"A+ Alternatives in Education Research, Energy and Technology"

Fall Meeting of the Illinois Section of the AAPT
October 8-9, 2010
Sherrard High School, Sherrard, Illinois

Friday, October 8, 2010

10:00 - 4:15
Registration. Hallway near the front door. Please make out checks to "ISAAPT".
Please Recycle. When you leave the meeting to return home, please place your plastic
name tag holder in the box which will be provided. It will be used at the next meeting. Thanks.

10:30 - 12:00
Workshop W1. "Learning Sequences as Instructional Resources"
Carl Wenning, Illinois State University. B-10

12:00 - 12:45
Lunch - on your own. A list of local eating places will be available.

Here is the list of those who are doing contributed presentations.

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12:45
Welcome - Auditorium

12:50 - 1:45
"How a School District Can do a Large Turbine Project"
Scott Engstrom
Account Executive, Ameresco
Auditorium

I will discuss the basic features and requirements of a wind turbine including cost, function and efficiency. I will focus on what it takes for a public entity in Illinois to install a large scale wind turbine generator. I will touch base on the four school districts in Illinois that have large scale turbines and will speak about our experiences in many areas throughout the state.

1:45 - 2:45
"Wind for Schools"
Matt Aldeman and Jolene Willis
Auditorium

We will discuss the Wind for Schools program that is just getting off the ground this year. Western Illinois University and Illinois State University are partnering to establish the Wind for Schools program in Illinois, and this fall we are attempting to reach out to schools across the state to generate interest in the program.

Depending on the level of funding we receive, we will be partnering with three to five or more schools to erect meteorological towers on school grounds, implement energy and wind energy-focused curriculum, and ultimately assist in the procurement of a small wind turbine on school grounds.

2:45 - 3:15
Break and Wind Turbine Tour. B-12 and outside

3:15 - 3:45
Panel Discussion - "The New Local Physical Science Alliances"
Morten Lundsgaard, Tom Holbrook, Douglas Brandt, Rob Mason, Carl Wenning, and Ken Wester, Moderator
Auditorium

ISAAPT, IACT and ISTA have joined forces to establish Local Physical Science Alliances throughout downstate Illinois. The panel will discuss the structure, the mission statement, the aims of the organization and the benefits it has to offer the classroom teacher, both at the high school and college level. Questions will be addressed concerning all aspects of LPSA's. Details are available at this website: www.phy.ilstu.edu/lpsa

3:45 - 5:15 Session A - Auditorium - Chair: TBA

3:45 - A1 - Teaching

Flux and the Faraday Generator. Jim Rabchuk, Western Illinois University, Macomb, IL 61455. Richard Feynman said that the character of physical law is mathematical. By this, he meant that the mathematical expressions of Electric force, etc., have a higher reality than any mechanistic model we might try to ascribe to them. I've been thinking about this as I continue to struggle to make the topic of Electricity and Magnetism manageable for the students in our intro physics sequence. In particular, I've been exploring the possibility of constructing a mechanistic model for EM based on the concept of flux. Here, I'm thinking of flux as a rate of flow of electrical influence, \( \frac{q}{\varepsilon_o} \). The fundamental concepts are then the material property, charge, and the permittivity and 3-D nature of physical space. One phenomenon that might serve to distinguish whether flux is "real" is the mechanism behind Faraday Generators and Homopolar Motors. I'll discuss the model and a proposed experiment in my talk.

4:00 - A2 - Teaching

Reframing the Familiar Damped Oscillator for Sophomores/Juniors. Narendra K. Jaggi, Illinois Wesleyan University, Bloomington, IL 61702-2900. I will share my experience in ‘framing’ the familiar damped harmonic oscillator in terms of a single variable parameter, a framing that differs from the usual three-parameter formulation i.e. inertia, stiffness and damping coefficient, only slightly. Even though the difference is admittedly quite minor, I have found it to be useful in two ways. In our lab, it can help by making explicit the foundation for the kind of universal scaling analysis which our students are asked to perform when they synthesize ALL of their data from a variety of electronic and mechanical oscillators. In the theory course, it can ‘clean up’ some of the derivations, e.g. of the free decay, of amplitude resonance, of the transient response to step-like or pulse-like external stimuli. It may also help the students see a bit more clearly why/how the NON-LINEAR damped oscillator is richer both in terms of the mathematics and the phenomena displayed by these systems.

4:15 - A3 - Other

How Well Do You Know MY Students. Dave Sykes, Lincoln Land Community College, Springfield, IL 62794-9256. At the beginning of the Fall Semester, 2010, a group of physical science students completed a short survey to determine their knowledge of some numerical facts. In this talk the results of the survey will be provided along with an opportunity for attendees to predict the percentage of students who answered the questions within a "reasonable" range of correctness.

4:30 - A4 - Teaching

A Silly Story About a Bad Car. Bill Hogan, Joliet Junior College, Joliet, IL. I will discuss using stories as one of the many ways that we can engage our students in class. I will use an example of a story I tell my students about a car to demonstrate some ideas related to inertia. This talk was inspired by a grocery store meeting with a student who took my class over a decade ago who remembered this story in great detail and still understood the concepts involved despite having little recall of the rest of the course.

4:45 - A5 - Active Learning

A Slightly More Advanced Look at the Vibrating String Lab. Andrew Morrison, DePaul University, Chicago, IL 60614. The vibrating string laboratory is a classic of undergraduate physics courses all over. A common way of setting up a vibrating string lab is with a mechanical shaker and a non-magnetic string. A perhaps less common way of looking at a vibrating string is with a metal string and electromagnetic driving and/or detection. In this presentation we will suggest a variation on the introductory lab and pedagogic approaches which make the lab appropriate for advanced undergraduate labs.

5:00 - Take Fives

T1. Ken Wester, "Illinois High School Science Bowl"
T2. Deborah Lojkutz, "Adding Vectors"
T3. Roger Malcolm, "Visualizing Circular Motion using Christmas Lights"
5:30 - 6:00  Social Time/Cash Bar - Milan Community Center, 2701 1st St E, Milan, Illinois
Directions: The Milan Community Center is 8.44 miles from Sherrard High School:
• Start out going West on 176th Ave/County Road NN toward 45th St.
• Turn right onto US-67 N/1st St E.
• Turn right on 2701 1st St E.
6:00 - 7:00  Banquet - Milan Community Center
Presentation of the Distinguish Service Citation to Deborah Lojkutz, Joliet West High School

7:00 - 8:00  "Technology Innovation to Increase the Productivity of Agricultural Systems"
John Reid
Product Technology and Innovation, Deere and Company, Moline, Illinois
Milan Community Center

I will present the importance of Technology Innovation to help society meeting the challenges of future food production required to meet global demand. These global challenges for sustainability will be met through developing competency in understanding the dynamics of complex systems and technology innovations to make these systems more productive.

Saturday, October 9, 2010

7:00 - 8:00  ISAAPT Council meeting - Library  Presiding: Carl Wenning, President. Bagles and fruit will be served.
8:00 - 9:00  Registration.  Hallway near the front door.  Please make out your checks to "ISAAPT".
8:15 - 9:45  Session B - Auditorium - Chair: TBA

8:30 - B2 - Teaching
These are a Few of My (Classes) Favorite (Activities) Things.  Gary Wolber, Rock Island High School, Rock Island, IL 61201. Over the years I have attempted to reach my students through a number of hands-on activities that are intended to improve their understanding. Many of these activities were ones that I learned at previous ISAAPT meetings and workshops. I will share two activities that my students enjoy doing and then reflect on the effectiveness of these activities on my students' understanding.

8:45 - B3 - Research
Dark Energy Cosmology in your First Semester Class.  Tom Carter, College of DuPage, Glen Ellyn, IL 60137. I will show an explanation for the cosmological concept of dark energy which is particular well suited for a college freshman physics class. I'll also briefly discuss why you'll probably never see this explanation except at an ISAAPT meeting.

9:00 - B4 - Active Learning
Terminal Velocity.  Don Reid, Lincolnwood HS, Raymond, IL 62560. In most of the work we do, air (fluid) resistance is ignored or considered negligible. However, we know that air (fluid) resistance is real and can become an important factor. This presentation will include a lab that takes into account fluid resistance for an air bubble traveling through a fluid.

9:15 - B5 - Teaching
Individualized Problem Development.  Cherie Bibo Lehman, Eastern Illinois University, Charleston, IL 61920. There are several systems that enable the teacher to give each student or group of students problems with unique numbers. As students work with
each other to solve problems, they are forced to pay more attention to the concepts. ExamView test generating software provides an environment for the teacher to design a variety of question/problem types. Development of several problem types will be demonstrated.

9:30 - 9:45  Break and Wind Turbine Tour.  B-12 and outside

9:45 - 12:00  Session C - Auditorium - Chair: TBA

9:45 - C1 - Research

The Rayleigh Limit of Resolution and the Heisenberg Uncertainty Relation. *Kishor T. Kapale*, Western Illinois University, Macomb, IL 61455. The Rayleigh diffraction limit for resolution of an optical imaging instrument is commonly accepted as a fundamental limit of resolution, at least as it is portrayed in the standard optics textbooks. Furthermore, the Rayleigh limit is thought to be intimately connected with the Heisenberg's Uncertainty Relation as the latter is derived from the former in several of the elementary quantum mechanics texts. In this short talk I will elucidate the connection between these two, as well as show that obtaining resolution beyond the Rayleigh limit is possible while still satisfying the truly fundamental Heisenberg Uncertainty Relation.

10:00 - C2 - Teaching

Math, Physics and Excel. *Rob Mason*, Olney Central College, Olney, IL 62450. One often overlooked skill for STEM students is competency with Microsoft Excel, or similar applications. Math problems, such as solving simultaneous equations or finding roots to an equation, or physics problems, such as projectiles or vector addition, can be displayed with multiple representations (graphs, tables, numerical results, etc.). Additionally, the results can be dynamic so that they change based on the user's input.

10:15 - C3 - Research

Changing the Color of a Tunable Dye Laser: from Visible to Ultraviolet. *Pengqian Wang*, Western Illinois University, Macomb, IL 61455. Laser spectroscopy is a powerful method in exploring the atomic-level microscopic structure of molecules. In order to excite the electrons inside a molecule, a tunable light source in the ultraviolet regime is needed, while most commercially available lasers are operated in the visible. In this talk I present our research of producing a continuously tunable ultraviolet light source by frequency-doubling a dye laser using a nonlinear optical crystal. In the experiment the automatic fine rotation of the crystal is essential for generating the ultraviolet light when the input wavelength is tuned. We use a quadrant photodiode to detect the deviation of the ultraviolet laser beam. The signal from the photodiode is amplified, discriminated and normalized by a home-designed circuit to control the rotation of the crystal. The generated ultraviolet light is tunable in the wavelength range of 205-400 nm. This project is supported by the WIU-URC grant.

10:30 - C4 - Teaching

Formative Assessment in an Algebra-based Physics Course. *Nathan Frank*, Augustana College, Rock Island, IL 61201. Teaching an algebra-based physics course is challenging due to the large number of students (over 110) and the variety of student backgrounds. For most students this course is difficult since they have forgotten or never covered the relevant mathematics, and they come with little to no background in physics. To combat these particular challenges, I implemented a set of formative assessments for this course. The initial formative assessment probes relevant mathematical knowledge and physics conceptual understanding using the Force and Motion Conceptual Evaluation (FMCE). The formative assessment continues throughout the course based on Just-in-Time Teaching (JITT) techniques, Peer Instruction, and Interactive Lecture Demonstrations. A brief overview of the course design and an example of how a topic is covered will be presented. In addition, student feedback to the course and assessments will also be presented.

10:45 - C5 - Teaching

Local Physical Science Alliances for Illinois. *Carl J. Wenning*, Illinois State University, Normal, IL 61790-4560. ISAAPT, IACT, and ISTA are collaborating to establish twelve (12) Local Physical Science Alliances (LPSAs) in zones across Illinois outside of metropolitan Chicago. Each zone is centered on a major population area, and will be led by experienced teachers or teacher educators. LPSAs will involve in-service and retired teachers, scientists, teacher educators, and teacher candidates. The purpose of LPSAs is to provide networks for teachers of physical science to explore curricular and instructional resources and strategies, as well as pure and applied educational research and innovations, in order to promote excellence in teaching and learning of the physical sciences throughout Illinois. A zone leaders meeting was held at Illinois State University on August 28th, and now efforts are under way to hold zone meetings across the state. This presentation will provide an overview of LPSAs for Illinois, and describe important efforts in which YOU might become involved.
Developing an Online Introductory Astronomy Course. **Noella D'Cruz**, Joliet Junior College, Joliet, IL 60431. Online course offerings are increasingly popular these days. Joliet Junior College has been increasing its online offerings steadily. One of the courses that is now being offered in the online format is the lecture-only introductory level astronomy for non-science majors. I will describe how I developed this course, and how students reacted to it when I offered it last spring.

Implication of Cognitive Load Theory for Teaching Physics. **Tom Foster**, Southern Illinois University Edwardsville, Edwardsville, IL 62026. One educational theory that helps explain how students learn is Cognitive Load Theory. Cognitive Load Theory begins with the well-established idea that everyone's working memory can hold $7 \pm 2$ unique items. This quirk of the human brain is why phone numbers are 7 digits long. This quirk is also why we forget peoples' names after just meeting them, keep the iron on when we leave the house, and become overwhelmed as students of new material. Once the intricacies of Cognitive Load are understood, it becomes possible to design learning environments to marshal the resources students have and guide them to success. Lessons learned from Cognitive Load Theory can and should be applied to teaching physics.

Lab Reports as Learning Through Writing. **Jeff Chamberlain**, Illinois College, Jacksonville, IL 62650. Assessment in my department is focused on demonstrating that our goals for student learning are being met. After years of writing the same comments while grading lab reports, I began to question whether this exercise was serving the purpose that I intended. An alternative to the traditional lab report was developed to focus the students on the writing goals that I have for the lab. I'll present the format along with possible variations.

T4. **Dave Sykes**, "Have Office Hours Become Obsolete?"
T5. **Don Reid**, "A Safer/Easier Potato Gun"
T6. **Pengqian Wang**, "Table cloth"

The following three books that are provided by the AAPT will be given as door prizes. You must be present at lunch to win.

1. *Catching the Light: The Entwined History of Light and Mind* (Zajonc)
2. *Relativity: The Special and General Theory* (Einstein)
3. *NetLearning: Why Teachers Use the Internet* (Serim & Koch)

**Last update: October 7, 2010**