THE 2021 SPS INTERN SYMPOSIUM

Friday, August 6, 2021
11 AM –2:00 PM EDT

AIP
American Institute of Physics

SPS

Welcome Remarks —11:00 AM EDT

Michael H. Moloney, AIP Chief Executive Officer
Jim Borgardt, Sigma Pi Sigma President
Brad R. Conrad, SPS & Sigma Pi Sigma Director

Presentations —11:10 AM EDT

Jess Zeldes

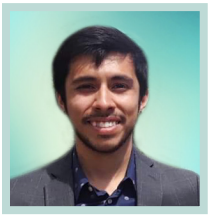
Society of Rheology/Soft Matter Kitchen

Haverford College

Bringing the Lab Home: The Physics of Cooking at the Soft Matter Kitchen

Presentation Time: 11:10 AM EDT

Rheology, the study of the flow and deformation of complex materials, can feel esoteric, but it plays a crucial role in our everyday lives. Many of the things that make our favorite foods distinct and interEDTing are due to important rheological properties. In this talk, I will give a brief explanation of the mission of the Soft Matter Kitchen program, which seeks to engage people with the fields of rheology and soft matter physics through food. Then, I'll give a couple of examples of educational content I worked on this summer. You'll learn what makes mayonnaise stable, how bread dough can be used to visualize the Weissenberg effect, and how to use the principles of rheological design to emulate one of the biggEDT food trends of the past few years. Along the way, I'll explain a few of the important properties used to describe non-Newtonian fluids, and explain why we care about these complex flows.



Rob Gauna

NIST Gaithersburg

Massachusetts Institute of Technology

Subsurface Structure Characterization Using Remote Bias EFM

Presentation Time: 11:18 AM EDT

Scanning Kelvin Force Microscopy (SKFM) is a form of noncontact atomic force microscopy (nc-AFM), more specifically an electrostatic force microscopy (EFM) technique, which makes use of the electrostatic forces between the cantilever probe tip and the sample to image and characterize the sample properties at sub nanometer scales. Because electrostatic forces occur over long distances SKFM/EFM can be used to characterize subsurface structures, making it useful for imaging/tEDTing 3D integrated circuits. SKFM/EFM is used today for measuring circuit properties such as dielectric constant, accumulated charges, and conductivity variations. I will present on my remote bias EFM simulations which focused on characterizing subsurface aluminum strips embedded in Silicon Dioxide (SiO2) and Hafnium substrates with varying probe tip geometries.

Karthik Rao

NIST Gaithersburg

Texas A&M University

Profiling the Shape of Electrostatic Force Microscopy Probes Using Finite Element Simulations

Presentation Time: 11:26 AM EDT

Electrostatic force microscopy (EFM) is a non-contact atomic force microscopy technique which gives access to electrostatic and electronic surface properties of samples with high precision. This technique involves applying a bias voltage to excite a cantilever oscillation, which oscillates with an amplitude that depends on the electrostatic force interaction between the probe tip and sample. COMSOL Multiphysics is a finite element analysis and Multiphysics simulation software platform that allows conventional physics-based user interfaces. Using this software, simulations of EFM with different probe shapes were performed in both 2-D and 3-D. The results of these simulations will be compiled into a database that will be used in determining unknown probe shapes in the future.

Julia Bauer

AIP FYI Science Policy News

Davidson College

Science Policy and the Mitigation of Climate, Energy, and Health Issues

Presentation Time: 11:34 AM EDT

Worsening climate change has necessitated greater investment in monitoring technologies, while outdated energy R&D policies have impeded marginalized communities' ability to access reliable energy sources. Underlying both issues is science policy, particularly as it concerns congressional appropriations to federal science agencies. During my presentation, I will discuss the importance of current funding gaps in three areas of science policy, as well as how policymakers are attempting to remediate those gaps. The presentation will address the House Science Committee's work to improve satellite technology for monitoring wildfires, energy equity policy, and the uncertain future of DOE's low-dose radiation research program.

Madison Brewer

AIP *Physics Today*

University of Pittsburgh

Writing about Research: *Physics Today*'s Publishing Process

Presentation Time: 11:42 AM EDT

When it comes to publishing, there is a lot of behind-the-scenes work—writing isn't the only thing to be done. There's also research and interviewing and editing, processes that require at least five people in addition to the writer. I have gotten to see this firsthand as well as take part in it this summer. Much like science, writing is a collaborative process. And at science publications like *Physics Today,* writers and researchers must work together to create an accurate and exciting story. I will outline the process of composing a story, from finding the research to posting it on the website. Other steps include interviewing, writing, and editing. This presentation will focus on "Jerk causes energy loss on the loop-the-loop," an article I wrote for the *Physics Today* website about the iconic demonstration.

Kirk Kleinsasser

APS Careers

Lycoming College

Employment Trends: Desirable Applicant Skills of Physics Degree Holders

Presentation Time: 11:50 AM EDT

Many undergraduates in physics see graduate school as the ultimate goal of their education. However, the majority of physics bachelor's find employment outside of academia. Physics training encompasses a diverse set of skills—physics degree holders at all levels are highly employable in the private and government sectors, which may require a different type of skill set than academia. To invEDTigate this point, my work this summer has focused on extracting desirable skills based on sector and degree requirements from the data available to APS. Over the course of my internship, I developed a program to collect and process APS Job Board postings, exporting common keywords that may hold significance, based on a variety of factors. The board pools job postings in various job sectors from APS and partner societies, including *Physics Today*, SPS, AAPM, and IEEE Computing. In collaboration with my mentor, I took this data and found the most relevant keywords to analyze. In this presentation, I will explain my approach and present the results of the APS job board analysis.

Hannah Wistrand

APS Public Engagement

Colorado School of Mines

Engaging the Public to Fight the Spread of Scientific Misinformation

Presentation Time: 11:58 AM EDT

As I started my time at APS, the world was beginning to navigate through the next steps of a global pandemic, and our country was leaving behind a period of widespread misinformation and mistrust. During a time when the public needs to know which sources they can trust to make decisions that will directly affect their health, the American Physical Society has set out to help combat the spread of scientific misinformation. To determine the most effective strategy for the role APS and its members play in this trying time, a trial campaign was developed to train APS members in effective communication skills. The intention was that these members would discuss commonly misinterpreted scientific topics with their friends and neighbors, then report to the APS team about their experiences. Moving forward from this trial and feedback, APS will learn to define what an "effective strategy" means to their organization and members, as well as be better equipped to continue their pursuits of political and social advocacy. This presentation sets out to discuss the methods of engagement and analysis being used by APS for this goal.

Zeynep Tuna

APS Education & Diversity

Bowdoin College

From Data and Categories to a More Diverse Physics Education

Presentation Time: 12:06 PM EDT

In light of a global pandemic, the Black Lives Matter movement, and the efforts to stop Asian and Pacific Islander violence, it is more important now than ever to focus on making our physics community more diverse and inclusive. In order to succeed in this mission, we must better understand the rapidly changing demographics of the field of physics. During my internship at APS, I had the opportunity to analyze the national physics education statistics based on race, ethnicity, and gender, observe improvements made in diversity and inclusion in physics year-by-year, and realize the further changes and improvements we need to make. This presentation will focus on how diversity and inclusion data for physics degrees is obtained, categorized, and presented so that the institutions and the community can make active decisions to reach racial and gender parity in the field of physics.

Break — 12:15 PM EDT

Gina Pantano

NASA Goddard Space Flight Center

University of Tampa

High-Fidelity Simulations of EXCLAIM Mission Data

Presentation Time: 12:25 PM EDT

The EXperiment for Cryogenic Large-Aperture Intensity Mapping (EXCLAIM) is a balloon-borne mission designed to invEDTigate why the star formation rate declined around redshift $z \sim 2$, despite the continued clustering of dark matter. EXCLAIM will use a relatively new observational technique, known as line intensity mapping, to measure the integrated sky emission of carbon monoxide and singly ionized carbon line transitions at different redshifts. EXCLAIM will analyze the evolution of these tracers by integrating these snapshots and cross correlating our observations with galactic surveys, which will allow us to provide a more detailed reconstruction of star formation patterns. During my presentation, I present high-fidelity simulations of these three-dimensional intensity maps based on current EXCLAIM models and mission data.

Joseph Watson

NASA Goddard Space Flight Center

McMurry University

Instrument Design and Implementation for Cryogenic Balloon Borne Telescope

Presentation Time: 12:33 PM EDT

EXCLAIM's mission is to use a cryogenic balloon-borne telescope to record a three-dimensional intensity map in the microwave electromagnetic range corresponding to carbon monoxide and carbon ion emission to study galaxy evolution and star formation. My work focused on the spectrometer package and readout, taking a preliminary design meeting mission requirements to a complete mechanical design that has been sent to machine shops for fabrication. These tasks have involved challenging special, thermal, magnetic, and electrical constrains. After everything was verified, drawings of highly complex parts were produced and sent to machine shops for quotes and future purchase.

Maura Shapiro

AIP Center for History of Physics and Niels Bohr Library & Archives

University of Pittsburgh

Carbon-Foote Print: Eunice Newton Foote and her Forgotten Discovery

Presentation Time: 12:41 PM EDT

In 1856, Eunice Newton Foote, an American scientist, inventor, and suffragette, prophesied climate change. She discovered the heat-absorbing properties of water vapor and carbon dioxide by recreating atmospheric conditions in glass jars and exposing them to sunlight. In her paper "On the heat in the sun's rays" she declared "an atmosphere of this gas [carbon dioxide] would give to our earth a high temperature." Until the past decade, however, credit for this groundbreaking discovery was awarded to John Tyndall, a famous Irish physicist. Today, amidst record-breaking heatwaves, droughts, and floods, we experience her conclusion firsthand, as climate change impacts our daily lives. Despite her pioneering contributions and insight, her work was ignored, and her name forgotten. This talk will discuss her work, the factors that contributed to suppressing her discovery, and my experience researching her for teaching guides and a *Physics Today* Online article.

Alan Wright

American Association of Physics Teachers

Purdue University

Summer Break for Teachers

Presentation Time: 12:49 PM EDT

There is a lot more to being a teacher than many realize. Teachers are always improving their classroom skills, learning new content, and collaborating with other teachers to get new ideas. AAPT provides plenty of opportunities for teachers to engage in these ways, and this summer I had the opportunity to be a part of several activities AAPT is involved with, including a quantum computing workshop, undergraduate discussion panel, and initiative to promote diversity in physics. In this presentation I will give an overview of some of the important and impactful activities in which I participated and how these activities relate to my goals of becoming a physics teacher.

Noah Johnson

AIP SPS SOCK

New York University

A Summer of Outreach: Captivating Kids with Physics

Presentation Time: 12:57 PM EDT

Outreach is a fundamental part of the Society of Physics Students (SPS) and the most common activity chapters do. Being the SOCK Intern, my responsibilities not only covered the SOCK program, but a whole range of outreach. In this talk I will outline new physics demonstrations

for students of all ages, my work around the acoustic based SOCK (expanded) and the Psi* Program, which formally joined SPS as part of the outreach toolkit. We will go over other side projects as well, including physics jeopardies and running the SPS Demo Competition.

Casey Roepke

AIP Mather Policy - NIST

Mount Holyoke College

Schrödinger's Cat: A Superposition of Funding Contingencies

Presentation Time: 1:05 PM EDT

The first year of a new administration brings new energy to government, as the President signs new legislation, staff's political appointments, and crafts their political priorities. My role as an AIP Mather Policy Intern at the Office of Advanced Manufacturing (OAM) in the National Institute of Standards and Technology (NIST) allowed me to explore the nuance in crafting and implementing science policy to support advanced manufacturing innovation and competitiveness in the first year of a new administration. OAM is constantly creating contingency plans to deal with legislative uncertainties, and we often treat a piece of legislation as simultaneously "alive" and "dead" (just like Schrödinger's cat) to prepare for different science policy outcomes. In this presentation, I will draw on my internship experience — from advisory groups to education budgets, from outreach and engagement strategies to reading Congressional bills — to demonstrate the fast-paced, intense, and fulfilling environment of science policy at NIST.

Guido Dominguez

AIP Mather Policy

Pomona College

The Marriage of Science and Politics

Presentation Time: 1:13 PM EDT

The American political scientist Don K. Price once said that "The union of the political and scientific EDTates is like a marriage, it will not be improved if the two become like each other, but only if they respect each other's quite different needs and purposes." As the AIP Mather Policy Intern for the House Committee on Science, Space, and Technology, I had the great privilege to witness this union on a daily basis. Through the countless hearings, briefings, reports, and summaries I attended and prepared it was clear to me that science is once again at the forefront of the nation's priorities. This summer alone the committee has shepherded the passage of the National Science Foundation for the Future Act by the House, led the way for an increase in NASA's budget of $1.5 billion, and held hearings on some of the most important scientific challenges of our time. There is still much more to do and room for a greater utilization of and respect for science throughout the policy process, but as Don K. Price masterfully concluded when talking about this marriage, "No great harm is done if in the meantime they quarrel a bit." In my talk, I'll be giving an overview of the process behind these achievements and more, as well as why I'm more hopeful than ever about the marriage between science and politics.

Intern Outreach Demo — 1:25PM EDT

Noah Johnson, AIP SPS SOCK Intern

Closing Remarks — 1: 35PM EDT

Brad R. Conrad, SPS & Sigma Pi Sigma Director
Kayla Stephens, SPS Assistant Director

SOCIETY OF PHYSICS STUDENTS
An organization of the American Institute of Physics

SPS would like to thank the following mentors for their time and dedication to the 2021 SPS Interns

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Melanie Mueller, Audrey Lengel, & Corrine Mona,
AIP Niels Bohr Library & Archives

Gregory Good & Joanna Behrman, Center for History of Physics

Arif Nelson, Society of Rheology

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American Physical Society

Eric Switzer & Thomas Essinger-Hileman, NASA Goddard Space Flight Center

Mark Hannum, American Association of Physics Teachers

Brad R. Conrad, AIP Society of Physics Students

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