Spring 2017 Joint Meeting of the Texas Section of AAPT, Texas Section of APS, and Zone 13 of the Society of Physics Students
San Antonio, Texas
http://meetings.aps.org/Meeting/TSS17/
Thursday, March 9, 2017 6:00PM - 9:00PM –
Session S1 SPS Get Together  Chance Academic Center 204 MESA Room - Toni Sauncy, Texas Lutheran University

6:00PM S1.00001 SPS Get Together –

Thursday, March 9, 2017 7:00PM - 8:45PM –
Session T1 Texas Section AAPT Council Meeting  Oppenheimer OC 108 - Andra Petrean, Austin College

7:00PM T1.00001 AAPT Council Meeting –

Thursday, March 9, 2017 7:00PM - 8:45PM –
Session T2 Texas Section APS Council Meeting  Oppenheimer OC 110 - Jodi Cooley, Southern Methodist University

7:00PM T2.00001 APS Council Meeting –

Thursday, March 9, 2017 8:45PM - 9:30PM –
Session T3 Joint Council Meeting  Oppenheimer OC 110 - Andra Petrean, Austin College

8:45PM T3.00001 Joint Council Meeting –

Friday, March 10, 2017 8:15AM - 9:37AM –
Session A1 Plenary Session I  McAllister Auditorium Auditorium - William Waggoner, San Antonio College

8:15AM A1.00001 Welcome –

8:25AM A1.00002 Plenary: The Modern Professor’s Teaching Toolkit TIMOTHY SLATER, University of Wyoming — University professors start each new year with increasingly diverse groups of undergraduate students populating their introductory science survey courses. By and large, the current cadre of faculty teachers fully understand the value and importance of having a wide diversity of students who understand and contribute to the scientific enterprise; yet, few professors have had the opportunity to learn how to best teach the quickly broadening range of contemporary student audiences in multi-cultural classrooms. Successfully teaching an ever-increasing diversity of students requires professors to have a flexible toolkit of various teaching strategies. Today’s professors need to be able to do far more than deliver information accurately with illustrations to their students. Instead, professors need to be able to also manage two-way interactions with students through real-time questioning and providing multiple, alternate representations of ideas. Strategies based on students voting on question choices and completing collaborative group activities during class is one approach. Another approach is to use in-class time for students to do research projects while allocating outside of class time to reading and listening to Internet-delivered lectures. Today’s professors need wide variety of strategies at the ready to be able to help all students learn.

9:01AM A1.00003 Plenary: Physics and Music  , GORDON RAMSEY, Loyola University - Chicago — I will trace a typical work of music from composition to emotional reaction. It starts with the printed page as a reflection of the composer’s ideas and goes through the stages of, the artist’s interpretation and performance, the technical aspects of instruments generating the sound waves, the physiological perception by the audience and culminating with an emotional reaction. The technical aspects of creating sound will be illustrated by recent research in a comparative study of stringed instruments. This presentation will address what goes into the production and performance of the sound resulting in an emotion of the audience.

Friday, March 10, 2017 9:45AM - 10:05AM –
Session FB1 Coffee Break I  Oppenheimer Foyer - Tak Gurung, San Antonio College

9:45AM FB1.00001 Coffee Break –

Friday, March 10, 2017 10:00AM - 11:48AM –
Session B1 AAPT: Computational Physics and Others  Oppenheimer OC 108 - Paul Williams, Austin Community College
10:00AM B1.00001 Who Needs Computation in Undergraduate Physics Courses? , NORMAN CHONACKY, Yale University — In recent years computation has significantly shaped science and engineering practices. Research and development in the professional sciences and engineering have adopted this “three legged” approach at “warp speed” amid breath taking achievements. But with few exceptions, computation has not yet been integrated with theory and experiment across undergraduate curricula. This suggests that the transition process is either very difficult or not a high priority. Physics faculty have traditionally been responsible for designing the physics curriculum in this country. The AAPT SPINUP study found that undergraduate curricula – standard offerings, topics, and their arrangement in the courses – are highly standardized among American colleges and universities, despite a lack of external standards. This implies that agreement on content among undergraduate physics instructors is quite uniform, even if their pedagogy is not. Faculty are the key to breaching this uniformity. This talk describes a path for transition based upon survey findings of the American Institute of Physics (AIP). That study stimulated the Partnership for Integration of Computation into Undergraduate Physics (PICUP) to develop a framework for faculty development learning to use computation in their courses. Now, with the support of the NSF and the AAPT, PICUP projects are underway to carry out this work in supportive and collaborative environments. Faculty and students need this.

10:24AM B1.00002 Using Glowscript in the Introductory Physics Laboratory, THOMAS O’KUMA, Lee College — During the past several years, I have used VPython (http://vpython.org) to perform certain mechanics and electricity and magnetism laboratory activities in my calculus-based courses. Starting fall 2016, I have switched these activities to Glowscript (http://www.glowscript.org). In this presentation, I will discuss what I am currently doing in these laboratory courses, some of the advantages in using Glowscript, and some student generated results.

10:36AM B1.00003 Implementing a visual programming editor for VPython1 , CODY BLAKENEY, MICHAEL DUBE, HUNTER CLOSE, AIMEE ROUNTREE, Texas State University — Programing skills are becoming increasingly more important in physics and other STEM fields. Existing tools for teaching physics and engineering using computational modeling, like VPython, can require students to already have a foundation of programming, thus narrowing students learning opportunities. Block programming with visual environments like Blockly provides a way to engage learners with algorithmic thinking without extensive pre-requisite knowledge of keywords, functions, and syntax. It has also been observed to have various benefits for beginning programmers. We have created a prototype for a visual programming environment that allows students to create physics simulations utilizing the open source projects VPython and Blockly. This prototype is currently being imported into an existing website for teaching coding, and we hope to report on that process as well. We discuss lessons learned during development and initial user testing about the challenges of making a visual programming environment for physics simulations.

1Supported by the Office of Research Development at Texas State University

10:48AM B1.00004 Review of research on student learning of physics through computation , AARON COLLINS, HUNTER CLOSE, Texas State University — "Programming is everything." According to the recent Joint Task Force on Undergraduate Physics Programs report "Phys21: Preparing Physics Students for 21st Century Careers", the most common thing that physics graduates entering the STEM workforce say they wish they could have learned is programming. The growing PICUP (http://www.compadre.org/PICUP/index.cfm) movement in physics instruction is expanding both the opportunities and the need for physics education research focusing on student learning of computation. New research should be grounded in existing literature on student learning in computer science. We review studies to understand the state of teacher professional development in the area, visual programming environments, and student learning of computational concepts. In particular, we look at research on Scratch and VPython environments and idea-mapping as a method of assessing computational thinking.

11:00AM B1.00005 Introductory Physics Labs – Using ‘smart phones’ to engage students , TONI SAUNCY1, Texas Lutheran University — While cell phones are sometimes an unwanted distraction, new applications that access the multiple sensors on these common devices make them useful laboratory tools. Students in freshman physics labs have been encouraged to find new ways that smart phone functions and applications can be used in the design and execution of lab experiments. Several examples for both the intro mechanics and intro E&M labs will be discussed.

1Must be scheduled on Friday.

11:12AM B1.00006 Making In-House Videos for Lab Instruction , LIONEL HEWETT, Texas AM University-Kingsville — It is often impossible to schedule physics laboratory experiments to coincide with the lectures that cover the same material. As a result, students often enter the laboratories completely unfamiliar with both the laboratory topic and the experimental equipment. Sometimes these deficiencies are also true for the student teaching assistants who help manage the laboratory sessions. Preparing these students for performing the experiments can consume considerable amounts of repetitive time from our departmental faculty. In order to reduce this teaching load, we have begun preparing short demonstration video for each lab. To reduce the costs and speed up turn-around time, we have chosen to prepare the videos in-house. This talk outlines our procedure for making such videos, discusses our experience so far, and shows some sample videos of what we have accomplished.

11:24AM B1.00007 A Tale of Two Slinkies: Learning about Model Building in a Student-Driven Classroom , CALVIN BERGGREN, Texas Lutheran University, PUNIT GANDHI, JESSE LIVEZEY, RYAN OLF, University of California, Berkeley — We describe a set of conceptual activities and hands-on experiments based around understanding the dynamics of a slinky that is hung vertically and released from rest. The motion, or lack thereof, of the bottom of the slinky after the top is dropped sparks students’ curiosity by challenging their expectations and provides motivation and context for learning about scientific model building. This curriculum helps students learn about the model building process by giving them an opportunity to enlist their collective intellectual and creative resources to develop and explore two different physical models of the falling slinky system. By engaging with two different models, students not only have the opportunity to understand an intriguing phenomenon from multiple perspectives, but also learn deeper lessons about the nature of scientific understanding, the role of physical models, and the experience of doing science.

11:36AM B1.00008 How Much Does the Laboratory Component of Entry Level Physics Courses Affect the Lecture Component? , JOHN WINFREY, Retired — Suppose one were to ask a room full of Physics instructors: 1) What is/are the purpose(s) of Laboratories, 2) Do Laboratories have stand-alone goals or do they (in part) influence the Lectures, and 3) If you think Laboratories influence Lectures, how much? It is unlikely there would be much consensus. In this presentation, two examples are presented that show that there is a non-trivial influence of Laboratories on Lectures. The mechanism is conceptual understanding. Also presented: some examples of tuning old Labs into Millennial-generation Labs: bigger Bang for your Buck.
10:00AM B2.00001 Search for beyond the Standard Model Higgs boson decaying to a pair of new light bosons in boosted dimuon final states, SVEN DILDICK, TAMU, CMS COLLABORATION — Light bosons that couple weakly to Standard Model (SM) particles are predicted in several extensions of the SM. These extensions include supersymmetric (SUSY) models with hidden valleys (dark SUSY) or with extended Higgs sector (such as NMSSM). In these scenarios the new light bosons are produced in non-SM Higgs decays or in the cascade of SUSY particles. In dark SUSY the light bosons may also have a non-zero lifetime. If the dark bosons couple to muons this may result in displaced muons in the event signature. While exotic SM Higgs decays can hide in indirect searches, e.g. because the branching ratio is too small, direct searches for light bosons can provide a powerful alternative to understanding the nature of the SM Higgs boson. We present preliminary results at 13 TeV of a direct search for non-SM Higgs boson decays to a pair of new light bosons with boosted dimuons in the final state using the CMS detector.

10:12AM B2.00002 Resonant Di-Higgs Production in the $b\bar{b}W^+W^-$ channel with W lepton decays: Probing the Electroweak Phase Transition at the LHC, TAO HUANG, Texas AM — With the discovery of the Higgs boson at the LHC, exploring the thermal history associated with electroweak symmetry-breaking (EWSB) has taken on heightened interest. The process of EWSB in the early Universe, the electroweak phase transition, provides conditions able to explain the observed cosmic matter-antimatter asymmetry if the transition were of first order and sufficiently strong. The prospects for resonant di-Higgs production searches at LHC, in the context of probing the electroweak phase transition, will be presented. We explore the sensitivity of the $b\bar{b}W^+W^-$ channel, with W lepton decays. The presence of neutrinos in the final state do not allow the reconstruction of the invariant mass of the heavy scalar, diminishing the sensitivity of this channel. We present a novel technique, called High Mass Estimator (HME), that allows to fully reconstruct the kinematic of the process, and therefore to reconstruct the heavy Higgs invariant mass. We prove that, with HME technique, the statistical sensitivity can be achieved in the same or even better performances than current Higgs channels, leading to a potential discovery of resonant di-Higgs production with the datasets accumulated in High Luminosity phase of LHC, foreseen in 2035.

10:24AM B2.00003 Distinguishing Standard Model Extensions using Monopost Chirality, IAN TAUILLI, TERUKI KAMON, RYAN MUELLER, Texas AM University — Many theories beyond the standard model of particle physics may produce top quarks with a specific chirality, either left-handed (LH) or right-handedness (RH). The handedness can be reflected in several kinematical distributions of the decay products of the top quark. We suggest a ratio of the bottom-quark energy to the top-quark energy, to examine the chirality. Monte Carlo simulations were performed to evaluate what would happen at the LHC if there exists a heavy color-triplet scalar mediator that decays into either a LH or RH top quark along with a dark matter particle. In the hadronic decay mode of the top quark, followed by hadronic decays of the simulation shows that the handedness of the model can be discerned to a high degree of accuracy by studying the shape of the distribution. If new models of particle physics preferentially produce a top quark of a specific chirality then they can be investigated at the LHC, providing a robust test of the standard model.

10:36AM B2.00004 Dynamics of Particles in the Early Universe at High Temperature, SAMINA MASOOD, University of Houston Clear Lake — We study the electromagnetic properties of particles in the early universe and show that electromagnetic properties of the system become explicit functions of temperature for such systems. Parameters of the system such as dielectric constant, magnetic reluctivity, Debye length and the plasma frequency are expressed as a function of temperature in the early universe. Renormalization techniques of QED are used to determine the collective behavior of the medium. We compute propagation speed, refractive index, plasma frequency and Debye shielding length of a QED plasma at extremely high temperatures in the early universe.

10:48AM B2.00005 Planck Constraint on Relic Primordial Black Holes, STEVEN CLARK, Texas AM University, College Station — Recent detections by LIGO have shown evidence of black hole mergers in the galaxy. While current black hole formation is well understood, numerous works have investigated methods through which they could be created in the early universe. We investigate constraints on the abundance of these black holes known as primordial black holes (PBHs) in the mass range $10^{15} - 10^{17}$ g using data from the Cosmic Microwave Background (CMB) and extragalactic gamma-ray background (EGB). PBHs in this mass range emit energy through Hawking radiation which leaves an imprint on the CMB through modification of the ionization history and the damping of CMB anisotropies. Using a model for redshift dependent energy injection efficiencies, we show that a combination of temperature and polarization anisotropies, we can place constraints on the relic abundance of PBHs. The prospects for PBHs as a dark matter candidate in the early universe, their impact on the thermal history, and their influence on the CMB and EGB will be discussed.

11:00AM B2.00006 Cosmological Signature In Light Mass Dark Matter Searches With Phonon Mediated Detectors, FEDJIA KADRIBASIC, None — We are presenting a method for using solid state detectors with directional sensitivity to Dark Matter interactions, which provides an excellent tool to discriminate for WIMPs originating from the galactic sources against the irreducible backgrounds including solar neutrinos. There is a large body of literature for high-mass WIMPs detectors with directional sensitivity, in particular those using low-pressure TPC detectors, but there is no available technique to cover WIMPs in the mass range < 500 MeV. We argue that very low temperature phonon-mediated semiconductor detectors, such as those developed for the future low-mass WIMPs search in SuperCDMS and beyond, also allow for directional sensitivity if properly calibrated. We find a signal to noise ratio for WIMPs of Mass < 1 GeV large enough to identify the direction of nuclear recoil from WIMP scattering. This provides, for the first time, a straightforward directional sensitivity for low-mass WIMP dark matter.

11:12AM B2.00007 The influence of dark energy on the expansion rate of the universe and its effects on dark matter relic abundance, ESTEBAN JIMENEZ MOYA, Texas AM University, College Station — The expansion rate of the universe has a strong influence on the origin of the dark matter abundance during the early stages of the universe's evolution, mainly prior to big-bang nucleosynthesis. Any departure of the expansion rate of the universe from the standard cosmological model during that time can modify the dark matter abundance. In this talk, I will explore the role played by a scalar field on the modification of the expansion rate of the universe arising from scalar-tensor theories of gravity coupled both conformally and disformally to matter, and also, I will show how these variations to the expansion rate would modify the dark matter content of the Universe.
Translational and angular accelerations measured inside a novel, physical model of a human head

Jacoby Moldenhauer, Stephen Slaughter, Cora Keil, Sydney McCloskey, Andrew Chang, James Frisby, University of Dallas — Studies of collisions occurring during concussive level events, such as in athletic competitions and training sessions consistently report translational and angular accelerations in correlation with concussions. In fact, more severe concussions seem to occur from relatively higher angular accelerations rather than higher translational accelerations. Currently, most measurements are recorded from devices placed externally on the head or inside the helmet of an athlete. We present results obtained from placing inertial measurement units (IMUs) inside a physical model of a human head, brain, and skin constructed from ballistic gel and other materials during concussive type collisions. We compare the translational and angular accelerations inside the head to those obtained outside the head in a consistent collision. While the translational accelerations are consistent within 1σ, \( a_{in} = 34.8 \pm 2.1 \, g \) and \( a_{out} = 29.2 \pm 4.1 \, g \), for inside and outside, respectively, the angular accelerations inside the head \( \alpha_{in} = 7545 \pm 1004 \, \text{rad/s}^2 \) consistently measure larger (more than 2σ) from those obtained outside the head, \( \alpha_{out} = 3235 \pm 1000 \, \text{rad/s}^2 \). This new data from inside a physical model of a head supports higher angular accelerations in more severe concussions.

1 Marcus Fund, Donald A. Cowan Physics Institute

Friday, March 10, 2017 10:00AM - 11:30AM — Session B3 AAPT: Workshop I - Implementing Small Group Learning Activities to Teach Astronomy

Chance Academic Center CAC 344 - Timothy Slater, University of Wyoming

Implementing Small Group Learning Activities to Teach Astronomy, TIMOTHY SLATER, University of Wyoming — In this participatory workshop participants will learn how to use a lecture-tutorial approach to actively engaging astronomy students. Created by faculty affiliated with the CAPER Center for Astronomy & Physics Education Research Team, lecture-tutorials are purposefully designed to support students’ intellectual engagement with challenging astronomy concepts by augmenting lectures for 10 minute intervals where students collaboratively wrestle with how to apply ideas in novel settings. Astronomy education research consistently demonstrates that students significantly increase their understanding of astronomy through the use of lecture-tutorials and that teachers find them easy to implement. Classroom-ready materials will be provided to all participants.

Friday, March 10, 2017 10:00AM - 11:30AM — Session B4 AAPT: Workshop II - The Origin of Modern Physics: Planck’s Constant

Chance Academic Center CAC 338 - Beverly Trina Cannon, Eastfield College

The Origin of Modern Physics – Planck’s Constant, TRINA CANNON, Eastfield College — This is the beginning of Modern Physics and all high school classes should include this simple experiment in the spring portion of their curriculum year. Participants will use 5 LED’s in a simple circuit to collect data. The data will be plotted to determine Planck’s constant. The participants will receive the LED's and pot switch to take with them. Additional packages with class sets (8 lab stations) of LEDs and Pot Switches will be available for purchase- $30.

Friday, March 10, 2017 10:00AM - 11:30AM — Session B5 AAPT: Workshop III - Easy to Grade Lab Practicals Using Google Forms

Chance Academic Center CAC 349 - Kenric Davies, Liberty High School

Easy to Grade Lab Practicals Using Google Forms, KENRIC DAVIES, CHRISTINE RITTENHOUSE, Liberty High School — Teachers know that sometimes the only way to learn physics is by doing physics. One of the problems this creates for teachers, however, is the extreme amounts of time spent on grading lab reports. This session will detail how you can perform lab practicals that test both students’ knowledge of physical concepts and calculation accuracy without the tediousness of lab reports using Google Forms that grade it all for you!
1:15PM C1.00001 AAPT Board Update . GORDON RAMSEY, Loyola University - Chicago — The American Association of Physics Teachers is participating in numerous projects that affect physics teaching at all levels. From teacher training to curriculum development to outreach programs for students and the general public, there is a tremendous involvement of the Board, staff and membership to conduct these activities. We are holding workshops at national meetings for grades 9-12 and two-year and four-year colleges. The plan is to extend this to outreach programs for grades 5-8 teachers. Our publications continue to be of high quality and of great use to physics educators around the world. Richard Price (MIT) has assumed the position of Editor of AJP, replacing David Jackson. Our challenge is to keep the journals' high quality, while generating appropriate revenue to keep them healthy. We plan to increase communication and exchanges with other worldwide physics education organizations. AAPT staff are updating our Web site to make the contents even more useful to the world of physics educators. We are continually adding material to COMPadre on the site, which has materials and information that are used by physics educators worldwide. I will outline some of the key projects in progress and some being proposed to affect physics education worldwide.

1:27PM C1.00002 UTeach Maker Physics1  . JILL MARSHALL, JASON HARRON, University of Texas, Austin — The Maker Movement, publicized by Make Magazine and Maker Faires now happening across the US, has begun to make inroads into STEM education. Maker Spaces, where students have access to technological tools and a safe environment in which to create, are appearing in many public schools and other locations accessible to teachers. A recent Noyce teacher preparation grant to the UTeach program at the University of Texas at Austin aims to investigate the effect of incorporating Makers into pre-service teacher education. I will report on the incorporation of a Maker strand into a class using the University of Washington Physics by Inquiry curriculum (McDermott et al., 1996). I used a project-developed framework and rubric to evaluate the Maker projects and will present a first look at the effect on student learning of optics and circuits.

1Supported by NSF Robert Noyce grant DUE 0630376

1:39PM C1.00003 Introductory Physics Students’ Epistemological Resources - Group Differences . ERIN SCANLON, Texas Lutheran University — A qualitative investigation was conducted to determine the epistemological resources (Hammer & Elby, 2001) employed by introductory physics students while solving mathematics and physics problems. Students enrolled in introductory, algebra-based physics were observed solving problems during the laboratory portion of the course as well as during one-on-one office hour sessions. The epistemological resources used and their associated usage patterns were investigated by analyzing transcripts of the students’ discussions. The epistemological resources were identified using emergent coding and by implementing an operationalized coding scheme from Jones (2015). Differences between students disaggregated by their mathematics and science prior experience were identified.

1:51PM C1.00004 Statistical Correlations between Introductory Physics and Performance in Engineering Courses . JONATHAN PERRY, WILLIAM BASSICHIS, TATIANA ERIKHIMOVA, Texas AM University — Introductory physics forms part of the foundation of knowledge for all engineering majors, independent of field, or institution. Instruction of introductory physics courses can vary greatly due to professor, textbook, and overall course design. Using academic records for more than 50,000 engineering majors over the past two decades, this work seeks to build an understanding of the statistical correlations between performance in introductory courses, specifically physics, and the follow-on engineering courses, overall GPA, retention, and matriculation rates. This work focuses specifically on variations in student performance based on whether their introductory physics credits were earns through high school credit, transfer credit from another institution, or completion of either of the two types of introductory physics offered at Texas A&M University.

2:03PM C1.00005 Longitudinal Visualizations of Testing Data . SARAH STEPHENS, University of Texas at Austin — Due to the substantial amount of standardized testing data collected, there is a need for accurate and coherent data visualization to determine longitudinal patterns in the data and the effectiveness of academic policy changes. Specifically, we would like to develop new methods to analyze the data set collected by the Texas Education Research Center. Building on the visualization techniques of Bendinelli, et al., we have developed a new visualization method, “modified streamlines”, that minimizes the effects of regression to the mean and can accurately predict student outcomes with only three years of data. The ability to anticipate the future performance of a group of students in just a few years will allow policy makers to infer the long-term outcomes of new policies in a reasonable time-frame.


2:15PM C1.00006 New Video Resource for Calculus-based Introductory Physics at TAMU . JONATHAN PERRY, WILLIAM BASSICHIS, TATIANA ERIKHIMOVA, Texas AM University — Use of videos as an additional component of education has been a continual rise in recent years. Video engagement as an instructional technique can be beneficial if the material is designed at an appropriate level, and presented in an accessible manner. Many existing, popular resources have content designed for algebra based courses, which are not suitable for STEM majors in calculus based introductory physics. This work consists of the development of a new set of online video resources being developed at Texas A&M University to exhibit the fundamental physical concepts, laws, and equations in a manner appropriate for calculus based physics courses at any institution, independent of textbook. Information about the development, deployment, and early analysis on the effectiveness of these videos modules will be presented for modules deployed during the fall term of 2016, and those modules deployed so far during the spring 2017 term.

2:27PM C1.00007 Teaching Teachers . EVAN RICHARDS, Lee College — Physical Science is a course that education majors at Lee College can take toward satisfying their required science electives. Recently, I decided to augment the course by integrating in elements of a survey on Physics Education Research reforms. After making such changes, interest in the course dramatically increased. In this talk, I’ll discuss these changes to the course.

2:39PM C1.00008 Lessons Learned from the Last 200 Planetarium Education Research Dissertations . TIMOTHY SLATER, University of Wyoming — The synthesis-oriented literature review is a ubiquitous component of any comprehensive science research program. Few scholars would argue against the notion that discipline-based astronomy education research studies need be firmly situated within the existing scholarly landscape in order to establish relevance and theoretical underpinnings. Yet, some well-meaning journal reviewers have proposed all references and citations should focus first on recent papers published within the last five years. Such a constraint is often welcomed by nascent researchers, as it dramatically limits the scope of literature that must be surveyed. At the same time, some reviewers admonish writers to focus only on peer-reviewed journal articles at the expense of looking at unpublished dissertations. Through the iSTAR international STudy of Astronomy education Research project at istardatabase.org, we have found more than 200 dissertations on planetarium education research from the last 100-years, which yield results largely unpublished in journals providing insight into longstanding planetarium education efforts.
behind their metastability remains unknown. In this SANS study conducted at the Institut Laue-Langevin, MgB$_2$...
Different size text files will be sent between the two modules to analyze the quickness of the process and their range of transmission. Software familiarization will allow for communication between the transmitter and receiver, which is vital for this testing phase.

EDGAR GARCIA, RODRIGO SANCHEZ, Stephen F. Austin State University (SPS Chapter 6874), DATA JACKS TEAM — A series of different tests will be applied to the product that will revolve around the satisfaction of the client. A transmission test will assure the capabilities of the system by using filters in order to eliminate wavelengths of light that lie on the outskirts of the detection range for our light sensor. In addition, we discuss the merits of performing the experiment in a gaseous environment that simulates the atmospheric conditions present on Earth, such as our nitrogen-rich environment.

1SPS Chapter Research Award for 2016

2:03PM C3.00003 Determining the Shape of Glowing Objects: Applications to Supernovae1, ZAKARY NOEL, SUZANNE WHEELER, GABRIANNA ESCAMILLA, DANIEL DOVE, CRISTIAN BAHRIM, Department of Physics, Lamar University — Our experiment aims to provide a methodology for determining the shape of a glowing object using polarimetric measurements. We propose a simple, but reliable, tabletop setup, which includes a polarizer/ analyzer pair for light analysis located between a black body radiator and a light sensor. Polygons of different shapes are imaged on a glowing cavity which characterizes the shape of a glowing object. We have determined that a comparison between the experimental ratios of normalized probe signals to control (circular) signals based on area coverage of the polygon can lead to the identification of the aperture’s shape. The overall perceived intensity of the detected light depends on the sensitivity of the photo-detector; therefore, we plan to improve our well calibrated system by using filters in order to eliminate wavelengths of light that lie on the outskirts of the detection range for our light sensor. In addition, we discuss the merits of performing the experiment in a gaseous environment that simulates the atmospheric conditions present on Earth, such as our nitrogen-rich environment.

1Work supported by the National Science FoundationDMR-1453752.

2:15PM C3.00004 Synthesis and properties of new U3TiSb5-type compounds1, MAEGAN IDROGO, Texas Lutheran University, DANIEL JACKSON, DERRICK VANGENNENP, JAMES HAMLIN, University of Florida — Recently it was found that single crystals of Ce3TiSb5 exhibit a complex temperature/magnetic-field phase diagram with several metamagnetic transitions and a possible re-entrant disordered phase. In this presentation I will discuss our efforts to synthesis and characterize other members of the 3-1-5 family of compounds. In particular, we synthesized single crystal of both Ce3ZrSb5 and Pr3TiSb5 using Sn flux growths. We find that Pr3TiSb5 exhibits similar magnetic transitions at high field as Ce3TiSb5.

2:27PM C3.00005 Measuring Q-Values and Elastic Nuclear Scattering Cross Sections for Protons on Lithium Fluoride — KASSIE MARBLE, JAMES FLORENCE, DANIEL MARBLE, Tarleton State University — Elastically scattered protons and nuclear reaction products have been measured for MeV energy protons incident upon Lithium Fluoride targets. Spectra for protons on lithium fluoride show three separate interaction mechanisms: Rutherford scattering, nuclear elastic scattering, and nuclear reactions. Modeling of the elastic scattering portion of the spectra with RUMP for protons incident upon lithium fluoride supports incident beam energy of 1.29 MeV but, the ratio of the lithium to fluorine yields from the elastic scattering portion of the spectra deviates from the Rutherford 22 dependence indicating the presence of elastic nuclear scattering. In addition to nuclear scattering effects, the spectra also showed multiple peaks with energies greater than the incident ion beam energy due to nuclear reactions. Using these high energy peaks, Q-values are obtained that are within 7% of accepted values for the 7Li(p,7He)4He reaction, the 7Li(p,4He)7He reaction, and the 16O(p,4He)7Li reaction. A discussion of our experimental results will be presented along with our work to improve measurements of elastic nuclear scattering cross sections as a function of incident energy for protons on lithium by using special enriched ultra-thin lithium targets deposited on a thin-layer of gold on carbon combined with Rutherford scattering of helium on lithium.

2:39PM C3.00006 Research paper on "dye doped nematic liquids used in detecting gravitational wave in less sophisticated method". LASIN ABDURAHIMAN, MUHAMMAD SAJEER P, None — In the present work, non linear properties of liquid crystal is applied to detect and study Gravitational waves in LIGO, even with the use of much less sophisticated devices like sensors and Vaibles, complete vacuum and Vaibles could not be attained. We hereby propose a simple and cost effective method using Dye doped Nematic liquid crystals to produce electro magnetic soliton which maintains its amplitude and energy without any lose. When Gravitational waves are passing through the crystals, there would be small change in the orientation of the crystal causing chaotic changes in the refractive index these changes indicates the presence of Gravitational waves.

2:51PM C3.00007 Wireless Data Transmission. COLTON WATSON, JOSH MCLAIN, BRAYLON JOHNSON, EDGAR GARCIA, RODRIGO SANCHEZ, Stephen F. Austin State University (SPS Chapter 6874), DATA JACKS TEAM — A series of different tests will be applied to the product that will revolve around the satisfaction of the client. A transmission test will assure the capabilities of the Xbee Pro 900 XSC S3B and its ability to transmit data wirelessly. The team will become familiar with the software that is needed to program the system. Software familiarization will allow for communication between the transmitter and receiver, which is vital for this testing phase. Different size text files will be sent between the two modules to analyze the quickness of the process and their range of transmission.
The PICUP conducts NSF sponsored projects to support physics faculty integrating computational thinking and practice into their courses. The project at this meeting – Fostering Local Computational Communities – introduces a strategy and tactics for quickening the integration process for faculty affiliated with one another locally, e.g. AAPT section colleagues. Our strategy ties computational physics ideas to existing physics course content, endeavoring to economize faculty time investment and minimize disruption to their current instruction. We call this “lowering barriers to computational integration.” Our tactics introduce faculty to newly developed resources such as exemplary exercises to adopt or adapt according to their instincts and ingenuity for using computation in courses they already teach. They also help faculty build a collaborative environment within the locale to stimulate and support their efforts to include computational methods into all their courses. Such methods are important because they already have transformed professional physics, science, and engineering practice. We invite you to take advantage of this opportunity to enlarge your vision and possibly commit yourself to integrating computation. Please consider attending this sectional meeting and participating with us. Your future students will thank you.

Friday, March 10, 2017 1:15PM - 3:15PM –
Session C5 AAPT: Workshop V - Engagement Activities for Introductory Physics
Chance Academic Center CAC 336 - Stephanie Ingle, Kingwood High School

Friday, March 10, 2017 2:55PM - 3:15PM –
Session FB2 Coffee Break II
Oppenheimer Foyer - Tak Gurung, San Antonio College

Friday, March 10, 2017 3:15PM - 5:15PM –
Session D1 AAPT: Workshop VI - Engaging Ways to Introduce Quantum Concepts
Chance Academic Center CAC 338 - Karen Jo Matsler, University of Texas, Arlington

Friday, March 10, 2017 3:15PM - 5:15PM –
Session D2 SPS: SPS Workshop - Outreach Tools: Building Physics Demos for Fun and Interaction
Chance Academic Center CAC 344 - Tim Head, Abilene Christian University

Friday, March 10, 2017 4:30PM - 4:30PM –
Session D3 APS AAPT SPS: Poster Session I
Oppenheimer Foyer - Evan Richards, Lee College

D3.00001 Item Response Curves for the Science Literacy Concept Inventory, CRISEL SUAREZ, PAUL WALTER, GARY MORRIS, St. Edward’s University, ED NUHFER, California State University (retired) — As has been done for the Force Concept Inventory (FCI), we examine the data of the 25-item Science Literacy Concept Inventory (SLCI) using item response curves (IRCs). The SLCI assesses science literacy through 12 science concepts, gathers data on demographics, education and socioeconomic factors. IRCs are a form of item response theory (IRT) where we evaluate each question to determine the quality of multiple-choice questions and percentage of students at different ability levels. We present preliminary results.
D3.00002 Exploring student attitudes toward reformed instruction in introductory physics, GABRIELLE HARMON, ELIZABETH CZAJKA, REBEL NICHOLSON, CHASE GAMMON, ELEANOR CLOSE, Texas State University — The physics department at TXST has implemented a Learning Assistant (LA) program with reformed-based instructional changes in our calculus-based introductory sequence. Students in these courses spend a significant portion of class time in small groups, often working through materials from the research-based curricular supplement “Tutorials in Introductory Physics.” These instructional practices, while shown by numerous studies to dramatically improve student learning, are often in conflict with student expectations and their beliefs about how they learn best. In this study, we examine written reflections completed by students in the first course in the sequence for evidence of their attitudes and beliefs with regard to the research-based instructional changes (interactive small-group learning) and materials (e.g., Tutorials) used in the course. We explore the reasons they give for their attitudes and beliefs, whether they report that their beliefs change over time, and if so, what reasons students give for the change. Findings can inform instructors on how to effectively promote productive student engagement in research-based instructional activities.

D3.00003 Study strategies employed by physics students during upper level, undergraduate physics courses - a pilot study, GARY PETERSEN, ROBERT MICHAEL, Angelo State University — The purpose was to explore predominant study strategies employed by physics students during upper level, undergraduate physics courses. A survey method was employed at one regional university in Texas. Deviating into differences by grade levels, study strategies employed by A level students include, listening to others talk about course material as a way to learn, asking oneself why questions to make connections between new and old material, reading and re-reading to learn material, and providing personal explanations for problems. Study strategies employed by the most B level students include listening to others talk about course material as a way to learn, asking oneself why questions to make connections between new and old material, and using reflection such as actively writing or thinking about material to make mental connections. Study strategies employed by the most C level students include reading to learn material, taking notes when reading, and using concept mapping or imagery. Based on these findings faculty could encourage study strategies employed by A through C level students, but may suggest those employed by high performing students. Although differences appear to exist, higher numbers of respondents are necessary to establish significance levels.

D3.00004 Trends in Houston Surface Ozone Levels, ANDY BARNES, GARY MORRIS, PAUL WALTER, St. Edward’s University — We examine how the diurnal ozone cycles of surface ozone in Houston have changed in the spring and summer seasons over a time period long enough to establish trends in the data of statistical significance. We initially consider a 4-5 year time period as a test and then will investigate the record back to 1980 at 9 separate stations in the Houston-Galveston-Brazoria area. We also report on the daily maximum and minimum averages as well as the max 8-hour average by season over that time period.

D3.00005 Adding[?]–Values in Contemporary Economies through “Danding” Cojuanc0 1. C. HELMY HERLABANG, SE, “Kompas-Gramedia” Bandung branch -40115, AUGUST PARENGKUAN, HE. MR, the Republic of Indonesia Embassy- Rome/Italy, H. DEDI MUHTADI, SE, Head of “Kompas-Gramedia” Bandung branch -40115 — Instead as well as ‘bamboo 0.4 mm line’ & ‘binder note high –C’ to Bilan & Roman: “Interconnections between Public Indebtness & Inflation in contemporary Economies,” Economics & Sociology, hidden Years we have <https://en.wikipedia.org/wiki/Cluster_munition>-also of “inflationary universe & somophicity” Andrei Linde provides cq : “Particle Physics” completes the INDUSTRIALIZATION to be Export Promoting & Import Substitutes preferers. We intends to relates ”preent value”/Yukawa potential to “accumulation value” of Plack equation requires to appreciates the Georg Windsor Earl Historian to HE. Mr. Drs. P SWANTORO through “GlobalWirelessE-Voting machine” from Reddy Mahendra Reddy adding-values of HE. Mr. Prof. B.J. HABIBIE added-V to “Danding” COJUANCO fulfills.

1Heartfelt gratitude to HE.Mr. August Parengkuan

D3.00006 Quantum Physics for High School Teachers, KAREN JO MATSLER, University of Texas Arlington, THOMS O’KUMA, Lee College — Thanks to a grant provided by the American Institute of Physics, workshops targeting quantum concepts were offered in the summer of 2016 at Lee College, Fort Worth Museum of Science, and Austin College. The professional development format of these workshops was unique in that both high school students and teachers attended the workshop. The curriculum and resources developed by the Perimeter Institute for Theoretical Physics. In this poster, we will share the strengths and weaknesses of this model as well as the data.

D3.00007 ATE Workshops for Physics Faculty, THOMS O’KUMA, Lee College — The ATE Workshop for Physics Faculty project is finished after completing 14 3-day workshops and 10 3-day working conferences. In this poster, we will display information about what the project accomplished.

D3.00008 Challenges and Rewards in Directing Undergraduate Research Projects, ANDRA PETREAN, Austin College — Over the last year I directed a few undergraduate projects involving depositing and characterizing films at nanoscale. Some of the research was done exclusively at Austin College, and some was in collaboration with a group within the Materials Science and Engineering Department at University of Texas at Dallas. The number of students in the teams I directed varied between one and three, and the students’ prior experience with the systems under study and their physics background varied greatly. The measurements included Hall effect, electrical, and optical measurements. I will discuss both the challenges and the rewards of directing the different teams.

D3.00009 Study of the Dynamics of the Nature Inspired Turbine Blade, KYEONG MIN KIM, SEUNG KI LEE, RICHARD KYUNG, Choice Research Group — Blade is the most significant part in the wind generator. The windmill uses blades with regard to the research-based approach to achieve desired efficiency. Due to the great amount of centrifugal force applied to the blade during rapid rotation, the shape of the blade is crucial for its efficiency. In addition, accuracy of the balance between blades should be improved. The ideal shape of the wind turbine, as with maple seeds falling in spiral motion, can be found in nature. Although each maple seed embraces a unique shape, all fall with continuous spiral motion. Therefore, establishing a relationship between the shape of maple seeds leads to a universal design of wind turbines. A few of the blade shapes developed by National Advisory Committee for Aeronautics(NACA 4412-4418) were used for the simulations. There was no significant difference of coefficient of lift due to difference in thickness, but coefficient of drag was increased as the thickness was increased. Also the relations between Coefficient of drag vs. Coefficient of lift has been found for the NACA 4412-4418. This paper uses computational software to design a wind turbine considering angle of attack, speed and density of the wind, and shapes of blade.
D3.00010 Study on the Mood Regulations and Antipsychotic Substances, MIN KYUNG SEONG, RICHARD KYUNG, Choice Research Group — The main causes of depression are known to be faulty mood regulation, genetic susceptibility, stressful events, and medical issues. In better understanding the diagnosis of depression, technological advancements, such as brain imaging technology, have played a significant role. With the help of technology, quantifiable measurements of neurotransmitters such as Serotonin, GABA, Acetylcholine, Dopamine, and Glutamate have become an essential site for observation of depression. Although there are no known methods of detection, computational simulation technology has been perceived as a possible solution for the diagnosis and anxiety in recent years. In this paper, using the modern tools, antipsychotic substances such as Reserpine molecule and CRF complexes are analyzed as they are able to give the psychological problems. The use of alternative complexes might lead to a solution with less active energy and greater efficiency. Used programs are capable of building a virtual molecule with optimized geometry using GAFF (General Amber Force Field) and then UFF (Universal Force Field). The theoretical structure of each feasible compound is also studied by using the stability of each molecule to predict the efficiency of the molecule in assessing the thermodynamic stability.

D3.00011 Assembling, cleaning, and testing a unique prototype open-ended cylindrical penning trap, KASSIE MARBLE, DANIEL MARBLE, Tarleton State University, DAN MELCIONIAN, PRAVEEN SHIDLING, Texas AM University — A new experimental beamline containing a prototype cylindrical penning trap has recently been constructed at the Cyclotron Laboratory at Texas A&M University. The new beamline will enable precision experiments that enhance our understanding of the limits on non-SM processes in the weak interaction through the measurement of the $\beta$-$$\nu$$ correlation parameter for $T = 0, 0^+ \rightarrow 0^+$ superalow $\beta$-delayed proton emitters. The prototype TAMU TRAP consists of an open-ended cylindrical penning trap of diameter of 90 mm with gold-plated electrodes of oxygen free high conductivity copper to prevent oxidation. The trap's electric quadrupole field is provided by a SHIP TRAPS RF electronic circuit to the four segmented electrodes at the center of the trap while the trap's 7 Tesla magnetic field is provided by an Agilent 210 250 250 magnet. A discussion of the assembly of the TAMU TRAP, the experimental setup, and alignment of the beamline will be presented. The method used to test the prototype penning trap using an ion source, Faraday cups, and micro-channel plate (MCP) detectors will also be discussed.

D3.00012 Enhanced Efficiency of Solar Cells Using Reflectors and Metamaterials, YUN JIN JEONG, RICHARD KYUNG, Choice Research Group — Solar power is produced by converting energy from the sunlight to electricity, thermal energy and other types of energy. To find the optimum environment for the maximum efficiency of solar energy production, this research shows various experiments to test different reflector shapes, altering the shape of the reflector on the solar panel to achieve highest efficiency. These alterations include plane reflector, spherical reflector, and parabolic reflector. By measuring the temperature change on the surface of the reflector and the amount of electricity produced by a voltmeter, the efficiency of each reflectors are compared. Light intensity and incident angle are considered since they are the most significant and influential factors of the production of electricity from photovoltaic cells. This paper also shows that how infrared or visible-frequency electromagnetic waves works with nano-scaled metamaterials, resulting in augmented payloads, longer missions and increased payloads. A novel concept in UAVs and satellite battery technology involves Surface Plasma Polorisation. The SPP uses metals and metal oxides to store solar energy, maximizing optical strength by exciting absorption layer with SPP modes through adjustments made with the incident light.

D3.00013 Stem Cell Bio-Image Resolution Enhancement Using a Polynomial Transformation, YOONJEONG KWON, St. Paul’s School, RICHARD KYUNG, Choice Research Group — For a certain bio images obtained from a device, the bio-image process requires work for morphological reconstruction than mere quantitative analysis, such as measurements. To apply various enhancement methods to produce a better image of a stem cell, we gathered the raw data and images on stem cells. We are able to improve the quality of the bio-image in a pixel scale by using a computational and mathematical method employing spectrum modification. By performing linear and quadratic transformation, a strategy for enhancement of bio-imaging technique is presented in this paper. Using histogram equalization of stem cells, which provides quantitative information about the condition of the cells, the shape, size, and coloration were studied. This research, by combining the histogram analysis and the proposed transformation, is conducted to observe an improved algorithm that increases the stem cell image quality. Previous attempts of enhancing bio-images by preprocessing, watershed segmentation, and morphological image processing had no significant effect on the quality of images. This research shows more effective algorithms in resolution enhancement and better segmentation of the stem cell as well as corneal epithelial cells using spectrum modification.

D3.00014 Rotation Light Curves and Taxonomy of 15th to 19th Magnitude Asteroids, LANDRIE GRANTHAM, SPS undergraduate student Tarleton State University, MIKE HIBBS, Tarleton State University — Knowledge of the composition, shape and rotation rate of an asteroid is extremely important in; evaluation the impact damage potential; development of impact avoidance strategies; and evaluating the feasibility and economic potential of mining. However, little data exists for the vast majority of known asteroids other than their orbital parameters. Observations made by Tarleton’s 8.1-meter telescope has produced several light curves and color indices of asteroids from 15th to 19th magnitude. This work represents the unique niche of Tarleton’s 8.8m telescope to collect statistically meaningful data as faint as 19th magnitude. Large professional survey telescopes do not have the time to do follow-up observations while smaller professional/amateur telescopes are too small to achieve a high enough signal to noise ratio to determine rotation periods and composition of the fainter and smaller asteroids. This poster, summarizes and presents some of Tarleton’s observations and data analysis.

D3.00015 Probing Ion Behavior in Porous Carbon Membranes Under Applied Electric Potential Through In Situ SAXS Experiments, FRANCISCO AYALA RODRIGUEZ, Department of Physics, The University of Texas at El Paso, PASQUALE F. FULVIO, University of Puerto Rico, Ro Piedras Campus, LAWRENCE M. ANOVITZ, Chemical Sciences Division, Oak Ridge National Laboratory, JOSE L. BAULEOS, Department of Physics, The University of Texas at El Paso — Ion transport and sorption kinetics in soft-templated mesoporous carbon is being studied using small-angle x-ray scattering technique (SAXS). Previous experiments of small-angle x-ray scattering experiments have shown that this technique can be used to detect structural changes due to ion adsorption at the solid-liquid interface and in the structure of the carbon membranes as the voltage is varied. The average structure of the MC-127 membrane is being determined through the use of SAXS and SASview analysis software. MC-127 has a cylindrical morphology with an average pore-pore distance of 9.4nm. Other properties contribute to its SAXS signal: these include a small spherical shape modification. By performing linear and quadratic transformation, a strategy for enhancement of bio-imaging technique is presented in this paper. Using histogram equalization of stem cells, which provides quantitative information about the condition of the cells, the shape, size, and coloration were studied. This research, by combining the histogram analysis and the proposed transformation, is conducted to observe an improved algorithm that increases the stem cell image quality. Previous attempts of enhancing bio-images by preprocessing, watershed segmentation, and morphological image processing had no significant effect on the quality of images. This research shows more effective algorithms in resolution enhancement and better segmentation of the stem cell as well as corneal epithelial cells using spectrum modification.

$^1$Tarleton Center for Astronomy Education and Research

D3.00016 Study on Mood Regulations and Antipsychotic Substances, MIN KYUNG SEONG, RICHARD KYUNG, Choice Research Group — The main causes of depression are known to be faulty mood regulation, genetic susceptibility, stressful events, and medical issues. In better understanding the diagnosis of depression, technological advancements, such as brain imaging technology, have played a significant role. With the help of technology, quantifiable measurements of neurotransmitters such as Serotonin, GABA, Acetylcholine, Dopamine, and Glutamate have become an essential site for observation of depression. Although there are no known methods of detection, computational simulation technology has been perceived as a possible solution for the diagnosis and anxiety in recent years. In this paper, using the modern tools, antipsychotic substances such as Reserpine molecule and CRF complexes are analyzed as they are able to give the psychological problems. The use of alternative complexes might lead to a solution with less active energy and greater efficiency. Used programs are capable of building a virtual molecule with optimized geometry using GAFF (General Amber Force Field) and then UFF (Universal Force Field). The theoretical structure of each feasible compound is also studied by using the stability of each molecule to predict the efficiency of the molecule in assessing the thermodynamic stability.
D3.00016 Study on Aquatic and Terrestrial Life in Well Preserved Area Using Computational and Physical Modeling, MIN JAE KIM, St. Mark’s School, SEOYOUNG KYUNG, Choice Research Group — For most natural life in well-preserved aquatic and terrestrial environments to continue their existence, local administrations, policy-makers, careful visitors, and scientific concerns must devise good strategies to build a safe boundary for proliferation and preservation of endangered wild life. These strategies include, but are not limited to, controlling temperatures and minimum concentration of dissolved oxygen of the aquatic life. Therefore, in order to protect aquatic and terrestrial life in a given area, a study on the social customs of the local people and prediction of the critical saturation deficit of environmental factors is crucial in preventing extinction of well preserved life. In performing this study, this research uses computational simulations and mathematical modeling taking account of many factors.

D3.00017 Study on the Mechanics of a Wind Turbine to Produce Efficient Wind Energy, JAIHONG OH, Lakewood Forrest, RICHARD KYUNG, Choice Research Group — Blades and turbines, rotating with high angular velocity to create centrifugal force, are the sources of a windmill’s power generating force. The shape of blades influences the amount of generated centrifugal force. Therefore, in considering wind power generation, this research studies physics and fluid mechanics of blade to enhance the windmill’s efficiency and accuracy. In studying the ideal flow through an actuator disc, momentum theory, tangential velocity, and accelerations are considered. In the simulations for the several NACA types of blades, comparisons of the ratio of lift coefficient to drag coefficient were found. Reynolds numbers, densities, and Mach numbers of the air were considered finding relationship between drag coefficient and lift coefficient. Incorporating these records, this research proposes ideal wind blades using computational software to simulate the angle of attack and other variables of the wind.

D3.00018 Stability and Thermodynamic Analysis of the Luminol Molecule and its Derivatives Using Computational Simulations, INYOUNG CHOI, SIEUN LEE, YONGWOO LIM, CHAI RIN KIM, Choice Research Group — Application of luminol that helps analyze blood evidence at crime scenes and develop biosensors is important in Forensic, medicine, and plant sciences research. The theoretical and computational analysis of the luminol molecule and its derivatives were presented in this research to identify the electronic density as functional. Optimized energies(kcal/mol) of luminol derivatives, analyzed through computational calculations, revealed molecule’s stability based on the electronic density functional analysis. Each of the molecule’s stability of different derivatives of luminal tautomers, compared with the original luminol has been recorded as numerical data. This numerical data translated to stability order, and an analysis on the stability order confirmed the use of electronic density analysis as functional. The study further presented a few influential factors of luminol tautomers’ relative stability. Also light reaction times were checked when luminescing solution reacts with other solutions. The major factors were found to be the aromaticity and electronic delocalization. Such factor is determined by the quantity of molecular orbitals of p character. Another factor consists of the molecules hydrogen bonding. The final, most important, factor was the charge distribution.

D3.00019 The effect of time on the dehydration of CsH2PO4 at 260 C using XRD, ANDREA MONTGOMERY, ISRAEL MARTINEZ, JUAN LEAL, ALAN GOOS, ALEX PRICE, HEBER MARTINEZ, CRISTIAN BOTEZ, University of Texas at El Paso — Solid Acids such as Cesium Dihydrogen Phosphate, CsH2PO4 (CDP), are excellent electrolytic material for the construction of intermediate temperature range hydrogen fuel cells. CDP exhibits a high protonic conductivity at temperatures ca. 235 C. Associated with the increase in conductivity, there is a polymorphic transformation from a monoclinic crystalline structure to a cubic structure. However, at the temperature that high conductivity is achieved there is a competing chemical dehydration process, which causes a phase transition from the cubic phase (CDP) to a pyrophosphate monoclinic phase. This appears to be the onset of the decline in conductivity of the material. Chemical decomposition (dehydration) of the material has been reported to be delayed heavily with the introduction of water vapor. In order to prevent the decomposition, it is imperative that data is gathered about the dehydration process.

1Department of Defense

D3.00020 Structural modifications in the RbxCs1-xH2PO4 (0≤x≤1) superprotonic conductor series: a single-crystal x-ray diffraction and impedance spectroscopy study, ALAN GOOS, ANDRES JOSE ENCERRADO MANRIQUEZ, HEBER MARTINEZ, ALEX PRICE, CRISTIAN BOTEZ. None — We have used single-crystal x-ray diffraction to investigate the structural modifications induced by Rb-doping of the superprotonic conductor CsH2PO4. Our data collected on the RbxCs1-xH2PO4 (0 ≤ x ≤ 1) series shows that the monoclinic P21/m CsH2PO4 modification persists upon Rb-doping up to x = 0.8. We found that Rb0.8Cs0.2H2PO4 exhibits a previously unreported P21/c monoclinic structure, where the mirror plane is lost and disorder is present in the PO4 tetrahedra even at room temperature. Higher levels of x display a tetragonal I-42d unit cell isomorphic with the known structure of RbH2PO4. The temperature dependence of the proton conductivity determined from impedance spectroscopy data collected within the 160C-250C range is also markedly different at high Rb-doping levels, x ≥ 0.8. Finally, we found that Rb0.9Cs0.1H2PO4 undergoes a transition from its room-temperature tetragonal I-42d phase to an intermediate-temperature monoclinic P21/m modification at a significantly lower temperature (~80 C) than its RbH2PO4 counterpart (~120 C).

D3.00021 Stability enhancement of solar absorber material Cu2S by Ag alloying, SAJIB BARMAN, MUHAMMAD HUDA, University of Texas at Arlington — Cu2S is an important solar absorber material and has great prospect in the field of renewable energy. However, this material suffers from instability due to spontaneous Cu vacancy formation and Cu diffusion in the structure. The spontaneous Cu vacancy causes the material to possess high p-type doping, which leads the material to behave as a degenerate semiconductor. This is a vital obstacle for this material to be used as an effective solar absorber material. A relatively new predicted phase of Cu2S which has an anatase-like structure was found to be more preferable than the well-known low chalcolite Cu2S. However, the Cu-vacancy formation tendency in this phase remained similar. We have found that alloying silver with this structure can help to reduce Cu vacancy formation tendency without altering its electronic property. The band gap of silver alloyed structure is higher than pristine anatase Cu2S. In addition, Cu diffusion in the structure can be reduced with Ag doped in interstitial sites. Here, we present a systematic approach within the density functional theory framework to study Cu vacancy formation tendency and diffusion in silver alloyed anatase Cu2S, and proposed a possible route to stabilize Cu2S against Cu vacancy formations by alloying it with Ag.
D3.00022 Determining the density if the ionic liquid [C10MPy][Tf2N] confined in silica nano pores using small-and wide-angle x-ray scattering , MELISSA CANO, Department of Physics, The University of Texas at El Paso, PASQUALE FULVIO, Department of Chemistry, University of Puerto Rico, Río Piedras, GERNOT ROTHER, Chemical Sciences Division, Oak Ridge National Laboratory, JOSE LEONARDO BANUELOS, Department of Physics, The University of Texas at El Paso — The structure of the ionic liquid (RTIL), [C10MPy][Tf2N], confined in silicas with 8 nm and 2.8 nm pores was investigated. RTILs have negligible volatility, excellent thermal and electrochemical stability, and are of interest in areas such as nano-lubrication, energy storage, and environmental and materials synthesis. The dynamics, structure, and thermodynamics of RTILs under confinement are not completely understood, yet elucidating these properties is key to new advancements. Previously, confined RTIL dynamics were probed with neutron spin echo spectroscopy (NSE), and structural properties were probed with small-angle neutron scattering. In this work, small- and wide-angle x-ray scattering (SWAXS) results (Q-range:0.01-3Å⁻¹) of the confined RTIL are presented. The higher Q-range in these new measurements gives access to inter-ion distances, and allows us to correlate them to the RTIL density inside pores and the NSE dynamics. The confined RTIL density was obtained by calculating the scattering invariant and applying a model to the empty and RTIL-filled silicas. The relation between RTIL structural peak parameters and measured density and dynamics will be discussed.

D3.00023 Spectroscopic investigation of antimicrobial nanoparticles , JINGYAO DOU, Texas AM university, DMITRI VORONINE, Texas AM universityBaylor University — E. coli is a common bacteria for spectroscopic analysis of antimicrobial agents. We use plasmonic metal nanoparticles for inactivation of bacteria and nanoscale spectroscopic analysis of the effect of the nanoparticles. Scanning probe microscopy such as SEM and AFM can be used for nanoscale imaging of the bacteria-nanoparticle interactions. We investigate the effects of the laser wavelength and temperature on the bacteria.

D3.00024 Elongation affinity of Aβ-42 via molecular dynamics simulations1 , ROBERTO RODRIGUEZ, LIAO CHEN, Department of Physics and Astronomy, University of Texas at San Antonio, GEORGE PERRY, Department of Biology, University of Texas at San Antonio — 42 Aβ peptides. The 42-residue variant Aβ-42 has emerged as a key factor in the pathology of Alzheimer’s disease. Very recently, the functional structure of Aβ-42 fibrils has been elucidated via high-quality NMR studies. We conducted molecular dynamics simulations on this recently published structure and calculated the free energy needed to elongate an Aβ-42 fibril, finding excellent agreement with experimental measurements. We also studied the effect of the mature amyloid fibrils on the conformational stability of free peptides attached to their surface, and find that at least a dimer is needed for the free peptides to retain their fibrillar conformation, in support of the well-known second-order nucleation mechanism.

D3.00025 Study of the Neurochemicals Creating Happiness and Positive Psychology , HEE SOO KIM, Seoul International School, RICHARD KYUNG, Choice Research Group — The feeling of happiness is not merely the result of a single neurochemical in the brain. Rather, happiness is dependent on seven different neurochemicals that are affected by one’s lifestyle. Knowing which daily activities release certain neurochemicals related to happiness and partaking in such activities will increase one’s likelihood of achieving happiness. Electrical brain waves, brain structure, and neurochemicals are important in emotional processes. This paper specifically examines neurochemicals in relation to happiness. Happiness is dependent on four neurochemicals known as Dopamine, Oxytocin, Serotonin, and Endorphins (DOSE). Each neurochemical has an independent function in creating one’s happiness. Discovering which day-to-day activities trigger the release of such neurochemicals will result in higher daily happiness levels. Higher happiness levels, in turn, increase productivity. In this research, Chemcraft and Avogadro were used, as they are capable of determining the theoretical and chemical properties of the happiness molecules. The theoretical structure of each feasible neurochemicals has been studied by using the stability of each molecule to predict the efficiency of the molecule in assessing the physical stability and measure of the happiness itself.

Friday, March 10, 2017 6:30PM - 8:00PM —
Session CB1 Banquet Hacienda Santa Maria Magnolia Gardens Picante Grill - William Waggoner, San Antonio College

6:30PM CB1.00001 Banquet —

Friday, March 10, 2017 8:15PM - 9:15PM —
Session CB2 Banquet Speaker McCreless Auditorium Magnolia Gardens - William Waggoner, San Antonio College

8:15PM CB2.00001 Banquet Speaker —

Saturday, March 11, 2017 8:00AM - 8:51AM —
Session E1 Plenary Session II McAllister Auditorium Auditorium - William Waggoner, San Antonio College

8:00AM E1.00001 Welcome —
8:15AM E1.00002 Plenary: Misconceptions About Misconceptions: New Views on Teaching the Hard Stuff, STEPHANIE SLATER, Center for Physics & Astronomy Education Research — Despite the substantial body of "misconceptions" education research literature, the development of an actionable theory of conceptual change to mitigate students' misconceptions continues to be less than satisfying. What if a new, action-oriented cognitive model allowed us to deeply probe and more efficiently operate on students’ learning difficulties in a fruitful manner? We propose that instead of binning all erroneous student thinking into a single misconceptions construct, which leads to prescribing only a single instructional strategy, perhaps it is time for a new model focusing on "misconceptions" as a mixture of at least four learning barriers: incorrect factual information, insufficient cognitive structures (e.g. spatial reasoning), and affective/emotional difficulties. Each of these types of barriers can then be targeted more effectively by education researchers and be more efficiently addressed with an appropriately aligned instructional strategy.

Saturday, March 11, 2017 9:25AM - 9:50AM —
Session SB1 Coffee Break III Oppenheimer Foyer - Tak Gurung, San Antonio College

9:25AM SB1.00001 Coffee Break —

Saturday, March 11, 2017 10:00AM - 12:00PM —
Session F1 AAPT: General Session II Oppenheimer OC 108 - Tak Gurung, San Antonio College

10:00AM F1.00001 Computation as Part of a Balanced Undergraduate Physics Curriculum1, MARIE LOPEZ DEL PUERTO, University of St. Thomas — A balanced undergraduate physics curriculum requires that students progressively work on computation, experiment, and communication skills throughout the program. The University of St. Thomas Physics Department has been working toward integrating computation by embedding it in different ways in different courses, starting with an introduction to computational physics in our sophomore-level “Applications of Modern Physics” course and laboratory, building on skills through short computational projects in many of our lecture-based courses, and developing a “Methods of Computational Physics” course. In this talk I will outline the structure of our program and where it is headed. I will then go into some detail on the homework problems and laboratories that have been developed as part of the “Applications of Modern Physics” project, discuss our experience implementing them, and give interested faculty information on how to obtain these materials.

1This project has been funded in part by NSF grant DUE-1140034.

10:24AM F1.00002 Teaching Arduinos in an Accelerated Semester, ANDRA PETREAN, Austin College — This January I taught a hands-on class on Arduino Microcontrollers. The class was advertised as an opportunity to build fun projects. The students had a variety of backgrounds: Computer Science majors who had programming experience, Physics majors who were familiar with electrical circuits, and students with a general interest in Arduinos. They worked in teams that benefited from their various skills and built eight interesting projects involving Arduinos, such as a MIDI controller, a levitating magnet, an LED strip that reacts to music, an infrared touch surface, and a laser cat toy.

10:36AM F1.00003 A New Assessment Approach that Models Legitimate Practice, DAVID DONNELLY1, Texas State University — The author modified his assessment methods in both an upper division Math Methods course and a graduate Electrodynamics course in the fall 2016 semester. The modification was made to better align the assessment methods used in the courses with the practices of professional physicists. Instead of using timed tests, students took one timed test, gave one oral presentation, and submitted one written report. Details of how the process was managed, and student feedback will be presented.

1I am attending a workshop Friday 1-5, so I will not be able to present during that time.

10:48AM F1.00004 Physics Teacher Education at Texas State University1, HUNTER CLOSE, ELEANOR CLOSE, DAVID DONNELLY, Texas State University, TRACY COOPER, Dripping Springs High School, RUSSELL KRUMMELL, San Marcos High School, PAMELA WORD, John Jay High School — The Department of Physics at Texas State University has taken up physics teacher education as one of the core components of its mission. We have been running a Learning Assistant (LA) program in physics since 2012, we began as a comprehensive PhysTEC site in Fall 2015, and we have started a Noyce teacher scholarship program in Fall 2016. We have new degree programs with physics teacher certification and new physics courses for secondary and elementary teachers. The PhysTEC program includes building a community with area high school physics teachers to form bonds between prospective and practicing teachers. Research in our LA program has focused on understanding students developing ideas about teaching and learning to better understand how students are drawn into the education enterprise and, in some cases, into the teaching profession. Our program efforts have also revealed just how much difference can be made by forming productive relationships across campus with many different faculty, staff, and administrative offices.

1Supported by PhysTEC and the Office of the Provost and the College of Science and Engineering at Texas State University

11:00AM F1.00005 Austin-San Antonio Area Physics Teacher Network1, PAMELA WORD, John Jay High School, TRACY COOPER, Dripping Springs High School, RUSSELL KRUMMELL, San Marcos High School, HUNTER CLOSE, ELEANOR CLOSE, DAVID DONNELLY, Texas State University — Teaching physics can be difficult, whether you are a first-year teacher or a veteran. It helps to have a support network comprised of peers who are or have been in your shoes. As an individual teacher, it can take a long time to build this type of network, and for those just starting out it is nearly impossible. The PhysTEC team at Texas State University in San Marcos aims to build a network of current and pre-service physics teachers in the Austin-San Antonio region by bringing them together on a near monthly basis and providing them with support in the form of discussion, teaching resources, and camaraderie. In this talk, I will describe a typical event, how it is organized, and how the support extends beyond the event itself.

1Supported by the Physics Teacher Education Coalition
11:12AM F1.00006 Problem-based learning in the high-school physics classroom.
TRACY COOPER, Dripping Springs High School — Problem-based learning is an approach to learning that teaches strategies necessary for
success in the twenty-first century. It is very like project-based learning but done on a smaller scale. Problem-based learning is easier to execute
in a traditional high school setting, where time is limited. Students work in collaborative groups to identify what they need to solve a problem.
The teacher acts as the facilitator of the learning process instead of providing knowledge. Students develop the ability to think critically, work
together, and to communicate, all in a small timeframe that keeps the teacher on schedule. In this presentation, I will discuss some ways to
implement problem-based learning and give examples of some problems I've used in my classes.

11:24AM F1.00007 Quantum Physics for High School Teachers, KAREN JO MATSLER, University
of Texas - Arlington, EVELYN RESTIVO, Mayoral High School, JANIE HEAD, Foster High School, KENRIC DAVIES, Liberty High School,
THOMAS O'KUMA, Lee College — Thanks to a grant provided by the American Institute of Physics, workshops targeting quantum concepts
were offered in the summer of 2016 at Lee College, Fort Worth Museum of Science, and Austin College. The professional development format
of these workshops was unique in that both high school students and teachers attended the workshop. The curriculum and resources developed
by the Perimeter Institute for Theoretical Physics. We will share the strengths and weaknesses of this model as well as the data.

11:36AM F1.00008 Adventures in Outreach - Austin Community College Hands-on
Science (ACChaOS). PAUL WILLIAMS, Austin Community College — The Physics Department at Austin Community College
has been conducting an outreach program - Austin Community College Hands-on Science (ACChaOS) - for the past six years. ACChaOS
is a hands-on on the road program. We carry 80 small, simple exhibits to elementary schools as well as other public events. The exhibits
are intended to model the scientific method. This presentation will describe the background of the program, several example exhibits and
the structure of a typical event. The program has been conducting one to two events per month but future plans are to significantly increase the
number of events conducted.

11:48AM F1.00009 Lessons from the IPLWCs, THOMAS O'KUMA, Lee College — The IPLWCs (Introductory
Physics Laboratory Writing Conferences) were part of the ATE Workshops for Physics Faculty Project that operated from 2010 to 2016.
These nine 3-day conferences were to develop “new” laboratory activities for high school and college/university introductory physics courses.
Some of the IPLWCs had a theme or target topical area. In this talk, I will describe the IPLWCs, discuss some of the “products” from them,
and finally some of the lessons we learned in doing them.

1 Partial Funding from NSF ATE grant DUE-1003633

Saturday, March 11, 2017 10:00AM - 11:24AM —
Session F2 APS: Atomic, Molecular and Optical Physics; Astronomy, Astrophysics
and Space Science Oppenheimer OC 110 - David Hough, Trinity University

10:00AM F2.00001 Nano-optical Imaging of 2D Materials, CHENWEI TANG, ZHE HE, Texas
AM University, DMITRI VORONINE, Texas AM University; Baylor University — Monolayer transition metal dichalcogenides (TMDC) are
2D materials with great potential in fabricating optoelectronic devices, biosensors and catalysts. Their heterostructures with nanometer-scale
boundaries could be used as new platforms to improve the spatial resolution of optical imaging or as accurate sensors. Here we image molybdenum
and tungsten based 2D materials and heterojuctions with a few nanometer spatial resolution using tip-enhanced photoluminescence (PL) and
Kelvin probe spectroscopies. From the changes in the PL and surface potential, we determine the bandgap, defects and tip-sample interaction
with nanoscale resolution.

10:12AM F2.00002 Ab Initio Study of the Barrier to Planarity of Cyclobutane,
Silacyclobutane and Germacyclobutane, HYE JIN CHUN, ESTHER J. OCOLA, JAAN LAANE,
Department of Chemistry, Texas AM University, College Station, TX-77843-3255, USA — Theoretical computations have been carried out to calculate
the structures of both TMS and TMS+ based on the previously published spectra. The refined ring-puckering potential energy functions fit the experimental data very well.

1The authors wish to thank the Robert A. Welch Foundation (Grant A-0396) for financial support.

10:24AM F2.00003 Ring-puckering Potential Energy Functions and Structures for
Trimethylene Sulfide and Its Monovalent Cation, HYE JIN CHUN, ESTHER J. OCOLA, JAAN LAANE,
Department of Chemistry, Texas AM University, College Station, TX-77843-3255, USA — The vibrational spectra of trimethylene sulfide (TMS)
and the vacuum ultraviolet mass-analyzed threshold ionization spectra of the trimethylene sulfide cation (TMS+) have been reported.

1The authors wish to thank the Robert A. Welch Foundation (Grant A-0396) for financial support.
10:36AM F2.00004 Constraining Dark Energy and Curvature Parameters with Observations of Supernovae, Cmb Radiation, and Baryon Acoustic Oscillations1, ALVARO JOSEPH HU2. University of Dallas — In 1998, the universe was discovered to be expanding at an accelerating rate, contrary to the assertion that its expansion was slowing down at the time. This acceleration can be accounted for by adding a Λ term to Einstein’s field equation. The common belief among cosmologists is that this Λ, or as it is also known, the cosmological constant, is associated with a dark energy component of the universe that contributes to the repulsion of the massive structures in the universe. Although current models of the universe operate under the assumption that Λ is constant, there are some in the field that are working at determining whether or not this is in fact true. In a model with a varying dark energy, the current dark energy is given as w while the red-shift-dependent dark energy is w0. Using cosmological data, including Supernovae data sets PANSTARRS, JLA, and Union, and pairing them with different values for the Hubble constant, we are able to achieve constraints for w, w0, and Ω. We use these dark energy models using CosmoMC for parameter fitting and CosmoEJS for visualization of the fit and expansion history of the models.

1The Texas Advanced Computing Center at The University of Texas at Austin
2I am a senior physics major at the University of Dallas and did my summer research project under Dr. Moldenhauer on Astrophysics and Cosmology at the University of Dallas.

10:48AM F2.00005 The Analysis and Observational Fitting of Modified Gravity Models using CosmoEJS1, BLAKE PALMER, DR. JACOB MOLDENHAUER, ALVARO HU, University of Dallas — The purpose of this research is to describe and attempt to understand the nature of modern cosmology through the use of modified gravity models. We present these models as alternatives to the standard Lambda CDM model. The origin, development, and growth of the universe must be accounted for in regards to a chosen theoretical cosmological model, and following recent results show the ways in which different models attempt to handle this. This project deals primarily with five different modified gravity models, those being the Einstein-DeSitter, Dvali-Gabadadze-Porrati, Modified Polytropic Cardassian, Interacting Dark Energy, and Generalized Chaplygin Gas models. These theoretical models are compared to observational data from cosmological distances on expansion history and structure growth. Also, a background and an analysis of each model is performed using new simulations built from CosmoEJS.

1Donald A. Cowan Physics Institute

11:00AM F2.00006 The case of USNO-B1.0 1219-0427833: Binary, variable or both?1, MARK RODRIGUEZ, ARTHUR SWEENEY, RICHARD OLENICK, University of Dallas — Observations of a suspected variable star, USNO-B1.0 1219-0427833, revealed a perplexing light curve. R-band observations were made with a robotic 200 mm astrograph f/1.5 located at the University of North Texas Monroe Observatory. Over 5000 images were gathered over a five week period in July-August 2016. The extracted light curves were analyzed with differential photometry to remove possible spurious signals. Peranso was used to analyze the signals present. The star has a mean magnitude of 10.124, a B-V of 1.115, and an observed amplitude of 0.1313 with a period of 0.1652 days. The star shows several aspects of W Ursae Majoris binaries, with one or both stars pulsating. Analysis of the observations and preliminary modeling are presented.

1This work is supported by the Donald A. Cowan Physical Sciences Institute

11:12AM F2.00007 Plausible Answers to Questions Regarding Abiogenesis on Prebiotic Earth1, GRANT COOPER, Texas Tech University — Evidence indicates Earth’s surface acquired necessary life-giving volatile elements - carbon, nitrogen, sulfur - from a collision with a Mercury-like planetary embryo ~4.4 billion years ago. Icy comets containing hydrocarbons collided with a cooling prebiotic Earth to create impact reactive environments that - via classical anthropic causality - introduced primordial "ribosome-like" RNA complexes which could duplicate a few molecular units per 24 hrs. Randomly classical processes introduced energetically accessible duplex RNA segments containing keto - amino (entanglement) hydrogen bonds, where hydrogen bonded amino protons were subjected to quantum uncertainty limits, \( \Delta x \Delta p_x \geq \hbar/2 \). This introduced a probability of EPR arrangement, keto-amino (entanglement) \( \rightarrow \) enol-imine, where reduced energy product protons are each shared between two indistinguishable sets of intramolecular electron lone-pairs belonging to enol oxygen and imine nitrogen on opposite genome strands. Product protons participate in entangled quantum oscillations at \( \sim 10^{13} s^{-1} \) \( \sim 4800 m s^{-1} \) between near symmetric energy wells in decoherence-free subspace until measured, in a genome groove, \( \delta t \ll 10^{-13} s \), by an evolutionary selected Grover’s quantum bio-processor. This quantum entanglement resource for reactive evolution provides a sequence of 12 incremental entanglement-enabled improvements to genome fitness, of the form: RNA-ribozyme \( \rightarrow \) RNA-protein \( \rightarrow \) DNA-protein.

1Texas Tech University Research Funds

Saturday, March 11, 2017 10:00AM - 12:00PM —
Session F3 AAPT: Workshop VII - Engaging Everyday Students in Real Astronomical Research
Chance Academic Center CAC 336 - Stephanie Slater, Center for Astronomy Physics Education Research

10:00AM F3.00001 Workshop: Engaging Everyday Students in Real Astronomical Research, STEPHANIE SLATER, Center for Astronomy and Physics Education Research — The latest National Research Council publications describing effective learning environments call for all students to engage in scientific research and participate in scientific discourse — in essence themselves learn to be scientists. Most scientific results demonstrate that in order for novice science students to effectively design, conduct, report, and defend science observations and experiments, learners must be purposefully supported in each step of the scientific process before they are able to successfully pursue scientific questions of their own design. This participatory workshop provides strategies for bringing these two ideas together. It is an introduction to scaffolding strategies that teach students to fruitfully engage in scientific thinking and design astronomy investigations by mining online astronomy databases. Participants in this workshop will learn how to structure effective student learning experiences using online resources such as GalaxyZoo access to the Sloan Digital Sky Survey and JPL’s Solar System Simulator. Participants are encouraged to bring their personal laptop computers.

Saturday, March 11, 2017 10:00AM - 12:00PM —
Session F4 AAPT: Workshop VIII - Einstein’s Major Award Impacting Today’s Electronics
Chance Academic Center CAC 338 - Beverly Trina Cannon, Eastfield College
10:00AM F4.00001 Workshop: Einstein’s Major Award impacting Today’s Electronics, TRINA CANNON, Eastfield College — Teaching the Photoelectric Effect can be a challenge for the teacher and the student. This is a unit of study that students can complete, gain an understanding of the phenomenon, and address the Photoelectric Effect with reasonable confidence. The materials will be reviewed and worked in the presentation. With confidence, the teacher and the students will be prepared and secure with the concept of the Photoelectric Effect.

Saturday, March 11, 2017 10:00AM - 1:00PM –
Session F5 AAPT: Workshop IX - Make and Take Chance Academic Center CAC 243 - Bill Franklin, Forma PTRA

10:00AM F5.00001 Workshop: Make and Take Apparatus, BILL FRANKLIN, Former PTRA — Participants will be able to build and take home demonstration and/or laboratory apparatus designed for physics classrooms.