SACS-AAPT Spring 2010 Meeting Program
University of South Carolina – Aiken
March 19 & 20, 2010

Friday March 19 (Business & Education Center – Room 122)

6:00 – 6:30pm Registration

6:30 – 7:30pm Dinner

7:20 – 7:30pm Welcome to USC-Aiken by Dr. Thomas L. Hallman
Chancellor of the University of South Carolina – Aiken

7:30 – 8:30pm Keynote Address by Dr. Carlton W. Ulbrich
Emeritus Professor of Physics at Clemson University

Saturday March 20 (Science Building – Room 327)

7:30 – 8:00am Registration

8:00 – 9:50am Presentations Session 1

9:50 – 10:00am Break

10:00 – 12:00pm Presentations Session 2

12:00 – 12:30pm Lunch and Posters

12:30 – 1:30pm Presentations Session 3

1:30 – 2:30pm SACS-AAPT business meeting

2:30 – 4:00pm Workshops

Presentations – Session 1

8:00 – 8:20am

1. Developing and deploying computational exercises in introductory mechanics

Marcos Caballero and *Michael F Schatz*, Georgia Institute of Technology and *Matthew A Kohlmyer*, North Carolina State University

Students taking introductory physics are rarely exposed to numerical computation, that is, using a computer to solve science and engineering problems. An introductory physics course at Georgia Tech, based on the Matter and Interactions (M&I) curriculum by Chabay and Sherwood, utilizes numerical computation as a tool for describing physical phenomenon not easily described using analytic methods. Students are taught to develop visual 3D models of a variety of physical phenomenon (e.g., the motion of a spring-mass system exposed to viscous drag in 3D). We present an overview of the computational component of this curriculum and the development of exercises to enhance students' understanding of numerical computation and visualization introduced in the M&I curriculum. This work is on-going and supported by NSF DUE-0942076.

8:20 – 8:40am

2. Using a Hybric Teaching Model to Promote Increased Student Engagement.

Taha Mzoughi, Kennesaw State University

Since spring 2009, I have substituted lectures in the second semester of the introductory algebra-based physics course by recordings and lecture quizzes. Students watch the recordings, complete the lecture quizzes, and formulate questions about the content being covered before coming to class,. Class time is used to discuss the questions they have formulated and to answer new questions. Labs are enhanced through the use of pre-lab simulation driven exercises. In this presentation, I will provide details about the methods used, and how they have affected the class dynamics.

8:40 – 9:00am

3. Nature of sound propagation: Naïve, scientific and experimental

Zdeslav Hrepic, Columbus State University and *Chelsea Bonilla*, Fort Hays State University

In order to reveal the longitudinal wave nature of sound phenomena to students, an experiment with a candle flame in front of a loudspeaker has been suggested as a clear demonstration. In this paper we describe the behavior of a flame under a range of frequencies and amplitudes of sound produced by a loudspeaker. The results show that desired effect can be demonstrated only within a relatively narrow frequency-amplitude (f-A) range. At the same time, for a variety of other ranges, the demonstration outcome might likely reinforce, rather than dismiss, the most common alternative conceptions and incorrect mental models related to sound propagation. This urges caution on the instructor's part when this demonstration is performed. The results are also relevant for researchers who use this experiment to study students' understanding of sound because questions related to outcomes of this experiment may not have single and unambiguous answers.

9:00 – 9:20am

4. The effect of noise on neurons - a computational approach

Corey Edward Klein, *Nicole Sztokman* and *Sorinel A Oprisan*, College of Charleston

Neural cells receive thousand of inputs simultaneously and some are very low threshold, so week that they cannot induce an action potential but are rather characterized as "noise". However, such "noises" have a physiological effect - they bring the cells to firing threshold and, therefore, facilitate communication between neurons. We investigated how a Morris-Lecar (ML) model neuron responds to an externally injected noise current of different distributions. The magnitude of oscillation, defined by the standard deviation of the external noise, was manipulated to apply ranging intensities of noise to our system. ML model could be easily tuned to represent a type 1 (spiking) or type 2 (bursting) excitable cell. For a type 1 cell we found that the level of noise significantly changes the average firing rate in the model. Type 2 neurons act as resonators and they tonically respond only to certain frequencies present in the background noise. From a biological point of view, type 1 excitable cells seem to be more sensitive to noise level and are ideal candidates for information processing. Type 2 neurons are relatively resistant to noise, and are presumably responsible for biorhythms and pacemakers.

9:20 – 9:40am
5. Remote Sensing as a Tool for Environmental Physics
J.B. Sharma, Gainesville State College

The spatial quantification of the physical environment has become possible to a high degree of accuracy and precision with rapidly emergent technologies. Remote Sensing is a geo-spatial technology that is rooted in the principles of physics and has emerged as an indispensible tool for Environmental Physics. Remote Sensing involves the accurate determination of land cover features and objects and generates the fundamental data layer needed for the analysis and modeling of Earth surface/environmental phenomena. This talk will about the nature of remotely sensed data, tools for its analysis and how these can be integrated into a physics, physical science or environmental science course. A shareware remote sensing program developed by Purdue University called Multispec will be demonstrated using freely available satellite imagery.

9:40 – 9:50am
6. The Inaugural USA Science & Engineering Festival
Frank Lock, retired high school physics teacher

This is a national event, with the festival being held on the mall in Washington, D.C. on October 23 & 24, 2010. Information about the festival will be presented, and discussion of SACS participation in a satellite event will be encouraged.

9:50 – 10:00am - Break

Presentations – Session 2

10:00 – 10:20am
1. Using Quasars as Flashlights to Trace Galaxy Evolution
Varsha Kulkarni, University of South Carolina

The formation of the first generation of stars > 12 billion years ago marked the beginning of the metal enrichment of galaxies. How the universe evolved from those early stages to the current epoch with earth-like planets is the subject of cosmic chemical evolution models. We recently uncovered a ``missing metals problem" in low-redshift galaxies, i.e. a discrepancy between the observed amount of metals and the amount predicted by the chemical evolution models. On the other hand, we have recently discovered a new population of galaxies with very high levels of metals, including some that had reached several times the Sun's metallicity 7-10 billion years ago! In this talk, I will discuss clues emerging from our imaging/spectroscopic observations that promise to shed light on several aspects of galaxy evolution.

10:20 – 10:40am
2. Pre-Service Elementary School Teachers and Their Use of Representations in Science and Mathematics
David Rosengrant and *Amy Hillen*, Kennesaw State University

In this study we compare not only pre-service elementary teachers' skills in learning how to use and construct representations as well as their retention, but also look at how they transferred these abilities across different courses that are specifically designed for pre-service elementary school teachers (One course is in physical science, the other is mathematics). Both courses have a strong emphasis on multiple representations. Students in both courses took a pre and post test to gauge their improvement with their use of representations in the fall. We conducted follow-up interviews in the spring semester to see what information they retained. Part of this interview involved eye tracking so that we can gain more information about where the students focused while answering questions about representations. We present preliminary results here as this is an ongoing study.

10:40 – 11:00am
3. Determine RC time constant with a charge sensor
Ana Oprisan and *Sorinel A. Oprisan*, College of Charleston

We integrated short computer-aided experiments during regular lectures to prove a concept clearly and reinforce the confidence and the positive attitude of our students. The students are familiar with DataStudio software and Pasco interface from other experiments and short integrated experiments allows them to focus on the meaning of quantities measured rather than the experimental setup. The use of computers interface and electronic probes give immediate feedback to students and helps them connect concepts learned with actual measurements increasing information retention. We present a revised technique using charge sensor, Pasco interface and DataStudio software to study the RC time constant. An RC series circuit is first connected to a power supply in order to charge the capacitor, which is subsequently discharged through the series resistor. At all times, a charge sensor is connected across the capacitor and allows instant measurement of the electric charge and direct visualization during charging/discharging process. In this computer-aided experiment, the time constant was determined either by fitting the graph with exponentials or by measuring the time it takes to reach a certain charge threshold. The time constant error is less than 5% and the graphs were printed immediately for further analysis.

11:00 – 11:20am
4. The ballistic acceleration of a supercurrent in a superconductor
Milind N. Kunchur, University of South Carolina

A particle under the action of a single applied force accelerates ballistically in accordance with Newton's second law. In the presence of a frictional force, an applied force will ultimately maintain a constant velocity rather than produce acceleration. Analogously, an externally applied voltage can ballistically accelerate the superfluid in a superconductor, leading to a supercurrent that grows with time; whereas a constant applied voltage in a resistive conductor merely maintains a constant current. This acceleration phase of the supercurrent lasts for a very brief period before resistive processes set in, making it difficult to observe in the time domain in a correlated current-voltage measurement. The present work provides a clear experimental demonstration of this fundamental superconducting behavior."

11:20 – 11:40am
5. Physics in Portraits of Great Physicists - A Mnemonic device
Mikhail M. Agrest, College of Charleston

Understanding the deep meaning of the laws of Nature is a creative process of relating observed events. The Great unique minds like Newton and Pascal, Galileo Galilei and Einstein, and many others were capable to uncover the hidden meaning of events. We, the educators, were lucky to comprehend those ideas. Now our purpose is to enrich the rest of the Humankind with that wisdom, to encourage new generations to learn more about the Nature and to give credit to those great minds.Mnemonics is a powerful tool to relate concepts and to remember the uncovered relationships among concepts. Combining these two ideas we created visual mnemonic devices with elements of humorous flavor that help students to relate and so to remember the concepts and at the same time pay tribute to the authors of great ideas and have fun and pleasure doing so. In our mnemonic devices Portraits of Scientists whose names are given to the units of physical values act as those values.

11:40 – 12pm
6. The Lorentz Transformations
Stelios Kapranidis, University South Carolina at Aiken

The derivation of the Lorentz transformations in the context of the special theory of relativity requires mathematics that is well within the grasp of the second year physics student. However, students at this level have a hard time developing a good understanding of the implications of these transformations. To help my students in their study, I have used in the last three years computer-generated graphs to represent some important aspects of the Lorentz transformations. This approach seems to have a considerable degree of success. Recently I started developing an interactive Mathematica 7 program that is based on the graphs I used in the past. The program allows the students to experiment with the Lorentz transformations and study their various implications, such as the Lorentz contraction, time dilation, the concept of simultaneity, etc. In this presentation I will demonstrate the use of this program in its current state of development.

12 – 12:30pm - Lunch & Posters

Posters

1. Element Abundances in Galaxies >10 Billion Years Ago
Debopam Som, University of South Carolina

Absorption lines in quasar spectra offer a unique window into the high redshift universe providing useful information about galaxy evolution. The damped Lyman-alpha absorbers (DLAs) and sub-DLAs contain the majority of neutral gas in galaxies at high redshift. They also allow a direct determination of interstellar element abundances in galaxies as a function of redshift. The differences between DLAs and sub-DLAs pose open questions regarding chemical evolution of galaxies. To explore the answers, we have recently observed 15 absorbers at redshifts z > 1.7 using the MIKE spectrograph at the 6.5 meter Magellan Clay telescope in Chile. We will present observational data from this study on element abundances in a few high redshift DLAs and sub-DLAs.

2. Free flux vortex dynamics in MoGe
Manlai Liang, University of South Carolina

MoGe presents a uniquely low pinning system that shows for the first time free flux flow in the zero-current limit. This has opened opportunities to investigate the basics of flux dynamics in superconductors as well as more exotic flux behaviors such as instabilities. This presentation summarizes our ongoing research in this area.

Presentations – Session 3

12:30 – 12:50pm
1. Determination of Planck's constant using photoelectric effect with monochromatic light emitting diodes sources
Sorinel A. Oprisan and *Ana Oprisan*, College of Charleston

Photoelectric effect is widely used in introductory physics classes as a classical experiment that can give an estimate of Planck's constant. The accuracy of measurements depends, among other factors, on the quality of the monochromatic light source used to produce photoelectrons. Two commonly used monochromatic light sources relay either on spectral lines obtained through dispersion of light from a rarefied gas lamp or use gel filters with known spectral transmission. Light emitting diodes (LEDs) are cheap sources of monochromatic light with a narrow spectral emission band. We used high power LEDs and a traditional photoelectric apparatus to determine Planck's constant with less than 1% error. The procedure is straightforward and the students do not need to consider complicated corrections due to broad spectral characteristics encountered in gel filters.

12:50 – 1:10pm
2. Soda Bottle Speaker
Matt Marone, Mercer University

The "Soda Bottle Speaker" is a simple and fun experiment that combines elements of acoustics and electromagnetism. This multifaceted laboratory experiment can be used to teach students about resonance, frequency response, inductance, AC circuits and impedance. On the other hand, it is simply just fun to make your own working speaker. Several Soda Bottle Speakers will be demonstrated and compared to commercial speakers. The speaker consists of a soda bottle frame, paper diaphragm, soda straw voice coil, and a magnet. Tape and hot-glue are used to hold it all together. Step by step instructions for making your own speaker will be presented. We are particularly interested in introducing high school students and teachers to this experiment. For those interested in using the speakers as a laboratory experiment, there will be a workshop in the afternoon session. If you plan to attend the workshop, please bring a soda or water bottle along. We will provide the other materials.

1:10 – 1:30pm
3. Understanding How Our Mind Works: More Observations Re Human Perception
Henry Gurr, Professor Emeritus, University South Carolina Aiken

In order to design and build an airplane, we apply statics, dynamics, aerodynamics, and materials science, etc. Similarly, in order to teach we need an applicable science. I will start by summarizing my last fall's presentation, which largely discussed **"**learning/perception blockages**"**, and how these typical hang-ups are often remarkably solved by a **"**Flash of Insight **AHA****". From this, I will discuss additional of my observations concerning human perception and learning. The audience will participate in several exercises, designed to induce difficult learning, so as to remind us (anew) of the "feelings**"** and "body language**"** that happens when "learning gets tough**"**. Lessons learned will be applied to physics teaching and learning in the classroom (and lab). The observations so discussed, may contribute to an eventual "applied science of teaching & learning**"**.

1:30 – 2:30pm - SACS-AAPT business meeting

Workshops

2:30 – 4pm (Room 325)
1. The Kitchen "Radar Oven" Comes Alive For Students: Hands on Demonstration & Explanation.
Henry Gurr, Professor Emeritus, University South Carolina at Aiken

The common microwave oven offers many attention getting (& student pleasing) demonstrations in physics of electromagnetic waves, and practical electricity. For the benefit of the physics teacher, my presentation will largely replicate what I have actually shown my students for many years. Throughout the demonstrations and hardware examination, we will be applying introductory level physics principles, to understanding the electrical components and microwave components, of the oven.

2:30 – 4pm (Room 212)
2. Soda Bottle Speaker
Matt Marone, Mercer University

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