South Atlantic Section - American Association of Physics Teachers (SACS-AAPT)
Spring 2002 Meeting Program
Gainesville College, Gainesville, GA 30504

Friday April 5

5:00 pm - 6:00 pm
Registration
Science Building Lobby

6:00 pm - 7:00 pm
Banquet
Lanier A/B Student Activities Building

7:00 pm to 8:00 pm
Invited Presentation
HyperPhysics: Experiences with a free web physics exploration environment
Rod Nave, Georgia State University
Lanier A/B Student Activities Building

8:15 pm - 9:00 pm
Tour of Gainesville College Physics flex Lab/Classroom

Saturday April 6

CONTRIBUTED PRESENTATIONS
Room 103 Science Building

8:00 am - 8:15 am
USG On-Line Physics Course
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The University System of Georgia is offering a number of programs and on-line courses under its GLOBE program (http://www.georgiaglobe.org/). One eCore team is designing a calculus based Physics 2211K course, which will be offered in Fall 2002 (http://webct. usg.edu/). The author is a member of the eCore course development team along with Dr. Johnson and other members. The issues encountered and compromises made in the development of this course are discussed in this presentation.

8:15 am - 8:30 am

Newton's Cradle Revisited,

Fred Watts,
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We have all seen Newton's Cradle sitting on someone's desk or as a demonstration of a special (equal masses) case of an elastic collision. Examination of a more general case of elastic collisions, between unequal masses, reveals that maybe Newton's Cradle is not such a special case after all. We will demonstrate cases of elastic collisions of masses hanging from supports that reverse the total linear momentum after each collision.

8:30 am - 8:45 am

Making a Wave Demonstrator

Don Franklin
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How would you like to make a wave demonstrator in 15 minutes. Packages will be available for $5.00 which will allow you to build the latest version demonstrated at the AAPT winter meeting. This unit allows for changes in the eccentric mass, tension in the system, and needs no solder skills. The major change is the use of duct tape and a new motor with a gear drive. Anyone can build this demo!

8:45 am - 9:00 am

"**Computer Simulation of Laser Surgery**"

Michael Burns-Kaurin
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As part of a module on "Light and Color" in a course for non-science majors, the students use a computer program that simulates the use of lasers in surgery. The program depicts the heating and ablation of tissue as time passes during a laser pulse. Students can choose the type of laser, laser intensity, and the total time of the pulse, as they attempt to complete a particular type of surgery (LASIK or tattoo removal) while minimizing damage to the surrounding tissue.

9:00 am - 9:15 am

At-Home Activities for an Online Physical Science Course

John Stanford, Mariam Dittmann, Bill Lahaise, Ulrike Lahaise
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Additional author: Michael Denniston

Laboratory exercises are difficult to arrange for online science courses, but activities designed to be carried out at home offer the opportunity to allow the student to gain "hands-on" experience. We present a number of at-home activities designed for use in an online Physical Science course. These activities, aimed at students with minimal science background, utilize easily obtained materials to conduct safe, unsupervised demonstrations of physical principles.

9:15 am - 9:30 am

Comparison of the Optical Properties of Trivalence Praseodymium Doped Lanthanum Fluoride Nanocrystals and Glass

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Additional authors: Wesley Wells, Chris Schmitt, and Joe Bell

We investigated the optical properties of Pr^{3+}(0.01 at. %) doped LaF_3 nanocrystals and glass. Emission, excitation, and absorption spectra are presented at different temperatures. Relaxation processes of the two types of ions are also studied. Two types of Pr^{3+} ions, those in LaF_3 nanocrystals and those in glass substrate, are distinguished by spectroscopic and dynamical methods. 4f5d band of Pr^{3+} in the glass is lower than that in the nanocrystals and can be selectively excited, yielding UV emission. There is no evidence found for the excitation transfer between the ions in the substrate and in the nanocrystals at this concentration. A symmetric study for higher concentrations is underway.

9:30 am - 9:45 am

Multi-Sensory Interaction in Physics Classroom Activity

Mikhail M. Agrest, Ph.D.
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Presented work is dedicated to improvement of teaching-learning process and classroom time utilization.
Visual aids: Transparencies and/or PowerPoint Presentation incorporated with the identical hard copy of the Lectures on Physics [1], [2] were developed. Students participate in the teaching-learning process through listening, discussing and making notes in the space provided in their hard copy completing ideal supplementary issue for their study out of the classroom. Presented method provides an opportunity to cover more material in class with the important for Physics classes derivations and correlation of concepts. It also saves time for discussion qualitative issues, demonstrations, problem solving etc.
The teaching-learning effectiveness has been increased at the College of Charleston and positive feedback was received from students and faculty at the College and some other Universities.

9:45 am - 10:00 am
A Conversation about Teaching Physics with WebAssign
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This presentation considers existing processes in college/precollege physics teaching and explores the opportunity for integrating techniques to redesign instructional materials. In this quest, we have adopted WEBASSIGN suites of on-line technologies for our introductory physics classes. Apart from increased access and flexibility, it has added value tom my classroom teaching. Such experiential teaching-learning issues will be discussed.
Equipment needed: Computer interface to power point floppies

10:00 am - 10:15 am
Constructing Simulations in Mechanics and Electrostatics using Interactive Physics
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'Interactive Physics' allows students to construct their own simulations of mechanical and electrostatic phenomena. This allows the integration of student constructed simulations in laboratory exercises and other classroom activities. Simulations can help students in visualizing word problems and strengthen physical intuition. In addition, this program is also used extensively in our K-12 outreach efforts in which 5th and 6th graders construct their own simulations to explore physical law in an interactive manner. Examples of possible demonstrations and activities will be presented.

Coffee Break 10:15 am - 10:30 am

STUDENT PRESENTATIONS :

10:30 am - 10:45 am
Forced Oscillations With Nonlinear Friction
Chris Schmitt
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Dr. Xiao-jun Wang, Dr. Marvin Payne

Abstract
Experiments of forced oscillation with a frictional force that is linear in velocity are commonly discussed in general and classical mechanics texts. Though the dominating friction is either air friction or sliding friction and both involve a nonlinear dependence of the friction on the velocity. In these experiments the sliding friction is reduced to become negligible and air friction will become dominant. A slider car is positioned between two stretched springs on an air track where a sinusoidally driven arm will provide the forced oscillations. A sail will be attached to a track car to provide dominance due to air friction. Approximation methods will be used to describe the differential equations of motion and it will be shown that the experimental results will agree with the theoretical calculations.

10:45 am - 11:00 am
Bose—Hubbard Model Parameters for Bose—Einstein Condensates in Optical Lattices
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We have calculated parameters that are important in Bose—Hubbard (BH) models of gaseous Bose—Einstein condensates (BECs) in the presence of an optical lattice. A BEC of neutral atoms is a novel state of matter in which all the atoms occupy the same quantum state. When an optical lattice is applied to such a system by shining two counter-propagating laser beams at the BEC, a sinusoidal potential is generated. When this potential is strong, atoms are localized in the bottoms of the wells and are well

described by the BH model. The BH model assumes that the localized atoms are confined to the ground state of each well and that there is a probability, *J*, for atoms to “hop” from each well to its nearest neighbors. We show that *J* is related to the lowest two eigenvalues of the lattice potential and compute it for experimentally realistic situations.

11:00 am - 11:15 am

Theory, Laser Light and the Adiabatic Approximation

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This study examines how the adiabatic approximation can be used involving the interaction of laser light with atoms. It relates to understanding an experiment that happened at Harvard University. This experiment attempted to completely stop light. The experiment was performed using two laser pulses that interact with each other on the optical properties of an atomic vapor. The adiabatic approximation leads to analytical solutions to a theoretical model for the stopped light problem, which has been used for many explanations of the effects. This contribution will involve delineating situations where the adiabatic approximation gives accurate results and situations where it fails. The stopped light problem involves a three-state quantum mechanical system where the lasers interact resonantly with the system. Simpler two-state systems will also be used to illustrate the conditions that must be satisfied in order to make the adiabatic approximation accurate for solving the time-dependent Schrödinger equation.

Coffee Break 11:15 am - 11:30 am

11:30 am - 12:00 pm

Using Physlet-Based Interactive Exercises to Enhance Student Learning

Mario Belloni, Melissa Dancy, and Wolfgang Christian
Davidson College

From the invention of the television to the invention of computers and the World Wide Web, educators have often pinned their hopes of better instruction on technology. Yet teaching with technology, without a sound pedagogy, is unlikely to yield a significant educational gain. Physlets® (small, scriptable, Java applets created at Davidson College) appear to be delivering on technology’s promise. By having the students decide what measurements to make and what variables to change and by providing them with real-time feedback, students are put in control of the exercise. A visual and interactive exercise enriches their understanding far more than if the physics is simply explained on a page of text. Physlets are ideally suited for use with any pedagogy and have been used as in-class demonstrations, pre- and post-lab exercises and traditional end-of-the-chapter homework problems. One of the most promising uses of Physlets is in combination with the Just-in-Time Teaching approach. Just-in-Time Teaching (JiTT), an interactive pedagogy constructed around current internet technologies, is one approach that has been shown to produce positive cognitive gains. Students engaged by Physlet-based JiTT exercises are better prepared for class, are better motivated to learn the material and our results indicate that they perform better on standardized assessment instruments.

Additional information can be found at: http://webphysics.davidson.edu/.

Part of this work was supported by an Associated Colleges of the South Teaching with Technology Fellowship and a Cottrell College Science Award (CC5470). Physlets are supported by the National Science Foundation (DUE-9752365 and DUE-0126439).

12:00 pm - 12:30 pm

Improving Students' Performance in Introductory Physics: Adaptation of the SCALE-UP model to Coastal Carolina University

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In 1987, the American Association for Higher Education published "Seven Principles for Good Practice in Undergraduate Education," which states that Good Practice:

1. Encourages Contacts Between Students and Faculty
2. Develops Reciprocity and Cooperation Among Students
3. Uses Active Learning Techniques
4. Gives Prompt Feedback
5. Emphasizes Time on Task
6. Communicates High Expectations
7. Respects Diverse Talents and Ways of Learning

Unfortunately, even fifteen years later, most introductory Physics classes taught at American universities use pedagogical techniques that address few, if any of these principles. It is not surprising that both student enthusiasm and student performance are generally quite low.

At Coastal Carolina University, we have implemented the SCALE-UP model of Physics instruction, which was developed at North Carolina State University. This model combines lecture and laboratory into single entity, emphasizes active learning, student cooperation, and applications of technology. In this presentation, we will illustrate the SCALE-UP model and report on its positive impact on student performance.

Lunch 12:30 pm - 1:25 pm
Concurrent Business Meeting 1:00 pm - 1:25 pm
Lanier A/B Student Center

Afternoon Workshops

Three workshops will be offered concurrently beginning at 1:30 pm

1:30 pm - 3:30 pm
Room 228 Science Building
1) Using Interactive Java-Based Pedagogy in the Classroom
Mario Belloni and Melissa Dancy
Davidson College

Participants will learn how to use Physlets (i.e., interactive Java applets written at Davidson College) to design various types of interactive curricular material. We will present and distribute examples of Just-in-Time Teaching, Peer Instruction, traditional in-class demonstrations, pre- and post-laboratory exercises, and media-focused homework. Prior experience with HTML is useful but not essential since this workshop is based on a ready-to-run CD. (Teachers wishing to script their own Physlet-based exercises should consider attending our daylong summer workshop at a national AAPT meeting.).

1:30 pm - 3:00 pm
Room 216 Science Building
2) Interactive Demonstrations for Elementary Astronomy
Dr. Richard Summers
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Phone No. (770)720-5597
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The workshop will present a number of interactive demonstrations intended to convey basic concepts of physics and astronomy in a way that is fun and involves commonly available materials such as balls, flashlights, string and paper. These exercises usually convey their messages much more effectively than simple words in a book could. Included are demonstrations intended to help students understand the answers to such questions as:

(1) Why is the sky (and Pleiades) blue?
(2) Why does the moon have phases?
(3) How far away is the Proxima Centauri?
(4) What is a pulsar and why does it pulsate so fast?
(5) What are the different types of solar and lunar eclipses and why do they occur?
(6) Why was it so difficult to measure parallax until the 19th century?

(7) What causes a supernova explosion?

1:30 pm - 3:00 pm
Room 213 Science Building
3) Multimedia in the Physics Laboratory: An Interactive Computer–Based Introductory Physics Lab Manual

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Teachers have frequently observed that student learning is enhanced by the use of visual aids. These visual aids have progressed from diagrams on a chalkboard to overhead transparencies and PowerPoint presentations used in lectures. Traditional classroom demonstrations have been enhanced by those on laser disk and DVD, as well as simulations created using Java applets that are available on the web and CD-ROM. Introductory physics laboratory manuals have not generally kept pace with the changes seen in lecture materials.

This state of affairs, combined with a growing interest in computer-based multimedia, inspired the author to engage over the last four years in the creation of an interactive multimedia lab manual on CD-ROM. Twenty-five laboratory exercises have been created to date that cover two semesters of introductory physics through mechanics, thermal physics, waves, electricity and magnetism, instrumentation, light and spectroscopy. The CD-ROM features the use of digital video to demonstrate the instruments and techniques used in each laboratory. Instructional videos illustrating the use of a spreadsheet application to analyze and graph data are included in each laboratory as needed. Several labs have QuickTime virtual reality object movies of devices such as a spectroscope or force table that allow students to familiarize themselves with the instruments they will be using. Students are able to enter data directly into a database from the lab manual application; the database can be saved in a format that can be opened in spreadsheet applications such as Excel.

The author will demonstrate the features of the manual and lead attendees in exploration of several of the exercises. Attendees will be provided a cross-platform (Mac or Windows compatible) CD-ROM with all of the currently available exercises.