Winter, 2024

Issue 55

Long Island Physics Teachers Association Newsletter

President's Message

Engineering Design is a new area in the NYSSLS/NGSS that was not previously addressed in either the Physics Regents or the AP curricula, although I'm pretty sure the IB curriculum has always had some Engineering Design elements. Many of us have already been doing some engineering-related projects, so we may be ahead of our Living Environment or Chemistry counterparts. In fact I really enjoy challenging my students to engineering problems; they're fun for the students, foster critical thinking and problem-solving skills, and many correlate directly with the material we are working on. Since Engineering Design challenges can be fun for the students as well as being educational, they are also great activities for what I call attention-deficit days such as just before a holiday or when school days are sandwiched between days off.

The Egg Drop activity is familiar to many of us: design and build either a device to catch a raw egg or a packaging device that will protect a raw egg from breaking on impact. I've seen videos of Amazon drone deliveries, and some of the videos make it look as though Amazon could use better packaging devices, or at least that's what I tell my students. Testing the devices is a popular activity and keeps the students actively engaged, always. The rubric for this activity can include a design stage, testing, and redesign, touching on many areas of the Engineering standards. In particular, it addresses HS-ETS1-2 (Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering) and even HS-ETS1-3 (Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts); although I'm not sure how it relates to the social, cultural and environmental impacts. While on one level this might seem like a crafts project, I believe that the constraints, design, redesign, and optimization make it a real engineering project.

Another Engineering Design challenge that I enjoy is the Brookhaven National Lab Bridge Building contest. Simply designing a bridge to meet the specifications is difficult for students, many of whom have never met specifications or constraints before. I like to have the students start by designing a bridge on paper, drawn to scale. Once I am satisfied that their design meets the specifications, I give them enough wood to build their bridge. Their grade is based on whether they meet the specifications, so every student has a good chance to be highly successful. Breaking the bridges is very satisfying, and can be quantified using a force plate to measure the force needed to break the bridge, making this somewhat competitive in class. Students can go on to build subsequent bridges that they can enter in the BNL Bridge Building contest.

And of course, it is easy to assign a design challenge with circuits. An easy circuit design challenge is with lights and switches, to incorporate Boolean AND and OR statements, the beginnings of digital processing! I like the challenge to design

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Important Dates

Physics Olympics	**Wed, Mar 13**
Spring Conference	**Sat, Apr 13**
AP Physics C Exams	**Tues, May 14**
AP Physics 1 & 2 Exams	**Fri, May 17**
AP/IB Analysis	**Sat, June 1**
Regents Physics Exam	**Tues Jun 25**
End of year BBQ	**Thurs Jun 27**

Check the LIPTA website ***www.lipta.org*** for any updated information.

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a "friend test": you are my friend IF (insert a clause, such as "you like physics") AND (another clause, such as "you watched the Oppenheimer movie"). The Boolean AND is a series circuit, while the OR is a parallel circuit, so a good challenge is to have both an AND and an OR statement in the same circuit: draw the circuit and then create it using switches and lights. Before you know it they'll design a working computer!

I have a harder time figuring out how to incorporate NYSSLS/NGSS standard HS-ETS1-1 (Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants). It seems to me that major global challenges are a little beyond high school students. Maybe my Egg Drop project that addresses Amazon drone delivery system qualifies? That is surely a major global challenge!

Short Course
Active Learning in Introductory Physics Courses: Research-Based Strategies that Improve Student Learning (Including Virtual, Distance Learning)
July 29-31, 2024, Portland, Oregon

Designed for those who teach introductory physics at universities, colleges and high schools.
Graduate credit will be available through the University of Oregon*

Instructors: David Sokoloff, University of Oregon and Ronald Thornton, Tufts University

Participants in this two-and-a-half-day course will be introduced to research-validated, classroom-tested strategies for each component of the introductory course that have been demonstrated to improve learning. These include *RealTime Physics (RTP)* labs (including a distance-learning version), *Interactive Lecture Demonstration (ILDs)* (including *Clicker ILDs* and *Home-Adapted ILDs*—for distance-learning), Collaborative Problem-Solving Tutorials, and *Physics with Video Analysis (PVA)*. Participants will be introduced to the latest, versatile data acquisition and video analysis software that—in addition to Mac OS and Windows—is compatible with Chromebooks, tablets and smartphones. Physics topics will be chosen from both semesters of introductory physics. Research on the effectiveness of these strategies will also be discussed.

Complimentary printed copies of and online access to curricula (published by Wiley and Vernier) will be distributed. (These are also available for high school use at a special price as the *ABP High School E-dition*.)

The course fee is $250. (Early bird registration until June 10 is $225.)
* Up to 3 graduate credits from the University of Oregon will be available for an additional $150/credit.

For more information and to register:
http://pages.uoregon.edu/sokoloff/CHAUT.htm

LIPTA Fall Conference Highlights

LIPTA President Gillian Winters welcomed a large crowd of 50 participants to the annual Fall conference which was held at Manhasset HS. Undoubtedly, the big draw was the presentation that was offered by Harvard Professor Eric Mazur. And Dr. Mazur did not disappoint! He kept us captivated with his presentation about teaching methods and even had us become students ourselves once again to see the benefits.

Dr. Eric Mazur

Dr. Mazur cherishes the teaching profession having been a product of parents who were educators and even being a licensed high school teacher himself. Even though his original intent was to enter into an industry job after doing a Postdoctoral program at Harvard, he found his life's passion at Harvard when he began lecturing there. Dr. Mazur admitted that he was a "great" lecturer by all accounts. He had full classes and students gave him rave reviews, but he realized that with all his great lectures, students were still not necessarily learning much from them. He saw that lectures were not the way to go. As he joked, " Some people talk in their sleep, but lecturers talk while others sleep."

Dr. Mazur understood that knowledge cannot just be transmitted, but knowledge needs to be figured out by the students and that true understanding can only be acquired by students through more interactive means. The classes he now teaches includes little lecturing. He embraced the flipped classroom where students read his notes before class and then when they get into class, he teaches by questioning in more of a Socratic method.

He introduced us to his method of *Question>Think>Poll>Discussion among students>Repoll>Explain* by an example. He gave us an Archimedes principle problem which described a passenger holding a rock in a boat on a lake. If the person throws the rock overboard, the question posed was whether the water level in the lake will rise, fall or remain the same. He simply asked us to think about it on our own and then he polled our answers by simply requesting us to place a finger on our chest corresponding to our choice. After looking around, he saw there was quite a diverse set of answers which was a good thing. A poll ranging from 30% to 70% of correct choices is best. If the poll is less than 30%, then there's not enough students to make this system work and if it's above 70%, students will get off task too quickly. We were then tasked with searching out others who had different choices than we did and argue our cases. After much animated discussions among everyone, we repolled and there was a marked change in choosing the correct answer. From there, we discussed the explanation. It was from this type of teaching model that students become more emotionally invested in the learning process and this helps promote greater retention of the subject matter. Dr. Mazur claimed that the peer instruction method tripled the normalized gain in learning over traditional lecturing in his courses.

Dr. Mazur's philosophy of education is that it is not about transferring information and getting students to do what we can do, but rather, it is to get students to go above and beyond what we can do and figure out more problems. And this is more readily achieved by peer interaction. If you are interested in slides from the conference and other presentations that Dr. Mazur has done, please visit Mazur.Harvard.edu.

LIPTA Vice President Bill Leacock then gave a short presentation about the upcoming changes to the Regents Physics and AP Physics curricula. The Regents Physics changes are supposed to be implemented in the 2025-26 academic year with its alignment with the New York State Science Learning Standards. Bill said there are about six pages in the standards that pertain to physics and one page that refers to engineering. How the new standards will be affecting the Regents course specifically is still a bit fuzzy.

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The AP Physics 1 and 2 courses are changing for 2024 by swapping some content between the two courses. *Fluids* will now become part of the AP 1 course which will drop *Mechanical Waves and Sound* which will go to the AP 2 course. The AP C courses are not undergoing any major changes. All AP Physics exams will have a similar structure: 50 multiple choice questions in part 1 and four free-response questions in part 2.

To end the conference, Farmingdale HS Physics Teachers, Adriana Martini and Sara Whitaker, shared a lesson they have done that is more aligned with the NGSS standards. Students use their engineering skills to build a model conveyor belt which is then used to analyze the work and power that their construction uses. It's a newfangled take on the traditional running up the stairs power and energy lab. Using ordinary materials, like cardboard tubes, rubber bands, wheel and axles, etc, each group of students constructs a conveyor belt that will lift objects up to the top of an incline. Students need to describe the energy transformations that are involved with their apparatus and then by taking measurements they do a basic lab exercise on determining the work and the power that is generated by their machine. Adriana and Sara brought in several prototypes of the machines that their students built and handed out the lab worksheets that students must complete for their experimental analysis of work and power.

If you missed the Fall conference you can see the full presentation on a link through the LIPTA Fall Conference option on the LIPTA website.

Quantum EduQation Professional Development

Taught by: Angela Kelly, Dominik Schneble, & Tzu-Chieh Wei, Department of Physics & Astronomy

Professional Development Workshop Series
- **Tuesdays, May 14, 21, 28, June 4, 2024**
- 5:30-8:30pm
- Physics Building P-118, Stony Brook University
- For questions contact: **angela.kelly@stonybrook.edu**

Quantum Education for Students & Teachers
Stony Brook University

Register with QR code:

- Taught by Stony Brook University quantum physics and science education faculty.
- Open to 30 high school STEM teachers.
- Basic knowledge of physical science required.
- Aligned with NYSSLS and NGSS.
- Attendance at all four sessions required; $500 stipend provided.

Free parking
Materials provided
Dinner/refreshments served

JOIN US TO LEARN ABOUT QUANTUM IDEAS, including:
(1) core quantum principles and current research trends;
(2) basic quantum computing practices and building quantum circuits with Quantum Composer (IBM);
(3) curriculum planning for integration of quantum science;
(4) quantum computing careers and academic pathways.

Need CTLE credits?

- ♦ Fall and Spring Conferences (3 credit hours for each conference)
- ♦ AP/IB Physics Exam Analysis (3 credit hours)

CTLE Certificates are available.

New Orleans Physics Immersion

by Tania Entwistle

The AAPT Winter Meeting took place from January 6-9 at the Riverside Hilton Hotel right in the heart of New Orleans. All of the workshops and presentations took place in the hotel, which was very convenient. I took a Saturday workshop on using Augmented Reality which allowed me to try a number of AR headsets (not the new Apple, alas) with some interesting developments in educational tools being shown. Though it's not quite ready for prime time, this workshop was an interesting opportunity to see new instructional approaches. Other workshops on Astronomy, Large Hadron Collider Physics, Quantum Computing, Robotic Telescope Labs, and AP Course Revisions were offered on this first day in a mostly four hour format for an additional charge.

Committee meetings happened throughout the meeting. Organization positions like Section Representative, Meeting Planning, and Physics in High School gave AAPT members a chance to participate in policy actions on a national level. Presented papers began on Sunday. These were15 minute to half hour talks organized into blocks like *Physics of Jazz* and *Integrating Lab and Lecture*. These blocks continued throughout Monday and ended Tuesday morning. Trying to decide how to see as much as possible was a challenge! An app was provided which helped to sort things out.

The Exhibition Hall opened on Saturday night with a Cajun food celebration and remained open so that participants could see Pasco, Vernier, and other teacher resources. Tasty snacks were provided during the day to refresh and showcase NOLA specialties. Commercial workshops were offered to allow a hands-on experience with classroom equipment.

The highlight of the conference was the inspirational women who offered delightful stories about their experience in scaling the ladder of success in various fields. Astrophysicist Katherine Mack, was the recipient of the Richtmyer Memorial Lecture award. Laura Greene, chief scientist at the National High Magnetic Field Laboratory, won the Oersted Medal. K. Renee Horton, of NASA's Electrified Powertrain Flight Demonstration Project, dazzled with her sense of style (say what?). All offered hilarious and riveting stories about their experiences achieving the goals that they sought for themselves.

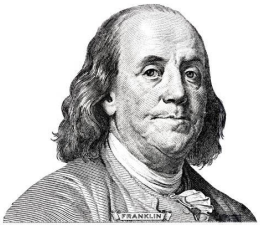
But what about the good times? The hotel was a short walk from the French Quarter and numerous delicious places to eat. Did I say Brennan's? Amazing lunch! Café Du Monde? Delicious coffee and beignets. Walking on Bourbon Street on a sunny Saturday afternoon was mind-bending. The walk along the river offered a lovely respite from the intense concentration of the conference program.

Nicest of all was the opportunity to talk to physics teachers from all over the country from both high school and college. The Alabama Physics teacher who shared the desperation that she feels in a state where the number of physics teachers numbers in the dozens. The college teachers who are confused and frustrated with the way that students are being vetted for entry to their schools. The number of high school physics teachers attending is increasing and I was impressed with the group of young, enthusiastic organizers who created a high school teachers' lounge with opportunities for group meeting about various topics including the upcoming AP changes.

The AAPT is trying to reach out to high school teachers with activities like a "Coffee Hour" which gives high school teachers around the country a chance to interact. The Barbara Wolff-Reichart Travel Grants provide money for teachers to travel to AAPT meeting when the considerable costs of the conferences are not supplemented by school districts. The High School Teacher Grants provide $100-500 allotments to create a classroom project. Other opportunities are available on the AAPT website- and watch for the summer meeting in Boston July 6-10 at the Westin Boston Waterfront Seaport District!

Did You Know …

by Harry Stuckey



Undoubtedly, you know that Ben Franklin was one of the founding fathers of the United States. You may also know that he was a printer, publisher, diplomat, and the first postmaster general of the USA. But did you know that he is also generally acknowledged as the first American scientist? Despite only two years of formal education, Ben was a voracious reader and curious about phenomena. He became interested in electricity after seeing demonstrations using static electricity. He proposed that "vitreous" (think glass) and "resinous" (think amber) electricity were not distinct types of "electrical fluid" (the term for electricity at the time), but the same "fluid" under different pressures. He was the first to label them as "positive" and "negative". Through his experiments, he deduced conservation of charge.

While the Leyden jar capacitor was well known, he was the first to fashion a parallel plate version. Ben then constructed a multiple plate capacitor by stacking eleven panes of glass between lead plates to form an "electrical battery". While not an electrochemical cell like Volta's pile, it did provide significant electrical energy after charging. Other electrical terms that he introduced include condenser, conductor, charge, and armature. As a useful demonstration of electricity, he killed several turkeys by electric shock and roasted them on an electrical spit, noting that the birds prepared this way "…eat uncommonly tender".

There is a question as to whether he actually performed his most famous experiment, flying a kite in a thunderstorm. Ben did publish a proposal for the experiment, which was performed by others, sometimes with tragic results. Joseph Priestly published an account in 1767, which was read by Ben in manuscript and most likely supplied by him. It indicated that Ben stood on an insulator and kept dry under a roof to avoid an electric shock, so he may have performed it. The kite was used to collect electric charge from a storm cloud utilizing a key and Leyden jar to show that lightning was electrical. He understood the use of the electrical ground and combined that with the lightning rod to protect buildings.

He received the Royal Society's Copley Medal in 1753, and in his honor, the CGS unit of charge was designated the franklin (Fr). But wait; there's more! Besides electricity, Ben influenced population studies, charted and named the Gulf Stream, and investigated evaporative cooling. Besides the lightning rod, he invented the Franklin stove, bifocal glasses, and the flexible urinary catheter. Oh, and in his spare time he helped found a new nation.

Tell me and I forget, teach me and I may remember, involve me and I learn" — Benjamin Franklin

Do you have any comments, information, or tips to share for future newsletters? Send it via email to: *keogh@lipta.org*

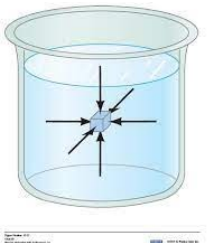
LIPTA Spring Conference
Sat, April 13
Sachem East HS
8:30 am— 12 noon

8:30– 9:00 Registration and Breakfast

Come early for light refreshments and to see science posters created by the Sachem East science honor society students.

9:00– 9:15 Welcome

9:15– 10:15 Rob Krakehl – AP 1 Fluids



AP Physics 1 is once again undergoing a change! While we may feel like we are sometimes treading water with this course, this workshop is here to help you learn to float! I will show you everything you need to know to make your students successful for the newly added Fluids unit. We will discuss the Standards, sample problems, a sample timeline and sequence for the material, and several experiments and the required equipment to conduct them. I will also share all the materials that I have developed in my several years of teaching the Fluids unit in my AP Physics 2 course.

10:15-10:45 Coffee Break

10:45-11:00 Rich Gearns – Increasing Physics Enrollment

Rich Gearns will lead us in a discussion about student enrollment in physics, and will help us brainstorm ideas to increase enrollment

11:00-12:00 Justin King and Rich Slesinski – NYSSLS Assessments

Your students may be taking a Physics Regents based on the New York State Science Learning Standards (NYSSLS) as early as June 2026. What will that exam look like? We don't know for sure, but we have some ideas. We will share test samples from NYS elementary- and intermediate-level NYSSLS-based exams, Next Generation physics test samples from other states, and dissect the new standards to see what questions on the new Physics Regents *should* look like.

Register at lipta.org

Current Members: $15 (pre-registration), $20 (after Apr 11)

$30 for non-members (includes 1 year membership)

3 CTLE credits are available to attendees