SOCIETY OF PHYSICS STUDENTS
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The 2020 SPS Internship Symposium Abstracts
Friday, August 7, 2020

Kyle Blasinsky, AIP Mather Policy
John Carroll University
The National Mood and a New Meaning of Interdisciplinary Physics
Presentation Time: 11:10 AM EST

As a student of interdisciplinary physics, I prided myself on being able to work across disciplines when a task required it or would benefit from that approach. However, the challenges the nation faces today and that our Congress must address require a level of interdisciplinarity and collaboration that even I would not have fully appreciated until recently. The national mood largely sets that diverse, overlapping agenda, as it should in a republic, but how did the agenda we saw being shared in media and on the streets translate to my, albeit unrepresentative sample, of work in a Congressional office? This presentation will seek to answer those questions about the national mood, my work, and other day-to-day duties and experiences as a Congressional intern on virtual Capitol Hill.

Madison Swirtz, APS Education & Diversity
Colorado School of Mines
Studying People is Difficult: What I learned about doing diversity statistics at APS
Presentation Time: 11:18 AM EST

Although many STEM fields have made significant progress towards gender and racial parity, physics has lagged significantly behind: women only make up 20% of the undergraduate physics degrees awarded yearly despite making up half of the population, and Black, Hispanic, Native American, and Pacific Islanders only account for 15% of undergraduate degrees awarded yearly despite these populations making up about 30% of the college-aged people in the United States. In the wake of COVID-19 and the Black Lives Matter movement, the question of how we will make physics more inclusive has been put at the forefront of the community's conversations, and that question is still left largely unanswered. In my time at APS, I have learned a lot about where the culture of physics stands now, what structures are reinforcing this culture, and what work people have done and are doing to make physics a more inclusive place for everyone. This presentation explores what I learned this summer while working with APS Education & Diversity Statistics, attending the American Association of Physics Teachers conference and Physics Education Research Conference, and doing analysis on a survey from APS funded outreach programs.

Joseph Dees, APS Bridge Program
Henderson State University
Methods of Raising Awareness and Increasing Participation of Underrepresented Minorities in Physics Ph.D. Programs
Presentation Time: 11:26 AM EST

In a time where diversity and privilege are being underscored with events around the nation, the plight of underrepresented minority (URM) students becomes more prevalent. Diversity of background and culture is necessary in the research community as that diversity will drive the inclusion of different ideas and techniques for exploring and learning about the past, present, and future. With many studies evaluating how to increase the number of URM students attending and graduating from colleges and universities with a bachelor's degree, one question still remains. How can we also improve the quality and quantity of these same students that pursue a post-baccalaureate degree? And more specifically, how do we increase the

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number of URM students attaining a Ph.D. in Physics? While there are programs, such as the APS Bridge Program, already in place to assist in reaching these students, the knowledge of these programs is lacking in many of the colleges and universities that are graduating the highest number of URM students in physics. The focus of this discussion is how to increase the distribution of materials, raise awareness of the bridge program, and solicit highly qualified URM applicants to the APS Bridge Program.

Jack Moody, APS Careers
University of Massachusetts, Amherst
Helping Budding Physicists Find Career Success
Presentation Time: 11:34 AM EST

When most physicists enter their freshman year of college, many believe they will go on to become tenured college professors. While this is a possibility, there are so many other amazing opportunities for budding physicists to pursue! My mission this summer was to show undergraduates the vast array of careers within their grasp and provide resources to both them and their advisors so they may reach their full potential. This presentation will go over the methodologies I used to reach undergraduates and their advisors to provide career tools.

Paul McKinley, AIP Mather Policy
Pomona College
Shaping the research landscape through reauthorization legislation
Presentation Time: 11:42 AM EST

Open dialogue between lawmakers, experts, and government agencies exists at a nexus that is critical for creating informed and impactful policy. Authorization legislation from Congress is one opportunity for this type of collaboration, serving as a means to guide funding and allow continued operation of Federal programs and agencies across the country. The House Committee on Science, Space & Technology is charged with drafting authorization and reauthorization bills that directly affect members of the scientific community, as well as STEM education and future research and development. This presentation explores the underpinnings of upcoming reauthorization legislation for the National Science Foundation (NSF), with a particular focus on the collaborative role stakeholders from research institutions and professional organizations play in aiding final production of such an important bill. This coordination is vital to allow a widely-influential Federal organization like NSF to effectively support researchers, educators and students, as well as maintain adaptability in the face of an ever-changing research environment.

Max Dornfest, AIP Mather Policy – NIST
University of California, Berkeley
A study in deciding names for abstracts
Presentation Time: 11:50AM EST

This paper examines the treatment effect of institutes of advanced manufacturing seeded by the interagency Manufacturing USA program. With tens of millions of dollars awarded annually in grants resulting in even more private sector investment it is expected that there is an empirical (and positive) impact because of these manufacturing innovation institutes. First, a standard regression analysis establishing the average national trends for our metrics of choice (unemployment, median wages, productivity, etc) is performed on data obtained from both the Census Bureau's (CB) county business patterns database, and through EMSI (a data aggregation utility used by U.S. Department of Commerce staff). A second method of analysis is a regression discontinuity design. Many institutes have satellite

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campuses which were incorporated at later dates. We look at whether introduction into the Manufacturing USA program has a similar impact across a multi-year scale for any given organization—not simply institute headquarters. If we are successful in showing that the utility derived from the establishment and funding of advanced manufacturing programs is real and measurable, then we are also simultaneously providing tangible evidence in support of federal budgets which continue to fund the office's ongoing mission and the next generation of manufacturing programs that AMNPO and MEP will sheppard.

Samantha Creech, *Physics Today* Science Writing
University of North Carolina, Asheville
Finding A Voice: Writing Stories for Physics Today
Presentation Time: 11:58 AM EST

While all of science journalism shares broad, universal themes, each media outlet has nuanced differences that give them unique voices and niche functions in society. Physics Today, for instance, is a unique outlet that targets an audience of experienced physicists. This presentation follows the process of writing a science story– from gathering ideas to final publication– in a Physics Today context. I will recount my own experiences as an intern in order to both introduce the process of science writing and elaborate on what distinguishes Physics Today from its competitors.

Hale Stolberg, AIP FYI Science Policy
American University
Undergraduates in Physics Aren't Interested in Politics. That's a Problem
Presentation Time: 12:06 PM EST

This presentation is styled in the format of a TED Talk and will connect the need for undergraduates in physics and the sciences to be engaged in politics and policy with my experience working with FYI: Science Policy News from AIP. In this presentation, I will discuss the need for scientists to be proficient communicators, how engagement with the policy process hones this skill, and how I personally have worked through my time with FYI. I will also discuss how policy can impact undergraduate physics majors and scientists, as well as my own experience covering those policies through FYI. I will conclude my presentation by discussing what undergraduates can do to begin engaging in policy and politics.

Holly Fortener, AIP SPS SOCK
Marquette University
Sharing Physics Through Sound: Undergraduate Outreach
Presentation Time: 12:25 PM EST

The Society of Physics Students values opportunities in physics and astronomy for undergraduates and places global science outreach for younger generations at its core. Science Outreach Catalyst Kits (SOCKs) are free to SPS chapters while supplies last and contain an exploratory physics and science activity. SOCKs are specifically designed for SPS chapters to use in outreach presentations for elementary, middle, and high school students. Each SOCK comes with the essential materials to conduct a set of demonstrations, a comprehensive manual, and instructions on how to expand the demonstration to become a tried-and-true outreach activity. The 2020-21 SOCK is celebrating the international year of sound by theming its demonstrations around acoustics and expanding its availability to Acoustical Society of America chapters. Come learn about the 2020 SOCK if you are just starting out or are demo pro!

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Abigail Ambrose, Society of Rheology and AIP Niels Bohr Library & Archives
The College of Wooster
Where Did They Come From: Biographies for the Society of Rheology Fellows
Presentation Time: 12:33 PM EST

A lot of times we hear these big names within a field and know nothing about them. This summer, I have worked to put together biographies for the Society of Rheology Fellows. These include everything from accomplishments to where they began. It also takes a look at how these fellows have helped the Society throughout the years. This way we get to discover who is behind the name and how they have come to the place they are. We get to see past just the great discovery that got them their awards into the service they have provided and some insight about their lives as scientists.

Maria Stokes, AIP Center for History and Niels Bohr Library & Archives
University of Utah
Omitted History: Education and Outreach Avenues in the History of Physics
Presentation Time: 12:41 PM EST

Standard historical narratives of physics overlook the substantial contributions of many individuals. Small inclusions regarding the stories of individuals from underrepresented groups in the international physics community can be showcased in lesson plans on a variety of physics topics. I have completed three teaching guides that each introduce a physics topic, highlight the contribution of an individual from an underrepresented group in physics, and include a unique visual element as a tool for classroom engagement and outreach. This presentation includes examples from these lesson plans and discusses explored outreach avenues, particularly regarding science communication writing in the Ex Libris Universum blog at the Niels Bohr Library & Archives.

Benjamin Petkie, American Association for Physics Teachers
Worcester Polytechnic Institute
Using Creativity to fight Inequality
Presentation Time: 12:49 PM EST

Women in Physics are underrepresented, one need not to look further than a few statistics to see the data shows only 20% of Physics undergrad majors are female. APS and AAPT are doing something about this with STEP UP, a motivated group focused on achieving equal representation of minorities in the physics community. I've been a part of this organization since the internship began and focused on making a Podcast on what STEP UP is all about by interviewing STEP UP student ambassadors. Ambassadors can teach lessons on anything from careers in physics to women in physics or just spread the word about the group. We delved into their own work as well as their involvement with STEP UP. There are ways to spread the word about issues of inequality, I'm hoping the AAPT Physics Podcast can be one as well as provide useful information to the physics community about other organizations who make an impact.

Alexander Mikulich, NASA Goddard
Colorado School of Mines
Airbrush deposition for improving homogeneity of laser desorption/ionization targets
Presentation Time: 12:57 PM EST

Use of laser desorption ionization (LDI) for mass spectrometry requires careful deposition of the analyte onto the laser target. Specifically, performing quantitative abundance measurements of biomarkers or

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abiotic organic materials (with or without matrices promoting ionization of unfragmented ions) requires reduction of variations in the mass spectrum intensities resulting from spatially inhomogeneous targets. Additionally, coupling of LDI to liquid based separation methods (e.g. chromatography or electrophoretic) can be done by continuously spotting the concentrated eluate onto a moving substrate and, later, extracting retention times of these analytes by examining the spatial variation of the composition of the deposit. Uncontrolled wetting of the substrate leads to poor definition of retention time while deposition of well-defined spots improve calculated retention time. Direct deposition of eluate using a capillary or pipette, the dried droplet method, is sensitive to the substrate surface roughness, substrate-solution interaction, and gravity. In particular, the formation of a ring during drying is found to occur regardless of surface chemistry and results in the so-called "coffee stain" effect. For these reasons, airbrushing through stencil masks presents an attractive method for improving both the spatial homogeneity of the deposition and reducing the spot size of the deposited analyte over the simpler dried-droplet approach. Initially, the researchers tried using a micropipette to deposit small amounts of rhodamine onto a stainless steel plate. Then, several variables were altered, including solute concentration, solvent type, plate temperature, and the delivery method. It was found that if the solvent were quickly evaporated after the droplets hit the surface, the solute molecules did not have enough time to migrate to the edges. Thus, isopropanol as a solvent helped reduce coffee staining. This was further improved by heating the sample plate to a temperature between 100 and 150 degrees Celsius. The tiny droplets that were atomized with the airbrush vaporized on contact, and thus a homogeneous deposition could be achieved. The use of an airbrush also allowed for smaller spot sizes. Even with a 0.5 microliter droplet from the pipette, the spot size was still several millimeters in diameter. An airbrush, coupled with a stencil, was able to give clearly defined spots measuring as low as 200 microns. Therefore, when performing mass spectrometry with LDI, airbrushing the solvent onto a hot plate through a stencil can offer significant improvement over a dried-droplet method.

Anna Murphree, NASA Goddard
Rhodes College
Controlling mechanisms of extreme precipitation events
Presentation Time: 1:05 PM EST

Extreme precipitation events (EPEs) can cause natural hazards such as flooding and landslides. To better predict these events and avoid hazards, this study aimed to identify controlling mechanisms of EPEs. Previous work generated a database of EPEs from the Integrated Multi-Satellite Retrievals for GPM (IMERG) dataset for the continental US (CONUS). This study developed code to characterize these events with meteorological variables from the Modern-Era Retrospective analysis for Research and Applications (MERRA-2) dataset. Variables such as humidity, wind speed, and temperature were collected at time steps before, during, and after the events. The study looked for correlations between these meteorological variables and characteristics of the EPEs, such as intensity, duration, and total accumulation. Further work is necessary to determine which variables best characterize EPEs. The study also computed seasonal trends of wind speeds over CONUS from 1980 to 2019 and found that the decreasing horizonal wind speed might be responsible for the decreasing propagation of short duration EPEs in the summer season.

Abdul Qadeer Rehan, NIST Gaithersburg
University of Richmond
Applications of Machine Learning for Defect Metrology
Presentation Time: 1:13 PM EST

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With decreasing feature dimensions, increasing layout complexity, and greater material variations, undetected semiconductor patterning defects can have both technological and financial consequences in nanoelectronics fabrication. Optical methods are ideal for the fast, non-destructive identification of defect locations, but separating defect-based signals from measurement noise is a daunting task. Data-driven Machine Learning has been successfully applied to classifying simulated images,1 and our project has optimized a dataset of experimental images collected at 193 nm wavelength for enhanced processing using supervised neural networks. Images of intentional defect arrays have been obtained using a scatterfield microscope and processed here to enhance the training of convolutional neural networks. Initial results are presented showing the successful binary classification of defect and no-defect examples with discussion of the imbalanced costs due to false identifications. 1) Mark-Alexander Henn, Hui Zhou, Richard M. Silver, Bryan M. Barnes, "Applications of machine learning at the limits of form-dependent scattering for defect metrology," Proc. SPIE 10959, Metrology, Inspection, and Process Control for Microlithography XXXIII, 109590Z (26 March 2019); doi: 10.1117/12.2517285

Trey Cole, NIST Gaithersburg
West Virginia University
Simulating a Vibrating Kelvin Force Cantilever with COMSOL
Presentation Time: 1:21 PM EST

Kelvin probe force microscopy is a technique in material imaging that can provide sub-nanometer scale spatial resolution. The instrumentation that makes this possible relies on the vibration of a cantilever, microns in size, that reflects the changes in surface potential of the imaged surface. There have been recent attempts at using KPFM to image subsurface properties, which is relevant in integrated circuit development in particular, along with many other applications. My aim was to construct an appropriately sized cantilever and measure its eigenmodes of vibration under the influence of various driving forces using the COMSOL Multiphysics software.

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