American Association of Physics Teachers

Appalachian Section Fall 2021 Meeting

Frostburg State University

Gira Center, Room 397

Saturday, October 23, 2021

8:30-9:00am Registration and Breakfast

9:00-9:05am Welcome
Eric Moore, Frostburg State University
President-Elect, Appalachian Section

9:05-9:20am Invited in-person
A Tribute to Dr. George Rudolph Plitnik
Francis M. Tam, Professor Emeritus, Frostburg State University
As a memorial to Dr. Plitnik, some of his achievements, funny stories and pipe organ music will be presented.

9:20-9:40am in-person
Undergraduate Research in Physics at WV Wesleyan College in Summer 2021
Joseph Wiest, West Virginia Wesleyan College

The talk describes the efforts of the Physics Department at WV Wesleyan College to focus on rebuilding research skills in our majors after the pandemic recess by having an eight-week research program during the summer of 2021. Funds were raised from four sources to cover all student living expenses and to provide summer compensation for each student and faculty member involved. Research topics involved included crystalline structures with a SEM, hyperfine laser spectroscopy, nuclear excited state lifetimes, and a search for the elusive particles of the neutrino and the mu meson through nuclear instrumentation and a cloud chamber.

9:40-10:00am in-person
Bohr's Hydrogen Atom and the Balmer Series of Hydrogen: Measuring the Balmer Wavelengths of Hydrogen
Gregory Latta, Professor Emeritus, Frostburg State University

In 1913 Niels Bohr postulated that the angular momentum of the electron orbits in Ernest Rutherford's nuclear hydrogen atom were quantized. The condition was that $L = nh/2\pi$ where L is the angular momentum of the electron and h is Planck's constant. As a result of the quantization of the angular momentum, the energy of the orbits was also quantized. Bohr additionally postulated that the electron could make a quantum leap from a higher energy orbit to a lower energy orbit by emitting a photon of energy equal to the energy difference in the orbits. Bohr calculated the energies of the emitted photons and found that only transitions from the $n = 3$ to the $n = 2$ orbits would yield photons in the visible portion of the spectrum. Previous spectroscopic observation of these photons and measurement of their wavelengths provided strong support to Bohr's hydrogen model.

These photons are normally observed and accurately measured using a spectroscope. However, a diffraction grating and simple optics can be used instead to observe and accurately measure the wavelengths of these photons. Most of the equipment can be found in the average undergraduate physics laboratory or can be made by the instructor. The details of the experiment and the results will be given, along with methods of constructing some of the lab equipment.

10:00-10:15am virtual

Azo Dye Functionalization of Polycarbonate Membranes

Sean P. McBride (Presenter)[a], Ashton Caruthers [b], Michele Fortner [c], and Carrie Cockerham[d]

Molecular dyes are one of the main pollutants in the World's growing textile industry. In aqueous solutions, these dye compounds dissociate into positive sodium ions and a negatively charged dye molecule. The research presented demonstrates that polycarbonate membranes with 100 nanometer diameter holes, when functionalized with azo dye molecules themselves, can successfully further remove negatively charged dye components from aqueous solutions of azo dyes after being initially functionalized. Rejection of the negative dye molecule is determined using Ultra Violet Visible light Spectroscopy on the pre and post filtered solution. This method of functionalization methods shows a decrease in flowrate and corresponding increase in rejection of the charged dye molecules. A brief look at the functionalization response of filters using 3 different azo dyes separately will be presented. Using an azo dye with an intrinsic charge of -6 to functionalize a polycarbonate filter has been shown to increases rejection for the same dye by 70% at a concentration of 50 µM. This work was carried out by a high school student and soon to be high school science teacher through a Preservice and Early Career Research for Teachers (PERT) program and assisted by an undergraduate engineering student through a Summer Undergraduate Research Experience (SURE) program.

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[d] Marshall University, Department of Civil Engineering, Huntington, WV 25755

10:15-10:25am Break

10:25-10:40am in-person

WVSU Experiments in Space: RockSat-X 2021

Christopher Bias, West Virginia State University

A team of West Virginia State University students designed an experiment that was successfully launched on a NASA sounding rocket in August of 2021. The RockSat-X program employed a Terrier-Improved Malemute rocket to carry student experiments from several West Virginia colleges, and colleges from across the country. WVSU experiments included components and devices that measured flight dynamics (acceleration and angular velocity), magnetic fields, UV intensity, temperature and pressure outside and inside of an enclosure, Geiger tubes and particle detectors to measure radiation, and a Teensy 4.1 microcontroller to handle all operations and on-board data logging. The NASA West Virginia Space Grant Consortium provided funding for the project.

10:40-10:55am virtual

Retrospection of WVSU's Six Years of Experience with Space Flight Design Challenge and RockSat
Marek Krasnansky, West Virginia State University

From 2015 WVSU's students have been designing and building experiments launched to space as a part of WV Space Flight Design Challenge and RockSat programs. The collected and evaluated data obtained during the space flights were presented at multiple conferences and symposia. For WVSU students these projects have been a huge success. In this talk I will share my experiences with mentoring the students working on the projects.

10:55-11:10am virtual

Search for Di-Higgs Boson Pair Production with Four Bottom Quark Final State
Lily Daneshmand, Marietta College; Advised by Flera Rizatdinova, Oklahoma State University

Near the end of 2027, the High Luminosity Large Hadron Collider (HL-LHC) project aims to be operational, allowing for more detailed study of phenomena associated with the Higgs boson. The HL-LHC expects to collect data for proton-proton collisions at 14 TeV. This research focuses on di-Higgs boson production in the four bottom quark decay channel using simulated data generated using the Monte Carlo method. The preliminary number of events due to di-Higgs boson production and dominant Standard Model background of dijets and top/anti-top quark pairs was evaluated, and those results were converted to the probability of observation of the Higgs boson pair production process at the HL-LHC. This analysis is incomplete, and additional background samples are required as research into this process is ongoing.

11:10am-12:00pm Business Meeting

12:00-12:55pm Lunch

12:55-1:00pm Keynote Speaker Introduction
Jamil Abdo, Frostburg State University
Chair, Department of Physics and Engineering

1:00-1:45pm Invited Keynote in-person

Using math in physics: What's the problem?
E. F. (Joe) Redish, Professor Emeritus, University of Maryland

I often find the students in my intro physics classes have trouble with the math even though they've done well in all the pre-req math classes. It turns out using math in science isn't the same as in a math class. I analyze what's going on and make suggestions for helping them to deal with the differences.

This seminar will be interactive. If you have a smartphone, tablet, or laptop with the Chrome or Firefox browser (Safari doesn't work - sorry) you can log into "https://app.tophat.com/e/132795" (choose to log in as guest) and you'll be able to contribute answers to my questions.

1:45-2:00pm in-person

Computational Failure Averted: How the Pandemic Helped Save a Computational Physics Course
Jason Speights, Frostburg State University

The computational physics course at FSU focuses on numerical methods and parameter estimation. It usually culminates in a project presentation using research quality data and analysis. During the same time when the Covid-19 virus began spreading in the US and a pandemic was eventually declared, it became clear to the instructor that course assignments were failing to adequately quantify student learning. Most of them had no idea what they were doing, and morale was suffering because of this. Using data from the pandemic, the assignments and final class presentations were redesigned. This successfully re-engaged the students and motivated them to take the extra time to catch up on the material.

2:00-2:15pm in-person

Lise Meitner: Reflections on a Life in Physics
Frances J. Bolden, Marietta College

Lise Meitner faced many obstacles to her study and research in physics as a woman of Jewish descent in Europe before and during the First and Second World Wars. She overcame many of these, achieving several firsts for women during her lifetime. She studied radioactivity and nuclear physics, and is most remembered for her work as part of the team of scientists who discovered nuclear fission.

2:15-2:30pm in-person

The Wheatstone Bridge and the Wye-Delta Transformation
John Lynch, Frostburg State University

The upper-division physics lab course generally requires equipment that is beyond the budget of smaller, less-endowed institutions. In this work we explore an inexpensive electronics lab that is appropriate for physics majors.

2:30-2:45pm Break

2:45-3:00pm in-person

How Does a Ball and String in Uniform Circular Motion Get Started?
Siegfried Bleher, Fairmont State University

The classic ball and string problem presented to first year physics students as an example of centripetal force and centripetal acceleration is invariably presented as an idealization, often without mentioning how the ball's motion is initiated, or the larger context of problems this example fits in. In the first and second parts of this article, we describe the essential physics required to initiate uniform circular motion from rest and how the ball and string problem fits within a larger context of problems in engineering. In the third part, we apply the equations of the ball on a string to the swing of a golf club. The motivation for this article is to highlight bridges between idealizations and real-world problems that can help students integrate their mathematics and physics courses at various levels.

3:00-3:15pm virtual

Designing a Computational Physics Minor at Marshall University
Maria Hamilton, Marshall University

Students hesitate to major in physics, because they are worried it won't ensure employment right after graduation. We broaden the range of carriers available to our students outside academia by designing a specialization/minor in Computational Physics at Marshall University. The curriculum starts with an introductory level class, suitable for freshmen and high-school seniors, followed by an intermediate, sophomore-level class, and culminating with a senior/graduate-level class. Physics students can add a specialization in Computational Physics to their major, while any other students in science and engineering can earn a minor in computational physics. We aim to make a difference in the way students relate to the physics major by showing that we care about their future career. This is timely, because in today's economy, we are witnessing a dramatic increase in the use of computer modeling. This creates a demand in the job market for scientists and engineers with good computing simulation skills.

3:15-3:30pm in-person

My Hijacked yet Still Productive Sabbatical Year
Hang Deng-Luzader, Frostburg State University

I was granted a sabbatical leave for Fall 2019 and Spring 2020. Unfortunately/fortunately, this coincides with a pandemic that changed everyone's life and changed the way we work, and it almost completely changed my sabbatical plan. It was devastating at first. But I was able to turn things around and find a silver lining. I would like to share with colleagues about what I have done, what I have learned, and how all these impacted my career paths now and in the future.

3:30-3:45pm virtual

Exploring Factors Influencing the Retention of Physics Majors
John Stewart, West Virginia University

This talk examines the retention of physics majors at West Virginia University physics department using 20 years of graduation data. Survival analysis identifies the point of highest risk for two potential paths out of the major: leaving college and changing majors. Substantial risk of losing majors exists through the first two years of college. Logistic regression is used to explore the factors related to retention in general and through the first two years of college. Decision trees, a method applied in machine learning, is used to quantify the thresholds of these variables important to evaluating risk.

3:45-4:00pm Closing remarks and adjourn