# SPRING 2009 KAPT (KENTUCKY ASSOCIATION OF PHYSICS TEACHERS) MEETING

**AT**

**BELLARMINE UNIVERSITY**
**2001 NEWBURG ROAD**
**LOUISVILLE, KY**

**MARCH 7, 2009**

**MILES HALL**
**ROOM M145 (GROUND FLOOR)**

**8:30 AM – 5:00 PM**

# KAPT'S MISSION STATEMENT

The objectives of the Association shall be to advance the teaching of physics, to further the role of physics in our culture, and to enhance effective communication among those concerned with the teaching of physics at all levels.

# MEMBERSHIP

Membership dues are $5 per year and $75 for lifetime membership.

# KAPT OFFICERS

Akhtar Mahmood (Bellarmine University) – KAPT President (amahmood@bellarmine.edu)
Kenny D. Lee (Warren Central High School) – KAPT Vice-President (kenny.lee1@warren.kyschools.us)
Arthur K. Pallone (Murray State University) – Secretary/Treasurer (art.pallone@murraystate.edu)
Richard Gelderman (Western Kentucky University) – Section Representative (gelderman@wku.edu)

# LOCAL ORGANIZING COMMITTEE

Dr. Akhtar Mahmood (KAPT President & Meeting Chair)
Dr. Syed Ahmad (Physics Faculty)
Ms. Jocelyn Cook (Assistant Director of Special Events)
Ben Draper (Physics Club Treasurer)
Ian Tracey (Physics Club VP)
Yan Chen (Physics Club President)
Tiffany Graznow (Student)

# SPONSORS

**Bellarmine University**
**KAPT (Kentucky Association of Physics Teachers)**
**AAPT (American Association of Physics Teachers)**
**Bellarmine University Physics Club**
**Campus Bookstore (Follett Higher Education Group)**
**Louisville Convention & Visitors Bureau**

# WEB LINKS

**OFFICIAL KAPT WEBSITE: http://physics.wku.edu/kapt/**

**KAPT MEETING WEBSITE: http://www.bellarmine.edu/faculty/KAPT/kapt09.htm**

**OFFICIAL AAPT WEBSITE: http://www.aapt.org/**

**BELLARMINE UNIVERSITY PHYSICS WEBSITE: http://www.bellarmine.edu/cas/physics/**

# WELCOME
# TO THE
# SPRING 2009 KAPT MEETING

**Bird's Eye View of Bellarmine University's Campus (Southeast Side)**

Bellarmine University is pleased and honored to host the Spring 2009 KAPT Meeting. The KAPT Local Organizing Committee has put together an exciting program for us. Over 20 talks and demonstrations in a wide range of topics in physics and astronomy have been scheduled to be presented at this year's Spring 2009 KAPT Meeting. At this meeting there will be a Morning and an Afternoon session, as well as a three-hour long Parallel Workshop session for physics teachers.

Our invited plenary speaker Dr. Neeti Parashar from Purdue University – Calumet will talk about the hunt for the famous Higgs Boson at the CMS Experiment at CERN's Large Hadron Collider (LHC). Her research work is being funded by the National Science Foundation (NSF).

We wish you an enjoyable and enriching Spring 2009 KAPT Meeting at Bellarmine University. We hope you find the presentations informative. We also hope that you make new friends at the meeting.

Thank you for joining us.

***Dr. Akhtar Mahmood***
*KAPT President and Meeting Chair*

# INVITED PLENARY SPEAKER

Saturday, March 7, 2009
9:30 am – 10:00 am
Room M145 - Miles Hall, Bellarmine University

***"Search for the Higgs Boson at the CMS Experiment at CERN's Large Hadron Collider (LHC)."***

**Dr. Neeti Parashar**
**Associate Professor of Physics**
**@**
**Purdue University Calumet**
***(Email: neeti@fnal.gov)***

Dr. Neeti Parashar holds a model of the Forward Pixel Detector that her research team has build for the CMS experiment at CERN with her collaborators.

After completing her Ph.D degree in 1995 from University of Delhi in India, Dr. Parashar obtained a Visiting Scientist position at Oxford University in England. She later won the prestigious INFN Fellowship from the government of Italy to continue her post-doctoral work at the Istituto Nazionale di Fisica Nucleare (INFN) in Pisa, Italy. In 1998, she obtained a Research Associate position at Northeastern University in Boston to pursue her research work on the DZERO experiment at the Fermi National Accelerator Laboratory (Fermilab), located in Illinois, USA. She joined Purdue University - Calumet in 2005 and is currently an Associate Professor of Physics and the leader of the High Energy Physics Program. She is a member of the DZERO experiment at Fermilab and the CMS (Compact Muon Solenoid) experiment at the European Organization for Nuclear Research (CERN) in Switzerland. She has authored over 300 research papers in experimental high energy physics along with her collaborators in international peer reviewed journals. She received the Outstanding Faculty Scholar Award at Purdue University Calumet in 2008. She is the leader of Forward Pixel Geometry Team at CMS and is the co-leader of the B-tau Simulation Group at CMS. Previously she and her research group were involved in building the Forward Pixel Modules for the CMS experiment. Her research work is currently funded by the National Science Foundation (NSF) and Fermilab. Along with her post-doc and research students, she is pursuing the search for the Higgs Boson at the CMS experiment.

# MEETING AGENDA

## MORNING SESSION
## (Room M145 - Miles Hall)

(Moderator – Dr. Richard Gelderman (Western Kentucky University)

**8:30 AM – 9:15 AM** Registration and Light Breakfast (Miles Hall Ground Floor Lobby Area)

(All presenters please download your powerpoint files on PC (desktop) in Room M145)

**9:15 AM – 9:20 AM** Welcome Remarks by Dr. Akhtar Mahmood (Bellarmine University) - *KAPT President*

**9:20 AM – 9:30 AM** **KAPT/AAPT Relationship** - **Working with the AAPT National Office to Increase and Broaden KAPT Membership.** Dr. Richard Gelderman (Western Kentucky University) - *AAPT Section Rep. for Kentucky*

**9:30 AM – 10:00 AM** **Search for the Higgs Boson at the CMS Experiment at CERN's Large Hadron Collider (LHC).** Invited Talk by Plenary Speaker Dr. Neeti Parashar (Purdue University Calumet)

**10:00 AM – 10:12 AM** **SKyTeach: Strengthening Physics Teacher preparation at Western Kentucky University.** Dr. Scott Bonham* and Kyle Curry (Western Kentucky University)

**10:12 AM – 10:24 AM** **Cosmic Voids: The Total Volume of Nothing.** Armin Smailhodzic*, Dr. Keith Andrew, and Dr. Brett Bolen (Western Kentucky University)

**10:24 AM – 10:36 AM** **Using Mousetrap Cars to Teach About Force and Motion**. William L. Schneider (Simon Kenton High School)

**10:36 AM – 10:48 AM** **Tracking Cosmic Ray Muons Using a Cloud Chamber**. Leah Wilson*, Lori Wilson (duPont Manual High School) and Dr. Akhtar Mahmood (Bellarmine University)

**10:48 AM – 11:00 AM** **Measurement of Muon Flux and Muon Lifetime Using the Bellarmine Cosmic Ray Muon Detector**. Lori Wilson*, Leah Wilson (duPont Manual High School) and Dr. Akhtar Mahmood, Dr. Syed Ahmad (Bellarmine University)

**11:00 AM – 11:12 AM** **Exponentially-Modified- Gaussian and -Lorentzian Line Shapes.** Dr. P.M. Wilt (Centre College)

**11:12 AM – 11:24 AM** **Teaching Chaotic Dynamical Systems to Freshmen with No Prerequisites.** Dr. Jim Kelly (Centre College)

**11:24 AM – 11:36 AM** **A "Mole Day" Activity to Discover the Law of Dulong and Petit.** Dr. Jean Oostens* (Campbellsville University) and Cheryl May (Lebanon Middle School)

**11:36 AM – 11:48 AM** **OH Masers in the Star Forming Region W49.** Brice Hamilton* and Dr. Phil Lockett (Centre College)

**11:48 AM – 12:00 PM** **Theoretical Mass Predictions of Double and Triple Charmed and Beauty Baryons Using the Bellarmine-Baryon-Mass-Model.** Ben Draper*, Yan Chen, Richard Jelsma, Ian Tracey, Rachel Keyser, Dr. Akhtar Mahmood, and Dr. Syed Ahmad (Bellarmine University)

**12:00 PM – 12:12 PM** **Discrepant Events: A Challenge to Students' Intuition.** Dr. Wilson J. González-Espada, Dr. Jennifer J. Birriel*, and Dr. Ignacio Birriel (Morehead State University)

**12:12 PM – 12:25 PM** **Monitoring Sky Brightness in Rowan County: A First Step To Reducing Light Pollution.** Jaclyn Wheatley* and Dr. Jennifer Birriel (Morehead State University)

**12:25 PM – 1:30 PM** **LUNCH BREAK** *(a list of nearby restaurants is provided in your packet)*

## PARALLEL WORKSHOP SESSION
## (Room 209B - Pasteur Hall)

**1:30 PM – 4:30 PM** **Ranking Task Workshop.** Kenny D. Lee *(Warren Central High School)*

## AFTERNOON SESSION
## (Room M145 - Miles Hall)

**1:30 PM – 1:36 PM** **Upgrading the Eddy Current Magnet Drop**. Dr. Keith Andrew (Western Kentucky University)

**1:36 PM – 1:48 PM** **Physics for the Life Sciences.** Dr. Phil Lockett (Centre College)

**1:48 PM – 2:00 PM** **Self-Fourier functions**. Dr. H. E. Montgomery, Jr. (Centre College)

**2:00 PM – 2:12 PM** **Hemodynamics Factors and the Prognostic Relevance of Hematocrit in Arterial Diseases**. Dr. Shewaferaw S. Shibeshi (Alice Lloyd College)

**2:15 PM – 2:24 PM** **Improving the Stability of an Ultra-Short Pulse Fiber Laser.** John H. Gruenewald* and Dr. Jason D. Neiser (Centre College)

**2:24 PM – 2:36 PM** **Can We Really Neglect The String In A Sliding System?** Catrinia Druen* and Dr. Ignacio BirrieL (Morehead State University)

**2:36 PM – 2:50 PM** **Effectively Selling Astronomy to the Public – Fusing Lessons Learned From Education, Entertainment, Advertisement and Public Relations.** Dr. Arthur K. Pallone* (Murray State University) and Jacque E. Day (Murray State University, *also* Public Radio Correspondent, Television Producer and Reporter)

# SUBMITTED ABSTRACTS

**Search for the Higgs Boson at the CMS Experiment at CERN's Large Hadron Collider (LHC)**

Dr. Neeti Parashar
*(Purdue University Calumet)*

Abstract

I shall provide an overview of experimental particle physics, also referred to as high energy physics. The particle accelerators that have been built to perform this type of research will be discussed. The primary focus shall be on the CMS (Compact Muon Solenoid Experiment) at the Large Hadron Collider (LHC) at the European Organization for Nuclear Research (CERN), located in Geneva, Switzerland. The LHC collider is located inside a circular 27-kilometer tunnel about 100 meters underground, between Switzerland's Lake Geneva and France's Jura mountains. When it begins colliding particles in summer of 2009, the 14 TeV LHC machine will be the world's most powerful particle accelerator. The CMS detector is capable of seeing up to 600 million collisions per second. CMS is one of two general-purpose detectors that will explore the physics at the Terascale, the energy region where we may find answers to the central questions about the very early universe. It is predicted that its very-high-energy collisions will yield extraordinary discoveries about the nature of the physical universe. The Higgs boson discovery potential of the LHC machine will be discussed.

**Hemodynamics Factors and the Prognostic Relevance of Hematocrit in Arterial Diseases**

Dr. Shewaferaw S. Shibeshi
*(Alice Lloyd College)*

Abstract

Computer simulation of hemodynamics on a right coronary artery explained the prognostic relevance of hematocrit in arterial diseases. The Navier-Stokes' and the Casson equations are used to represent the blood flow dynamics and blood rheology respectively. Hematocrit- dependent parameters in the Casson equation integrated the hematocrit level in the mathematical model. Then the mathematical model was linearized on a tetrahedral computational grid using the finite volume method. The simulation showed a significant dependence of hemodynamics factors on hematocrit levels. Since the onset of arterial diseases is associated with hemodynamics factors, their strong dependence on hematocrit revealed the prognostic relevance of hematocrit in arterial diseases, well in agreement with previous clinical and epidemiological findings.

**Tracking Cosmic Ray Muons Using a Cloud Chamber**

Leah Wilson*, Lori Wilson
*(duPont Manual High School)*
and
Dr. Akhtar Mahmood
*(Bellarmine University*)

Abstract

One of the most common types of cosmic rays that come from outer space and showers the earth's surface continuously is a subatomic particle called a muon. At sea-level, on average, one muon strikes the fingertip (an area of about 1 $cm^2$) every minute. The purpose of this research project was to detect cosmic ray muon tracks and measure the muon flux in Louisville, Kentucky. This research work was carried out at Bellarmine University. A cloud chamber was constructed out of a basketball display case. Felt pads placed inside the case were saturated with 91% pure isopropyl alcohol inside of the chamber to create a super-saturated atmosphere. The cloud chamber was then set on a block of dry ice and was cooled to create the required environment for muon detection. The muon flux count obtained by our cloud chamber was also compared with the muon flux data obtained on-line from the Cosmic Ray Detector located at SLAC's (Stanford Linear Accelerator Center) Visitor's Center. During a 100-minute time-frame in 5 different 20-minute experimental runs, a total of 593 muon events were observed. On average, about 6 muons were detected per minute. The mean flux was measured to be 0.06 muons per minute per $cm^2$ for this cloud chamber setup.

**Measurement of Muon Flux and Muon Lifetime Using the Bellarmine Cosmic Ray Muon Detector**.

Lori Wilson*, Leah Wilson
*(duPont Manual High School)*
and
Dr. Akhtar Mahmood, Dr. Syed Ahmad
*(Bellarmine University)*

Abstract

In order to measure the muon flux and the muon lifetime, a series of experiments were conducted both at Bellarmine University and the National City Tower (located in downtown Louisville) using a high resolution microprocessor-based Cosmic Ray Muon Detector. The muon detector consisted of a cylindrical column containing scintillator pads, a photomultiplier tube, and a high voltage power source. These were connected to an external data acquisition module via a BNC cable. The detector's data was fed to a laptop PC via a USB cable which ran the muon data acquisition software. This software was able to display the muon hits, the number of muon decay events and the muon decay rate. Four one-hour experimental runs yielded an average muon flux rate of 2.6 muons per minute per $cm^2$ with an average muon decay rate of about one muon per minute. In our final experimental run, the muon lifetime was measured to be $2.036 \pm 0.347$ $\mu$s.

**Theoretical Mass Predictions of Double and Triple Charmed and Beauty Baryons Using the Bellarmine-Baryon-Mass-Model**

Ben Draper*, Yan Chen, Richard Jelsma, Ian Tracey, Rachel Keyser, Dr. Akhtar Mahmood, and Dr. Syed Ahmad
*(Bellarmine University)*

Abstract

At Bellarmine University we have developed a Baryon Mass Model using the quark-gluon mass-energy relationship to predict the masses of the undiscovered double charmed and the beauty baryons. We will present the predicted masses of the seven ground-state double-charmed and the thirty-five beauty baryons with $J^p$ of $1/2^+$ and $3/2^+$. Charmed and Beauty Baryons for a very short times populated the early universe during the hadron era, less than a microsecond after the Big Bang. Baryon spectroscopy containing charmed and beauty quarks are very important for understanding the dynamics of quark and gluon interactions.

**Discrepant Events: A Challenge to Students' Intuition**

Dr. Wilson J. González-Espada, Dr. Jennifer J. Birriel*, and Dr. Ignacio Birriel
*(Morehead State University)*

Abstract

Research studies on student learning and conceptual change have resulted in several easily applicable teaching strategies. One of these strategies is known as discrepant events, a phenomenon usually presented by the instructor that occurs in a way that seems contrary to initial reasoning. Discrepant events are very powerful ways of stimulating interest, motivating students to challenge their covert science misconceptions, and promoting higher order thinking skills. In this presentation, we aim at describing discrepant events and their role in conceptual change. In addition, we will share our favorite and most successful discrepant events implemented in our physics and physical science courses. Attending colleagues will be encouraged to share their own favorite discrepant events.

**Monitoring Sky Brightness in Rowan County: A First Step To Reducing Light Pollution**

Jaclyn Wheatley* and Dr. Jennifer Birriel
*(Morehead State University)*

Abstract

This project represents the first stages of documenting night-sky brightness in the Rowan County area: this includes the city of Morehead, Cave Run Lake, and parts of the surrounding Daniel Boone National Forest. We begin by defining light pollution and discuss its negative impacts such as disruption of wildlife, the impact on humans, and wasted energy. We briefly discuss natural sources of illumination in the night sky. Natural night sky brightness represents the baseline for comparison when attempting to combat the problem of light pollution. We present our first results: a grid map of night sky brightness as a function of latitude and longitude in the Rowan County area using two commercially produced sky quality meters from the Unihedron Corporation. Documenting night-sky brightness is a necessary first step to increasing awareness to the problem of light pollution and ultimately reducing the light pollution in our region.

## Can We Really Neglect The String In A Sliding System?

Catrinia Druen* and Dr. Ignacio Birriel
*(Morehead State University)*

Abstract

In most introductory examples and experiments, some masses are considered negligible and are not included in theoretical calculations. A classic example is that of two boxes connected by a string with one box is suspended vertically over a pulley while the other slides on a horizontal surface. Usually, the motion of such a system is described theoretically by including friction but not the mass of the string. In this study, we examined the influence of the string in such a system using strings, each with a different mass per unit length. We record the position of the horizontal block as a function of time using the PASCO digisonic ranger and Vernier LabPro data software. We find that in the case of a "heavy" string, the position of the block as a function of time is best described by including both frictional forces and the mass of the string.

## A "Mole Day" Activity to Discover the Law of Dulong and Petit

Dr. Jean Oostens*
*(Campbellsville University)*
and
Cheryl May
*(Lebanon Middle School)*

Abstract

Cups of coffee cool down when a metallic spoon is immersed into the liquid. How much cooling depends amongst other on what metal the spoon is made of. Finding an answer to this question can be an occasion to introduce the concept of mole and discover the Law of Dulong and Petit. First four blocs of metal labeled A,B,C and D are to be identified knowing each contains one mole. After determining the mass of each bloc, one fills four Styrofoam cups with hot water, each provided with a temperature probe connected to a computer. The purpose is to find how much cooling results when each bloc of metal (Cu,Zn, Al and Fe) is immersed. The exercise can be completed by looking up the properties of a number of other elements and dividing the specific heat by the atomic mass. The activity will be performed live at the meeting.

## Upgrading the Eddy Current Magnet Drop

Dr. Keith Andrew
*(Western Kentucky University)*

Abstract

Teaching Demonstration: We use novel magnetically sensitive plastic to provide students with a clear view of the magnet as it falls through the opaque conducting pipe.

**Self-Fourier functions**

Dr. H. E. Montgomery, Jr.
*(Centre College)*

Abstract

Some functions are their own Fourier transforms. Best known of these self-Fourier Functions (SFFs) are the Gaussian and hyperbolic secant. A survey of the literature gives the general impression that these might be the only SFFs. We will show that it is possible to construct an infinite number of SFFs. The behavior of these functions will be characterized using the Heisenberg uncertainty product and the Shannon information entropy sum.

**Teaching Chaotic Dynamical Systems to Freshmen with No Prerequisites**

Dr. Jim Kelly
*(Centre College)*

Abstract

Is studying the three body problem with first-year students having no calculus or physics background a recipe for certain disaster? It isn't at all, given the proper motivation, a variety of teaching modes, and a quick introduction to programming. I will report on the organization and outcome of a course a course on chaotic dynamical systems taught during the three week winter term at Centre College in January, 2009. The visual appeal of fractal geometry served to lure the students into the subject, while a programming component ensured that a wide variety of dynamics phenomena were experienced firsthand, using only code that the students each wrote. The class was quite successful, as judged by both students and the instructor, and even resulted in one talented student pursuing a major in physics. Sources for material, the organization of the course, pitfalls and successes, the outcome of oral presentations, and student comments will be shared.

**Improving the Stability of an Ultra-Short Pulse Fiber Laser**

John H. Gruenewald* and Dr. Jason D. Neiser
*(Centre College)*

Abstract

This work investigates the design and construction of an all-fiber laser that implements a novel method for generating ultra-short pulses of light. A nonlinear optical loop mirror (NOLM) is a fiber-based component that is completely reflective for low intensity pulses, but portions of high intensity pulses can be transmitted. Upon many round trips through a laser cavity, a pulse with sufficient power will be shortened by the NOLM, enabling pulses with duration on the order of femtoseconds. The NOLM we have designed uses polarization maintaining fiber (a special type of highly birefringent fiber) in order to increase the stability of the laser. An additional stabilizing element used is an all-fiber spectral filter that is currently under development. The operation of these two components in the cavity will be explained.

**Exponentially-Modified-Gaussian and Lorentzian Line Shapes**

Dr. P.M. Wilt
*(Centre College)*

Abstract

Asymmetric line shapes of spectral transitions can sometimes be described by Exponentially-Modified-Gaussian(EMG) or –Lorentzian(EML) profiles. This paper will explain the mathematical procedures used to fit data with these shapes, and will compare the results for an example taken from an optical-pumping experiment.

**OH Masers in the Star Forming Region W49**

Brice Hamilton* and Dr. Phil Lockett
*(Centre College)*

Abstract

W49 is an intense star forming region located about 50,000 LY from Earth. It is totally obscured at visible wavelengths by dust and can only be observed using radio and IR telescopes. It is also the Galaxy's most intense source of MASER emission. MASER lines are usually very intense with narrow linewidths. However, certain excited state transitions of the OH molecule in W49 have been observed to be weak with broad linewidths. These observations have yet to be explained by theoretical models. We have modeled these masers including the important effects of line overlap. We will present our preliminary results, which are in reasonable agreement with the observations.

**Physics for the Life Sciences**

Dr. Phil Lockett
*(Centre College)*

Abstract

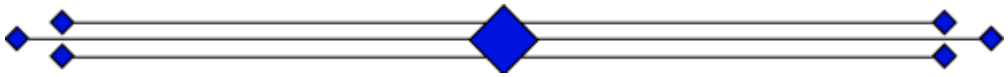
I am developing a one semester physics course designed for students in the life sciences. The course assumes students have completed a one semester physics course covering the basic concepts of mechanics. The new course will study fluids, waves, thermal physics, electricity, magnetism and optics. One term is not long enough to cover these topics in detail, so the course will be specifically designed to meet the needs of life science students. Computer simulation and visualization will play an important role in the course. I also plan to introduce topics not normally taught in the introductory physics course. I will discuss my preliminary ideas for the course.

**Cosmic Voids: The Total Volume of Nothing**

Armin Smailhodzic*, Dr. Keith Andrew, and Dr. Brett Bolen
*(Western Kentucky University)*

Abstract

We are examining the volume of the universe that is occupied by empty voids. Large scale observational surveys have found that a sizeable fraction of the observable universe is filled with voids surrounded by sheets, filaments and clusters of luminous matter. From these surveys a power law similar to Zip's Law can be fit to the observational data and to numerical runs using the Gadget II N body code. A valuable pedagogical method of using these tools can be found be comparing the universe to a sponge which also obeys a Zipf Law distribution function. Here we give the results of the comparisons in terms of the power law exponents.

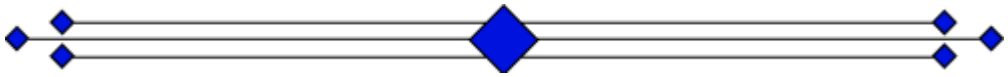


**SKyTeach: Strengthening Physics Teacher Preparation at Western Kentucky University**

Dr. Scott Bonham* and Kyle Curry
*(Western Kentucky University)*

Abstract

SKyTeach, Western Kentucky University's new math and science teacher preparation program, is strengthening physics teacher preparation in the WKU service region. SKyTeach is part of the national consortium replicating the University of Texas UTeach model. This innovative program addresses many of the barriers to preparing physics teachers. SKyTeach actively recruits students as they consider and enroll at WKU. Two former high school physics teachers serve as master teachers and role models for SKyTeach students. The first year cohort has five declared physics majors. We will describe the program model and share one student's experience.



**Effectively Selling Astronomy to the Public – Fusing Lessons Learned From Education, Entertainment, Advertisement and Public Relations**

Dr. Arthur K. Pallone*, and Jacque E. Day
*(Murray State University)*

Abstract

A great celestial story is only as effective as the teller of the tale. With passion and knowledge at the helm, we must search for ways to pass on the enthusiasm to others while conveying sound science. Based on our experiences, we present an integrated approach – one that borrows elements from education, entertainment, advertising, and public relations – to choose an event, hook and keep the public's attention while making them want more, and provide some tips for increasing media presence.

**Using Mousetrap Cars to Teach About Force and Motion**

William L. Schneider
*(Simon Kenton High School)*

Abstract

I will be taking about the of use mousetrap cars to teach Force and Motion to 4th grade, high school, and college students. The method incorporates a range of modeling, including sketches, computer simulations, videotaping, algebraic, and hands-on testing. The rigor of the lesson is scaled to an appropriate level for students.

**Ranking Task Workshop**

Kenny D. Lee
*(Warren Central High School)*

Abstract

Ranking tasks are tools that allow instructors to evaluate their students understanding of a concept. Ranking tasks have students compare and contrast several similar situations and rank those situations from greatest to least. In order to successfully rank the situations, students must understand the concepts involved and be able to use any corresponding equations as guides to the answer. In this 3-hour workshop I will demonstrate how ranking tasks can be used in the classroom and as homework to evaluate student learning. Participants will have the opportunity to try some tasks to get a feel for what is involved in successfully ranking the situations. Participants will also have time to modify or develop their own tasks that they can take back for use in their classes. This workshop is for both high school and university instructors. Ranking tasks are easily modified for use in physical science, physics, and advanced physics and astronomy classes. High school teachers can earn professional development hours (1/2 day) for attending. There is no cost for the workshop and materials and handouts will be given to each participant.

NOTE: This Workshop will be held in Pasteur Hall in room 209B.