Southern Atlantic Coast Section of the American Association Physics Teachers

Fall Meeting, October 30th & 31st, 2015,
The Citadel, The Military College of South Carolina
Charleston, SC

Local Organizing Committee
COL Joel C. Berlinghieri  LTC Patrick R. Briggs  Dr. Mikhail M. Agrest
Ms. Deborah Howard  Mr. John Bradham  Mr. Jim Near
Program at a Glance

Registration Desk: Front Foyer, Grimsley Hall
Friday Keynote Dinner: Second Floor, Greater Issues Room, Mark Clark Hall
Saturday Plenary Sessions: Copeland Auditorium, Grimsley Hall
Posters: First Floor Hallways, Grimsley Hall
Workshops: Second Floor Laboratory Rooms, Grimsley Hall
Exhibitor Tables: Front Foyer, Grimsley Hall
Lunch and Coffee Break: Front Foyer, Grimsley Hall

Friday, October 30th, 2015
5:00 pm – 6:30 pm Registration (Foyer of Grimsley Hall)
6:30 pm – 6:35 pm COL Joel C. Berlinghieri, Chairman of the Physics Department, Welcome and Introductions (Greater Issues Room)
6:35 pm – 7:15 pm BG Connie Ledoux Book, Provost and Dean of the College Keynote Speech: Technical Realm of Communications
6:30 pm – 8:00 pm Buffet Dinner

Saturday, October 31st, 2015
7:30 am – 8:30 am Registration and Poster Setup (Foyer of Grimsley Hall).
8:30 am – 10:30 am Plenary Presentations A (Copeland Auditorium).
10:30 am – 10:45 am Coffee Break & First Poster Session (Hallways of Grimsley Hall).
10:45 am – 12:33 pm Plenary Presentations B (Copeland Auditorium).
12:40 pm – 1:30 pm Lunch & Second Poster Session (Hallways of Grimsley Hall).
1:30 pm – 2:00 pm SACS-AAPT Information Meeting (Copeland Auditorium).
2:00 pm – 4:30 pm Workshops (Second Floor Laboratory Rooms 211, 221, 241).

Company and Program Representation

Table 1. Jack Deyton, Account Manager, Mid-Atlantic Region, PASCO Scientific.
Table 2. Rhonda Ewing, STEM Center of Excellence, The Citadel.
Table 3. Academic Program Literature, School of Science and Mathematics, Department of Physics, Department of Chemistry, Department of Biology, Department of Mathematics and Computer Science, Department of Exercise Science. Also the School of Science and Mathematics.

Sponsors
School of Science and Mathematics, The Citadel
Department of Physics, The Citadel
The Purcell Fund for Physics, The Citadel
SACS – AAPT
STEM Center for Excellence, The Citadel
PASCO Scientific
Keynote Dinner  
Friday, October 30th, 2015, 6:30 pm – 8:00 pm  
Keynote Address by BG Connie Ledoux Book, Provost and Dean of the College, The Citadel  
“Technical Realm of Communications”

Plenary Presentations  
Saturday, October 31st, 2015

### Contributed Talks - Session A  
**8:30 am - 10:30 am**

<table>
<thead>
<tr>
<th>Time</th>
<th>Title</th>
<th>Speaker(s)</th>
</tr>
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<tbody>
<tr>
<td>8:30 am - 8:42 am</td>
<td>The Revised Advanced Placement Physics Course (AP 1) and How It May Impact University Physics Courses.</td>
<td>Frank Lock, Georgia State University</td>
</tr>
<tr>
<td>8:42 am - 8:54 am</td>
<td>Nonlinear Ion Traps for Undergraduate Research</td>
<td>Don Franklin, Penfield College/Mercer University</td>
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<tr>
<td>8:54 am - 9:06 am</td>
<td>Integrating Classwork Problems and Laboratory Activities for DC Circuits</td>
<td>Rob Clark, Dylan Green, Timothy Burke, The Citadel</td>
</tr>
<tr>
<td>9:06 am - 9:18 am</td>
<td>Use of Scratch in Teaching Special Relativity</td>
<td>Kenneth Sales, Georgia Gwinnett College</td>
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<tr>
<td>9:18 am - 9:30 am</td>
<td>Oscillations in magnetoresistance</td>
<td>Milind Kunchur, Charles Dean, U S C.</td>
</tr>
<tr>
<td>9:30 am - 9:42 am</td>
<td>Contemporary Trends in Remote Sensing</td>
<td>JB Sharma, University of North Georgia</td>
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<tr>
<td>9:54 am - 10:06 am</td>
<td>Planning Instruction through Students’ Reflections: Action Research</td>
<td>Ozden Sengul, Renee S. Schwartz, Georgia State University</td>
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</tbody>
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### Contributed Talks - Session B  
**10:45 am - 12:33 am**

<table>
<thead>
<tr>
<th>Time</th>
<th>Title</th>
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<tbody>
<tr>
<td>10:45 am - 10:57 am</td>
<td>A Standardization for Numerical Information &amp; The Identification of Dominant Structures in the Numerical Universe</td>
<td>Joseph E. Johnson, USC Columbia</td>
</tr>
<tr>
<td>10:57 am - 11:09 am</td>
<td>Clickers using mobile phone</td>
<td>Alexis Nduwimana, Georgia Perimeter College</td>
</tr>
<tr>
<td>11:09 am – 11:21 pm</td>
<td>The Effect of Laboratory Reform on Students’ Learning and Attitudes</td>
<td>Zeynep Topdemir, David N. Trusty, Brian D. Thoms, Georgia State University</td>
</tr>
<tr>
<td>11:21 pm – 11:33 pm</td>
<td>Quick Quiz Feedback Alternative</td>
<td>Ashley August, Georgia Southern University</td>
</tr>
<tr>
<td>11:33 pm – 11:45 pm</td>
<td>Integrating computation into physics -- A preview of exciting things to come</td>
<td>Larry Engelhardt, Francis Marion University</td>
</tr>
<tr>
<td>11:45 pm – 11:57 pm</td>
<td>Mechanical Equilibrium</td>
<td>D.G.S.P. Doluweera, Brian D. Thoms, Georgia State University</td>
</tr>
<tr>
<td>11:57 pm – 12:09 pm</td>
<td>A New Introductory Physics for Life Sciences Course</td>
<td>Louis Keiner, Teresa Burns, Coastal Carolina University</td>
</tr>
<tr>
<td>12:09 pm – 12:21 pm</td>
<td>Integrating teaching and research – a high-impact teaching and learning strategy</td>
<td>Sorinel Oprisan, Ana Oprisan, College of Charleston</td>
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</table>

12:40 pm – 1:30 pm  
Lunch & Second Poster Session  
Hallways of Grimsley Hall.

1:30 pm – 2:00 pm  
SACS-AAPT Information Meeting  
Copeland Auditorium.
Posters

P.1 Direct Imaging of Non-Equilibrium Fluctuations of Nanocolloids in the Presence of Magnetic Field
Ashley Rice, Ana Oprisan, College of Charleston

P.2 Response of class 1 excitable cells to current pulses
Lincoln Fraley, Sorinel A Oprisan, Ana Oprisan, College of Charleston

P.3 Response of class 2 excitable cells to current pulses
Dave Austin, Lindsay M. Evans, Sorinel A. Oprisan, College of Charleston

P.4 MetaNumber - A Standardization of Numerical Information Author
Joseph E. Johnson, University of South Carolina

P.5 Enhancing Diversity in Physics Teacher Preparation through the Georgia State University PhysTEC Project
Brian Thoms, Joshua Von Korff, Sumith Doluweera, Georgia State University

P.6 Singlet Oxygen Quantum Yield of Gold Nanorods
Miranda Roesing, Linda Jones, College of Charleston

P.7 Penetration of near infrared laser light through various fabrics, wraps, and bandages
Ashley Gartner, Linda R. Jones, College of Charleston

P.8 Studies of FCAVT uvby Photometry of mCP Stars with Period04
Saul J. Adelman, The Citadel, Robert J. Dukes, College of Charleston

P.9 A studio physics class model for science teachers
Ana Oprisan, Sorinel Oprisan, College of Charleston

P.10 Expression, purification and crystallization of Mycobacterium tuberculosis Penicillin-Binding protein 3 and challenges for its structure determination.
Alena Fedarovich, The Citadel (former MUSC), Dzmitry Fedarovich, MUSC, Robert Nicholas, UNC at Chapel Hill, Christopher Davies, MUSC

P.11 Testing Athletic Mouthguards

P.12 Aerodynamics of Simple Structures
Joel C. Berlinghieri, Marc Eteve, and Sam Long, The Citadel.

P.13 Measurement of Model of Hadley Cell
Joel C. Berlinghieri and Shane Haydon, The Citadel.

P.14 The Atsa 1 Camera: Engineering Pathfinder for the Atsa Suborbital Observatory

P.15 Abundances of High-Energy Iron and Oxygen in the Interplanetary Medium during Solar Events

Post Deadline Posters

P16.

P17.

P18.

P19.

P20.

Workshops 2:00 pm - 4:30 pm

W.1 Room 241, Grimsley Hall
Using the AAPT High School Physics Photo Contest Photos in an Introductory Lesson
Frank Lock, Georgia State University

W.2 Room 221, Grimsley Hall
A Standardization for Numerical Information & The Identification of Dominant Structures in the Numerical Universe
Joseph E. Johnson, University of South Carolina

W.3 Room 211, Grimsley Hall
Laboratory Experiments using Modified PASCO Instrumentation
Joel C. Berlinghieri, The Citadel
The Atsa Suborbital Observatory: Using New Technologies to Enable a Low-Cost Space-Based Astronomy


Coffee Break & First Poster Session 10:30 am – 10:45 am
Hallways of Grimsley Hall.
B.1 10:45 am - 10:57 am
A Standardization for a Numerical Information & The Identification of Dominant Structures in the Numerical Universe
Joseph E. Johnson, USC Columbia SC 29208
Numerical values are ill-defined without their dimensional units, accuracy level, and defining metadata. But standards are lacking for the encoding of each of these three properties. We have constructed a Python coded environment that provides an optimal standardization of each of these three attributes which integrates them with the value itself, so that every number comes in a "metanumber" object – a universal standard for all numerical data (www.metanumber.com). All dimensional error analysis is automatically performed, and all computations are tracked allowing reuse of results, supporting AI, Big Data, and automated data exchange. Then with a novel process using Lie algebras and Markov type groups, each table is converted into two mathematical networks, among the entities and among the properties, from which the dominant clusters are extracted using our novel agnostic cluster identification algorithm. These networks are then linked into a superpet spanning all numeric information. If this standard were to be adapted, then from the birth of a number in a sensor or observation, numbers would subsequently inherit the units, accuracy, and defining metadata with automatic metanumber standardization throughout their evolution in the "universe of numerical information".

B.2 10:57 am - 11:09 am
Clickers using mobile phone
Alexis Nduwimana, Georgia Perimeter College
Clickers have been used for several years to engage students in the classroom. In order to use them, students have to spend money to buy them in addition to the cost of tuition and textbook. Today, almost every college student has a mobile device that can be used as a clicker at no additional cost to student. In this presentation, I will share my success using Socrative system with mobile device and I will show how it is easy to use.

B.3 11:09 am – 11:21 pm
The Effect of Laboratory Reform on Students' Learning and Attitudes
Zeynep Topdemir, David N. Trusty, Brian D. Thoms, Georgia State University
The Physics Education Group at Georgia State University has reformed the laboratory portion of the calculus-based introductory physics courses in order to improve students' understanding. Traditional verification-based three-hour experiments were converted to one-hour tutorial and two-hour inquiry-based experiments. In the first hour, the University of Washington Tutorials are led by undergraduate Learning Assistants with the assistance of graduate Teaching Assistants (TAs). In the remaining two hours, inquiry-based experiments are led by TAs with the main goal of improved conceptual understanding. In this study we have measured changes in both students' attitudes and in their conceptual understanding as a result of the redesigned labs.

B.4 11:21 pm – 11:33 pm
Quick Quiz Feedback Alternative
Ashley August, Georgia Southern University
After students take a quiz they must wait for their professor to grade it to get feedback. This can take days upon which students may forget the mistakes they have made. Utilizing a studio classroom style classroom structure, instructors predict the quiz again once the students were given a chance to get feedback. This forced the timeline was shortened. Both quizzes, individual and learning team, were graded with the majority of learning teams attaining a score of thirty-two percent higher than their individual scores. Overall, quiz feedback time was shortened and student-centered learning caused a thirty-two percent gain in score.

B.5 11:33 pm– 11:45 pm
Integrating computation into physics -- A preview of exciting things to come
Larry Engelhardt, Francis Marion University
Almost everyone agrees that computational skills are important, especially for students graduating with physics degrees. However, there are a variety of barriers that prevent faculty from integrating computation into their physics courses. The "Partnership for Integration of Computation into Undergraduate Physics" (PICUP) is an organization that is seeking to lower those barriers. In the coming years, PICUP will be developing computational materials, conducting workshops, and providing online support to give a preview of these exciting activities. This work is supported by the National Science Foundation under DUE IUSE grants 1524128, 1524493, 1524963, 1525062, and 1525525.

B.6 11:45 pm– 11:57 pm
Mechanical Equilibrium
D.G.S.P. Doloweera, Brian D. Thoms, Georgia State University
As a comprehensive PhysTEC site, GSU has undertaken a reform of calculus-based introductory physics. As part of this reform, an inquiry based experiment was developed to enhance students' conceptual understanding of mechanical equilibrium. The experiment is an extension to the well-known force table experiment to include calculation of net torque in addition to forces. The basic idea of the experiment is not new to many of physics community since it has been around as a traditional experiment. In the experiment, four or five different 2D forces are applied to a horizontal aluminum plate at different points via strings attached to weights. The aluminum plate is made to rest on three ball bearings placed on a base plate, which is placed on the force table. The equilibrium of the aluminum plate is reached by adjusting weights and directions of forces. Design considerations, the experiment and student responses are discussed.

B.7 11:57 pm – 12:09 pm
A New Introductory Physics for Life Sciences Course
Louis Keiner, Teresa Burns, Coastal Carolina University
Recently, in order to better serve the majors of the life sciences (Biology and Exercise and Sports Science), the Physics Program decided to develop a dedicated introductory sequence for these majors, Introductory Physics for Life Sciences (IPLS). While the existing introductory sequence does prepare students for the current MCAT, upcoming changes in that exam and changes in the nature of Biology as a whole necessitated a new look at the content that was being taught to these majors. There are currently several high-profile IPLS courses being developed around the country, but none completely matched the focus and content that we needed for our students. We have therefore developed this new sequence with inputs from many sources while working with the faculty of the life sciences departments. It will include several topics that are not covered in the traditional introductory physics sequence, and will reduce or eliminate several topics that are of little use to life science majors. This presentation will include explanations of the scope, coverage and challenges in creating this new IPLS sequence.

B.8 12:09 pm – 12:21 pm
Integrating teaching and research – a high-impact teaching and learning strategy
Sorinel Oprisan, Ana Oprisan, College of Charleston
Integrating teaching and research in undergraduate curriculum has multiple benefits: (1) allow students to immediately apply theoretical knowledge to solving practical problems, (2) gives students a better understanding of scientific method and the methodology of defining and testing research hypothesis, (3) and provide job-related training. There are two main approaches to integrating teaching and research for undergraduates: (1) on-one-one interaction between faculty and student during a summer research project/internship, and (2) course-based high-impact, integrated research experience. While the first option has been traditionally used to engage highly motivated students (1) it can only reach a very small fraction of the student population and (2) provides a very heterogeneous experience. Integrating teaching and research in a high-impact, research-oriented, learning experience has the potential of reaching out a larger number of students.Due to the breadth of prerequisites for interdisciplinary courses the success of such approaches rely on using new teaching strategies, such as integrating teaching and research. In our biophysics course, we introduced interdisciplinary research projects and assignments in physics and biology undergraduates with complementary backgrounds to facilitate discovery and learning. We showcase a few high-impact class projects that enhance teamwork and effective collaboration.

B.9 12:21 pm – 12:33 pm
Planning Instruction through Students’ Reflections: Action Research
Ozden Sengul, Renee S. Schwartz, Georgia State University
This action research study examines implementation of an alternative approach to teaching and learning practices in an undergraduate physics laboratory in an urban university. Instructor-as-researcher, plans, observes, acts, and reflects on teaching and learning processes by incorporating the SE instructional model. The main purpose of this study is to explore how the SE model can be incorporated into lesson planning for three-hour laboratory instruction as a way to enhance the effectiveness of teaching practices. Data includes lesson plans, post/pre post reflective journal of the instructor and students’ reflective journals. In this particular study, we will report how students’ reflections on the instructional strategies help the instructor receive information from students on their learning experiences and re-plan the instruction.
Posters

P.1 Direct Imaging of Non-Equilibrium Fluctuations of Nanocolloids in the Presence of Magnetic Field
Ashley Rice, Ana Oprisan, College of Charleston

Nanoparticles of iron oxide have a high surface area and can be controlled by an external magnetic field. Since they have a fast response to the applied magnetic field, these systems have been used for numerous in vivo applications, such as MRI contrast enhancement, tissue repair, immunocassay, detoxification of biological fluids, hyperthermia, drug delivery, and cell separation. In order to investigate the concentration-driven fluctuations using magnetic nanoparticles in the absence and in the presence of magnetic field. Exp. 1: free diffusion, Exp. 2: magnetic field and uniformly concentrated cell, Exp. 3: magnetic field and concentration gradient. Our direct imaging experimental setup involved a glass cell filled with magnetic nanocolloidal suspension and water with the concentration gradient oriented against the gravitational field and a superluminescent diode (SLD) as the light source. Nonequilibrium concentration-driven fluctuations were recorded using a direct imaging technique. We used a dynamic structure factor algorithm for image processing in order to compute the structure factor and to find the power law exponents. We saw evidence of large concentration fluctuations and permanent magnetism. Further research will use the correlation time to approximate the diffusion coefficient for the free diffusion experiment.

P.2 Response of class 1 excitable cells to current pulses
Lincoln Fraley, Sorinel A Oprisan, Ana Oprisan, College of Charleston

We performed non-equilibrium free-diffusion experiments to investigate thermo-mechanical properties of nanocolloids in concentration-induced fluctuations. Specifically, continuous video recordings of concentration fluctuations in 100 nm silver nanocolloids at 4.375, 8.75, 17.5, 25, and 50% concentrations were analyzed using a dynamic light scattering algorithm (DLSA). We found that the structure factor has a very large slope, which indicates giant concentration fluctuations. The DLSA allowed us to also measure the correlation time of fluctuations, which determines the diffusion coefficient.

P.3 Response of class 2 excitable cells to current pulses
Dave Austin, Lindsay M. Evans, Sorinel A. Oprisan, College of Charleston

Neurons have mechanisms that allows them to respond and adapt to environmental stimuli. One of these mechanisms allows changing their firing rate in response to external stimuli. The relationship between the external stimulus timing and the change in the firing rate of the neuron is called a phase resetting curve (PRC). We investigated numerically the scaling pattern for the PRC across different frequencies of neural oscillators and different amplitudes and durations for the stimuli using class 2 excitable cells.

P.4 MetaNumber - A Standardization of Numerical Information Author
Joseph E. Johnson, University of South Carolina

Numerical values are ill-defined without their dimensional units, accuracy level, and defining metadata. But standards are lacking for the encoding of each of these three properties. We have constructed a Python coded environment that provides an optimal standardization of each of these three attributes which integrates them with the value itself, so that every number comes with its units, uncertainty, and the exact meaning collectively attached in a “metanumber” object – a universal standard for all numerical values (www.metanumber.com). All dimensional & error analysis is automatically performed, and all computations are tracked allowing reuse of results supporting AI, Big Data, and automated data exchange. Then with a novel process using Lie algebras and Markov type groups, each table is converted into two mathematical networks, among the entities and among the properties, from which the dominant clusters are extracted using our novel agnostic cluster identification algorithm. These networks are then linked into a supernet spanning all numeric information. If this standard were to be adapted, then from the birth of a number in a sensor or observation, numbers would subsequently inherit the units, accuracy, and defining metadata with automatic metanumber standardization throughout their evolution in the “universe of numerical information”.

P.5 Enhancing Diversity in Physics Teacher Preparation through the Georgia State University PhysTEC Project
Brian Thoms, Joshua Von Korff, Sumith Duluweera, Georgia State University

As a PhysTEC comprehensive site in the third year of a three year grant, the Georgia State University team is working to develop an effective model of physics teacher recruitment and development at a diverse, urban research university. One of our goals is to prepare and support more physics teachers from under-represented minority groups. In addition to creating a well-qualified physics teacher work force in the Atlanta area, this also creates role models and mentors for a diverse high school student population to inspire them toward careers in science and engineering (and maybe even physics teaching). Recent efforts to build a thriving physics program with increased minority student success have established a more diverse physics teacher force. Our PhysTEC project attempts to use our teacher-in-residence, learning assistants, and recruiting to bring more diverse students into physics teaching.

P.6 Singlet Oxygen Quantum Yield of Gold Nanorods
Miranda Roesing, Linda Jones, College of Charleston

There has been a recent increase of interest in the photosensitizing properties of noble metal nanoparticles for biomedical research, particularly in the application for photodynamic therapy (PDT). Gold nanoparticles are promising in PDT, as they have been found to be biocompatible and stable. The singlet oxygen (102) production by gold nanorods (Au NRs) with an aspect ratio of 4.1 was detected by monitoring the decomposition of singlet oxygen probe 1,3-diphenylisobenzofuran (DPBF). DPBF undergoes a singlet oxygen-dependent formation upon interaction with singlet oxygen, causing the dye to decrease in peak absorbance at 410 nm. Methylene blue (MB) was used as a standard photosensitizer, and the ratio of DPBF decomposition due to Au NRs and DPBF in the dark indicated a slight decrease in absorbance of DPBF at 410 nm. This decrease was accounted for in the calculation of the &delta;#934;#937;#916; The Au NR and DPBF solution were then irradiated with an 800 nm laser and the average &delta;#934;#937;#916; obtained was 0.151 (±0.045). Future investigation of nanoparticles composed of silver or graphene for their photosensitizing properties would be beneficial in the search for highly effective photosensitizing materials in modern PDT.

P.7 Penetration of near infrared laser light through various fabrics, wraps, and bandages
Ashley Gartner, Linda R. Jones, College of Charleston

Therapeutic shared lasers are used to promote wound healing and to treat dermatitis, inflammation and pain. We measured the transmittance of NIR laser light through various materials to determine whether the laser can be used effectively through clothing or bandages. The light source was a Class IV K-Laser Cube 4 delivering 660, 800, 905 and 980 nm. Transmittance and reflectance of laser light through the materials was measured with an integrating sphere spectrophotometer. Accuracy of the system was verified with a solution of 20% Intralipid. Twelve common fabrics were tested with the integrating sphere and it was found that weave had an effect upon the transmittance. Results for various bandages and wraps showed that a therapeutic light dose might be possible when laser treated through certain fabrics, but the transmittance ranging from 0 to 97%.

P.8 Studies of FCAPT uvby Photometry of mCP Stars with Period04
Saul J. Adelman, The Citadel, Robert J. Dukes, College of Charleston

We present differential Strömgren uvby observations of a few magnetic Chemically Peculiar (mCP) Stars from the Four College Automated Photometric Telescope to illustrate some interesting results found using Period04. Without an observer monitoring the weather, quality control depends on a several part process of closely inspecting the data. For each star we found a preliminary rotation period from the periodograms of the 4 filters and then used the accompanying non-linear least square tool to refine it. Next we repeated the analysis on the residuals from the fit to determine other periods. Usually we found the higher harmonics for those stars with non-stellar light. Sometimes there were two low frequency terms. These high quality datasets usually have a greater number of yearly values obtained over more observing seasons than published studies. Strömgren intermediate bandwidth filters have mean wavelengths of 42500 for u, 44400 for v, 46500 for b, and 45700 for y with halfwidths of 300, 190, 180, and 230 Angstroms, respectively. The v and y values are often affected by broad, continuum features centered near 44200 and 45200. Studioparallel interesting results include a very interesting smallest amplitude period 5797 whose v variable and an apparent period one half the period derived from the other filters, and HD 49713 whose periodogram shows strong power up to the third harmonic in conformity with this very asymmetric light curve as well as a possible low frequency term.
P.9 A studio physics class model for science teachers
Ana Oprisan, Sorinel Oprisan, College of Charleston

The College of Charleston offers an interdisciplinary Master of Education in Science and Math for Teachers Program. We reorganized the traditional lecture and lab of physical science section of SMFT program by converting all classes to studio courses. This change was in part prompted by staffing constrains and the necessity to reduce the number of contact hours from six to three. Using studio physics approach allowed us to maintain high-quality learning experience need by pre-service teachers. In all SMFT studio physics classes, we integrate lecture with hands-on, laboratory format, activities. Through carefully balancing lecture time, problem solving, and hands-on activities, we succeeded in strengthening conceptual understanding, sharpening problem solving skills, and enhancing experimental skills. Among other active learning methods, we use reading assignments, a technology-enhanced learning environment, and collaborative group work. The main advantage of our SMFT studio physics is that it facilitates a high level of faculty-student interaction.

P10 Expression, purification and crystallization of Mycobacterium tuberculosis Penicillin-Binding protein 3 and challenges for its structure determination.
Alena Fedarovich, The Citadel (former MUSC), Dmitry Fedarovich, MUSC, Robert Nicholas, UNC at Chapel Hill, Christopher Davies, and MUSC

Tuberculosis is one of the leading causes of death in the world from infectious disease and its incidence is increasing. Considering the growing problem of multidrug-resistant tuberculosis, there is the urgent need to develop new therapeutic strategies against this pathogen. An important area of application of physics, the high-resolution macromolecular X-ray crystallography, is one of the powerful techniques used in structural biology. After the first high-resolution 3-D protein structure was solved in 1988 more than 90,000 protein structures were determined revealing or predicting molecular mechanisms of many biological processes. In our study we have been using X-ray crystallography and other biophysical methods to evaluate structure-function of a Penicillin-Binding protein 3 (PBPA) from Mycobacterium tuberculosis as a potential drug target. Challenges in PBPA structure determination are described.

P11 Testing Athletic Mouthguards

We are developing a testing protocol for commercially available mouth guards to determine the efficacy of materials and designs. We are using a pendulum that has been instrumented to measure the motion and forces that arise when the pendulum strikes mouth guard-protected cast model teeth.

P12 Aerodynamics of Simple Structures
Joel C. Berlinghieri, Marc Eteve, and Sam Long, The Citadel.

A wind tunnel can be used to investigate the aerodynamic characteristics of simple shaped objects. Undergraduate physics majors, for their senior research requirement, investigated the lift, drag, and turbulence produced by blunt-shaped objects. Blunt shapes are of particular interest in designing radar evading aircraft; are usually aerodynamically unstable; and are often difficult to fly, requiring computer assistance. Measurements were made at low speeds where incompressible flow can be assured. Models were fashioned from simple but robust materials such as plastic and heavy card stock using printed patents. Also models were printed using 3D printing and ABS plastic.

P13 Measurement of Model of Hadley Cell
Joel C. Berlinghieri and Shane Haydon, The Citadel.

The mechanism for the transport of thermal energy through the atmosphere is characterized by three circulation cells, the Hadley, the Midlatitude Ferrel, and the Polar. The Hadley cell which occurs in the equatorial region is based on three main assumptions; the atmospheric circulation is constant, angular momentum is conserved, and ground level return air is subjected to dissipative forces. The forces generated by equatorial thermal gradients initiate the movement of air in the cell. The uplift forces were measured in a simplified model of a convection cell using a high-resolution PASCO force transducer.

P14 The Atsa 1 Camera: Engineering Pathfinder for the Atsa Suborbital Observatory

As part of a larger study of the charge states of energetic ions produced in impulsive solar events, we are studying fluxes of Iron (Fe) and Oxygen (O) ions at energies of 10 - 100 MeV/nuc. Our data comes from the Solar Isotope Spectrometer (SIS) aboard the Advanced Composition Explorer (ACE) satellite. We identify individual events from the temporal record and compute energy spectra for both Fe and O; we also calculate Fe/O flux ratios at several energies. Preliminary results show surprising event-to-event variability in the Fe/O ratio.

Workshops 2:00 pm - 4:30 pm

W.1 Room 221
Using the AAPT High School Physics Photo Contest Photos in an Introductory Lesson
Frank Lock, Georgia State University

Files of the winning entries to the AAPT High School Physics Photo contest from 1998 through 2015 are available on the AAPT website (http://aapt.org/Programs/contests/photocontest.cfm) This workshop will introduce how these photos can be used in introductory lessons in your high school course or in a university first course in physics.

W.2 Room 231
A Standardization for Numerical Information & The Identification of Dominant Structures in the Numerical Universe
Joseph E. Johnson, University of South Carolina

This workshop will demonstrate the MetaNumber software we have developed that is based on a standardization for numerical information that joins the units of measurement, numerical uncertainty, and defining metadata to the value itself. The cloud based system (www.metanumber.com) manages all computations with dimensional analysis, computation of resulting uncertainty and other aspects of metadata structures. More information is available on the “Resources” tab at the above web site. Applications to both teaching and research will be discussed.

W.3 Room 211
Laboratory Experiments using Modified Pasco Instrumentation
Joel C. Berlinghieri, The Citadel

The introductory physics laboratory courses for technical-majors at The Citadel use sensors, computers with Excel and Capstone, and modified PASCO equipment to perform a few standard experiments with enhanced capabilities. This workshop willallow participants to perform these experiments, receive write-ups with pictures of set-ups. Period of a Simple Pendulum including Amplitude Variation. Temperature Coefficient of Expansion as Function of Temperature, Power and Energy Measurements of Faraday’s Law. Net Buoyant Forces of Wide Range of Object Densities.