they have proven to have a broader range of activity and a lower potential for resistance development. The most promising AMPs are those with shorter sequences because they are more easily able to penetrate the cell membrane of target cells. In this study, two previously identified AMPs RR and RIKA were modified by the addition of two arginine residues to the N-terminus 2(Arg)-RR and 2(Arg)-RIKA. These modified peptides were synthesized using solid phase peptide synthesis and evaluated for antimicrobial activity against E.coli with a minimal inhibitory concentration (MIC) assay. RR and RIKA have previously demonstrated consistent antimicrobial activity against E.coli. In this study, 2(Arg)-RR and 2(Arg)-RIKA demonstrated antimicrobial activity and tested at lower MIC concentrations than RR and RIKA previously exhibited.

"Application of Convolutional Neural Networks in Disentangling Exoplanet Atmospheric Chemical Composition Spectra Measured by the James Webb Space Telescope (JWST)"

Armani Travis | UL Lafayette | LaSPACE LURA | Poster # 7

Among James Webb Space Telescope (JWST) data, there are spectral measurements during exoplanet transits around the host star. The absorption spectra of the key chemicals undergo different pipelines of data analysis to differentiate the targeted information. The targeted data can indicate the chemical composition and ratio of chemicals of the exoplanet atmosphere determining habitability, presence of life, etc. The project intends to establish a Convolutional Neural Network model that can enhance the spectral analysis of exoplanet composition with the use of JWST online data repositories and Python-coded simulations via Jupyter notebook files. In the process of developing the data analysis pipeline, I have been learning data manipulation in Python to cater to

my learning about computational techniques as tools for understanding complex systems and datasets, while allowing me to experience the process of independent research. At the end of this research project, we hope to propose the idea of integration and implementation of computational techniques, analysis pipelines, and models into existing JWST data analytics.

"Surface Tension Measurements of Molten Aluminum 7075-T6 Alloy on Different Substrates"

Chukwudalu Uba | UL Lafayette | LaSPACE REA | Poster # 23

Surface tension significantly dominates various surface and interface phenomena. For liquid metals with high melting temperatures, a profound understanding of the surface tension behavioral characteristics is crucial in industrial processes, such as casting, welding, and solidification. Aluminum alloys are essential engineering materials with remarkable physical properties and find many applications in modern technology. Al series alloys of 7041, 7075, and 7095 have several applications in the aerospace, military, and nuclear industry. Furthermore, Al alloys are prime candidates for In-Space Manufacturing due to their lightweight and relatively low melting temperature characteristics. In this study, the surface tension (liquid–gas interfacial tension (IFT)) and the molten droplet characteristics (such as contact angle, drop shape parameter and height, and wettability) of commercial Al 7075-T6 alloy were investigated from 973.15–1073.15 K (700°C–800°C) under an argon atmosphere on three substrates: porous hight-refractory aluimna, nonporous high-refractory alumina, and tungsten substrates using the sessile drop technique (OCA 25-HTV 1800, DataPhysics Instruments, Germany). Furthermore, the solid–gas free energy characteristics of the three substrates were investigated using the Ownes–Wendt–Rabel–Kaelble-model (OWRK-model), which considers the geometric mean of the dispersive and polar parts of the surface tension of the employed liquid and the surface energy of the solid substrate. Finally, the liquid–solid free energy characteristics of the Al 7075-T6 specimen as a function of the different substrates were investigated using Young's equation. The measured surface tension values are close to that of pure Al reported in the literature. Meanwhile, the results reveal that the surface free energy characteristics of the substrates affect the surface tension of the alloy and the liquid–solid free energy values.

"Optical Spectra from InP/ZnS quantum dots"

Yalearie Wildy | Grambling | LaSPACE HIS | Poster # 17

Quantum dots (QDs) are ubiquitous. They can be found in almost all aspects of our life, ranging from TV displays and energy conversion devices such as QD TV and solar cells, to biological applications such as research on imaging stem cells and cancer cells. Compared to the well-known, conventional CdSe QDs, the synthesis of InP/ZnS QDs are mainly driven by the need of QDs of less toxic, environmentally friendly, and benign to human body. They have been welcomed in many applications including bio-medical applications. In this presentation, we discuss the fundamental aspects of QDs such as QD size, electronic properties of QD and their impacts on fluorescence, structural properties such as core, shell, and ligands using InP/ZnS QDs as an example. The optical spectra from InP/ZnS QDs will be discussed. This project is funded by NASA LaSPACE, NSF PREM program and NSF-CIMM seed grants.

"Water Separation from Ionic Liquids used to Recover Oxygen and Metals from Regolith Using Low Energy Direct Contact Membrane Distillation"

Maark Wong | Vir Sagar | LaTech | LaSPACE REA | Poster # 8

Water Separation from Ionic Liquids that can be used to Recover Oxygen and Metals from Regolith Using Low Energy Direct Contact Membrane Distillation" Obtaining valuable metals and oxygen from the metal oxides in regolith is essential for manufacturing items and generating breathable atmosphere on Moon outposts. The acid-digestion of regolith with ionic liquids leads to the solubilization of metal cations and the formation of water in the spent ionic liquid. Ionic liquids have been identified that can separate metal cations from oxygen anions. To reduce resupply of ionic liquid, the spent ionic liquid needs to be regenerated. The regeneration process requires the removal of water prior to non-aqueous electroplating of metals. Typical methods to remove water from ionic liquids involve standard distillation (essentially boiling the water off at temperatures that degrade ionic liquids) or vacuum distillation, a complicated process. The proposed work will evaluate the effectiveness of an ambient pressure procedure, which only requires waste heat from other processes, to remove water from the spent ionic liquid. Water separation from some ionic liquids has been achieved using direct contact membrane distillation (DCMD) at temperatures of only ~50 °C, a temperature discharged by other processes. The pure water could then undergo electrolysis to produce oxygen or be used in life support systems.