



Indiana Section of the
American Association of
Physics Teachers

April 17, 2009

Registration: 5:00 - 6:30 pm

Trains and Brains Workshop: 5:30 - 7:30 pm

Ice Breaker Social: 6:30—7:00 pm

Demo Derby "Show and Tell" : 6:30 - 7:30 pm

Undergraduate Poster Presentations: 5:30-7:30 pm

Physics Club Demo Show: 7:30 - 8:30 pm

Kirkwood Observatory Star Gazing: 9:00 - ??

April 18, 2009

Registration: 8:00 - 10:00 am

Opening Remarks: 8:20 am

Sessions: 8:30 am - 11:15 am

Lunch: 11:30 - 12:30 pm

Business Meeting: noon - 12:30 pm

Keynote Speaker: 12:30 - 1:30 pm

Workshop - Frontiers in Physics: 2:00 pm - 6:00 pm

Food and Drink: 6:00 - 6:15 pm

Tours of IU Cyclotron/Proton Therapy Facility: 6:30 -
7:30 pm

Indiana University, Department of Physics

Bloomington, Indiana

Friday Evening Session 4/17/09

Time: 5:30 pm to 7:30 pm

Location: Swain West 152

Title

Trains and Brains Workshop - Physics labs using model trains.

Abstract

Students learn more when tasks assigned to them are fun and enjoyable. One time tested technique for making physics more palatable is to put more play into course activities. In this workshop we explore ways to mix play and learning using computer controlled model trains.

Take home and equipment giveaway. CRU

Workshop Schedule

5:00-5:30 pm Traditional Analog Train Control
5:30-6:00 pm Using Digital Command and Control Systems
6:00-6:30 pm Computerized Train Control Using Scripts
6:30-7:00 pm Demonstrations and Experiments using DCC
7:00-7:30 pm Demonstration of Knowledge Learned

Contact Information

Dan Beeker
Physics Department Laboratory Coordinator
Indiana University
debeeker@indiana.edu

**Saturday Afternoon Session
4/18/09**

Time: 2:00 pm - 6:00 pm

Location: Swain West 119

Title

Frontiers of Physics Workshop

Abstract

Physics faculty will talk about how their research is helping to piece together the unknowns in understanding our natural world. Do you wonder about dark matter, dark energy, how the LHC can detect the Higgs Boson or, for that matter, just what is the Higgs boson? Or perhaps you are wondering what a biophysicist does? The Frontiers in Physics workshop is the place to find out.

Contact Information

Dan Beeker
Physics Department Laboratory Coordinator
Indiana University
debeeker@indiana.edu

Session A - Talk 1

Time: 8:30 am to 8:45 am

Location: Swain West 119

Title

The role of the Health Physics Society

Abstract

The Health Physics Society's main mission is to disseminate information on radiation protection to professionals in the Health Physics field as well as to the general public. I will describe how the HPS fulfills that role. I will also provide sources of information that can be used in K-12 classrooms to learn about radiation and radiation safety.

Contact Information

Andrew H. Edwards
Health Physicist
Indiana University Cyclotron Facility
acedward@indiana.edu

Session B - Talk 1

Time: 8:30 am to 8:45 am

Location: Swain West 007

Title

A Demonstration of the Impulse Momentum Theorem

Abstract

The results of a demonstration show the equality of the impulse, as measured with a dual-range force probe, and the change in momentum of a cart, as measured with an ultrasonic motion detector.

Contact Information

Donald R. Zimmerman
Adjunct Professor
Embry-Riddle Aeronautical University, Indianapolis Campus and
Dept. of Physics, Indiana University-Purdue University at Indianapolis
dr_z3920@sbcglobal.net

Session C - Talk 1

Time: 8:30 am to 8:45 am

Location: Swain West 238

Title

High School Magnetism at the Nano-scale

Abstract

For matter at such a small scale, the applications of nanotechnology and nanoscience are huge forces in physics research today. The National Center for Learning and Teaching in Nanoscale Science and Engineering offers professional development to enable middle and high school teachers to build their personal knowledge about nanoscience and to smoothly introduce lessons, based on the nine "Big Ideas of Nanoscience," into the classroom. Nearly 100 of my Honors Physics I students worked through a three-day inquiry-based magnetism unit developed during a two-week summer institute at Purdue University. Magnetism, already part of many introductory physics classes, offers a natural fit for the Big Idea that size and scale impact the property of materials. The unit was structured to help students understand that the paramagnetic properties of ferrofluid arise from its nano-sized iron oxide clusters. Successes and limitations of the lesson as well as evidence of student learning will be presented.

Contact Information

Tracy Hood
Plainfield High School
thood@plainfield.k12.in.us

Session A - Talk 2

Time: 8:50 am to 9:05 am

Location: Swain West 119

Title

A Closer Look at Full Length Mirror Image Predictions

Abstract

It has been widely reported that most people believe that a person can see more of himself/herself as he/she moves farther away from a plane mirror. Such a belief, which remains strongly held even after formal instruction and laboratory investigations of reflection of light, implies that the minimum size of a plane mirror needed for full length image viewing should decrease as a person moves further from the mirror. To more fully investigate this belief, preservice elementary teachers were asked to illustrate the size and location of the smallest mirror necessary for viewing one's full length image from varying distances. Results indicated that although an overwhelming majority of students do believe that the mirror size should decrease, their diagrams revealed different patterns of thought not previously uncovered by research, and not affected by traditional ray tracing activities.

Contact Information

Joel A. Bryan, Ph.D.
Department of Physics and Astronomy
Ball State University
jabryan@bsu.edu

Session B - Talk 2

Time: 8:50 am to 9:05 am

Location: Swain West 007

Title

Statics and Equilibrium Can Be Fun

Abstract

High school students build Balsa bridges within time, material, and design constraints. At the competition (Purdue campus), the bridges are judged on aesthetics, and tested to determine load-carrying ability. Sometimes students go home with prizes, sometimes just with the splintered remains of bridges. The project reinforces static equilibrium concepts as well as the discipline and attention to detail required in a construction project. Some students use design software, some use seat of the pants engineering. Aside from all of that, it's a lot of fun.

Contact Information

Jim Clark
Andrean High School
jamcol@comcast.net

Session C - Talk 2

Time: 8:50 am to 9:05 am

Location: Swain West 238

Title

The Math of Science: A One-week foundation for ICP, Chemistry, or Physics

Abstract

Students with weak math skills often struggle during the first several weeks of physical science classes, when the focus is on developing mathematical skills, such as equation manipulation, dimensional analysis, and scientific notation. Plainfield High School has offered a one-week summer enrichment camp for 6 years to help give students a head-start in reviewing or learning such math skills. Anecdotal evidence of success and information about developing a similar program will be shared.

Contact Information

Tracy Hood
Plainfield High School
thood@plainfield.k12.in.us

Session A - Talk 3

Time: 9:10 am to 9:25 am

Location: Swain West 119

Title

Low Cost Physics I: Translational and Rotational Equilibrium

Abstract

High school physics teachers most often do not have access to the same expensive laboratory equipment they likely used in their undergraduate physics courses. However, you don't need specialized expensive equipment to perform many data collection investigations that are appropriate and essential for introductory physics. Force scales, meter sticks, and string are all you need to perform the translational and rotational equilibrium activities described in this session. Handouts provided

Contact Information

Joel A. Bryan, Ph.D.
Department of Physics and Astronomy
Ball State University
jabryan@bsu.edu

Session B - Talk 3

Time: 9:10 am to 9:25 am

Location: Swain West 007

Title

*An Energy Representation for All Contexts**

Abstract

Qualitative representations are a very productive component of problem solving in physics. For example, properly drawn free-body diagrams make writing the appropriate Newton's second law equations for a system straightforward. In spite of their value we lack such a qualitative representation for one of the most important concepts in physics—energy. In this talk I will present a version of a representation—an energy bar chart—that can serve for dealing with energy in all topic domains of physics. I will illustrate its use on examples from mechanics, thermodynamics and electrostatics.

*This work was supported in part by the National Science Foundation under grant DUE 0632963.

Contact Information

David P. Maloney
Physics Department
Indiana University Purdue University Fort
Wayne
maloney@ipfw.edu.

Session C - Talk 3

Time: 9:10 am to 9:25 am

Location: Swain West 238

Title

Scientific reasoning skills and success in Introductory physics

Abstract

Scientific reasoning is an important ability in learning that has attracted much attention in physics education research. The Lawson Classroom Test of Scientific Reasoning (LCTSR) assesses six reasoning domains, including proportional reasoning, control of variables, and hypothetico-deductive reasoning. When given as a pretest, the LCTSR scores are strongly correlated with the posttest scores on Force Concept Inventory (FCI). Our school uses this test as a pretest in all science classes in order to assess how our curriculum influences our student's reasoning skills throughout their high school years. We are considering how this test can help with placement of students in classes and identification of students who are in need of remediation. This paper will focus on the relationships involving students' scores on the LCTSR and multiple factors including completion of course assignments, performance on exams, and student scores on the FCI.

Contact Information

Hugh Ross
Guerin Catholic High School
hross@guerincatholic.org

Session A - Talk 4

Time: 9:30 am to 9:45 am

Location: Swain West 119

Title

Low Cost Physics II: Constant and Relative Velocity

Abstract

High school physics teachers most often do not have access to the same expensive laboratory equipment they likely used in their undergraduate physics courses. However, you don't need specialized expensive equipment to perform many data collection investigations that are appropriate and essential for introductory physics. Battery operated cars, meter sticks, stopwatches, tape, and string are all you need to perform the constant and relative velocity activities described in this session. Handouts provided. stopwatches, tape, and string are all you need to perform the constant and relative velocity activities described in this session. Handouts provided.

Contact Information

Joel A. Bryan, Ph.D.
Department of Physics and Astronomy
Ball State University
jabryan@bsu.edu

Session B - Talk 4

Time: 9:30 am to 9:45 am

Location: Swain West 007

Title

An Energy Conservation Lab using a Vertical Simple Harmonic Oscillator

Abstract

I will describe a lab performed in our introductory mechanics course that investigates energy conservation using a vertically oscillating mass-spring system. The spring with attached hanging mass is suspended from a Vernier force sensor, while the mass's position and velocity are measured using a floor-mounted Vernier motion sensor. The system's spring constant k is determined from the force and position measurements. Students use all of these measurements to calculate the system's kinetic, potential, and total energy as functions of time.

Contact Information

Dennis E. Krause
Department of Physics
Wabash College
kraused@wabash.edu

Session C - Talk 4

Time: 9:30 am to 9:45 am

Location: Swain West 238

Title

What's a lab for? A decade of continuous laboratory revision

Abstract

What is the purpose of a laboratory? What are the goals for student learning? Over the past decade we have been involved in the continuous revision of all of our laboratories from introductory to advanced undergraduate. The basic tenets in each of these laboratories have been to develop the student's experimental skills, their independence and to help them understand and apply physics to their investigations. The methods adopted to achieve these goals in a variety of venues will be discussed.

Contact Information

Mark F. Masters
Department of Physics
Indiana University Purdue University Fort
Wayne
masters@ipfw.edu

Session A - Talk 5

Time: 10:00 am to 10:15 am

Location: Swain West 119

Title

Teacher Friendly Physics

Abstract

Teacher Friendly Physics Volume One provides 30 lab activities covering the topics of motion, forces, and energy. Each of these activities are written on a level that middle school/high school students can understand, use inexpensive equipment that most schools own, and do not require expensive technology in order to get good reproducible results. Best of all-they can easily be stored as a kit and take minimal time for setup! For \$35 you can purchase Teacher Friendly Physics Volume One and receive 30 activities with teacher notes, “dummy data” for absent students, “dummy data” answer keys, and a CD-ROM with grading spreadsheets to help you quickly and accurately grade individual student data. All of the activities in the book can be completed in a short time frame that won't lose student interest. These activities have been used for years in a high school classroom and students love the activities!

Contact Information

Stacy McCormack
Penn High School Physics Teacher
A Matter of Science, LLC
smccormack@phm.k12.in.us

Session B - Talk 5

Time: 10:00 am to 10:15 am

Location: Swain West 007

Title

Using Reverse Game Play to Engage Students in Formulating and Testing Hypotheses

Abstract

We have become aware of the need to teach the nature of science to students in all science classes. Typically, it is assumed that students will "get" the nature of science through implicit instruction in the laboratory. We believe that for students to understand science explicit experience working with scientific processes is required. Given the background understanding necessary to effectively function scientifically it is difficult for students to gain these insights into the scientific process in the laboratory setting. To resolve this situation we developed an activity based on a quote from Feynman that utilizes abstract strategy games in which the students use data derived from actual game play to determine the rules of the game. This activity can be encapsulated within a single laboratory session and addresses the essence of formulating and testing hypotheses. During the presentation we will provide the activity to the audience for hands-on experience and discussion.

Contact Information

David P. Maloney (maloney@ipfw.edu)

Mark F. Masters (masters@ipfw.edu)

Department of Physics

Indiana University Purdue University Fort
Wayne

Session C - Talk 5

Time: 10:00 am to 10:15 am

Location: Swain West 238

Title

Dispersive behavior on a slinky or a length of 'piano wire'

Abstract

There are not many dispersive systems which are easy to study in the laboratory. Transverse waves on wires ('flexural' waves) are definitely dispersive, and can be easily by suspending several meters of wire and attaching one end to a 'sound board'. When the wire is struck in the middle, high frequency flexural waves arrive at the sound board before lower frequencies do. The free-ware program Audacity may be used to measure the arrival times of different frequencies. Then a plot can be done to show that the arriving waves are travelling at the group velocity and not the phase velocity. A slink has a rectangular cross-section, and it generates two different sets of flexural waves.

Contact Information

Michael Moloney
Rose-Hulman Institute of Technology
moloney@rose-hulman.edu

Session A - Talk 6

Time: 10:20 am to 10:35 am

Location: Swain West 119

Title

Teacher Friendly ICP

Abstract

Teacher Friendly ICP is a standards-based resource that provides hands-on activities and worksheets covering the topics of Newton's Laws, motion, gravity, energy, electricity and electromagnetism. I have discovered that the hands-on approach of my ICP curriculum has increased the engagement of my students. Because I have the struggling learners and readers in my ICP classes, I use a great deal of graphic organizers such as Venn diagrams, cut and paste activities and charts. As a result of these strategies, students have increased comprehension of the science content. The graphic organizers help students make connections between vocabulary terms and make sense of the content. All of the activities use basic science equipment or basic supplies that can be purchased at the store. Activities and worksheets are accompanied by answer keys so teachers can grade quickly.

Contact Information

Carey Munoz
Ben Davis High School
317-885-9028

Session B - Talk 6

Time: 10:20 am to 10:35 am

Location: Swain West 007

Title Continuation of Session B - Talk 5

Using Reverse Game Play to Engage Students in Formulating and Testing Hypotheses

Abstract

We have become aware of the need to teach the nature of science to students in all science classes. Typically, it is assumed that students will "get" the nature of science through implicit instruction in the laboratory. We believe that for students to understand science explicit experience working with scientific processes is required. Given the background understanding necessary to effectively function scientifically it is difficult for students to gain these insights into the scientific process in the laboratory setting. To resolve this situation we developed an activity based on a quote from Feynman that utilizes abstract strategy games in which the students use data derived from actual game play to determine the rules of the game. This activity can be encapsulated within a single laboratory session and addresses the essence of formulating and testing hypotheses. During the presentation we will provide the activity to the audience for hands-on experience and discussion.

Contact Information

David P. Maloney (maloney@ipfw.edu)

Mark F. Masters (masters@ipfw.edu)

Department of Physics

Indiana University Purdue University Fort
Wayne

Session C - Talk 6

Time: 10:20 am to 10:35 am

Location: Swain West 238

Title

The Hubble Constant and Quantum Numbers of the Nearest Stars

Abstract

It can be demonstrated that if Hubble's values are not constant then the concept of constant density is not going to hold. Of two equations connecting quantum numbers to the nearest stars one involves the Hubble Constant. Combination of the two equations, assuming the connection to Hubble's, values predicts a smooth increase in Hubble's constant with distance. Distance being radial and velocity being tangential, according to Newton; it is difficult to predict an expanding universe from the definition of redshift. The difference in the nature of light and sound according to the application of Doppler's principle is a starting point for conjecture.

Contact Information

Jonathan O. Brooks
Ivy Tech
j.o.brooks@att.net

Session A - Talk 7

Time: 10:40 am to 10:55 am

Location: Swain West 119

Title

Integrating the Integrated/Chemistry Physics Curriculum

Abstract

When the state standards for Integrated Chemistry/Physics were presented a few years ago, teachers across Indiana were scrambling to find a way to teach this curriculum. Instead of teaching the class as two separate semesters, a few teachers found a way to teach the physics and chemistry side-by-side using "energy" as the overarching theme. For \$5.00 you can obtain a copy of a CD-ROM with the entire curriculum (that covers all state standards) and use them at your school! Most of the labs require very inexpensive lab equipment that most schools already have in a storeroom. The curriculum is lab-driven and has writing assignments at the conclusion of each unit. Come and learn how to teach the course using the topics of Mechanical Energy, Nuclear Energy, Heat Energy, Electromagnetic Energy, and Light/Sound Energy.

Contact Information

Stacy McCormack
Penn High School Physics Teacher
A Matter of Science, LLC
smccormack@phm.k12.in.us

Session B - Talk 7

Time: 10:40 am to 10:55 am

Location: Swain West 007

Title

AP Physics B Free Response Rubrics

Abstract

Every year approximately one hundred dedicated High School and College Physics teachers gather for a week of comradery and work grading the Free Response Questions of the AP Physics Exams. The first order of business is to determine the rubrics to be applied that year. In this session the rubrics for the 2008 APB Physics exam will be covered. Explanations on what students did well and how to improve scores will be given.

Contact Information

Linda (Lin) Wozniewski
Indiana University Northwest
lwoz@iun.edu

Session C - Talk 7

Time: 10:40 am to 10:55 am

Location: Swain West 238

Title

Diurnal and Seasonal Variations in the Measurement of a Weight using a Spring-Type Scale

Abstract

A mass resting on a force sensor shows a very small, but regular variation in the recorded weight when examined over time periods of 24 hours or longer. We have developed an explanation which links this weight variation to the centripetal acceleration of the mass on the rotating earth. The component of this acceleration on a line between the mass and the sun acts as a small modulating acceleration on the centripetal acceleration of the earth (and mass) associated with the yearly revolution about the sun.

Contact Information

Dr. George Devendorf
Ashley Nagel
Indiana Academy for Science Mathematics
and Humanities
Ball State University
gsdevendorf@bsu.edu

Session A - Talk 8

Time: 11:00 am to 11:15 am

Location: Swain West 119

Title

ACP Concurrent Enrollment: A model to offer high school students a rigorous college introductory physics course for college credit

Abstract

In an attempt to focus on increasing the number of Indiana high school students who are prepared for college, IU has created the Advance College Project (ACP), a partnership between the university, high schools, high school teachers, and high school students. Qualified high school teachers are given adjunct faculty status and deliver college courses to high school students in the high school setting during the regular school day. College faculty act as liaisons between the university and high schools. Students who earn a 'C' or better can transfer their college credit to any public post-secondary in Indiana; credit often transfers to other institutions.

Contact Information

Becky Carter
Advance College Project
Indiana University
reacarte@indiana.edu

Session B - Talk 8

Time: 11:00 am to 11:15 am

Location: Swain West 007

Title

AP Physics C Free Response Rubrics

Abstract

Every year approximately one hundred dedicated High School and College Physics teachers gather for a week of comradery and work grading the Free Response Questions of the AP Physics Exams. The first order of business is to determine the rubrics to be applied that year. In this session the rubrics for the 2008 APC Physics exam, both mechanics and Electricity and Magnetism will be covered. Explanations on what students did well and how to improve scores will be given.

Contact Information

nda (Lin) Wozniowski
Indiana University Northwest
lwoz@iun.edu

Session C - Talk 8

Time: 11:00 am to 11:15 am

Location: Swain West 238

Title

*Teaching Introductory Physics in an
Advanced High School (College-like setting)*

Abstract

Teaching general (non AP) Physics at The Indiana Academy provides a unique opportunity to explore a different approach in teaching introductory science courses to a general (non-science) student population. This approach is not radically different in style, but the teaching emphasis (or direction) is gradually shifting away from a content oriented emphasis to a “discussion, exploration, and development of ideas” emphasis. A strong emphasis on lab activities and lab work forms the core of the course, and efforts are being made in the classroom to shift away from a traditional content oriented curriculum to one which emphasizes the development and understanding of important scientific ideas.

Contact Information

Dr. George Devendorf
Indiana Academy for Science Mathematics
and Humanities
Ball State University
gsdevendorf@bsu.edu

Keynote Speaker

4/18/2008

Time: 12:30 pm to 1:30 pm

Location: Jordan Hall Room 124

Dr. Lawrence Krauss

*Foundation Professor in the School
of Earth and Space Exploration*

Arizona State University

*Lecturer and author of Physics of
Star Trek and Fear of Physics*

Dr. Krauss will be speaking on "Einstein's Greatest Blunder", The talk is about Einstein's inclusion and subsequent removal of a cosmological term to his general theory of relativity. Dr. Krauss will review the history of the cosmological constant and discuss its context in the light of recent discoveries in physics and astronomy.

Notes:

Time	Session A - SW 119	Session B - SW 007	Session C - SW 238
Talk 1 - 8:30 to 8:45 am	The role of Health Physics Society— pg 4	A DEMONSTRATION OF THE IMPULSE MOMENTUM THEOREM— pg 5	<i>High School Magnetism at the Nano-scale—pg 6</i>
Talk 2 - 8:50 to 9:05 am	A Closer Look at Full Length Mirror Image Predictions— pg 7	Statics and Equilibrium Can Be Fun— pg 8	The Math of Science: A One-week foundation for ICP, Chemistry, or Physics— pg 9
Talk 3 - 9:10 to 9:25 am	Low Cost Physics I: Translational and Rotational Equilibrium— pg 10	An Energy Representation for All Contexts*— pg 11	Scientific reasoning skills and success in introductory physics— pg 12
Talk 4 - 9:30 to 9:45 am	Low Cost Physics II: Constant and Relative Velocity— pg 13	An Energy Conservation Lab using a Vertical Simple Harmonic Oscillator	What's a lab for? A decade of continuous laboratory revision— pg 15
Break - 9:45 to 9:55 am	Break	Break	Break
Talk 5 - 10:00 to 10:15 am	Teacher Friendly Physics— pg 16	Using Reverse Game Play to Engage Students in Formulating and Testing Hypotheses— pg 17	Dispersive behavior on a slinky or a length of 'piano wire'— pg 18
Talk 6 - 10:20 to 10:35 am	Teacher Friendly ICP— pg 19		The Hubble Constant and Quantum Numbers of the Nearest Stars— pg 21
Talk 7 - 10:40 to 10:55 am	Integrating the Integrated/Chemistry Physics Curriculum— pg 22	AP Physics B Free Response Rubrics— pg 23	Diurnal and Seasonal Variations in the Measurement of a Weight using a Spring-Type Scale— pg 24
Talk 8 - 11:00 to 11:15 am	ACP Concurrent Enrollment: A model to offer high school students a rigorous college introductory physics— pg 25	AP Physics C Free Response Rubrics— pg 26	Teaching Introductory Physics in an Advanced High School (College-like setting)— pg 27

Keynote Speaker information on page 28.