Michigan Section of the American Association of Physics Teachers

Spring 2012 Meeting
Announcement and Program Schedule

Grand Valley State University, Allendale, MI
April 21, 2012

Program Highlights

We are pleased to welcome Dr. Bernard Pope as our featured speaker. Dr. Pope is a member of the Experimental High Energy Physics research group at Michigan State University. In 2010 he received the MSU Distinguished Faculty Award with the following citation:

Bernard G. Pope is renowned for his work in experimental particle physics. Even his thesis work, a collaboration with Nobel laureate Leon Ledennan, made a huge impact on his field. He has held numerous prestigious positions in the international particle physics community, most notably a faculty position at Princeton University and a staff scientist position at the European Organization for Nuclear Research, or CERN, in Geneva.

Pope joined MSU's faculty in 1982 and helped build the particle physics group's reputation of international prominence and excellence. He was selected by Gov. James Blanchard to serve on a statewide committee charged with attracting the superconducting super collider project to the state. Although the project was cancelled before breaking ground, Pope was not discouraged. He went on as a founding member of the DØ (DZero) Experiment, a collaboration of more than 500 scientists worldwide at the U.S. Department of Energy Fermi National Accelerator Laboratory in Illinois. In 1995, the great breakthrough of the collaboration came on discovering the massive top-quark.

Dr Pope will deliver the keynote address on Saturday morning describing his work using the ATLAS detector at the Large Hadron Collider (LHC) in Geneva, Switzerland. He will also talk about how those results are being used to guide the direction of future experiments using the LHC.

Program Overview

Location: Sessions and workshops will take place in the **Seymour & Esther Padnos Hall of Science** on the GVSU Allendale campus. For campus maps and directions to the Allendale (main) campus of GVSU, visit their website at: http://www.gvsu.edu/maps.htm. (Padnos Hall is labeled building 57 and is located in region F-4 on the campus map found at the above URL.)

Registration: Registration cost is $10 per meeting. Students and first-time attendees, though, may attend *free* of charge.

Program Overview (cont.)

Parking: Parking is free on Saturday in all campus lots. The most convenient lot to use is **Lot F,** located along Campus Drive directly opposite Padnos Hall.

Lunch: "Fresh Food Company," a market-style all-you-can-eat restaurant, located in the upper level of the **Commons** (building 8), adjacent to Padnos Hall. Cost of lunch is $8.75 (all inclusive).

Hotels: For those who wish to stay overnight for the meeting, local hotel information can be found online at: http://www.gvsu.edu/hotels.htm. Recommended hotels include:

Sleep Inn & Suites, Allendale, MI: http://www.sleepinn.com, (616) 892-8000
Days Inn, Downtown Grand Rapids: http://www.daysinn.com/DaysInn/control/home, (616) 956-9304 or toll free at (800) 426-7866
Courtyard by Marriott, Downtown Grand Rapids: http://www.marriott.com/hotels/travel/grrdt-courtyard-grand-rapids-downtown/, (616) 242-6635 or toll free at (800) 321-2211.
Holiday Inn Express Southwest, Grandville (7 miles from GVSU): http://www.ichotelsgroup.com, (616) 532-0202 or toll free at (888) 532-8680.
Quality Inn, Hudsonville (8 miles from GVSU): http://www.choicehotels.com, (616) 662-4000.

Program Schedule

7:30 – 8:10 am **Registration/Morning refreshments**
Padnos Hall/Henry Hall Atrium
Meeting fee: $10.00 (FREE for students and first-time attendees)

8:10 – 8:20 am **Call to order and welcome**
Loutit Lecture Hall 101 (adjacent to Padnos Hall/Henry Hall Atrium)
Brad Ambrose, Grand Valley State University – MIAAPT President
Shaily Menon – Associate Dean, GVSU College of Liberal Arts and Sciences

8:20 – 9:50 am **Contributed Presentations I**
Loutit Lecture Hall 101 (adjacent to Padnos Hall/Henry Hall Atrium)

8:20 – 8:35 Hands-On Nuclear Physics
Jeff Whittaker, Dearborn Center for Math, Science & Technology *(jbwhittaker@hfcc.edu)*

8:35 – 8:50 Gauss's Method for Absolute Measurements of Magnetic Fields and Moments
D.A. Van Baak , Calvin College *(dvanbaak@calvin.edu)*

8:50 – 9:05 Decay Chains: Dice Simulation
Christopher Hoffmann, Western Michigan University *(christopher.a.hoffmann@wmich.edu)*

9:05 – 9:20 Getting Schooled in Optics By The Pros: Glass Is Reality
Philip Edward Kaldon, Western Michigan University *(philip.kaldon@wmich.edu)*

9:20 – 9:35 Life & Laws in a Rotating Reference Frame – Heads-a-Spinning!
David Schuster, Western Michigan University *(david.schuster@wmich.edu)*
David Cassidy, Western Michigan University
Betty Adams, Western Michigan University

9:35 – 9:50 But Only When I'm Moving …. Darn it, Coriolis!
David Cassidy, Western Michigan University *(david.p.cassidy@wmich.edu)*
Betty Adams, Western Michigan University
David Schuster, Western Michigan University

9:50 – 10:00 Break

10:00 – 11:00am **Keynote Address: Ongoing Work at the Atlas Experiment at the Large Hadron Collider at CERN**
Bernard Pope, Michigan State University
Loutit Lecture Hall 101 (adjacent to Padnos Hall/Henry Hall Atrium)

The Large Hadron Collider (LHC), located at CERN in Geneva, Switzerland, is the world's highest energy particle accelerator. Having taken 15 years to build, it has been operating for more than a year with collision energies of 7 TeV (trillion electron volts). Four large particle detectors are located around the 17-mile circumference of the LHC. Michigan State University (and the University of Michigan) physicists are members of the team of scientists working on the largest of these detectors, the ATLAS experiment. I will describe the LHC, ATLAS, and some of the physics results that have already been obtained. I will also mention future plans for running at higher energies and intensities.

11:00 – 11:45 pm **Contributed Presentations II**

11:00 – 11:15 Superhydrophobic Surfaces Students Can Produce and Explore in the Classroom
Tom Deits, NSF Regional Center for Nanotechnology Education *(tdeits@gmail.com)*

11:15 – 11:30 Student-Built Solar Panels
Tom Eldred, Kalamazoo Valley Community College
Dr. Kaniah Balachandran, Kalamazoo Valley Community College
(kbalachandra@kvcc.edu)

11:30 – 11:45 Solar Cooker Demonstration
Dr. Kaniah Balachandran, Kalamazoo Valley Community College
(kbalachandra@kvcc.edu)

11:45 – 1:00 **Lunch: Commons dining facility *(Fresh Food Company)***

1:00 – 1:30 pm **MIAAPT Business Meeting**
Loutit Lecture Hall 101 (adjacent to Padnos Hall/Henry Hall Atrium)
Brad Ambrose, Grand Valley State University – MIAAPT President

1:30 – 2:45 pm **Contributed Presentations III**

1:30 – 1:45 Expanding Online Homework Systems with Student Generated Graphs and Diagrams
James T. Laverty, Michigan State University *(laverty1@msu.edu)*

1:45 – 2:00 NASA Teaching From Space: Convection in Micro-Gravity
Greg McMillan, Macomb Math Science Technology Center *(mcmillan@wcskids.net)*

2:00 – 2:15 The Physics of the Flute
Maria Kerekes, Henry Ford Community College
Michael LoPresto, Henry Ford Community College *(lopresto@hfcc.edu)*

2:15 – 2:30 The Thermodynamics of Baking Brownies
Amanda Genaw, Henry Ford Community College
Michael LoPresto, Henry Ford Community College *(lopresto@hfcc.edu)*

2:30 – 2:45 The Rossi Reactor and Cold Fusion
Dr. Kaniah Balachandran, Kalamazoo Valley Community College
(kbalachandra@kvcc.edu)

2:45 – 3:00 Break

3:00 – 4:00 Workshops

3:00 – 4:00 Writing about Circuits with a Laboratory Activity
Michael C. Faleski, Delta College *(michaelfaleski@delta.edu)*
Padnos 106

Physics education research has shown that students have many misconceptions about simple circuits[1,2,3]. The "Essay Lab" (so-named by former students) is an activity designed to probe student understanding of circuits by having them: 1) discuss a set of multiple choice questions about circuits, 2) construct the circuits in the lab and record data, 3) discuss the questions again with the data, and 4) individually write essays about the physics of the circuits without using the data. In this session, participants will have the opportunity to participate in the classroom portion of the activity.

1. R. Cohen, B. Eylon, and U. Ganiel, "Potential difference and current in simple electric circuits: A study of students' concepts," Am. J. Phys **51** (5), 407-412 (1983).
2. Beth Ann Thacker, Uri Ganiel, and Donald Boys, "Macroscopic phenomena and microscopic processes: Student understanding of transients in direct current electric circuits," Am. J. Phys. Suppl. **67**(7), S25-S31 (1999).
3. Paula Vetter Engelhardt and Robert J. Beichner, "Students' understanding of direct current resistive electric circuits," Am. J. Phys. **72**(1), 98-115 (2004).

3:00 – 4:00 Tour of GVSU Positronium Annihilation Lifetime Spectroscopy (PALS) Laboratory
Dr. Rich Vallery, Grand Valley State University *(valleryr@gvsu.edu)*
Tour starts at Loutit Lecture Hall 101 (adjacent to Padnos Hall/Henry Hall Atrium)

Novel materials enable advances in many high tech areas such as medicine, information technology, and energy storage. In many cases the macroscopic properties of these materials are determined by engineering the composition at the nanoscale. To understand fundamental makeup of the materials in turn requires new probes to characterize the structure at these very small length scales. Positronium, the hydrogen-like bound state of an electron and a positron is a very sensitive probe of void structure of matter at scales down to 3 nm. Positronium Annihilation Lifetime Spectroscopy (PALS) is a unique metrology which studies the annihilation of positronium, whose mass is completely converted into energy as governed by Einstein's famous equation $E = mc^2$, to characterize the pores/voids in materials.

Join Prof. Rich Vallery for a tour and overview of the GVSU Positron Research Group lab. Discussion will include how the lab has paved the way for a high impact research program at GVSU that also actively involves undergraduate physics majors.

3:00 - 4:00 What Is Our Cosmic Connection?
Mandy Frantti, NASA, Munising Public Schools *(mpfrantti@hotmail.com)*
Padnos 107

How do stars relate to apple pie? Or to you? Examine stars' life cycles and related hands-on activities: sorting photos, estimating element proportions, and modeling spectra with musical chords. Multiple learning styles are addressed. Content applies to Physics, Chemistry, and Astronomy classes. NASA materials provided for participants.

4:00 pm Adjournment… ***See you in Philadelphia for the Summer 2012 AAPT meeting!***

Abstracts for Contributed Presentations

8:20 – 8:35 Hands-On Nuclear Phsycis

Jeff Whittaker, Dearborn Center for Math, Science & Technology *(jbwhittaker@hfcc.edu)*

Nuclear science is an important topic, in terms of its application to power generation, medical diagnostics/treatment, and national defense, however, the subatomic domain is far removed from the daily experiences of introductory physics students, and few learning aids are available to teachers. Presented will be a low-tech, hands-on, method to teach various concepts important to the study of nuclear physics, including the quark model, anti-matter, nuclear binding energy, stability, the nuclear shell model, and the importance of symmetry, in a simple activity using disc magnets.

8:35 – 8:50 Gauss's Method for Absolute Measurements of Magnetic Fields and Moments

D.A. Van Baak , Calvin College *(dvanbaak@calvin.edu)*

In 1835 C. F. Gauss made the first absolute measurements of magnetic fields and of magnetic moments in experiments which are simple and instructive to replicate. I show that using rare-earth permanent magnets and a re-creation of Gauss's technique, it is straightforward to quantify the horizontal component of the ambient geomagnetic field, as well as the magnitude of the magnetic moment of the magnets.

8:50 – 9:05 Decay Chains: Dice Simulation

Christopher Hoffmann, Western Michigan University *(christopher.a.hoffmann@wmich.edu)*

Dice have been used to simulate nuclear decays before. Students can also use them to study radioactive decay chains. Here at Western Michigan University we are implementing a lab in which students study the nuclear decays and chains of decays. Students investigate both long and short half-lives and observe how the radiation looks as atoms of different half-lives are decaying at the same time.

9:05 – 9:20 Getting Schooled in Optics By The Pros: Glass Is Reality

Philip Edward Kaldon, Western Michigan University *(philip.kaldon@wmich.edu)*

We teach simple optics and then try to generalize to real world lenses. Something as simple as maximum f-stop isn't just the aperture and focal length calculation, especially with wide angles and zooms. And then there are specialty lens. This talk will be an Alice in Wonderland tour of research into a mythic Nikon 85mm focal length lens.

9:20 – 9:35 Life & Laws in a Rotating Reference Frame – Heads-a-Spinning!

David Schuster, Western Michigan University *(david.schuster@wmich.edu)*
David Cassidy, Western Michigan University
Betty Adams, Western Michigan University

We are working on conceptual explanations to make sense of the 'fictitious' forces that arise in rotating frames of reference, in particular the centrifugal and Coriolis forces. What would Life and Laws be like on a large rotating platform? For example, how can you make sense of the mysterious 'centrifugal' force you experience when at rest on the platform, why is it larger further from the center and why is it proportional to mass, just like gravity? Can we make physical sense of these effects, by relating rotating and inertial viewpoints? Think ahead and bring your own examples and ideas-in-progress to the 'confer'ence.

9:35 – 9:50 But Only When I'm Moving …. Darn it, Coriolis!

David Cassidy, Western Michigan University *(david.p.cassidy@wmich.edu)*
Betty Adams, Western Michigan University
David Schuster, Western Michigan University

In a rotating reference frame, in addition to a centrifugal force, you also experience a mysterious 'sideways' force, the Coriolis force – but only if you are moving! While the centrifugal force depends on your radial location but not your velocity, the Coriolis force depends on your velocity but not location. And both are proportional to mass. How can we make conceptual sense of all this from rotating and inertial perspectives? Bring your ideas and examples to 'throw in' to the Coriolis discussion!

11:00 – 11:15 Superhydrophobic Surfaces Students Can Produce and Explore in the Classroom

Tom Deits, NSF Regional Center for Nanotechnology Education *(tdeits@gmail.com)*

A recent paper in Science describes the production of superhydrophobic surfaces using nothing more complex than candle wax. We have extended this result and have developed a simple laboratory investigation or demonstration that enables your or your students to produce superhydrophobic surfaces quickly and simply in the classroom. These surfaces enable investigation of roll off angle, critical angle, water and oil impermeability, droplet bouncing and self-cleaning - all key elements of superhydrophobic surfaces. I will demonstrate the technique and provide supplementary curricular material at the presentation.

11:15 – 11:30 Student-Built Solar Panels

Tom Eldred, Kalamazoo Valley Community College
Dr. Kaniah Balachandran, Kalamazoo Valley Community College
(kbalachandra@kvcc.edu)

At KVCC, we are introducing a new Lab project for Engineering Physics students to build solar panels. The procedures are being marketed by DIY.com. The main challenge is making the boxes, which a friend of mine has already done. I will share the experience with the audience. The next challenge is handling the "solar cell wafers" and soldering the leads. The process will be described in complete detail, along with the trials and tribulations.

11:30 – 11:45 Solar Cooker Demonstration

Dr. Kaniah Balachandran, Kalamazoo Valley Community College
(kbalachandra@kvcc.edu)

The enormous amount of energy showered on the Earth by the Sun is compared to the annual amount of energy from "power" plants. The feasibility of using solar energy in cooking will be described along with illustrations. If the weather permits, I plan to make pancakes and omelets as a demonstration, otherwise, I will show models of the equipment we have for teaching students.

1:30 – 1:45 Expanding Online Homework Systems with Student Generated Graphs and Diagrams

James T. Laverty, Michigan State University *(laverty1@msu.edu)*

One of the complaints against online homework systems is a lack of diversity in the types of problems that can be asked. In the LON-CAPA system, there are now two new problem types that allow students to generate visual representations as answers. The first allows students to draw a graph for themselves. The second has students create their own free-body diagrams. Both of these problem types require no hand grading by the instructor. This talk will demonstrate these new problem types and show some research indicating their effectiveness.

1:45 – 2:00 NASA Teaching From Space: Convection in Micro-Gravity

Greg McMillan, Macomb Math Science Technology Center *(mcmillan@wcskids.net)*

The Macomb Math Science Technology Center participated in NASA's **Teaching from Space MicroGravity eXperience.** In February, teachers traveled to the Johnson Space Center in Houston, Texas to conduct an experiment in reduced gravity and hyper gravity environments aboard NASA's "Reduced Gravity Flight". Students prepared an experiment designed to test conduction current formation at zero g and hyper g. The teachers conducted the student-designed experiment on a specially designed aircraft that is used to simulate a reduced gravity environment. This presentation will discuss the experience conducting research on a Reduced Gravity Flight and share other opportunities available through NASA.

2:00 – 2:15 The Physics of the Flute

Maria Kerekes, Henry Ford Community College
Michael LoPresto, Henry Ford Community College *(lopresto@hfcc.edu)*

Fitting a curve to a plot of the frequency vs. air column length for the musical pitches produced by a flute provides an equation of the form of the expression for a resonance tube open on both ends that includes a value for velocity of sound in air. This analysis also involves an end-correction that compensates for the presence of open and closed tone-holes and the embouchure hole.

2:15 – 2:30 The Thermodynamics of Baking Brownies

Amanda Genaw, Henry Ford Community College
Michael LoPresto, Henry Ford Community College *(lopresto@hfcc.edu)*

When baking brownies, the type of pan they should be baked in is more important than most would think. Baking brownies in aluminum, glass, and ceramic pans with the same recipe, the same temperature and for the same amount of time, showed that the aluminum pan proved to make the best brownies with the glass trial second and the ceramic pan worst. Before the brownies were baked the mass of the pan was measured with and without the batter. The temperature of the batter and the pan were taken before and after baking and after baking the pan was weighed again. The collected data were used in the expression, $Q = (m)(c)(\Delta T)$ to see if there was a quantitative reason that brownies baked in an aluminum pan are better than those baked in a glass pan or ceramic pan.

2:30 – 2:45 The Rossi Reactor and Cold Fusion

Dr. Kaniah Balachandran, Kalamazoo Valley Community College
(kbalachandra@kvcc.edu)

Pons and Fleischmann announced in March 1989 that they created "table top fusion". There were similar claims before and latest one seems to be "true". Andrea Rossi from Bologna claims to have successfully generated excess heat using powdered nickel and water. There are some aspects that he wants to keep as trade secrets. Several notable physicists including Brian Josephson have witnessed the demonstration and on a YouTube video "endorsed" Rossi's claim. I plan to describe what I read in the literature and what I hear from people who may have contact with people close to the inventor. I will also describe my attempt to simulate Pons and Fleischmann in 1989 or shortly thereafter, which needless to say was a total disaster!