"Minds-On Physics"
Fall Joint Meeting of the Illinois and Chicago Sections of the AAPT
October 26-27, 2012
Joliet Junior College, Joliet, Illinois

Friday, October 26, 2012

8:30 - 4:30  Registration - E Building Atrium  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.

9:30 - 11:30  Workshop W1
"Arduino Open-Source Electronics"
Andrew Morrison -- Joliet Junior College
E2006

Arduino is an open-source electronics prototyping platform based on flexible, easy-to-use hardware and software. It's intended for artists, designers, hobbyists, and anyone interested in creating interactive objects or environments. This workshop is designed to give physics teachers an introduction to the Arduino system and to show possible ways that the Arduino can be used in a physics classroom or laboratory.

Workshop attendees will learn how to configure their Arduino programming environment, how to design simple circuits for interfacing with the Arduino and how to write simple programs to control the Arduino. You will get hands-on experience programming in the Arduino environment, including interacting with the inputs and outputs of the Arduino. We will have Arduinos and electronics components for attendees to use, or you may bring your own Arduino and laptop if you prefer.

9:30 - 11:30  Workshop W2
"New Vernier Physics Apparatus and the Connected Science System"
John Gastineau -- Vernier
E2005

New physics apparatus from Vernier Software & Technology will be available for trial, including the Projectile Launcher, Diffraction Apparatus, and the Centripetal Force Apparatus. Data collection tools including the LabQuest 2, Vernier Video Physics for iPad, and Graphical Analysis for iPad will also be available. The Connected Science System allows students to work together, yet retain individual accountable by analyzing experimental data on the iPad and in browsers running on many platforms.

11:30 - 12:30  Lunch - on your own. JJC Cafeteria or off-campus. A list of places to eat will be included in your registration packet.

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

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Physics Education Research: What and whom we study, and why it matters
Steve Kanim
New Mexico State University
D2001

If we look at the history of physics education research (PER) as revealed by its publications, we can gain some sense of the trajectory of this research. In this talk I describe some patterns that I have observed in this history related to choice of topics, research methods, and student populations studied. The first detailed studies were in kinematics, dynamics, and electric circuits, and it has only been in the past few years that there has been detailed investigation of topics such as energy, thermodynamics, and relativity. I offer a hypothesis for what has determined this sequence, and describe why I think this sequence has been both beneficial for the growth of PER and potentially problematic for its future growth.

A second focus of this talk will be what I see as a disparity between the student populations that are most commonly studied by physics education researchers and the overall distribution of students taking physics. Because the research population tends to be selected from better prepared student populations and from more challenging courses, we may be in danger of developing an overly optimistic view of what students can do and of the effectiveness of research-based interventions.

Data Collection from There to Where:
A Brief Survey of Where Data Collection Has Been and Where It Is Going
John Gastineau
Vernier
D2001

Microcomputer-based laboratory equipment is now a central feature of many introductory physics courses. The use in physics education of the sonic ranger (aka motion detector) dates from 1983, yet we still use it nearly unchanged. In contrast, the computers we use are far faster and more powerful than the original microcomputers. We will review recent history in data collection for the classroom, survey current efforts, and consider directions for the future.
observations indicate a discrepancy from the model. This suggests energy loss mechanisms not included in the model.

2:45 A3. Introducing the Concept of Resonance
Andrew Morrison  
Joliet Junior College, Joliet, IL 60431
Teaching Methods
Understanding the concept of resonance is one of the most important goals for studying wave behavior. Students are often first introduced to resonance when they examine the standing wave behavior of simple one-dimensional systems such as stretched strings and pipes with open ends or one closed end. The concept has direct applications to the study of acoustics and beyond, but it is also a difficult concept for many students to understand. In our class, we discuss how looking at the boundary conditions of the systems we examine can be applied to predict what the resonant frequencies of the system are.

2:45 B3. Update on the New AP Physics 1 and 2 Courses
Martha Lietz  
Niles West High School, Evanston, IL
Other
On October 4th, the College Board posted the new Curriculum Framework for the long-awaited "new Physics B" courses, to be called Physics 1 and Physics 2. These courses will have similar content to Physics B, but it is divided into two years to provide time for students to develop deep conceptual understanding through an inquiry-based approach. In this talk, we will address the structure and content of the new framework, as well as provide information related to the new format of the exam. Strategies for modifying instruction based on the new framework in anticipation of the test will be provided. The presenter is a member of the Curriculum Development and Assessment Committee (CDAC) working to develop the new Physics 2 exam as well as professional development materials for teachers to use in their classroom.

3:00 A4. Physics Teaching in Theory of Mind
Max Lee  
Joliet Junior College, Joliet, IL 60431
Teaching Methods
Neural mirror system, Darwinian competitive neurons and reward-risk decision making mechanisms in the human brain are among many aspects of neuroscience that are related to teaching and learning. This presentation focuses on the compare and contrast, which is a combination of the second and third mechanism. Human beings learn novel things by comparing and contrasting these with the previously existing knowledge as claimed by the theory of mind. The process brings the subtlety of new and old concepts and helps the novice to learn better. This presentation draws insights from neuroscience research into physics teaching. Instead of teaching physics topics in a traditional linear sequence, (i.e., defining a new term or concept, explaining it, applying it, and then moving on to the next term), I present similar concepts in pairs or in parallel to compare and contrast them at the same time. The presentation will share some compare & contrast forms constructed by students.

3:00 B4. The Winter Break Effect in the Colorado Learning Attitudes about Science Survey (CLASS)
Tom Carter  
College of DuPage, Glen Ellyn, IL 60137
Active Learning
I will show data on the Winter Break Effect in the Colorado Learning Attitudes about Science Survey (CLASS) for a calc-based introductory physics class at a two-year college. By evaluating pre and post course results from the CLASS, previous publications have shown that students tend to have a less "expert-like" opinion of studying physics after taking an introductory physics class. Although this result was seen in the data provided here, we also saw that by merely waiting until after the winter break and surveying the same students at the beginning of the second term, their opinions appeared to shift back towards the more "expert-like" end. Although the statistics in this data sample are limited, the Winter Break Effect shown may imply that student opinions evaluated by the CLASS may depend on when in the term the survey is given.

3:15 Take Fives  D2001
T1. Dave Sykes  
"Student Presentations of PV diagrams"
T2. Deborah Lojkutz  
"Reaction Time and Texting"
T3. Tom Carter  
"Surprising Results from Two Clicker Questions"
T4. Andrew Morrison  
"New Faculty Experience for Two-Year College Instructors"
T5. Jim Rabchuk  
"Brownian Motion Demo"
T6. Dave Renneke  
"Spacecraft 3D app for viewing Curiosity on an iPad"  mars.jpl.nasa.gov/msl
3:45 - 4:15 Break - Refreshments     E2008

4:15 - 4:45

**How do we "Teach Problem Solving"?**

Dave Maloney  
Indiana University-Purdue University Fort Wayne  
D2001

Many (most) physics instructors contend that one of their primary goals is to teach problem solving. But what does that mean? This presentation will explore what processes and/or knowledge an instructor might have the students engage with in order to have the students learn problem solving while they are also learning physics.

4:45 - 5:15

**Grading matters at least one order of magnitude more than you think it does**  
Shawn Cornally  
Science/Math Instructor, Solon High School, Solon, Iowa  
D2001

Whether you're the most interesting, inquiry-based physics teacher or the lecturer with a silver tongue, the way you grade your students ultimately controls how they feel about what they're learning. Let's make sure that what we're doing creates efficacy and love for physics.

5:25 - 6:30 Free Time / Optional planetarium program, "A Tour of Tonight's Sky", Noella D'Cruz     F1001

6:30 - 8:00 Banquet     J0006 (across the JCC bridge)

8:00 - 9:00

**The Science of Speed: Why Driving Fast Isn't as Easy as You Think**  
Diandra Leslie-Pelecky  
West Virginia University  
JJC Theatre

Is it really all that hard to drive fast? No - if you assume a spherical racecar. If you think about the physics of a non-point particle turning highly banked corners at 3g on tires with coefficients of friction greater than one, you will quickly realize that there is far more to going fast than stepping on the accelerator. While the driver applies Newton's Laws on the track, a behind-the-scenes group of physicists and engineers are running computational fluid dynamics simulations, developing low-friction coatings, researching energy absorbing materials for safety, and even finding ways to use oranges to reduce flexion losses in tires.

In her book, *The Physics of NASCAR* and the motorsports blog *Building Speed*, Dr. Leslie-Pelecky shows why you cannot win races without getting the math and science right. Although race car drivers may not use terms like 'impulse' or 'friction', the best of them develop a strong gut-level understanding of the rules of physics. As one driver told her "If I'd only realized that racing was really just math and science, I would have paid more attention in school." The talk ends with a brief examination of how to use popular culture to get - and keep - people interested in math and science.

Saturday, October 27, 2012

7:00 ISAAAPT Council meeting - Presiding: Brian Davies, President     E2003

8:00 - 9:00 Registration - E Building Atrium     Please make out your checks to "ISAAAPT".

**Session C** - Chair: Joe Kozinski  
D2001

8:30 C1. Merging Content to Improve STEM.  
Robert E. Lang  
Glenbard South High School, Glen Ellyn, IL 60137  
Teaching Methods

The presenter will talk about how he has teamed with other content area teachers to provide an improved STEM experience for his students. Examples are: Teaming with the Industrial Technology teacher to have physics and AutoCAD students experience a design/build project that mimics the jobs of Engineers and Manufacturers. Teaming with the History teacher to help students have a better appreciation of the historical perspectives of science.

8:30 D1. Energies of Space Shapes.  
Ted Erikson  
IIT, R/E UnLtd., Chicago, IL 60615  
Research

The regular tetrahedron and its inscribed sphere are extremes of simple space shapes to be considered as relative factors in distal motions and central growths. Their surface-to-volume ratios (A/V) approach infinity as size diminishes and have a respective dimensionless property, \( A^{3/2}/V \), of \( \sim 19.34 \) and \( \sim 10.63 \) at any size. Three lines will connect a set of four points where points are at a vertex of 1, 2, or 3 lines. Possible ways of doing
this are 6, 9, and 1 for a total of 16 ways that imply 1-D, 2-D, and 3-D space “energy activities”. In short, this analysis suggests creation of 3-D mass has a 0.0625 certainty, leaving ~94% virtual.

8:45 C2. Using Learning Targets to Enhance Metacognition
Rebecca E. Vieyra
Cary-Grove High School, Cary, IL 60013
Teaching Methods

Helping physics students to identify their own strengths and weaknesses (metacognition) is one of the so-called “best practices” of teaching, but can be difficult to implement. This presentation will focus on strategies I have used in my own classroom to help students become more metacognitive (pre/post tests, diagnostic tools, reflections, concept maps, misconception lists, and teaching for mastery).

8:45 D2. View Homework as a Means not an End
Bill Hogan
Joliet Junior College, Joliet, IL 60435
Active Learning

I have made many changes over the years to the syllabi for my courses as I’ve tried to get students to focus more on understanding the material and less on their grade. I currently have some unusual policies about how homework and lab work are counted in determining student grades that I believe have been effective in influencing students to change their behavior and learn more from the homework and labs. My talk will provide details of these unusual policies and some comments about the effect they have had on student behavior.

9:00 C3. Teaching Mechanics with a Cheap Stroboscope
Morten Lundsgaard
UIUC, Urbana, IL 61801
Active Learning

In this presentation I will give examples on how a cheap, homemade stroboscope can be used in activities that help MS and HS students change their conceptions about motion and forces.

9:00 D3. Learning From Student “Cheat Sheets”
Timothy McCaskey
Columbia College Chicago, Chicago, IL 60605
Research

In an effort to shift course goals away from equation memorizing, I allowed two different introductory physics classes the opportunity to prepare a card or sheet of notes for the exams. I analyze and categorize the items students choose to include on a case-by-case basis. Students included some mixture of definitions, equations (general and specific), unit information, constants, statements of laws or concepts, math review, guides to symbols and variables, diagrams, and worked examples. I look at some individual students in depth, and try to gain insight on how we can use these artifacts to see what students perceive as important in the courses (or at least what's worth committing to paper). This semester, I ask survey questions that will try to get at both why students choose to include certain items and how helpful the students find the cheat sheets.

9:15 C4. A Inexpensive, Easy-to-Build Projectile Launcher
Christopher Wozny
Judson University, Elgin, IL 60123
Demonstrations

The projectile launcher described in this presentation is an original design with a per-unit cost of less than $5.00. Classes and groups ranging from elementary school and college students to science teachers have built projectile launchers in about 30 - 45 minutes. The launcher uses a rubber band as its energy source and is able to launch a one-inch wooden ball more than three meters. Materials and instructions will be provided; kits will be available for purchase at cost.

9:15 D4. Role of Knowledge Organizing in Understanding Science
Amitabh Joshi
Eastern Illinois University, Charleston, IL 61920
Research

Science has its rigid foundation and it provides highly systematic presentation of knowledge. The main goal of science is to remove ambiguity and use concepts in very precise manners. New learners can understand physical sciences in much convincing manner if they could organize their collected knowledge bank using the knowledge representation principles. This could provide a systematic way to keep their conceptual framework in line with that of experts' conceptual framework and hence in this way the goal of science education could be achieved. In this discussion operationizable methodology for organizing knowledge utilizing knowledge representation technique will be discussed. This can be done by organizing concepts using their cognitive function and then looking for most appropriate semantic relations to the concepts. Some findings on students’ learning of concepts in physical sciences will be presented.
10:30 - 11:15

**The Revised MCAT: Implications for Introductory Physics for the Life Sciences**

Robert C. Hilborn  
Associate Executive Officer, American Association of Physics Teachers  
D2001

The Association of American Medical Colleges is in the process of revising the Medical College Admissions Test (MCAT). The new version will be offered for the first time in 2015. Based on recommendations from a committee of medical school faculty, admissions officers, deans, and undergraduate science and social science faculty members, surveys of medical school faculty and staff, medical school students, and undergraduate science faculty members, the new MCAT will focus on testing pre-medical students’ competencies in the natural sciences, behavioral and social sciences, and critical thinking and reasoning. In this talk, I will focus on changes in the science part of the MCAT and the implications of those changes for introductory physics courses for life science students.

11:15 - 12:00

**The American Association of Physics Teachers:**  
*Providing Information and Professional Development Opportunities to Physics Educators*  
Beth A. Cunningham  
Executive Officer, American Association of Physics Teachers  
D2001

The American Association of Physics Teachers (AAPT) has as its mission to enhance the understanding and appreciation of physics through teaching. Two of the primary activities of AAPT are providing information to the physics community regarding the teaching of physics and offering professional development opportunities to physics educators at all levels. One movement that will affect the teaching of physics and physical science in K-12 schools is the development of new national K-12 science standards.

The Next Generation Science Standards (NGSS), based on the National Research Council's "A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas," are currently under development by Achieve, Inc. A summary of the role that AAPT has played in the development of the Framework and the NGSS will be discussed. In addition, AAPT's professional development activities to improve physics teaching at the high school, two-year college, and four year college and university levels will be discussed.

12:00 Lunch - *It must be ordered with Registration.* Your sandwich choice is on your name tag.

ISAAPT business meeting  
CSAAPT business meeting  
D2001  
D2002

1:00 - 3:00

**Workshop W3**  
"Using TIPERS to Help Students Make Sense of Physics"  
Steve Kanim, New Mexico State University  
Dave Maloney, Indiana University-Purdue University Fort Wayne  
E2006

This workshop will provide examples and ideas for ways to use Tasks Inspired by Physics Education Research (TIPERs) to have the students engage in sense making with physics in contrast with a focus on more traditional quantitative problem solving. Participants will receive ready-to-use resources at the completion of the workshop.