2019 AAPT SEPS Meeting
Abstracts for Invited Presentations

Friday invited speaker: Bill Berner, University of Pennsylvania
"Educational Boundary Conditions: A Report From the High School – College Discontinuity Zone"

A distillation of insights, highlights and hindsights gleaned from 50 years in high school and college physics classrooms. Or more to the point, an embarrassed admission that I could have done this job a lot better if I had lived my life backwards.

Saturday invited speaker: Eugenia Etkina, Rutgers University
"Investigative Science Learning Environment (ISLE): Learning Physics by Practicing It"

Success in the 21st century is determined by one's ability to pose problems and seek multiple solutions, to evaluate assumptions, and to cope with uncertainty in the answer. Around the world the knowledge of content (conceptual and quantitative) stops being the only goal of education. The engagement in the processes of science emerges as another equally important goal. How do we help our students achieve both? In this talk I will describe a learning system for physics courses that naturally and seamlessly engages students in the above practices, helps them develop the 21st century abilities, and can be implemented without major revisions to the infrastructure. The learning system, called Investigative Science Learning Environment (ISLE), helps student learn physics by systematically engaging them in the processes that mirror the practice of physics. It is based on the findings of brain research, history of physics, and physics education research and is supported by a set of comprehensive curriculum materials and numerous studies of student learning. In this talk I will discuss elements of ISLE and show how to use ISLE framework to design curriculum materials with examples from DC circuits and optics.

Saturday invited speaker: Angelo Armenti, Villanova University
"The Physics of Sports and Excel Spreadsheets"

The physics of many sports—including e.g., baseball, softball, tennis, soccer and golf—requires solving coupled differential equations in order to predict the trajectories of those various projectiles. Because of their strong math backgrounds, physics and science majors can readily handle air-resistance forces compounded with Bernoulli lift forces that affect the motion of all spinning objects. The students in my Physics of Sports course for arts majors typically lack strong math backgrounds but are receptive to learning how to solve those same real projectile motion problems using difference equations to calculate and plot the various trajectories quite accurately using Excel software. Spreadsheets appear well suited to calculate and project the trajectories of spinning baseballs, tennis balls, and golf balls.

Saturday afternoon workshop: Barry Feierman, Westtown School (ret.)
"Eight Challenging Labs for High School / College"

Barry Feierman will set up eight tables of demos/labs that will be challenging for the best of your students. Over a forty-year career, teaching at both the high school and college levels, he has managed to come up with some labs that are a challenge conceptually or mathematically (or both). Topics will include motion, dynamics, conservation of energy, electric circuits, thermodynamics, and resonance.

Poster Abstracts

“Why Doesn’t Every Cloud Bring Rain?”

Andrei Blinkouski, Penn State University – Abington

A typical lower altitude cloud is composed of tiny particles of water. These particles are heavier than air and should fall under gravity in the form of precipitation. However, not every cloud produces precipitation. Analyzing the dynamics of water particles, we found that the particles must reach a certain size to fall fast enough to reach the ground as precipitation. The collision-coalescence process can quickly produce a lot of very large droplets. The liquid water content and cloud thickness are the main factors determining whether or not the water droplets will be able to grow to an appropriate size to fall as rain.

“A Reason Why 1st Year Students Fail”

Gordon Thomas, New Jersey Institute of Technology

The failure rates of students under different professors differ by a factor of 5 with controls for course materials, texts, homework, exams and average SAT's.

“Discovery and Interaction in Astro 101”

Philip Maurone, Frank Maloney, Laurence DeWarf, Villanova University

The availability of low-cost, high-performance computing hardware and software has transformed the manner by which astronomical concepts can be re-discovered and explored in a laboratory that accompanies an astronomy course for arts students. We report on a strategy, begun in 1992, for allowing each student to understand fundamental scientific principles by interactively confronting astronomical and physical phenomena, through direct observation and by computer simulation. We present the current suite of laboratory experiments, and describe the nature, procedures, and goals in this two-semester laboratory for liberal arts majors at the Astro 101 university level.

Abstracts for Contributed Talks

1:30-1:45 "An Introduction to Extracting Astrophysics from Gravitational Waves"

Amber Stuver, Villanova University

A new era of multi-messenger astronomy began with the coincident detection of gravitational waves by LIGO (an event labeled GW170817) and electromagnetic waves by over 70 observatories across and orbiting Earth. Part of the light observed came in the form of a short gamma-ray burst; the source of this class of GRB has been a longstanding mystery. The observation of associated gravitational waves finally proved that the merger of a binary neutron star system is a source of these bursts. This talk will focus on how information about a gravitational wave source is extracted from the recorded signal and the contributions this makes to a fuller understanding of our universe. A Jupyter notebook containing an outline of the theory and accompanying Python code to analyze the GW170817 signal can be found here: https://tinyurl.com/Stuver-AAPT19

1:45-2:00 "Teaching Special Relativity"

Anne Tabor-Morris, Georgian Court University

Students often question differences between Einstein's Special Relativity and Galilean Relativity and why the speed of light is a necessary "speed limit" for matter. This presentation explores making that connection explicitly for the benefit of student learning.

2:00-2:15 "The Democratic Imperative for Inquiry Physics"

Ryan Batkie, The Shipley School

Why does physics class exist in schools? In the day-to-day life of a school, this question can remain appropriately closed. However, I argue that, to be more effective, each teacher must ultimately reckon with what they think the purpose of their course is. This will be highly variable, depending on the institution, department, student population, et cetera. To help prompt such reflection, I will lay out a civic justification for learning physics and discuss its implications for course design.

2:15-2:30 "Project Based Learning in High School Physics"

B. J. Enzweiler, Science Leadership Academy

Project Based Learning has become a buzzword of sorts in education circles, and as such seems devoid of meaning. This talk is designed to discuss the actualities of this model and to review the different major projects that are used in the 11th grade Physics class at Science Leadership Academy in Philadelphia.

2:30-2:45 "An LED Trick"

Harriet Slogoff, University of Pennsylvania (ret.)

This is an interesting way to switch an LED on and off. It comes from an activity done with visitors at the Franklin Institute using an LED and a CR2032 battery. We place the LED with the leads touching both faces of the battery (most people don't understand that one face is positive and the other negative). We then tape one lead to one side of the battery and slip a small straw over the other lead. Sliding the straw back and forth will switch the LED on or off. At the same time, this is a different way to set up a parallel circuit by connecting several LEDs to the battery.

2:45-3:00 "Droned"

Jay Bagley, Temple University