Spring 2021 Joint Meeting of the NCS-AAPT and TAAPT

Saturday, April 10, 2021

Meeting Program

Held virtually via Zoom

NCS AAPT Physics Education

North Carolina Section of the American Association of Physics Teachers

Enhancing the understanding and appreciation of physics through teaching

TENNESSEE SECTION

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Schedule of Events

All sessions will make use of the same Zoom link. Attendees will be able to choose their own breakout rooms for sessions having multiple options.

To access the meeting, use this Zoom link: Link to join Zoom meeting

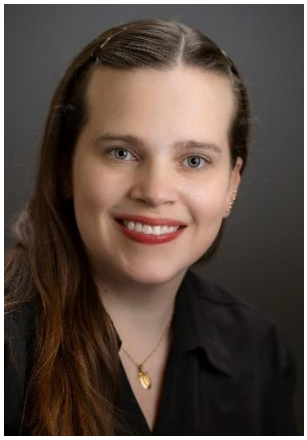
8:00 am – 8:15 am	Welcoming remarks
8:15 am – 9:15 am	Invited Talk: *Can you Surf a Gravitational Wave? Explaining LIGO Science* Amber Stuver, Villanova University
9:20 am – 10:20 am	Workshop 1: *Interactive Introduction to the Concepts of Machine Learning*
10:20 am – 10:50 am	Coffee Break
	Breakout Room 1: High-School Teachers
	Breakout Room 2: College/University Instructors
	Breakout Room 3: Undergrad/Graduate Student Meet and Greet
	Breakout Rooms 4 – 10: Free for anyone to use to chat
10:50 am – 11:50 am	Contributed 1
11:50 am – 12:50 pm	Poster Session / Lunch

- PDF versions of the posters can be found on Padlet. Poster authors can be found in the Zoom breakout rooms listed in the program if you would like to virtually "visit" their posters.
- There will be additional breakout rooms for those who would like to get together to chat over lunch.

12:50 pm – 1:50 pm	Workshop 2: *Incorporating LaTeX and GlowScript into your Courses*
1:55 pm – 2:55 pm	Contributed 2
3:00 pm – 4:00 pm	Business meetings
	NCS-AAPT – Breakout Room 1
	TAAPT – Breakout Room 2

Invited Talk (8:15 – 9:15 am)

Can you Surf a Gravitational Wave? Explaining LIGO Science



Amber Stuver – Villanova University

The first detection of gravitational waves (GW) by LIGO (Laser Interferometer Gravitational-Wave Observatory) has sparked new interest from physics and astronomy students in the often explosive processes and exotic objects that can be observed. This presentation will introduce the science of what GWs are and how LIGO detects them. We will also discuss several detections of gravitational waves, including describing the sources that created the GW. Most importantly, we will discuss how you can make connections between the science of GW and the concepts you are teaching in your high school and college classrooms. A summary list of resources will be provided, many of which will also be appropriate for public outreach purposes.

* This talk is presented on behalf of the LIGO Scientific Collaboration.

Workshop 1 (9:20 – 10:20 am)

Interactive Introduction to the Concepts of Machine Learning

Don Smith – Guilford College

Machine learning is rapidly becoming a part of almost every aspect of our lives. Physics teachers are well-positioned to grapple with these new tools, as they are based in concepts of gradient descent, convolution, and unit vector coefficients that we are very familiar with. The tools are becoming simpler and simpler to use (at the cost of hiding more and more of their functionality under the hood), although frustrating implementation glitches still occur regularly. In this workshop, I will lead participants through constructing and understanding several simple neural network activities, using the Google Colaboratory environment.

Contributed 1 (10:50 am – 11:50 am)

10:50 am **Reflections on Online Introductory Physics Teaching During the Pandemic**

Cahit Erkal – The University of Tennessee at Martin

We present some findings based on our experiences with two semesters of online introductory physics classes during the pandemic period. These reflections can be helpful to re-evaluate the traditional teaching mode and implement some changes. We will discuss, compare and contrast both positive and negative elements of online teaching. We will also identify several positive PER aspects (Physics Education Research) of the online teaching, which can be implemented during face-to-face teaching environments.

11:05 am **Using Oral Interviews as Assessments**

Joe Heafner – Catawba Valley Community College

In this talk, I will describe how I have implemented oral interviews as assessment in place of traditional written tests. In these interviews, students present solutions to problems written in LaTeX, with GlowScript

used in place of calculators for numerical calculations. Students must also present at least one entirely computational problem solution. There are no points to be gamed, and I ask questions in the spirit of Arnold Arons to probe students' understandings. These interviews are also an opportunity for students to get help with topics with which they may be struggling. The overall goal is to create a relaxed environment in which students and I have a discussion about their work.

11:20 am **Restructuring a Microcontrollers Course in Pandemic Times: Lessons and Opportunities**

Stefan Jeglinski – University of North Carolina at Chapel Hill

Physical Computing (a hands-on course in microcontrollers) has been taught every spring at UNC-CH since 2016. It evolved each year until 2020, when, half-way through the course, the university pivoted to remote learning. This pivot was a disaster for a laboratory-oriented course that also depended on the equipment resources of the university. When news that spring 2021 would continue to be remote, it forced a serious reevaluation of the course goals and methods. Christmas break 2020 saw the course rewritten mostly from scratch with the goal of no longer attempting to put square pegs into round holes, and the spring of 2021 has been the first experiment in a new approach. We'll briefly review the old version of the course and some of the bottlenecks that were already present, discuss new approaches to presenting the material and evaluating the work done by students, and assess the success so far. Importantly, new opportunities made themselves known over time, and it's likely that much of the "remote" structure will be retained going forward.

11:35 am **Google Sites as a Platform for Student Portfolios and Lab Notebooks**

Kristen Thompson – Davidson College

In response to the shift from in-person to virtual learning, I have adopted Google Sites as a platform for connecting with students in my introductory physics and astronomy courses. In this talk, I will describe how students use Google Sites to introduce themselves to the instructor, provide updates about their successes and struggles, create and maintain a digital lab notebook, and build a portfolio of their work and learning. I have found this platform to be quite effective and students have responded well to the model. Therefore, I will likely continue using Google Sites extensively in my courses post-pandemic.

Contributed Posters (11:50 am – 12:50 pm)

Authors will be available in the breakout rooms listed to discuss their posters at this time. Please interact with the authors in these rooms during the poster session or by leaving comments and reactions on the Padlet page. If you are signed in with a free Padlet account, your name will accompany your comments. If you are not signed in, your comments will be listed as anonymous. Note that enlarged versions of the posters can be viewed by clicking on their images within Padlet.

You can access posters at this web address: https://padlet.com/krthompson8/aaptS21

Compositional and Temperature Dependence of Indirect Optical Gap in As-S Glasses (Breakout room 1)

James Forsythe – Austin Peay State University

Co-author: Roman Golovchak – Austin Peay State University

Arsenic Sulfide glasses are abundantly used in fiber-optics and photonics due to their transparency to infrared radiation. The indirect bandgap of such glasses is known to be highly-sensitive to changes in temperature. Present results show a linear relationship between temperature and indirect bandgap, as well as a noticeable dependence on composition. The samples

from AsxS100-x glass-forming region (10<x<42) are investigated with optical spectroscopy from liquid nitrogen up to their glass transition temperatures.

Argumentation Practices in the Physics Labs: Linking Growth to Time on Task (Breakout room 2)

Eric Eaton – East Carolina University

Co-authors: Steven Wolf, Joi Walker, and Katy Hosbein – East Carolina University

Argument Driven Inquiry (ADI) is an instructional model of learning where students obtain knowledge of a specific discipline through scientific argumentation. In this study, scientific argumentation is observed in the first sequence of a two-semester general physics laboratory implementing the ADI model at East Carolina University. During the two-semester sequence, video recordings were taken of the students' scientific argumentation sessions. These video recordings were coded using the Assessment of Scientific Argumentation in the Classroom (ASAC) observation protocol. Previous results in Chemistry Labs using ADI have shown growth in argumentation scores over the course of the semester. The data obtained from the first semester of the physics lab did not exhibit a growth in argumentation over the course of the semester. We will examine the time on task during the argumentation sessions and compare these observations to the growth in argumentation practices.

Compiling Dissolve on PSC's Bridges-2 HPC Resource (Breakout room 3)

Jason Rivas – Austin Peay State University

Co-author: Justin Oelgoetz – Austin Peay State University

We detail the process of compiling Dissolve on Pittsburgh Supercomputing Center's HPC resource Bridges-2. Dissolve is a program that performs structure refinement for neutron scattering data, based on Empirical Potential Structure Refinement (EPSR), scalable to multi-million atom models. Bridges-2 is a large High Performance Computing Resource located at the Pittsburgh Super Computing Center. We will report on our efforts to compile the program as well as present initial timing data as well as discuss what sort of experimental data we will be analyzing in the coming months.

Case Study Analysis of Eigenvector Continuation Method Applied to the Anharmonic Oscillator (Breakout room 4)

Evert Garcia-Guzman – University of North Carolina at Pembroke

Co-author: James W. Graham – University of North Carolina at Pembroke

A thorough analysis is done comparing the results of the novel Eigenvector continuation (EC) method (Frame et al. 2018) with those of the well-studied Finite Difference (FD) method for different values of λ; with an additional focus on how well EC approximations hold for higher energies and values of λ. Various metrics, such as the spacing and placement of sample points and the size of the sample size are analyzed in order to judge the effects that they have on the accuracy of EC.

Temperature Dependence of Photocurrent in Mixed Ge-Sb-Bi- Based Chalcogenide Thin Films (Breakout room 5)

Killian Prue – Austin Peay State University

Co-authors: Jarres Plummer and Roman Golovchak – Austin Peay State University

DC electrical properties of amorphous germanium and antimony/bismuth-modified chalcogenide thin films were studied at different temperatures under simultaneous exposure to light of different wavelengths and intensities. The least photosensitive composition at most wavelengths and temperatures was found to be the non-modified Ge-S-Se-Te thin film.

Light exposure caused a 40 to 95% drop in samples' DC resistivity when compared to dark, showing a strong dependence on composition, photon's energy, and light intensity. The addition of antimony or bismuth caused a significant increase of sensitivity in the NIR range, with antimony-modified films having the highest photosensitivity for those wavelengths.

Radio JOVE Project and NASA Citizen Science (Breakout room 6)

Chuck Higgins – Middle Tennessee State University

The Radio JOVE Project (radiojove.gsfc.nasa.gov) promotes radio astronomy and citizen science to students, teachers, and the general public. We observe solar, Jupiter, galactic, and terrestrial radio emissions for science education and research. We partner with the NASA Heliophysics Education Activation Team (HEAT) and work with citizen scientists and institutions to establish radio telescope (20 MHz) and radio spectrograph (15-30 MHz) stations. I will overview the hardware and software of the current citizen science network, and show some recent observations. I will also highlight several other NASA citizen science projects (https://science.nasa.gov/citizenscience) to demonstrate the science opportunities available to the general public.

Workshop 2 (12:50 – 1:50 pm)

Incorporating LaTeX and GlowScript Into Your Courses

Joe Heafner – Catawba Valley Community College

In this workshop, I will show you how to use LaTeX (via Overleaf.com) and GlowScript (GlowScript.org) to create an efficient and professional workflow students can use to create and "publish" problem solutions. Before the workshop, attendees should create FREE accounts at both Overleaf.com and GlowScript.org. Some simple programming experience may be helpful, but is not essential. No prior knowledge of LaTeX is necessary. I will assume participants know how to manipulate PDF and .zip files on their respective platforms. We will focus exclusively on creating student problem solutions rather than other general documents.

Contributed 2 (1:55 pm – 2:55 pm)

1:55 pm **Developing a User-Friendly Program for Gold Nanoparticle Studies**

Kerri Prinos – Davidson College

Co-author: Solmaz Bastani – Davidson College

Nanomedicine is an emerging field where nano-sized carrier materials, known as nanoparticles, aid in disease prevention, treatment, and diagnosis. Before pharmacological and clinical use, the efficacy and safety of newly developed nanoparticles, must be evaluated with various studies. We have developed three user-friendly programs in Mathematica to analyze data collected from these common studies: cytotoxicity, biodistribution, and pharmacokinetic studies. The user will fill out the template Excel file with raw data and upload it to the Mathematica program. The program will perform all necessary calculations (e.g. IC50, pharmacokinetics parameters) and produce graphs (e.g. biological pathways responsible for uptake and clearance).

2:10 pm **Measured Versus Simulated Light Transmission Through Nanohole Arrays in Gold and Vanadium**

Nicholas Cottingham – Austin Peay State University

Co-author: Eugenii U. Donev – Austin Peay State University

Electromagnetic simulations of temperature-modulated extraordinary optical transmission show that light emerging from nanohole arrays perforated in bilayer films of gold and vanadium dioxide (Au+VO2) exhibits a 50-fold enhancement across the semiconducting-to-metallic phase transition of VO2. In contrast, optical measurements of a nanohole array milled with a focused ion beam show only a 25% increase in peak transmission. We tentatively attribute this large discrepancy to a residual VO2 layer due to incomplete milling. We present transmission measurements and supporting new simulations, whereby varying the thickness of VO2 material remaining in the holes drastically alters the transmission only in the semiconducting phase.

2:25 pm **Customizing a Physics Course for Non-physics Majors Using Relevant Problems**

Krista McBride – Belmont University

As physics educators, we strive for engagement in course material from non-physics majors. One way to peak student interest and excite students is to customize the course to appeal to their career path. I have found a creative way to break through the barrier of students only taking the course because it is required to students finding relevance and enjoyment. Students have been asked to create problems using scenarios for their major. These problems are used to teach and assess the students on the course material. This has been addressed for audio engineering students as well as pharmacy students and students interested in science fiction. Implementation of this idea will be discussed.

2:40 pm **The YouTube Channel doctorphys**

Michael Ruiz – University of North Carolina at Asheville

I will give an overview of my YouTube Channel doctorphys, which is now 10 years old. The channel contains hundreds of videos I made for my general-education courses in light and sound, as well as courses for majors in optics and theoretical physics. The channel has over 1.4 million views and 8031 subscribers. Participants are encouraged to visit the channel https://www.youtube.com/c/doctorphys before, during, and after the presentation to learn more. A Creative Commons text, homework, solutions, and exams for the current theoretical physics course can be found at https://www.doctorphys.com/courses/theoretical/.

CEU Credit for Meeting Attendance

There will be an opportunity to earn CEU credit for attendance at the Spring 2021 meeting. Participants will need to complete this short Google Forms questionnaire. Attendance and tracking of contact hours will be taken through Zoom reports. On the day of the meeting be sure to match your Zoom log-in with the name and email as submitted on the above form. A certificate will be emailed within a week of the meeting ending. It will be the responsibility of the individual attendees to submit the certificate to their appropriate LEA/Licensing office. Questions can be addressed to Thomas Hefner, Vice-President, NCS-AAPT, at hefnertw.gcs@gmail.com.

Prizes and Awards

There is a $100 prize for the best undergraduate student paper, a $100 prize for the best graduate student paper, and a prize of $150 towards expenses to present a similar paper at a national meeting suitably noting the support of the NCS-AAPT for the best pedagogical paper.

We also offer the following awards:

- Superior Undergraduate Student award - $100
- Walter C. Connolly Award - An award to recognize an individual for significant service and contributions to the Section - $300
- John L. Hubisz Award – An award to recognize an individual for significant service and contributions to the Section - $500
- Conrad "Bo" Wessell Award for Outstanding Teaching and Service at the Two-Year College Level – This award has been established to reward excellence in both teaching and service at the two-year college level in North Carolina. For consideration, a nomination letter, as well as two supporting letters detailing the nominee's teaching and/or service at the two-year college level, must be sent to the Section Representative or the Secretary-Treasurer. Recipients receive a certificate, a check for $300, a one-year membership in the national AAPT, and donated items from sponsors.

Prize Ballot for the Spring 2021 NCS/TAAPT Meeting

Please complete this Google Form to vote for the best undergraduate student paper and the best pedagogical paper presented at this meeting. All ballots must be received by Saturday, April 17, 2021.

NCS-AAPT

The North Carolina Section of the AAPT holds two meetings a year. Please consider your campus for hosting future meetings. Membership is $5 a year or a lifetime membership of $100. To learn more about NCS-AAPT and to join the Google group for email notifications, go to our site: https://sites.google.com/site/ncsaapt/.

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