

Keynote Address
Friday April 4th, 2008, 8:00PM Ulmer Planetarium
Open to the Public

Nanotechnology: the Nexus of Science Education.

An introduction to Nanotechnology will be presented, its interdisciplinary nature will be explored, and some applications will be overviewed. The far reaching impact of nanotechnology will be stressed and its impact on the intertwined endeavors of industry, the workforce, and education will be examined. Specific attention will be given to the impact of nanotechnology on secondary and post-secondary education in PA, in the US, and world-wide. The argument will be made that successful nanotechnology education, and therefore successful national economies, will be based on the realization that nanotechnology is the nexus of science education.



Dr. Stephen J. Fonash

*Bayard D. Kunkle Chair in Engineering Sciences
Director, Penn State Center for Nanotechnology Education & Utilization
Director, PA Nanofabrication Manufacturing Technology Partnership
Director, National Science Foundation Nanotechnology Advanced
Technology Education Center*



56th Annual Conference of the **American Association of Physics Teachers** **Central Pennsylvania Section**

AAPT-CPS

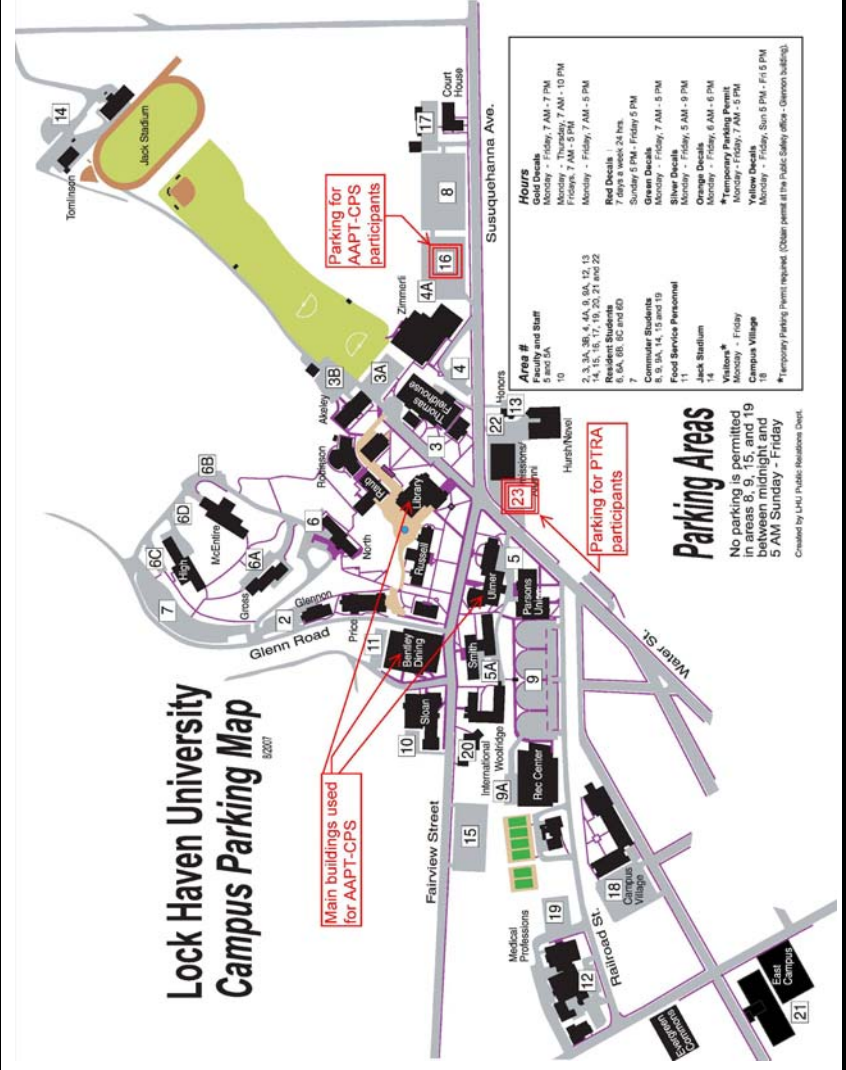


Lock Haven University of Pennsylvania
Lock Haven, PA
April 4-5, 2008



Lock Haven University Campus Parking Map

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Main buildings used for AAPT-CPS

Parking for AAPT-CPS participants

Parking for PTRA participants

Parking Areas

No parking is permitted in areas 8, 9, 15, and 19 between midnight and 5 AM Sunday - Friday

Area #	Hours
1-7, 9A, 9B, 9C, 9D, 9E, 9F, 9G, 9H, 9I, 9J, 9K, 9L, 9M, 9N, 9O, 9P, 9Q, 9R, 9S, 9T, 9U, 9V, 9W, 9X, 9Y, 9Z, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, and 22	Monday - Friday, 7 AM - 7 PM Monday - Thursday, 7 AM - 10 PM Friday, 7 AM - 5 PM
2, 3, 4A, 4B, 4C, 4D, 4E, 4F, 4G, 4H, 4I, 4J, 4K, 4L, 4M, 4N, 4O, 4P, 4Q, 4R, 4S, 4T, 4U, 4V, 4W, 4X, 4Y, 4Z, 5, 6A, 6B, 6C, 6D, 6E, 6F, 6G, 6H, 6I, 6J, 6K, 6L, 6M, 6N, 6O, 6P, 6Q, 6R, 6S, 6T, 6U, 6V, 6W, 6X, 6Y, 6Z, 7, 8, 9A, 9B, 9C, 9D, 9E, 9F, 9G, 9H, 9I, 9J, 9K, 9L, 9M, 9N, 9O, 9P, 9Q, 9R, 9S, 9T, 9U, 9V, 9W, 9X, 9Y, 9Z, 10, 11, 12, 13, 14, 15, and 19	Monday - Friday, 7 AM - 5 PM
10	Monday - Friday, 7 AM - 5 PM
11	Monday - Friday, 5 AM - 9 PM
12	Monday - Friday, 6 AM - 6 PM
13	Monday - Friday, 7 AM - 5 PM
14	Monday - Friday, 7 AM - 5 PM
15	Monday - Friday, 7 AM - 5 PM
16	Monday - Friday, 7 AM - 5 PM
17	Monday - Friday, 7 AM - 5 PM
18	Monday - Friday, 7 AM - 5 PM
19	Monday - Friday, 7 AM - 5 PM
20	Monday - Friday, 7 AM - 5 PM
21	Monday - Friday, 7 AM - 5 PM
22	Monday - Friday, 7 AM - 5 PM
23	Monday - Friday, 7 AM - 5 PM

*Temporary Parking Permits required. (Obtain permit at the Public Safety office - Gleason building)

NOTES

**56th Annual Conference
of the
American Association of Physics Teachers
Central Pennsylvania Section**

Lock Haven University of Pennsylvania
Lock Haven, PA

April 4-5, 2008

Acknowledgements:

The AAPT-CPS gratefully acknowledges financial support for the 56th Conference from the following sources:

Department of Geology and Physics, Lock Haven University
LHU Faculty Professional Development Committee Funds
Dr. David White, Dean of the College of Arts & Sciences, LHU

PROGRAM
Friday, April 4th, 2008

PTRA WORKSHOP

PTRA WORKSHOP - *Stevenson Library*
 Ground Floor Computer Lab

8:00 - 8:30 PTRAs Registration

8:30 - 12:00 Morning Session

12:00 - 1:00 Lunch – *Bentley Dining Hall*

1:00 - 3:30 Afternoon Session

AAPT-CPS

4:00-6:00 AAPT-CPS Conference Registration - *Ulmer 222*
 Poster Sessions - *Ulmer 219*
 Vendors - *Ulmer 216 & 224*
 Open House Tour of Ulmer Labs – *Ulmer 117, 118*

6:00-6:30 Reception – *Bentley Dining Hall*

6:30 - 7:30 Banquet Dinner – *Bentley Dining Hall*

8:00-9:00 Keynote Address – *Ulmer Planetarium*
 Dr. Stephen Fonash
 Nanotechnology: the Nexus of Science Education
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9:00-10:00 Stargazing - *Across the River at the Soccer Fields*
 Shuttle from Ulmer

NOTES

PROGRAM
Saturday, April 5th, 2008

8:00 - 8:30 Continental Breakfast - *Ulmer 222*

8:00 - 12:00 Registration -*Ulmer 222*

AAPT-CPS GENERAL BUSINESS MEETING

Ulmer Planetarium

8:30 - 8:40 Welcome Address by Dr. Keith Miller,
President of Lock Haven University

8:40 - 8:45 Approval of last business meeting's minutes

8:45 - 8:50 President's address (Abul Hasan)

8:50 - 8:55 Treasurer's Report (Sardari Khanna)

8:55 - 9:10 AAPT-CPS Award Presentations

AAPT-CPS Distinguished Service Award

AAPT-CPS Teacher Award

AAPT-CPS Student Award

9:10 - 9:15 Election of Officers of AAPT-CPS

PLENARY SESSIONS

9:20 - 10:45 Talks – *Ulmer 201*

10:45 - 11:00 Break – *Ulmer 222*

11:00 - 12:00 Talks – *Ulmer 201*

12:00 - 1:00 Lunch – *Bentley Dinning Hall*

1:00 - 2:00 Shuttle Tour of East Campus – shuttle from Ulmer

Open House Tour of Ulmer Labs – *117, 118 Ulmer*

Meet with Vendors – *Ulmer 216, 224*

2:00 - 4:20 Talks - *Ulmer 201*

4:30 - 4:40 Closing Meeting - *Ulmer Planetarium*

Certificates for Student Presentation

Raffle

Closing remarks (John Reid)

4:45 - 5:45 Executive Board Meeting

KEYNOTE SPEAKER
Dr. Stephen J. Fonash

Dr. Stephen Fonash holds the Bayard D. Kunkle Chair in Engineering Sciences, at the Pennsylvania State University. His activities at Penn State include serving as the director of Penn State's Center for Nanotechnology Education and Utilization (CNEU), director of the National Science Foundation Advanced Technology Education Center, and director of the Pennsylvania Nanofabrication Manufacturing Technology Partnership.

Professor Fonash's education contributions focus on nanotechnology post-secondary education and workforce development. His research activities encompass the processing and device physics of micro- and nanostructures including solar cells, sensors, and transistors.

He has published over 300 refereed papers in the areas of education, nanotechnology, photovoltaics, microelectronics devices and processing, sensors, and thin film transistors.

His book "Solar Cell Device Physics" has been termed the "bible of solar cell physics" and his solar cell computer modeling code AMPS is used by almost 800 groups around the world.

Dr. Fonash holds 28 patents in his research areas, most of which are licensed to industry. He is on journal boards, serves as an advisor to university and government groups in Puerto Rico and Sweden, and has consulted for a variety of firms. He has co-founded two companies. Prof. Fonash received his Ph.D. from the University of Pennsylvania. He is a Fellow of the Institute of Electrical and Electronics Engineers and a Fellow of the Electrochemical Society.

4:00 – 4:20

An Undergraduate Approach to Lattice Physics: Lattice Quantum Mechanics

Scott W. Moerschbacher, Lycoming College
moerschb@lycoming.edu

The experience of the undergraduate student participating in research in lattice physics can be somewhat limited in the scope of his research to the field of lattice quantum chromodynamics (LQCD). This paper presents a way to introduce the undergraduate student to lattice methods using the techniques studied in undergraduate quantum mechanics and introductory computer science courses, with no mention of quantum field theory. The projects proposed here are small-scale and thus solvable in one- or two- semesters, which is typically the timescale for an undergraduate senior project. Some preliminary results from my own students' work will also be presented.

4:30-4:40 Closing Meeting – *Ulmer Planetarium*

Certificates for Student Presenters

Raffle

Closing Remarks

3:20 – 3:40

Cosmic Rays: What Can They Tell Us About the Universe?

Abaz Kryemadhi, Messiah College
Patrick Walters, Columbia Public Library
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akryemadhi@messiah.edu

In an effort to increase the amount of data on UHECR phenomena, we are proposing an experimental study of cosmic rays using two different technologies. We intend to collect data from primary and secondary showers via ground detectors of the traditional scintillator variety, in conjunction with data from shower-induced RADAR skip via VHF-band radio receivers. The latter technology is new to this application. Our goals are to collect data on UHECR events and develop the related RADAR methodology simultaneously. Using the Local Cooperative Science Initiative (LCSI) model for our outreach efforts, we hope to partner with local high schools and local libraries to offer a broad base of resources and opportunities for participating students.

3:40 – 4:00

A Model for Creating an All Girls High School Science Club

Maxine Willis, Dickinson College
Kristen Bechtel, Gettysburg High School
willism@dickinson.edu

The YWCA of Gettysburg and Adams County has teamed with the Gettysburg Area School System and Gettysburg College to create successful all girls STEM programs in Grades 4 and 5 and also in the high school. The Grade 4-5 program is a 6 week after school LegoRobotics programs and the high school after school program participates in the TARC Rocketry program. The structure of the model for the programs will be described as well as the outcomes.

POSTER PRESENTATIONS

219 Ulmer

Encapsulation of Nanoparticles in Liposome Nanovesicles

Nicholas Drayer, Lock Haven University

Moving Toward All-solution Processing of Polymer LEDs

Sean Gephart, Lock Haven University

Conduction in Nano-Engineered Thin Films

Andrew Jones, Millersville University

Analysis of a Jacob's Ladder Apparatus

Jeremy Low, Millersville University

Fabrication of Nano-Engineered Thin Films by Thermal Evaporation

Drew Pulsifer, Millersville University

LivePhoto Physics: Active Learning Through Analysis of Real World Phenomena

Maxine Willis, Dickinson College

LIST OF TALKS

201 Ulmer

- 9:20 – 9:40 **A Bubble Level Heat Engine**
Kip Trout, Penn State York
- 9:40 – 10:00 **Various Projects Including Fuel Cells**
Andrew Strickler, Williamsport Area High School
- 10:00-10:20 **Does an Intelligent Tutor Homework System Encourage Beneficial Collaboration?**
Bret van de Sande, University of Pittsburgh
Robert Hausmann, University of Pittsburgh
- 10:20-10:45 **The Physics of 3D Cinema**
Don Simanek, Lock Haven University
- 10:45-11:00 Break – *Ulmer 222*
- 11:00-11:20 **Using Splines to Explore Graphical Representations of Physical Phenomena**
Michael Gallis, Penn State Schuylkill
- 11:20-11:40 **Construction of a Vibrating Sample Magnetometer**
Tim Guider, Lehigh University
- 11:40:-12:00 **Relaxation in the Dielectric Material of an Electrolytic Capacitor**
John Dooley, Millersville University

12:00- 2:00 Lunch & Tours

2:40 – 3:00

The Tablet PC: Technology in the Classroom for the Chalkboard Generation

Michael A. Doncheski, Penn State Mont Alto
mad10@psu.edu

During the 2007-08 academic year, I have been evaluating the tablet PC as a replacement for the chalkboard, the smartboard and the standard PC/laptop. In that time, I have taught, or am currently teaching, conceptual, algebra and calculus based physics courses as well as introductory calculus for science and engineering and vector calculus. In my presentation, I will discuss the benefits of the tablet PC over other lecture tools and techniques in technical (math, science, engineering) courses. In addition, I will discuss my in-class experiences with a tablet PC and provide feedback from my students concerning the tablet PC in the classroom.

3:00 – 3:20

The Effect of Particle Mass on the Dynamics of Avalanches on Three-dimensional Granular Piles

Ryan Cress, Moravian College
Faculty Advisor: Kelly Kriebel

Research on granular piles has shown that such systems exhibit dynamical behavior known as self-organized criticality (SOC). Several experimental studies have been performed in an attempt to duplicate and verify this behavior and determine the physical factors responsible. Such experiments often tend to use very small spherical beads (less than 1.0 mm) to try and closely resemble the small nature of particles in granular piles such as sand. Working with small particles introduces issues such as the consistency of the size and shape of the beads, and the effect of outside elements on the experiment such as condensation, static electricity and contaminants. We present here the results of an experimental study utilizing 6.0 mm diameter spherical beads as the granular material – constituent particles which are large enough to eliminate many of the problems accompanying the use of smaller particles. The study also examines varying the mass of the particles to determine what effect inertia may have on the size and distribution of avalanches.

2:00 – 2:20

Problem Solving in Introductory Physics

Edward Roeder, Moravian College

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The limited problem-solving abilities of students of the Life Sciences often restrict the kinds of problems that can meaningfully be discussed in the algebra based physics courses these students take at Moravian College. When I use step-by-step explanations in the solutions of more challenging examples, many of my students can grasp the basic concepts and learn to solve these kinds of problems on their own. My talk will concentrate on two kinematics problems which I chose from the problem-solving book I'm currently writing. The first deals with a drag racer who deploys a parachute to decelerate; the second considers the alternatives of a driver who is approaching a traffic light.

2:20 – 2:40

Detection of Cosmic Rays

Ryan Muschick, Lock Haven University

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Faculty Advisor: John Reid

The purpose of this project was to study cosmic rays; what they are, how they interact, and how to detect them. We researched the nature of cosmic rays and how they interact with the atmosphere. We accomplished tasks such as working on a light tight box, designing and constructing a patch panel for the light tight box, equalizing of Photomultiplier Tubes' gains, measuring the angular distribution of cosmic rays, learning how to use a Data Acquisition board from Fermilab National Laboratory, designing and building two organic scintillator "paddle" counters, and conducting an experiment of the lifetime of muons.

2:00 – 2:20 **Problem Solving in Introductory Physics**

Edward Roeder, Moravian College

2:20 – 2:40 **Detection of Cosmic Rays**

Ryan Muschick, Lock Haven University

2:40 – 3:00 **The Tablet PC: Technology in the Classroom for the Chalkboard Generation**

Michael Doncheski, Penn State Mont Alto

3:00 – 3:20 **The Effect of Particle Mass on the Dynamics of Avalanches on Three-dimensional Granular Piles**

Ryan Cress, Moravian College

3:20 – 3:40 **Cosmic Rays: What Can They Tell Us About the Universe?**

Abaz Kryemadhi, Messiah College

Patrick Walters, Columbia Public Library

3:40 – 4:00 **A Model for Creating an All Girls High School Science Club**

Kristen Bechtel, Gettysburg High School

Maxine Willis, Dickinson College

4:00 – 4:20 **An Undergraduate Approach to Lattice Physics: Lattice Quantum Mechanics**

Scott Moerschbacher, Lycoming College

4:30-:440 Closing Meeting – Ulmer Planetarium

ABSTRACTS FOR POSTERS

Friday 4-6PM, *Ulmer 222*

Encapsulation of Nanoparticles in Liposome Nanovesicles

Nicholas Drayer, Lock Haven University

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Faculty Advisor: Marian Tzolov

This presentation will focus on liposome production and application in the field of neuroscience with targeted delivery. It will also include a more focused discussion on encapsulated zinc oxide nanoparticles for the application as contrast enhancement of MRI imaging. The sonochemical synthesis of zinc oxide nanoparticles was investigated more in detail. The submicron imaging reveals a transfer of material between two distinct phases during this process. This way nanoparticles with different shapes were synthesized.

Moving Toward All-solution Processing of Polymer LEDs

Sean Gephart, Lock Haven University

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Faculty Advisor: Marian Tzolov, Anura Goonewardene

We explored the possibility of depositing the cathode for organic light emitting diodes (OLED) from solution. Successful deposition of a uniform silver layer on top of the polymer film was achieved and the device structures exhibited light emission. The recorded spectrum of the emitted light coincides very well with the photoluminescence spectrum of the polymer indicating that the origin of the light emission is the radiative recombination of injected charges. The recorded spectrum also coincides with the control sample which was created using well established methods of vacuum evaporation. The metal films were then characterized and several sources for the observed short lifetime were identified, like stress build up and cavity formation. This method for creating OLEDs is expected to change the existing technology, by making it more flexible and cost effective.

Conduction in Nano-Engineered Thin Films

Andrew Jones, Millersville University

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Faculty Advisor: Tariq Gilani

We have measured the conductivity of anisotropic thin films of chromium. We find that the conductivity is higher along the direction of tilt of the columns in the films. Measurements were made using a four-point probe at room temperatures. A device being completed is a specially constructed chamber attached to the refrigerator's cold finger. This device will be able to measure the conductivity of sculptured thin films when these samples become available.

11:00-11:20

Using Splines to Explore Graphical Representations of Physical Phenomena

Michael R Gallis, Penn State Schuylkill

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This presentation describes two computer activities in which students explore the graphical representation of a physical phenomenon by manipulating the control points of a cubic spline displayed in a Java applet. In the kinematics activity, students create a graphical description of 1-D motion by modifying position, velocity or acceleration (a change in any one of these quantities is immediately reflected in the graphs of the other two) and then "playing" the corresponding motion. In the potential energy activity, students create a potential energy function, set the kinetic energy and watch the resulting motion. For both activities, students are provided basic directions and principles as well as a list of questions to be answered based upon their observations using the applet.

11:20-11:40

Construction of a Vibrating Sample Magnetometer

Tim Guider, Lehigh University

Faculty Advisor: Joe Powlette

The construction of a low-cost vibrating sample magnetometer (VSM) will be described. The VSM produces hysteresis loops from various ferromagnetic materials which allow us to characterize these materials. Sample measurements will be shown which quantify the magnetic saturation, the coercivity, and the remanence of several magnetic materials.

11:40-12:00

Relaxation in the Dielectric Material of an Electrolytic Capacitor

John Dooley, Millersville University

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When measured with DC, the capacitance of a 100 microfarad electrolytic capacitor is larger than the manufacturer specifications. A plot of experimental data for capacitance versus frequency shows a large drop that is consistent with a relaxation process in the dielectric medium. A plot of experimental data for energy loss in the capacitor as a function of frequency shows a peak in the losses which is also consistent with dielectric relaxation.

12:00- 2:00 Lunch & Tours

10:00-10:20

Does an Intelligent Tutor Homework System Encourage Beneficial Collaboration?

Brett van de Sande, University of Pittsburgh

Robert Hausmann, University of Pittsburgh

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Physics instructors agree that homework assignments are an integral part of physics instruction. When students complete their assignments, we know they may work individually or in small groups. Unfortunately, most computer-based homework systems are structured for individual learners. In particular, these systems only evaluate the final answer, putting pressure on any students working in groups to engage in copying. In contrast, Andes is an intelligent tutor homework helper that requires students to show intermediate steps when solving a problem. Andes has been used successfully by instructors at several colleges and high schools. In order to investigate collaborative versus individual problem solving, we conducted a lab study where we recorded verbal self-explanations and logged solution steps as individuals and student pairs used Andes to solve a set of problems. We found that students working in pairs relied less on the tutor's hints and engaged in collaborative sense-making. Implications for instructional practices are discussed.

10:20-10:45

The Physics of 3D Cinema

Don Simanek, Lock Haven University

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A number of technologies have combined to improve and revitalize stereo cinema presentations: digital projectors, circular polarization, and narrow band interference filters. Some basic physics and physiology are cleverly exploited. Three new 3d systems are now being used in over 1000 theaters in the USA, and quite a few 3d movies are now being produced. Yet most people haven't a clue how any of these really work, or the physics behind them. This talk may remove some of the mystery. The talk will include a brief history of 3d cinema, from the late 19th century to the present.

10:45-11:00 Break – 222 Ulmer

Analysis of a Jacob's Ladder Apparatus

Jeremy Low, Millersville University

jjlow@marauder.millersville.edu

Faculty Advisor: Tariq Gilani

The Jacob's Ladder is an impressive visual tool that demonstrates the ionizing of air. Furthermore, it can also be used for an educational tool to help in the better understanding of the world around us. The Jacob's Ladder is comprised of two rods and a high voltage transformer. When a high voltage is applied across the rods, it ionizes the air between the rods and a rising electric arc is formed. For the project, I will be looking at a model that explains the rising electric arc. I will also be looking at the benefits the Jacob's Ladder apparatus has on education, such as the teaching of ionization, plasma, AC signal, transformer, and blackbody radiation.

Fabrication of Nano-Engineered thin films by Thermal Evaporation

Drew Pulsifer, Millersville University

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Faculty Advisor: Dr. Tariq H. Gilani

Sculptured thin films are grown by manipulating a material on the nano scale. They can be produced by laser ablation or thermal evaporation of the material on to a rotating substrate under the right conditions. The Millersville University Physics department has an old evaporation chamber. Dr. Gilani and I are working to modify this existing evaporation chamber in order to facilitate the production of Nano-Engineered thin films. These modifications include the fabrication of a new vacuum chamber, purchasing and installing vacuum rated servo stepper motors and the necessary control mechanisms. As of March 2008 we have been able to design and fabricate the vacuum chamber, procure the majority of the electronic components necessary, and are in the process of fabricating the rotating sample stages. The majority of work completed has been done on the fabrication of the vacuum chamber and substrate rotation apparatus. The chamber was completed and tested in August of 2007 and achieved a minimum pressure of 2.7×10^{-6} Torr. In the near future we hope to make our first attempt at creating sculptured thin films with the updated system.

LivePhoto Physics: Active Learning through Analysis of Real World Phenomena*

Maxine Willis, Dickinson College

E-mail: willism@dickinson.edu

Priscilla Laws, Dickinson College

Robert Teese, Rochester Institute of Technology

Patrick Cooney, Millersville University

Short digital videos, often just 20 to 30 frames in length, can be extremely useful in physics teaching. Computer analysis of these "live photos" involves measuring the positions of objects in successive video frames by pointing and clicking with a mouse. The data can be graphed, analyzed and compared with theoretical models.

The LivePhoto Physics Project team has created a collection of videos and classroom-tested activities that can be used as a basis for lecture demonstrations, in-class exercises, laboratories and homework. The team is offering series of 3-day and 5-day long professional development workshops designed to provide college and university physics instructors at all levels with opportunities to learn how digital video analysis can be used in conjunction with the findings of physics education research to help students overcome common learning difficulties. Workshop participants will be introduced to LivePhoto Physics curricular materials and state-of-the-art computer tools for video-based capture, data collection, display, analysis, visualization and mathematical modeling.

*This Project has been supported by National Science Foundation grants 0089380, 0424063 and 0717699 (<http://livephoto.rit.edu/>)

ABSTRACTS FOR TALKS

Saturday, Ulmer 201

9:20 – 9:40

A Bubble Level Heat Engine

Kip Trout, Chuck Gaston, Penn State York

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The bubble in an ultra-sensitive spirit level moves toward the warmer end when a small thermal gradient is introduced along the length of the glass vial. The motion is caused by a thermally generated pressure differential between the two ends of the two-centimeter-long bubble. The thermal gradient caused by the light from a flashlight is sufficient to move the bubble. Of further interest is the discovery that the bubble can be made to oscillate with a constant heat input if the current and initial location of a heating wire is in the correct range. The oscillations can cover more than five divisions on the level and can be sustained for at least 30 minutes, probably indefinitely.

9:40 – 10:00

Various Projects Including Fuel Cells

Andrew Strickler, Williamsport Area High School

Faculty Advisor: Lawrence Flint, Williamsport Area High School

With a team, a fuel cell car was built last year. I will talk about the design process and their successes we had with it. I will also share photographs of many other projects including snowmaking machines, wood stove, motorcycle repair stand, and automotive work.