

CSAAPT Spring 2023 Semi-Virtual Meeting



Chesapeake Section of the
American Association of Physics Teachers
Spring 2023 Semi-Virtual Meeting
April 1, 2023 @ **JAMES MADISON UNIVERSITY.**

Report of Contributions

Contribution ID: 1

Type: **talk (15-minute)**

A case for rudimentary labs.

Saturday, April 1, 2023 1:45 PM (15 minutes)

Science education equipment has made amazing leaps forward in the last 5-10 years. It's easy to get graphs that are of near professional quality. Has any learning happened, or is it just "magic data"? In this presentation I propose that, for intro physics students, using less perfect data collection and/or analysis leads to more learning.

Primary author: DOSS, Kerlin (North Stafford High School)

Presenter: DOSS, Kerlin (North Stafford High School)

Session Classification: Afternoon Session 1A

Contribution ID: 2

Type: **not specified**

Webb and Roman, the present and future of astronomical space telescopes

Saturday, April 1, 2023 11:00 AM (1 hour)

Dr. Margaret Dominguez has worked at NASA for over 13 years as an Optical Engineer. She has worked on the James Webb and the Nancy Grace Roman Space Telescopes. Webb is an orbiting infrared observatory which will complement and extend the discoveries of the Hubble Space Telescope. Roman seeks to study galaxies and dark energy. During her talk she will discuss the differences between these telescopes and the importance of physics in their design and operation.

Primary author: Dr DOMINQUEZ, Margaret (NASA)

Presenter: Dr DOMINQUEZ, Margaret (NASA)

Session Classification: Featured Talk 1

Contribution ID: 4

Type: **talk (15-minute)**

RIDING ON A LIGHT BEAM: ACCELERATION AND MASS RISE

Saturday, April 1, 2023 10:30 AM (15 minutes)

This presentation is a continuation of one I gave on April 1, 2022 on the velocity triangle and the Brehme Angle as a graphical solution to problems in Special Relativity. This presentation applies those concepts to a body undergoing uniform linear acceleration, to determine that linear acceleration is rotary motion in four dimensions. The simple graphical solution satisfies the classical equations of motion $v=at$ and $s=1/2at^2$ at small angles of rotation ($v \ll c$), and observed relativistic mass rise for rotational angles for greater velocities. The simple trigonometric model predicts that an unaccelerated observer will measure the body's location along a hyperbolic worldline, consistent with the trajectory derived in Gravitation (Misner, Thorne and Wheeler) using tensors.

Primary author: MCINTYRE, Lewis

Presenter: MCINTYRE, Lewis

Session Classification: Morning Session 2B

Contribution ID: 5

Type: **talk (15-minute)**

Teaching Students How to Explain Big Ideas with Simpler Words

Saturday, April 1, 2023 2:00 PM (15 minutes)

Special science language plays a big part in our lives. We often do not notice how confusing our language can be until either you or someone else just doesn't understand the words being used. The reason for this talk is to show you one way of teaching science-word-using to students in a fun and easy to remember way.

The idea for this talk came from the book *Thing Explainer*, by Randall Munroe. This talk will step through the steps of writing a student-led *Thing Explainer*, from choosing ideas to reading science papers to drawing pictures to choosing words other people can understand. We will cover good things and bad things that go along with the *Thing Explainer* and enjoy pieces of student work.

Munroe, R. (2015). *Thing Explainer: Complicated Stuff in Simple Words*. Houghton Mifflin Harcourt.

Primary author: FLOREK, Mike (Roanoke County Public Schools)

Presenter: FLOREK, Mike (Roanoke County Public Schools)

Session Classification: Afternoon Session 1A

Contribution ID: 6

Type: **talk (15-minute)**

Science Overdrive: A K-8 and HS Collaboration

Saturday, April 1, 2023 10:15 AM (15 minutes)

Improving elementary science education through collaboration between elementary and secondary science teachers has shown to be effective through the workshops of Science Overdrive, a Virginia 501c3. Teachers worked together to develop hands-on and active learning lessons that meet K-8 Virginia standards. Secondary teachers bring activity ideas, a depth of knowledge and passion for the content, while elementary teachers ideate age-appropriate activities and effective teaching methods for the elementary school classroom. Workshop participants are provided digital lesson plans, classroom materials, recertification points, and a 'vertical' network of support - all free of charge.

Primary author: AKESSON, Laura (Department of Energy)

Presenter: AKESSON, Laura (Department of Energy)

Session Classification: Morning Session 2A

Contribution ID: 7

Type: **talk (15-minute)**

Albert Einstein Distinguished Educator Fellowship

Saturday, April 1, 2023 10:30 AM (15 minutes)

Every year, the Department of Energy brings a select group of K-12 STEM teachers from across the country to Washington DC for 11 months. These Einstein Fellows are placed in a federal agency or on Capitol Hill to provide teacher perspective in the Federal space. I will talk about the application process and my experience of being an Einstein Fellow.

Primary author: STRAND, Michelle (Office of Congressman DeSaulnier)

Presenter: STRAND, Michelle (Office of Congressman DeSaulnier)

Session Classification: Morning Session 2A

Contribution ID: 8

Type: **talk (15-minute)**

Intro to Python for Scientists and Engineers: A bootcamp for data science.

Saturday, April 1, 2023 10:15 AM (15 minutes)

I will describe a new course offered in the Physics Department at the University of Virginia. It satisfies the basic computing requirement for physics and astrophysics (as well as several other major/minor requirements at the university). However, it is a general-education course, and as such, it does not focus on examples from the physical sciences. Instead, it focuses on the foundation of coding skills and statistics background that are required to employ the powerful data-science tools available in Python. The class covers Linux, Python, batch jobs, statistical methods and probability distributions, visualizing and analyzing data with Matplotlib, and concludes with a few lectures and assignments working with classification tools in Scikit-learn (neural networks for example). The goal is for students to develop general skills that are valid in most research and industrial environments. This is accomplished via a flipped classroom pedagogy employing a mini-lecture followed by extensive practice each day in class.

Primary author: GROUP, Craig (Virginia)

Presenter: GROUP, Craig (Virginia)

Session Classification: Morning Session 2B

Contribution ID: 9

Type: **talk (15-minute)**

Using ALEKS in the introductory physics courses at college level

Saturday, April 1, 2023 9:45 AM (15 minutes)

The introductory physics courses at the University of Virginia Physics Department are undergoing a massive change. A concerted effort has been made in the past several years to implement a more modern approach to teaching, including implementing various active learning practices.

A higher demand on students' focus and attention in the active learning environment requires a higher degree of support, including recognizing and supporting students' development in areas such as pre-calculus math, scientific writing and reasoning, and group work – all of which were previously assumed to be mastered or implicitly understood by our students.

In my talk I will briefly outline my experience with teaching introductory physics lab and lecture courses and describe how I use ALEKS software to both support and evaluate students throughout their two semesters of physics with us.

Primary author: BYCHKOV, Maxim (University of Virginia)

Presenter: BYCHKOV, Maxim (University of Virginia)

Session Classification: Morning Session 2A

Contribution ID: 10

Type: **talk (15-minute)**

Scaffolding the Transition to Higher-level Physics at the University of Virginia

Saturday, April 1, 2023 2:30 PM (15 minutes)

A recent restructuring of the curriculum at UVa resulted in the creation of a new physics course – one unlike any previously taught in our department. PHYS 2720: Problem Solving and Special Topics in Classical Physics, currently being taught for the first time, aims to bridge the gap between introductory physics, which students may have taken in a variety of settings, and the core courses of the physics major. I will discuss the course design and its aim to support 2nd year undergraduates as they learn to approach problems of the length and complexity they will encounter in higher-level physics courses, as well as share early results and lessons learned.

Primary authors: Dr JONES, Bob (University of Virginia); LARSON, Elizabeth (University of Virginia)

Presenter: LARSON, Elizabeth (University of Virginia)

Session Classification: Afternoon Session 2A

Contribution ID: 11

Type: **talk (15-minute)**

OPTYCs: An Update on Current Activities

Saturday, April 1, 2023 2:45 PM (15 minutes)

OPTYCs: An Update on Current Activities

The Organization for Physics at Two-Year Colleges is actively developing and providing professional development and other activities designed for two-year college physics faculty. This presentation will describe the ongoing activities and will include a preview of upcoming events. Information about how to get involved will also be provided.

Primary author: SAVRDA, Sherry (AAPT - OPTYCs)

Presenter: SAVRDA, Sherry (AAPT - OPTYCs)

Session Classification: Afternoon Session 2B

Contribution ID: 12

Type: **talk (15-minute)**

Adaptive Step and Adaptive Order for the Parker Sochacki Method of Solving Systems of Ordinary Differential Equations.

Saturday, April 1, 2023 3:00 PM (15 minutes)

The Parker Sochacki Method (PSM) or Power Series Method of solving systems of differential equations offers a very simple, powerful, general, fast (time proportional to order squared), and effectively symplectic method for solving systems of ordinary differential equations (odes), by treating all functions as Taylor series, and equating coefficients. It comes with a priori absolute error bounds. This presentation briefly shows PSM, and then offers the theoretical principles and a couple general methods of accurately choosing an optimum adaptive step and adaptive order over a specified domain.

Primary author: RUDMIN, Joseph (James Madison University)

Presenter: RUDMIN, Joseph (James Madison University)

Session Classification: Afternoon Session 2A

Contribution ID: 13

Type: **talk (15-minute)**

Free Resources and Curricula for Teaching Scientific Computing: DSECOP, PICUP, PY4E

Saturday, April 1, 2023 1:30 PM (15 minutes)

Physics programs introduce students to scientific computing in various contexts and at various levels. In this talk, free resources and curricula are discussed for teaching computing to physics students in the following contexts: as part of a regular physics course, in a stand-alone physics course (Computational Physics), as a separate course requirement (Introductory Programming), and in special projects. The collections in PICUP and DSECOP as well as the free curriculum for python programming, PY4E, are highlighted. Comparisons of commonly-used free environments for python programming are briefly discussed.

Primary author: O'NEIL, Deva (Bridgewater College)

Presenter: O'NEIL, Deva (Bridgewater College)

Session Classification: Afternoon Session 1A

Contribution ID: 14

Type: **demo (15-minute)**

Modeling Freefall with Drag Force on a Spreadsheet

Saturday, April 1, 2023 10:00 AM (15 minutes)

For many students, “calculus” is an intimidating word, while at the same time they find 1D motion with uniform acceleration to be intuitive and easy to visualize. Using a spreadsheet creates an opportunity to demystify this math connection for all students while adding a new skill and enhanced capability to the physics curriculum. Solving for any single unknown in a 1D motion problem is actually a single iteration of a numerical solution that can be “automated” with a spreadsheet model. This model can be adapted to study a wide range of non-ideal physical phenomena and objects in motion. A spreadsheet makes the ideal medium for connecting math to concepts (even for reluctant learners) while dramatically expanding computational modeling capability. This presentation will share the pedagogical technique in which students program a spreadsheet model using the fill handle to replicate calculations of Newton’s 2nd Law to model motion with changing drag force for a falling object reaching terminal velocity. With ideal physics equations and simple instructions, complex models can be built that simulate realistic motion that would otherwise require differential equations. When students assemble the model they can experiment with key variables knowing how the cells are linked in a spreadsheet including mass, cross sectional area and drag coefficient to observe an accurate representation of a real velocity versus time graph. A “living graph” responds to these changes enabling students to observe and study the dynamics of an object as it falls from rest and reaches terminal velocity using inquiry with instant, visual feedback. The presentation will demonstrate how to apply this methodology to a wide range of phenomena related to motion and how it can be efficiently delivered either remotely or in person with the same pedagogical approach. Color coding of cells and copy & pasting of formulas means this approach is readily adapted to be delivered to all student levels including English Language Learners (ELL) and special education students. Other applications include projectile motion, rockets, gravitational fields, electric fields, superposition principle and many others.

Primary author: MCCONNELL, Michael (Lindenwold Public Schools)

Presenter: MCCONNELL, Michael (Lindenwold Public Schools)

Session Classification: Morning Session 2B

Contribution ID: 15

Type: **talk (15-minute)**

The UVA Physics Bridge Program

Saturday, April 1, 2023 10:00 AM (15 minutes)

The UVA Physics Bridge program is designed to increase the participation rate of people from backgrounds that are currently under-represented in advanced study of Physics. Promising students from under-represented groups often come from unique learning backgrounds and, moreover, often come from institutions with non-standard Physics curricula. These effects can contribute to talented applicants from these backgrounds needing additional preparation before entering into a graduate curriculum to optimize their chances at ultimately receiving their PhD. Students accepted into the UVA Physics Bridge program receive individualized mentoring, follow a tailored curriculum, participate in academic and professional training, and experience research opportunities with UVA Physics faculty. In this talk, I will describe the logistics of the program, provide a few key best practices, and give a glimpse of the outcomes that students in the program have experienced since its inception in 2016.

Primary author: NEU, Chris (University of Virginia)

Presenter: NEU, Chris (University of Virginia)

Session Classification: Morning Session 2A

Contribution ID: 16

Type: **talk (15-minute)**

The Virginia Space Grant Consortium (VSGC)

Saturday, April 1, 2023 3:00 PM (15 minutes)

VSGC is a coalition of five Virginia colleges and universities, NASA, state educational agencies, Virginia's Center for Innovative Technology and other institutions representing diverse aerospace interests. It acts as an umbrella organization, coordinating and developing aerospace-related and high technology educational and research efforts throughout the Commonwealth, and connecting Virginia's effort to a national community of shared aerospace interests. VSGC has several K-12 programs available to the public. They include Virginia Aerospace Science and Technology Scholars, Virginia Earth System Science Scholars, Virginia Space Coast Scholars, Building Leaders for Advancing Science and Technology and Technology Saturdays.

Primary author: KASHIRI, rudo (Virginia Space Grant Consortium)

Presenter: KASHIRI, rudo (Virginia Space Grant Consortium)

Session Classification: Afternoon Session 2B

Contribution ID: 17

Type: **talk (15-minute)**

A "Transformative" Assignment on Rotation: A Seemingly Simple Question Becomes an Epic Four Part Exploration

Saturday, April 1, 2023 2:30 PM (15 minutes)

A seemingly simple either/or question about which shape Optimus Prime should transform into becomes, when guided by the instructor, a four-part, back and forth, edge-of-your-seat drama with a nailbiter conclusion. Topics covered include angular acceleration and momentum, moment of inertia, alternative axes of rotation, function optimization, and the semantics of "disk" vs. "cylinder." Different approaches for algebra-based and calculus-based courses are discussed, as well as student feedback from the first semester that the assignment/activity was implemented.

Primary author: HUNTRESS, Mark (Patrick & Henry Community College)

Presenter: HUNTRESS, Mark (Patrick & Henry Community College)

Session Classification: Afternoon Session 2B

Contribution ID: 18

Type: **talk (15-minute)**

Using new, smart, cellphone-controlled telescopes for education and outreach

Saturday, April 1, 2023 2:00 PM (15 minutes)

I will discuss our experimentation with two smart telescopes which have recently become commercially available. These instruments, the eVscope and the Stellina, are controlled using cellphone apps. Setup time is remarkably short and the imaging capabilities of these instruments are very impressive. I will discuss our testing of these instruments in an undergraduate research project and in our observational astrophysics course. Students find these instruments very easy to use. The potential opportunities for educational and outreach applications should be quite good. Both instruments will be on display at the meeting.

Primary author: SIMONETTI, John (Virginia Tech, Physics)

Presenter: SIMONETTI, John (Virginia Tech, Physics)

Session Classification: Afternoon Session 1B

Contribution ID: 19

Type: **talk (15-minute)**

Active Learning Strategies in Teaching Physics for Pre-health Students in Large Classroom

Saturday, April 1, 2023 2:45 PM (15 minutes)

Implementing active learning techniques in teaching introductory physics courses creates a positive learning environment and is proving to promote better understanding of the concepts via in-depth discussion among peers with support from the instructor and teaching assistants. This talk focusses on the active learning methods adopted by me in teaching physics for pre-health students at the University of Virginia in Fall 2022. I will be presenting a model of the activities carried out during a 50-minute class session and will be discussing the outcome in terms of student involvement and learning.

Primary author: SUNDARARAJAN, Jency (University of Virginia)

Presenter: SUNDARARAJAN, Jency (University of Virginia)

Session Classification: Afternoon Session 2A

Contribution ID: 20

Type: **talk (15-minute)**

Using Demonstrations to Engage Students in Lecture

Saturday, April 1, 2023 1:45 PM (15 minutes)

It's commonly received wisdom in physics teaching that practical demonstrations make a lecture course more exciting for the students. But how do we present demonstrations in a way that encourages students' active engagement with the topic? How do we move from merely showing a demonstration, to getting students to ask questions and make predictions? How do we choose demonstrations that will help the students make the leap to understanding the underlying physics?

Primary author: DAETWYLER, Clay (University of Maryland)

Presenter: DAETWYLER, Clay (University of Maryland)

Session Classification: Afternoon Session 1B

Contribution ID: 21

Type: **demo (15-minute)**

Active Learning Made Easy with Pivot Interactives

Saturday, April 1, 2023 9:00 AM (15 minutes)

Teachers know that students are engaged by active learning, but creating active learning environments and opportunities takes time, expertise, equipment, and supplies. It is challenging or impossible to do as often as we would like. We will explore interesting ways to engage students with MORE active learning and “doing science” throughout the learning cycle, without these constraints or added burden using Pivot Interactives.

Primary author: RHOADES, Eric (Pivot Interactives | Discovery Education)

Presenter: RHOADES, Eric (Pivot Interactives | Discovery Education)

Session Classification: Morning Session 1

Contribution ID: 22

Type: **talk (15-minute)**

Newton Rules Biology: How Physics Influences Sizes and Shapes of Animals

Saturday, April 1, 2023 9:45 AM (15 minutes)

We are used to seeing variations in size and proportions among humans and animals, often without thinking much of it. What limits their sizes? Why is it that the tallest man or woman is not taller than 8 feet? And, while at it, why aren't more of them? What challenges would a much taller person (or shorter) face in their day-to-day living? What about efficiency –how does food consumption relate to average specimen size? In this talk we will examine and attempt to answer some of these questions by placing nature's creatures under a "Physics" microscope.

Primary author: CLAIRMONT, Lilian (Appomattox Regional Governor's School)

Presenter: CLAIRMONT, Lilian (Appomattox Regional Governor's School)

Session Classification: Morning Session 2B

Contribution ID: 23

Type: **demo (15-minute)**

Demonstration of Schlieren Imaging

Saturday, April 1, 2023 1:30 PM (15 minutes)

The schlieren and shadowgraph techniques allow one to observe otherwise invisible phenomena in transparent gas, liquid or solid materials. These optical methods are very sensitive to changes in the refractive index of the media under observation. For example, the variations in air density in the convection plume of a candle's flame results in an impressive display of laminar and turbulent fluid flow. Thermal gradients can also be seen coming off a person's hand. The schlieren and shadowgraph techniques will be explained and demonstrated using a single mirror optics setup.

Primary author: TOBIAS, William A. (University of Virginia)

Presenter: TOBIAS, William A. (University of Virginia)

Session Classification: Afternoon Session 1B

Contribution ID: 24

Type: **not specified**

Lab Activities in Electricity, Magnetism, and Optics for High School Physics and Physical Science Teachers

Saturday, April 1, 2023 3:45 PM (45 minutes)

In this presentation, we will discuss the physics and pedagogy of selected lab and demo activities that have been used over the past years in workshops and courses at the University of Virginia for high school physics and physical science teachers. However, my main purpose is to hand out to teachers hard wired lab activities still available from these studies which are still new and never been used. Still available are electroscope kits, bread board kits with resistors, wires etc., several toolbox E/M kits with over 75 items, multimeters, several laser pointer kits, a few optical bench kits, waterproof cameras, tripods, physics like toys such as a slinky, mirascope, fire syringe, hand boilers, solar dancers, poppers, and dippy ducks. In addition to the kits there are numerous items that do not fit in a particular category such as bar magnets, digital thermometers, mini microphones, bags of resistors of all values, mini transformers, motors, and generators, etc. A list of most items with photos will be posted online. You will have the opportunity to view the list before you arrive. Some selected activities will be demonstrated and discussed hopefully giving you some new ideas. After discussion we will match you up with your first choice that you have previously selected. You may be permitted to select additional items if still available.

Primary author: LINDGREN, Richard (University of Virginia)

Presenter: LINDGREN, Richard (University of Virginia)

Session Classification: Featured Talk 2

Contribution ID: 25

Type: **talk (15-minute)**

Tapping into the STEM Pipeline at Jefferson Lab

Saturday, April 1, 2023 3:15 PM (15 minutes)

This session will present opportunities for STEM students and teachers available at Jefferson Lab — from internships, mentorships and summer programming for both high school and undergraduate students, to K-12 teacher professional development. We will also share information and resources regarding community outreach efforts and how to engage with the Lab for your events.

Presenter: SURLES-LAW, Lisa (Jefferson Lab)

Session Classification: Afternoon Session 2B

Contribution ID: 27

Type: **talk (15-minute)**

Creating Connections: McGraw Hill Resources for Physics

Saturday, April 1, 2023 9:15 AM (15 minutes)

Explore the variety of resources available via McGraw Hill to engage with your students and achieve a better learning experience whether in the classroom, in the lab, or at home.

Presenter: BRYSON, Allyn (McGraw Hill)

Session Classification: Morning Session 1

Contribution ID: 28

Type: **talk (15-minute)**

Teaching Applied Physics to an ISAT Audience

Saturday, April 1, 2023 3:15 PM (15 minutes)

This talk will be a brief overview of how we teach physics in the Integrated Science and Technology Program at JMU. We do it by picking and choosing topics that build a broad base of applied physics knowledge on which our students can build higher in the future depending on their need for learning more advanced physics topics after they graduate.

Presenter: HENRIKSEN, Paul (James Madison University)

Session Classification: Afternoon Session 2A

Contribution ID: 29

Type: **not specified**

Einstein's Gravity Playlist

Saturday, April 1, 2023 6:00 PM (1 hour)

This original planetarium show explores the ripples in space-time known as gravitational waves. Albert Einstein first predicted the existence of gravitational waves in 1916, and a century later, scientists detected these waves using incredibly precise laser technology here on Earth. In honor of this long-anticipated detection, the scientists who created the Laser Interferometer Gravitational-Wave Observatory (LIGO) won the 2017 Nobel Prize in Physics. In this show, viewers follow Lucia, a PhD student in physics, as she explores how gravitational waves are formed, how they move through the universe, and how scientists like her work to hear them.

Presenters: YAGI, Kent (University of Virginia); LOMUSCIO, Samantha (University of Virginia); AJITH, Siddarth (University of Virginia)