

Chesapeake Section of the AAPT Fall Meeting 2017
Saturday, October 21, 2017 at Howard Community College in Columbia, MD

Meeting Schedule

8:00 – 8:45 Registration and Continental Breakfast

8:45 – 9:00 Welcome by Rachele Dominguez and Patti Turner, Dean of the Science, Engineering, and Technology Division, Howard Community College

Session 1: Talks

9:00 – 9:15 **The Physics of Renewable Energy**
Harold Geller, George Mason University

Over the past decade, there has been an ever increasing interest in the development of renewable energy resources. Renewable energy is defined as "that energy that is collected from renewable resources, which are naturally replenished on a human timescale such as sunlight, wind, rain, tides, waves, and geothermal." We will discuss the structure and implementation of a physics department course in renewable energy, which has become a portion of the renewable energy minor in the department and a master's level program run as an interdisciplinary master's program across physics, engineering and environmental sciences.

9:15 – 9:30 **Video Analysis of an Unrolling Mat Using Tracker**
Carl E. Mungan, Physics Dept, U.S. Naval Academy

An ideal wheel rolling without slipping down a ramp conserves mechanical energy, gaining translational and rotational kinetic energy as it loses gravitational potential energy. In the limit of a horizontal ramp, this conservation implies the absence of static friction. In the limit of a vertical drop, the wheel becomes a yo-yo descending a string. Another system that conserves mechanical energy is a chain hanging in an initial U-shape (because both of its ends are held fixed at the same height above the ground) after one end is released. The kinetic energy that is lost by links turning the bottom corner of the chain and coming to rest is (surprisingly) added to the kinetic energy of the remaining falling segment. Hence that segment falls faster than g ! In effect, we can think of it as a rocket problem in which the falling segment is ejecting links upward relative to itself. Now how about combining both systems by considering a rolled up mat (on a horizontal table for simplicity) that starts unrolling without slipping? The mat loses gravitational potential energy as it goes from having its center of mass in a roll above the table to lying spread out flat on the table. The progressively decreasing size roll gains translational and rotational kinetic energy as it ejects more and more of the mat backward relative to itself. Is mechanical energy conserved? I use video analysis to experimentally determine the answer.

9:30 – 9:45 Using Screencasts to Present Homework Solutions in the Introductory Physics course, Randall Jones, Loyola University Maryland

Review of homework problems in a class of 40 introductory physics students is not a very effective use of class time; many students seem bored while another group seem lost. I have been generating screencasts of solutions using Camtasia™ and putting them on YouTube for students to watch on their own time. To encourage students to participate, I use a “two-pass” system in which students can resubmit homework problems for additional credit after watching the screencasts. I will present a sample screencast and discuss evidence of success.

9:45 – 10:00 Spectral Analysis Using Excel

Phuc Tran, John Tyler Community College, Midlothian, Virginia

Fourier transform is very useful in many applications, e.g. spectral analysis. To perform Fourier transform requires a computing platform. For the budget conscious institutions/students, buying a software package for use may not be practical. All of our John Tyler students have free access to Excel, so this is a convenient platform. In this talk, I will present a Fourier transform programmed in Excel. This is used to do a spectral analysis of sound from a guitar.

10:00 – 10:15 Advanced CCD Photometry and Exoplanet Transit Photometry

Kenny A. Diaz Eguigure: Howard Community College, University of Maryland, and Southern New Hampshire University

Advanced CCD photometry 2, a technique in astronomy occupied in light flux measurement, or the intensity of electromagnetic radiation of an astronomical object. It is one of the most fundamental technique and innovative research tool used by modern astronomy today. It is also an area where valuable contributions can be made by students of astronomy or amateur astronomers alike by making astronomical observations with small telescopes at observatories in universities and even observatories in backyards around the world. These observations could help the expansion on the search for new exoplanets. By understanding how the advanced CCD photometry 2 works, astronomy students could develop advanced techniques in how to collect more precisely stellar light data and to recognize the ideal weather parameters for the best advanced CCD photometry 2 conditions and finally, to develop more accurate light curves from the celestial object that it is being observed by them. This also could aid for a verification of discovery for some possible new exoplanets.

10:15 – 10:30 Break

Session 2: Talks

10:30 – 10:45 Acceleration of Rolling Objects

Anshu Sharma, Randolph-Macon College

This talk will cover the derivation of the acceleration of an object rolling down an inclined plane two different ways. One way will involve the application of laws of motion in translational form and shall take the point of rotation to be the center of the rolling object, and another will involve the application of the laws of motion in rotational form and shall take the point of rotation to be the contact point between the object and the plane. This talk will show how we can choose the point of rotation and how Newton's laws in translational form and Newton's laws in rotational form are related. Finally, it will show that for best understanding, if multiple conceptual approaches are available to reach a particular result, educators should show the derivation of the result multiple ways to foster the greatest conceptual understanding in students.

10:45 – 11:05 Using x-ray fluorescence spectroscopy to demonstrate Moseley's Law
Pegah Avazpour¹, Thaina Brito², Perry Wood³, Debra Ellis³, and Christopher Stromberg⁴,
University of Maryland, Frederick Community College, and Hood College

Integrating an innovative technology such as X-ray fluorescence (XRF) spectroscopy into a modern physics lab gives students a valuable opportunity for further understanding of the concepts in Moseley's law. Moseley's law is a linear relationship between the square root of frequency and the atomic number. XRF spectroscopy identifies elements by illuminating a sample with X-rays. The excitation and relaxation of the electrons from the innermost atomic shells produces a spectrum from which the elements can be easily identified.

A new experiment using XRF spectroscopy has been added to the Modern Physics course at Frederick Community College, in which students measure the energy emitted from several samples. They use the measured data from the XRF spectrometer and convert energy to frequency to create a plot of Moseley's law and from the slope calculate Rydberg's constant. In the last part of the lab, students will be challenged to identify an unknown sample using their linear fit equation from the plot.

Through Moseley's law, students will gain an understanding of the relationship between atomic number, frequency, and the energy an element emits. X-ray fluorescence spectroscopy is a simple, useful and relatively safe instrument that can easily be incorporated into any course that studies elements, energy and/or atoms.

This project was supported by Hood College, Frederick Community College, and Mount St. Mary's University and funded through the National Science Foundation's Improving Undergraduate STEM Education program (DUE-1431522).

11:10 – 12:10 **Keynote speaker: William Roncal**
Johns Hopkins University, Applied Physics Laboratory

William Roncal from Applied Physics Lab will give an overview of APL and talk about his research trying to model the wiring of the human brain.

12:10 – 12:20 Group Photo

12:20 – 1:30 **Lunch** (Posters on Display)

Session 3: Talks

1:30 – 1:45 **The Human Analemma Sundial**
Daniel Goldman, Rosa Parks Middle School

The human sundial is designed to be drawn on any sunny blacktop. It may be temporary (chalk) or permanent (paint). It requires a minimum area of 22 x 15 feet. It is designed to take advantage of the length of a person's shadow.

1:45 – 2:00 **Bathroom Physics Demos**
Russ Poch, Howard Community College

This presentation will illustrate physics concepts commonly seen in a typical bathroom, e.g. Newton's Laws, Bernoulli's Principle, heat transfer and change of phase, etc. The demos will feature readily available and inexpensive materials.

2:00 – 2:15 **A Scale for Measuring Mass/Weight**
Phuc Tran, John Tyler Community College

For this demonstration, I will show a simple scale that anyone can make with a piece of cardboard, paper, paper clip and strings. For calibrated masses, a simple and common object can be used. Making this scale will teach students the concept of center of mass/gravity and torque. For online classes, this scale is useful not only for measuring masses but also for doing experiment like buoyancy.

2:15 – 2:30 **The Wave-Particle Duality of Light**
Anshu Sharma, Randolph-Macon College

This talk will explore, through a demonstration of interference and a demonstration of activation energy, the wave-particle duality of light. The interference demonstration will involve a laser being shone through a diffraction grating to produce an interference pattern, showing how light has the properties of a wave. The activation energy

demonstration will involve a red laser, green laser, and fluorescent pink material. The red laser will show up as a red dot on the pink material but the green laser shall show up as a orange dot since green light has energy enough to activate the dye. This demonstration will show that light has particle-like properties as well. We will then discuss why particle-like properties cannot explain the interference pattern and why wave-like properties cannot explain the activation energy demonstration.

2:30 – 2:45 Make and Take Demo: Fun with Cartesian Divers

David Wright, Tidewater Community College

We'll play with both "open" and "closed" divers and look at a number of activities and investigations with Cartesian divers. Everyone will take home several Cartesian divers.

2:45 – 3:00 Voting and Break (Posters on Display)

3:00 – 4:30 Workshop: Introduction to Arduinos

Mark Edelen from Howard Community College

4:30 **Business Meeting** (All are welcome)

Dinner at Columbia Ale House

Note to presenters: All presenters are kindly asked to convert their presentations into PDF form and email a copy this week to: Elena Kuchina (kuchinae@tncc.edu).

CSAAPT Business Meeting Agenda

1. Announcement of Awards for Best Talks
2. Approval of Minutes from Spring 2017 Meeting (David Wright).
3. Proposed amendment to the CSAAPT Constitution (Rachele Dominguez)

Proposed Amendment: “The terms of the secretary and treasurer shall be for two years, and shall be staggered so that only one of these officers shall be elected at any one annual election. There are no limits to the number of consecutive terms that the secretary and treasurer may serve.”

Rationale and discussion

Email vote to follow immediately after business meeting requires 2/3 majority of those voting. Deadline for voting is November 1, 2017.

4. Planning for Future Meetings (Rachele Dominguez)

AAPT recent past meetings

- 2017 Fall Meeting: Howard Community College, Columbia, MD
- 2017 Spring: Concord University, Athens, WV (Joint meeting with Appalachian Section)
- 2016 Fall: Northern Virginia Community College, Sterling, VA
- 2016 Spring: Randolph-Macon College, Ashland, VA
- 2015 Fall: St. Mary’s College of Maryland, St. Mary’s City, MD
- 2015 Spring: University of Virginia, Charlottesville, VA
- 2014 Fall: Loyola University Maryland, Baltimore, MD
- 2014 Spring: American Center of Physics, College Park, MD

Possible future locations

- Spring 2018: St. Alban’s School, Washington, DC (Spring, 2018)
- Tidewater Community College, Virginia Beach, VA (2018 Fall, tentative)
- Radford U, Radford, VA (2019 Fall, tentative)
- St. John’s College, Annapolis, MD
- J. Sargent Reynolds Community College, Richmond, VA (may have a cost)
- Howard Community College, Columbia, MD
- Others?

3. Report on NSTA Physics Day, Friday, October 6, 2017, Baltimore, MD (Rachele Dominguez)

4. Treasurer's Report (Brett Taylor)
5. Section Representative's Report (Deonna Woolard)
6. New Representative for Washington Academy of Sciences. Current Rep: Father Frank Haig (Rachele Dominguez)
7. Any new business? (Rachele Dominguez)
8. Directions to dinner for those who are interested (Alex Barr)