Chesapeake Section of the AAPT Fall Meeting 2019
Saturday, October 12, 2019 at Virginia Commonwealth University in Richmond, VA

Saturday
Meet in room 2305 of the Honors College at 701 West Grace St.

8:00 – 8:45 AM, **Registration and Continental Breakfast**

$25 Regular attendee
$15 Students, K-12 teachers, and guests
$5 First time K-12 teachers

Cash, credit, and check accepted. Receipts available upon request.

8:45 – 9:00 **Welcoming Remarks** by Dr. Joseph Reiner, VCU Physics Department

Session 1: Contributed Talks

9:00 – 9:20 **Physics Olympics**
David Wright, Tidewater Community College, dwright@tcc.edu

A Physics Olympics is a great way to get the local high school and middle school science students involved in a fun, practical physics experience. We have sponsored a Physics Olympics in the Norfolk/Virginia Beach area for the last 30 years. I'll describe how it is organized, and then we will all have an opportunity to try out a sampling of the activities that have been done in our past Olympics

9:20 – 9:40 **Vertical Motion of a Ball Subject to Air Drag**
Carl E. Mungan, U.S. Naval Academy, mungan@usna.edu

Two identical balls are simultaneously launched vertically upward with the same initial speed, one in vacuum and the other in air. First, suppose the drag force is linearly proportional to the ball's speed. Which ball will take longer to return to its starting point: the one in vacuum, the one in air, both the same, or does the answer depend on factors such as the mass, launch speed, or drag coefficient? I will present a range of solutions varying from conceptual to a full numerical treatment.

Next, consider a more realistic quadratic drag force. Is it harder or easier to solve for the motion of the ball when the air resistance is proportional to the square of the ball's speed? A clue is provided by the fact that kinetic energy is also proportional to speed squared.

9:40 – 10:00 **A Relay-Based Adder Circuit Demonstration for Introductory Electromagnetism**

Jonathan Perry, Towson University, jperry12@students.towson.edu

Concepts like series and parallel circuits are often introduced to beginning students entirely through abstract problems (e.g., several resistors R1, R2, ... are arranged as follows ... find the equivalent resistance). To bring these concepts home to students in a more context-rich way, we asked our students how they would arrange a power supply, bulbs and switches to make (a) an AND gate, (b) a NOT gate, and (c) an OR gate. Then we created a demonstration showing how four of these gates can be simply combined to create a half-adder circuit. Our demonstration uses large relays with transparent cases so that students can actually see (and hear) how, for example, current flows through the AND gate when both input switches are thrown. For many students, this is the first time they intuitively grasp the relevance of basic circuit concepts to the complicated devices, like computers, that we use in everyday life.

10:00 – 10:15 **Break**

10:15 – 10:35 **The Spin-Statistics Theorem: Just an Axiom or a Consequence of Relativity?**

Anshu G. Sharma, Randolph-Macon College, anshu.g.sharma@gmail.com

The spin-statistics theorem is one of the fundamental theorems of quantum mechanics and statistical mechanics, determining the behavior of collections of different particles. From a pedagogical standpoint, it is interesting for (at least) two reasons: 1) It is treated as an axiom at the non-relativistic (undergraduate) level, and 2) Physicists have attempted to prove it without relying on relativity. How did those attempts turn out? And how should professors and teachers present the theorem in its physical, historical, and mathematical context?

10:35 – 10:55 **A Guided Tour of PhysPort**

Alex M. Barr, Howard Community College, abarr@howardcc.edu
Deonna Woolard, Randolph-Macon College, dwoolard@rmc.edu

The website PhysPort.org contains a wealth of valuable resources for physics instructors. They host a curated collection of research-based assessments and teaching methods, expert recommendations, and videos illustrating different instructional techniques. We will illustrate some specific resources, talk about how we have used them, and lead a group discussion around one of the teaching videos available.

Session 2: Workshop

11:00 – 12:00 **Getting Students Excited About Learning Physics with Active Learning**
Ching-Yu Huang, Virginia Commonwealth University, cyhuang@vcu.edu

Join us to brainstorm best practices to engage our students in learning physics. We will begin with defining scientific teaching and re-framing "active learning" that is closely aligned with and responsive to how students learn. Selected active learning strategies will be introduced with examples to help you to develop your own active learning exercises that are appropriate and efficient to promote higher-order cognitive skills, critical thinking and problem solving for your specific topics in physics and targeted student populations. This workshop aims to diminish the barriers we often encounter when implementing active learning in the classroom and to set the stage for faculty to design purposeful, active learning exercises. At the end of the workshop, we hope to inspire and help faculty to connect and engage students in the classroom, as well as improve students' learning.

12:00 – 1:15 **Lunch and Group Photo**

Session 3: Demos and Make-and-Takes

1:15 – 1:30 **Sound Visualizer**
Ramani Kharidehal, Northern Virginia Community College, rkharidehal@nvcc.edu

Sound is a vibration that propagates as an audible pressure wave through different media. The vibrations of a thin membrane caused by sound waves traveling in air is visualized in this demonstration. We use a container which has a stretched balloon at one end to serve as the vibrating membrane and the other open end is used to input sound. The different amplitudes and frequencies of sounds input into the open end of the container cause the membrane to vibrate at the other end. The various modes of vibration of the stretched balloon are picked up by a small light mirror attached to it. A laser beam reflected from the mirror displays interesting patterns and configurations on a screen.

1:30 – 1:45 **Demonstration of Atomic Force Microscopy with LEGO**
Dexian Ye, Virginia Commonwealth University, dye2@vcu.edu

Force is one of the central concepts in Physics. In this presentation, we demonstrate how the tiny force near a surface is detected and used to sense microscopic objects such as DNAs and proteins by the atomic force microscopy (AFM). The principle of AFM is exhibited by a LEGO model. This model can be introduced in high school AP Physics classroom, as well as in the robotic team practice.

1:45 – 2:00 **3D Printing**
Dexian Ye, Virginia Commonwealth University, dye2@vcu.edu

> 3D printing becomes popular in research and manufacturing sectors and is easily accessible to public in recent years. In Physics Department at VCU, our faculty use 3D printing process to produce circuits, bone structures, and tissues. In this workshop, we introduce bioengineering projects using 3D printing and demonstrate the manufacturing of a custom designed simple circuit. 3D printing can be employed in high school to explain physics concepts.

2:00 – 2:15 **A Simple Electroscope Make-and-Take**
Francesca Viale, Northern Virginia Community College, fviale@nvcc.edu

> A simple electroscope is designed to introduce electrostatics and the different behavior of insulators and conductors. In this "make and take" we share the material to prepare the demo: a short copper wire with two aluminum foil leaves together with a metal plate and an insulator plate.

2:15 – 2:30 **Break**

2:30 – 2:45 **Simple Bernoulli and Two Lenz Law Demos**
Tony Wayne, Albemarle High School, twayne@k12albemarle.org

> Ping pong™ balls, fluorescent light tube and some wind can make a great visual example of Bernoulli's principle. A new twist on the classic Lenz law demo of dropping a magnet through a copper tube. Everything can be purchased from local stores and Internet merchants.

2:45 – 3:00 **Brachistochrone and Tautochrone: or How to make the period of a pendulum independent of its amplitude**
Tatsu Takeuchi, Virginia Tech, takeuchi@vt.edu

> I will discuss the interesting properties of the brachistochrone/tautochrone curve and show how to construct a simple presentation that can be used in class.

3:00 – 3:15 **Break and Awards Voting**

3:15 **Awards, Elections, and CSAAPT Business Meeting** (All are welcome)

Optional dinner in the evening

Note to presenters: All presenters are kindly asked to convert their presentations into PDF form and email a copy following the meeting to: Elena Kuchina (kuchinae@tncc.edu) so that they may be posted on the CSAAPT website.

*All attendees are invited to bring posters to have on display during lunch and coffee breaks

Directions:

- Virginia Commonwealth University Honors College: 701 West Grace St.
    - https://maps.vcu.edu/pdfs/campus_map.pdf (Building 61)
- We will meet room 2305 of the Honors College (enter at the corner of Laurel and W. Grace, go up the stairs, turn right then turn left)
- Parking on the street is free on weekends or there are several parking garages nearby