

American Association of Physics Teachers Southern Atlantic Coast Section

**Fall 2003 Meeting
October 31 and November 1, 2003**

**Spelman College
Atlanta, Georgia**

Summary of Schedule

Friday, October 31

5:00 to 7:30 PM--Registration--*Living and Learning Center II Lobby*

5:00 to 7:30 PM--Vendor displays--*Living and Learning Center II Breakout B*

6:00 to 7:30 PM--Banquet--*Living and Learning Center II Auditorium*

7:30 to 9:00 PM--Registration--*Science Center Lobby*

7:45 to 9:00 PM--Keynote address by Rae Carpenter--*Science Center Auditorium*

Saturday, November 1

8:00 AM to noon--Registration, continental breakfast, vendor displays--*Science Center Lobby*

8:30 to 11:45 AM--Morning session of contributed talks--*Science Center Auditorium*

Noon to 1:15 PM--Lunch and business meeting--*Living and Learning Center II Auditorium*

1:30 to 2:15 PM--Afternoon session of contributed talks--*Science Center Auditorium*

2:30 to 4:30 PM--Workshops--*Science Center 133 and 226*

Friday, October 31

Keynote Address

7:45 PM--Science Center Auditorium

Physics Demos - Old and New - Tried and True but Often Borrowed

D. Rae Carpenter, Jr.

VMI Professor of Physics Emeritus

A dozen or so from the VMI collection contributed by the fantastic high school and college teachers in over a quarter century of demo workshops, mostly using items found around the household or in building supply stores.

Detailed Schedule and Abstracts of Contributed Talks and Workshops

Saturday, November 1

Contributed Talks--Science Center Auditorium (room 134)

8:30 AM

A proposal for the creation of a www-based database of physics demonstrations on video and simulations.

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The author proposes the creation of a database of physics demonstration videos on the www that are freely available to teachers and students, with integrated java-based simulations of the physical principles involved. Several sources of demonstration videos are extant on the web, but most are of either unacceptable quality or size and none feature integrated simulations. In this proposal, high-quality streaming videos will be made available in sizes appropriate for connections ranging from dialup to broadband, with downloadable versions also available. Each demonstration will have an integrated java-based simulation for students to explore that will allow them reach a deeper understanding of the physical principles.

8:45 AM

Physics Labs with Flavor: Dramatic Experience

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Presented work continues development of the recurrent approach discussed in previous presentations [1] of the *Physics Labs with Flavor* series, dedicated to improvement of effectiveness of the teaching-learning process throughout hands-on experience. The Track of Discovery is usually full of Dramatic experience. "The three layer presenting information" method was replaced by the "Dramatic Talk" method, which was already successfully used in *Lectures on Physics* [2 - 5]. While the Recurrent approach enhances learning and helps students comprehend the material by using learned material to predict and test the results within the same lab, the dramatic element of the process employs emotional component into the cognition process and motivates students' learning. This method was tested in Introductory and General Physics labs at the College of Charleston for both non-science majors and science, including Physics, majors. The teaching-learning effectiveness has been increased and positive feedback was received from students and faculty at the College and some other Universities. Learn how to bring flavor into any lab by making it "shot for your grade" type of a lab. 1. M. Agrest. *Physics Labs with Flavor: Recurrent approach*. SACS-AAPT Spring 2003 Meeting. Coastal Carolina University. March 28-29, 2003. M. Agrest. *Lectures on Physics*. Volumes I-IV. Tavenner Publishing Company, 2002. ISBN 1-930208-54-5; ISBN 1-930208-67-7; ISBN 1-930208-54-3; ISBN 1-930208-57-X

9:00 AM

WebTOP: Web-Based Interactive 3D Simulations of Waves and Optics

Taha Mzoughi
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WebTOP is a 3D interactive computer graphics system developed to help instructors teach and students learn about waves and optics. Currently, it is made up of sixteen modules spanning eight different subject areas: waves, geometrical optics, reflection and refraction, polarization, interference, diffraction, lasers, and scattering. WebTOP modules can be used for in-class demonstrations, homework assignments and supplementary laboratory activities. The talk will be used to demonstrate some of these activities. WebTOP is sponsored in part by the National Science Foundation (DUE 9950569 and DUE 0231217).

9:15 AM

Using a Large Dish, Radioastronomy Demonstration in an Introductory Astronomy Course

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and

Elena Mendez

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Introductory astronomy students at Converse College have used remote access of the 37 m telescope at MIT's Haystack Observatory as part of a laboratory exercise. Before the observation period, students were required to consider the frequency at which they would observe. Students gained familiarity with process involved in making radio astronomical observation. The procedures, challenges, and conclusions of the exercise will be discussed along with a brief description of the undergraduate research program at the Haystack Observatory.

9:30 AM

Determining Large-Scale Structure by Analyzing SDSS Data

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Galaxies are the visible markers that provide data for determining the size, structure and history of the universe. Plots of galactic data from the Sloan Digital Sky Survey (SDSS) will be presented, illustrating the pattern of filaments and voids characteristic of large-scale structure. Differences between spiral and elliptical galaxy cluster patterns are clearly visible in such plots. Calculation of the two-point correlation function provides a quantitative measure of the galaxy distribution.

9:45 AM

An Easy Way to Photograph Objects in the Solar System

Amy Richards and Bob Powell

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Electronic Imaging eyepieces for telescopes are available in both monochrome and color models at modest costs. These compact devices fit the standard telescope focusers and transmit live video images to a TV screen for observation by a group or to a video recorder for later viewing or processing to obtain regular photographs. Short focal length telescopes may be used to image the Moon and the Sun. Longer focal length telescopes may be used to image the brighter planets or close-ups of the Moon or sunspots. A video of Mars was shown to dozens of people on the night of its closest approach to the Earth in late August, 2003, when clouds prevented the red planet from being seen via a telescope.

10:00 to 10:15 AM

Break

10:15 AM

Physics Demos - Old and New - Tried and True but Often Borrowed - More of the Same

D. Rae Carpenter, Jr.

VMI Professor of Physics Emeritus

Some more from the VMI collection.

10:30 AM**Using Science Fiction Movies in Introductory Physics**

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Science fiction films can be used as a vehicle to get students thinking about science in general, and physics in particular. Students enjoy watching movies. Movies can confer a physical concept visually. Thus, showing scenes from a science fiction film is a helpful technique to supplement traditional teaching methods. Using films such as "Armageddon" and "Star Wars", introductory physics students watch certain scenes of a film and gather the information presented. With this information, students make calculations based on a relevant physical principle in order to determine whether or not the physics--as presented in the film--is correct. In addition to film related problem solving, student groups may have discussions on a movie's physics. Another method is to have each student write an essay explaining the physics in a film, discussing whether it is correct or incorrect

10:45 AM**Enhancing Undergraduate Physics Students Performance: The Role of 'Pizza Parties'**

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We present and discuss anecdotal evidence that outside of class interactions between students and instructors can enhance the academic performance of students. These "pizza party" events create an informal, nonthreatening arena for students to exchange information on their social lives, discuss their achievements in other courses and activities, and provide the opportunity to summarize their goals and plans upon graduation from college. Our observations indicate that if such an event, i.e., a "pizza party," is given early in the course, then students expanded their classroom participation and had a greater tendency to form problem solving groups. One consequence was the improvement of their overall academic performance as measured by both test scores and final course grades. While our conclusions are based on courses with small student populations, we suggest ways that this experience can be replicated for large classes.

11:00 AM**Predicting Student Performance in Science Courses**

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and

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Students' performance in introductory courses is sometimes below the instructor's expectations, possibly due to their diverse science backgrounds. Therefore, it may be worthwhile to develop a method for predicting performance, in order to administer appropriate remedies. We have examined various predictor variables, such as SAT, high school GPA, and a linear combination of these variables. We have also studied a cutoff method for predicting pass/fail, and we have found that SAT is not as good as high school GPA for introductory chemistry. The maximum for correct predictions ranges from 58 – 78%. A logistic regression was also performed for each predictor variable. This may be useful in advising students. For example, it was determined from the Fall 2000 – 2002 introductory chemistry course data at Morehouse College that a 3.0 high school GPA indicates a 50% probability to pass the course.

11:15 AM

Physical Science Camp at Georgia College & State University

Rosalie Richards, Ph.D.

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Georgia's Quality Core Curriculum Standards (QCCS) are part of a statewide basic curriculum geared at “*preparing students with the knowledge, skills, and attitudes necessary to reach their fullest potential as individuals and citizens*”. Science standards in public schools are assessed at grades 3 through 8 through the Criterion-Referenced Competency Tests (CRCT) but not again until grade 12 through the Georgia High School Graduation Test. Although students meet or exceed standards through the CRCT, there is overwhelming evidence that students are failing miserably at science process skills. The impact is manifested through the 12th grade graduation test when up to one-third of graduating seniors are unable to meet the basic skills in science on the first attempt. *Science Camp* at Georgia College & State University responds to these issues by embracing key science concepts that can be investigated in depth over two weeks through inquiry-based and research-based experiences. During *Physical Science Camp 2003*, students entering grades 6-9 from central and southern Georgia studied the science of air. The camp reinforced what students learn in elementary years and underscored what they will study in the middle grades science and beyond.

11:30 AM

Physics Partnerships across the P16 Continuum – A Case Study

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and

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Gainesville College Physics and North Georgia College and State University Science Education are implementing a project to teach K12 physics/physical science teachers how to use technology in instruction. This project has been funded by the Teacher Quality Program, which is a part of the ‘No Child Left Behind Act’. This project envisions training teachers in the use of computer technology in the classroom, including data acquisition (using Vernier LabPro), video-capture/analysis (using Videopoint), constructing simulations (using Interactive Physics), web based homework (using Webassign) and Physlet Physics. The teachers take the LabPro devices with sensors and software back to their classrooms and are expected to serve as change agents in their locales. The entire project also involves connecting with the school systems, assessment of local needs and site visits to ensure optimal implementation of the technology in the classrooms. The first phase of the project, which is an intensive two week summer workshop in learning the technologies, has been completed. The second phase involves a series of follow-up seminars, which are currently underway. Both the challenges and the opportunities afforded by the project will be discussed.

12:00 to 1:15 PM

Lunch--Living and Learning Center II Auditorium

1:30 PM

Cognitive Development of Newtonian Concepts in Middle School Students

Dr. Paul J. Camp, Spelman College

As part of an ongoing research and curriculum development project, we investigated the process by which Newtonian concepts are acquired by middle school students. In a project-based, inquiry-oriented eight week physics unit, several classes in the Atlanta area were given periodic multiple choice content tests. Distractors on the test questions were constructed to reveal early developmental stages in the acquisition of Newtonian reasoning skills. The same classes were given periodic performance assessments to characterize their reasoning in a small group setting. Finally, a smaller number of target students were engaged in structured interviews designed to assess the relative balance of phenomenological vs. Newtonian reasoning and the amount of scaffolding necessary to elicit the latter. We will describe the data collection strategy, as well as some of the more interesting results. Specifically, we will present evidence of what we call "mu-shaped" development -- that there is a time lag in the transition to more sophisticated developmental stages during which students can exhibit deeper understanding of a concept while simultaneously relying on an earlier understanding for reasoning and problem solution. Implications for instruction and assessment will be briefly discussed.

1:45 PM

Analysis of central force motion using normalized quantities.

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Central force motion is analyzed in terms of the energy, angular momentum, semi-major axis using the values of these quantities relative to an arbitrary circular orbit. These relative calculations show more clearly how orbits change with individual changes in these constants. Calculations show that all orbits are always concave inwards. Corrections to perturbed circular orbits in the latest edition of Goldstein Classical Mechanics are given.

2:00 PM

Low Temperature Measurements for Detecting Magnetic Spin Interactions in Transitional Metals

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and

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The magnetic properties of inorganic materials compounded with transitional metals such as manganese, iron, copper, and cobalt have been the subject of experimental study this summer. Determining the magnetic susceptibility as a function of temperature and discovering whether these samples are liquid crystals have heightened interest on how these materials behave at temperatures greater than or equal to 2 K. The aim of the present work is to investigate the magnetic spin interactions in the specimen, thereby determining whether they experience long-range ordering by measuring the magnetism as a function of temperature and magnetic field.

2:15 PM

Density functional Theory for single-particle systems

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Density functional theory is discussed in the context of single-particle systems in one spatial dimension. We show that the ground state density and energy are simply related to a family of external potential energy functions and their respective ground state wave functions and energies.

2:30 to 4:30

Workshops--Science Center

Room 226

WebTOP: Web-Based Interactive 3D Simulations of Waves and Optics

Taha Mzoughi

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WebTOP is a 3D interactive computer graphics system developed to help instructors teach and students learn about waves and optics. Currently, WebTOP is made up of sixteen modules spanning eight different subject areas: waves, geometrical optics, reflection and refraction, polarization, interference, diffraction, lasers, and scattering. Each module has an interactive simulation, a theory section, sets of examples and exercises, and a scripting feature for recording sessions. WebTOP can be run from our website, <http://webtop.msstate.edu> or be downloaded and run on the user's local machine. During the workshop participants will learn how to use WebTOP, how to record and replay sessions, and how to use scripts to develop their own WebTOP-based web pages. Further information about WebTOP can be found at <http://webtop.msstate.edu>. The participants will be given a CD that contains the WebTOP software, some additional instruction, and a copy of the workshop tutorial. WebTOP is sponsored in part by the National Science Foundation (DUE 9950569).

Room 133

Constructing Physics Simulations Using Interactive Physics

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Interactive Physics allows the construction of simulations in mechanics and electrostatics. It is a very effective tool for helping students develop 'physical intuition' in which they have to put together physical systems visually. It helps in developing the ability to interpret both word problems and their solutions. This tool has relevance ranging from middle school physical science, all the way to introductory college physics courses. The self-authorship of simulations by students is a more powerful learning experience than working with 'canned' simulations. A demo version is available free as a download, which makes this tool immediately deployable in the physics classroom. Possibilities for student activities will also be discussed.