SPRING 2019 MEETING

Texas Section of the
American Association of Physics Teachers

Texas Section of the
American Physical Society

Zone 13 of the
Society of Physics Students

This is a draft of the meeting program that was last updated on 3/3/2019. Press Control-F on your keyboard to find a presentation. Email astro@sfasu.edu if you have any corrections.

Hosted by
The Department of Physics, Engineering, and Astronomy

Stephen F. Austin State University
Nacogdoches, TX

March 7-9, 2019

Mobile Program

Meeting Schedule

Thursday, March 7	Event	Location
6:00 - 8:00 PM	Registration	STEM Building - Room 102
6:00 - 8:00 PM	SPS Reception	STEM Building - Room 102
7:00 - 9:00 PM	TSAAPT Executive Committee Meeting	STEM Building - Room 203C
7:00 - 9:00 PM	TSAPS Executive Committee Meeting	STEM Building - Room 311
9:00 - 9:30 PM	TSAPS & TSAAPT Executive Meeting	STEM Building - Room 201

Friday, March 8	Event	Location
8:00 - 11:50 AM	**Registration**	STEM Building - Room 102
8:45 - 9:00 AM	**Welcome**	Kennedy Auditorium
9:00 - 9:45 AM	**Plenary 1** Potential for Exoplanetary Neighbors in Alpha Centauri BILLY QUARLES Georgia Institute of Technology	Kennedy Auditorium
9:45 - 10:00 AM	*Coffee Break*	
10:00 - 10:45 AM	**Plenary 2** Involving Undergraduate Students in Shock Wave Physics and Chemistry Research ERIC PETERSEN Texas A&M University	Kennedy Auditorium
10:45 - 11:45 AM	**Plenary 3** YOU'RE UP NEXT! Share your favorite physics demo! Lead by WALTER TRIKOSKO Stephen F. Austin State University	Kennedy Auditorium
12:00 - 1:15 PM	**Luncheon**	University Center - 2nd Floor Grand Ballroom
12:45 - 1:15 PM	**Business Meetings (AAPT/APS)**	University Center - 2nd Floor Grand Ballroom

Friday, March 8	Event	Location
1:30 - 5:00 PM	TSAAPT Workshops (W1-W4)	STEM Building – Rooms 108,111
1:30 - 5:00 PM	**Contributed Paper Session** AAPT APS SPS	 STEM Building – Room 103 STEM Building – Room 401/402 STEM Building – Room 201
1:30 - 5:00 PM	**Registration and Exhibits**	STEM Building – Room 102
3:00 - 4:00 PM	**Poster Session**	STEM Building – 3rd Floor Hallway
6:30 - 8:00 PM	**Banquet and Awards** The Unknown Physics Teacher and Her Place in History JILL A. MARSHALL University of Texas at Austin	University Center - 2nd Floor Twilight Ballroom
8:30 - 9:00 PM	**Planetarium Show** 'Dark Universe'	STEM Building (Atrium)

Saturday, March 9	Event	Location
9:00 - 12:00 PM	**Exhibits and Registration**	STEM Building – Room 102
9:00 - 9:45 AM	**Plenary 4** Innovations in Integrating Cavity Technology: Sensitive Detection in the Most Turbid Environments JASON D. MASON Texas A&M University	Kennedy Auditorium
9:45 – 10:00 AM	*Coffee Break in STEM 102*	
10:00 - 11:15 AM	**Contributed Paper Session** APS/AAPT	STEM Building – Room 401/402
10:00 AM - 12:30 PM	**TSAAPT Workshops (W5-W6)**	STEM Building – Rooms 108,111

Schedule of Presentations

Friday	
8:45-9:00 AM	**Welcome** (Kennedy Auditorium)
9:00-9:45 AM	**Plenary 1** (Kennedy Auditorium)
9:45-10:00 AM	**Coffee Break** (Kennedy Auditorium)
10:00-10:45 AM	**Plenary 2** (Kennedy Auditorium)
10:45-11:45 AM	**Plenary 3** (Kennedy Auditorium)
12:00-1:15 PM	**Lunch and Business Meetings** (University Center, Second Floor, Grand Ballroom)
1:15-1:30 PM	**Move to STEM Building**

Sessions	STEM Room 103	STEM Room 401	STEM Room 201	STEM 3rd Floor	STEM Building
01:30 PM	AAPT-01	APS-01	SPS-1		
01:42 PM	AAPT-02	APS-02	SPS-2		Workshops
01:54 PM	AAPT-03	APS-03	SPS-3		01:30 PM
02:06 PM	AAPT-04	APS-04	SPS-4		to
02:18 PM	AAPT-05	APS-05	SPS-5		03:00 PM
02:30 PM	AAPT-06	APS-06	SPS-6		W1 - Rm 108
02:42 PM	AAPT-07	APS-07	SPS-7		W2 - Rm 111
02:54 PM	AAPT-08	APS-08	SPS-8		
03:06 PM	AAPT-09	APS-09	Break for Posters	All Posters	
03:18 PM	AAPT-10	Break for Posters	and Refreshments	03:00 PM	Workshops
03:30 PM	Break for Posters	and Refreshments	APS-16	to	03:15 PM
03:42 PM	and Refreshments	APS-10	APS-17	04:00 PM	to
03:54 PM	AAPT-11	APS-11	APS-18	STEM Third Floor	05:45 PM
04:06 PM	AAPT-12	APS-12	APS-19	Hallways	W3 - Rm 108
04:18 PM	AAPT-13	APS-13	APS-20		W4 - Rm 111
04:30 PM	Invited-1	APS-14	APS-21		
04:42 PM		APS-15	APS-22		
04:54 PM					
6:30-8:00 PM	**Banquet** (University Center, 2nd Floor, Twilight Ballroom)				
8:30-9:00 PM	**Planetarium Show** (STEM Building Atrium)				

Saturday		
9:00-9:45 am	**Plenary 4 (Kennedy Auditorium)**	
9:45-10:00 am	**Coffee Break in Room 102 of the STEM Building**	
Sessions	**STEM Room 103**	**STEM Building**
10:00 AM	APS-23	Workshops
10:12 AM	APS-24	10:15 AM
10:24 AM	APS-25	to
10:36 AM	APS-26	12:15 PM
10:48 AM	APS-27	W5 - Rm 108
11:00 AM	AAPT-15	W6 - Rm 111

Friday Morning
Kennedy Auditorium

Plenary

APS, AAPT, and SPS
Chairs: Harry Downing
Christopher Aul

Plenary-1 **Potential for Exoplanetary Neighbors in Alpha Centauri**
Friday
9:00-9:45 AM
BILLY QUARLES, Georgia Institute of Technology — Multiple star systems account for a significant fraction of sunlike stars, where two of the nearest sunlike stars to Earth are actually in a gravitationally bound triple system, alpha Centauri. Astronomers have been observing this system for the past few decades in the hopes to identify an Earthlike world that could potentially support life as we know it. In addition, space-based observations of more than 100,000 stars have suggested that almost every star should host at least one planet, which strengthens the case for searching our nearest stellar neighbors for planets. I will summarize the historical search for exoplanets in orbit around either star in the inner binary alpha Centauri AB and the discovery of an Earth-mass planet orbiting the distant tertiary companion, Proxima Centauri. The habitability of alpha Centauri will also be discussed including the astronomical effects due to the stellar companions. There are also efforts to possibly explore this system using probes within the next few decades which makes the study of alpha Centauri timely and exciting. Finally, I will discuss the future observations of this system using direct imaging that could provide the most in-depth characterization of a world outside our solar system.

9:45-10:00 AM **Coffee Break**

Plenary-2 **Involving Undergraduate Students in Shock Wave Physics and Chemistry Research**
Friday
10:00-10:45 AM
ERIC PETERSEN, Texas A&M University — At the Turbomachinery Laboratory at Texas A&M University, we have been involving undergraduate (UG) students in research in shock-tube physics and chemistry for over ten years. Much of this research has been conducted in a year-round nature, involving local A&M engineering students in laboratory research in the Petersen group. In most cases, the students work alongside the graduate student and postdoctoral researchers over a period of several months and up to a few years. All aspects of shock-tube and shock wave research have been covered over this time frame, ranging from hardware and vacuum-system design to optical diagnostics and spectroscopy. Such experiments involving shock waves require high-speed acquisition and careful experiment timing due to the microsecond time scales involved. Additional research opportunities have stemmed from a long-running research experiences for undergraduates (REU) site sponsored primarily by the National Science Foundation with a theme of energy and propulsion. This REU site has involved over a dozen faculty members at A&M and extends to a collaboration at Stephen F. Austin State University. The nature of the research involved and the team that has been assembled provide a variety of projects that are topical, multidisciplinary, and ideal for giving the UG participants experiences that will encourage them to enter graduate school. From the authors' experiences, faculty mentors that have research groups with more than a few people, particularly ones that involve experiments and/or close ties to experiments, are the most successful for providing a positive experience to the UG students. With these principles in mind, a strong group of senior personnel and topics, including international experiences, has been involved in this site. The projects all have a firm footing in energy, combustion, and propulsion science, but they also span a range of disciplines including mechanical engineering, chemistry, materials science, aerospace engineering, and chemical engineering.

Plenary-3 **YOU'RE UP NEXT!**
Friday
10:45-11:45 AM
WALTER TRIKOSKO, Stephen F. Austin State University — Share your own physics demonstrations in this plenary session. We invite all meeting attendees to bring their favorite physics demonstration to share with everyone.

12:00-1:15 PM **Lunch in the Grand Ballroom of the Student Center**

AAPT-01 **Using Glowscript in Electrostatics**
Friday 1:30 PM
TOM O'KUMA, Lee College — For several years, I have used first VPython, https://vpython.org, and then Glowscript, http://www.glowscript.org, to introduce my introductory physics students to computational modeling and exploring electrostatic ideas.In this talk, I will present the latest order of computational modeling I am using to aid students in their understanding of electrostatic ideas and to boost their computational modeling ability. I will show what labs were are doing, student examples of the finished programs, and how they fit into the overall coverage of electrostatic ideas.

AAPT-02 **Using Peer feedback to Improve Student Lab Reports**
Friday 1:42 PM
PAUL WILLIAMS, Austin Community college — Peer feedback on writing assignments can be used to improve writing. This presentation will discuss the author's first attempt at replacing instructor feedback with peer feedback on a draft of a formal lab report in the second semester calculus-based introductory physics course. Google Classroom was used to assign students a template for the formal lab report that they could edit and on which their lab partners could comment. Results will be presented on the percentage of students who complied with the assignment, the types of feedback they provided, and a comparison of the quality of the reports to those submitted in a previous semester graded by the same rubric. Plans for future improvements will be discussed.

AAPT-03 **New York Times Centripetal Force Articles which help teach physics**
Friday 1:54 PM
JOHN P CISE, Austin Community College — The New York Times has had many articles that use the Centripetal Force concept. Some examples are: Black holes and newtron stars spiraling into collision producing gravitational waves, trains speeding off tracks on turns , tilting single passenger cars, dancers dancing in circles , spinning X game athletes,orbiting satellites-asteroids-comets-exoplanets,etc. The 35 articles I will show are among over 1000 applications located at 2016-2019 section at: http://CisePhysics.homestead.com/files/NYTCisePhysics.pdf

AAPT-04 **A Circuit Kit**
Friday 2:06 PM
TOM O'KUMA, Lee College — Many years ago, I put together a reasonably inexpensive DC circuits kit for use in introductory physics. The intent was to have a DC circuit kit that would be used in developing student ideas for simple, non-simple and some RC circuit ideas. In this talk, i will talk about the contents of the Circuits Kit and how I use it in my introductory physics classes.

AAPT-05 **1968 Gravity Wave Research Experiment at Missouri S&T**
Friday 2:18 PM
STEVEN A. MEZINES, Missouri University at Rolla — A brief description of an early gravity wave experiment performed at Missouri University at Rolla (now Missouri S&T) during the spring of 1968. Includes the trials and tribulations faced and overcome in developing, conducting and evaluating the results of the data collected. Typical photos of similar experiments used and sketches showing the basic test set up used at Rolla along with computer support equipment available at the time the experiments were performed is discussed. Results from the experiment are included.

AAPT-06 **Rope Magic And Vector Forces**
Friday 2:30 PM
DAVE WALL, Navarro College, Waxahachie campus — Use magic in the physics lecture hall? It was an accident the first time it happened, but it worked! Here is what it became.

AAPT-07 **Free Physics Videos**
Friday 2:42 PM
WILLIAM BASSICHIS, JONATHAN PERRY AND TATIANA ERUKHIMOVA, Texas A&M University — To help our students master calculus based physics courses we have recorded 75 videos with free access. The videos are about five minutes in duration and are meant to be textbook independent. Each topic is explained in a short concept video followed by two videos demonstrating the solution to typical problems. The videos were recommended to a large number of students in both a Mechanics and an Electricity and Magnetism course and logon statistics were obtained. There was no charge and no credit connected to watching. The effect on exam grades of participation was studied with some surprises. The overall results were sufficiently positive to lead to the videos being put online for general use.

AAPT-08 **Centenial of the Eddington Experiment**
Friday 2:54 PM
N. L. MARKWORTH, Stephen F. Austin State University — A. S. Eddington, the famous British physicist, went to the remote island of Príncipe (off the coast of Africa) to observe the eclipse of May 29, 1919. He wanted to measure the bending of starlight as it grazes the eclipsed Sun. Newtonian physics predicted a bending of 0.84 arcseconds, while General Relativity predicted 1.75 arcseconds. Eddington confirmed the Einstein result and Einstein's fame was made.

AAPT-09 **Bad Weather Astronomy**
Friday 3:06 PM
DOUGLAS PARSONS, Tyler Junior College — Astronomy should be a fun, hands-on, experience for students regardless of weather conditions. In this paper, use of Stellarium – an open source planetarium software package – as a teaching resource for astronomy labs is discussed, along with the impact it has on students in their engagement in the course.

AAPT-10 **Preliminary Analysis of a Departmentally Sponsored Supplementary Instruction Program**
Friday 3:18 PM
LIONEL HEWETT, Texas A&M University-Kingsville — Supplementary Instruction (SI) is an organized and targeted tutoring program that provides additional instruction to students outside of the regular lecture classroom. It has been used on our campus for several years and found to be of great value in increasing the performance of the students taking many of our introductory physics classes. Unfortunately, our SI Program was never fully institutionalized, so that when the funds for its implementation dried up, it was discontinued and our student performance dropped accordingly. This presentation describes how our department decided to try to provide this SI service ourselves and presents an analysis of the outcome of this effort during its first semester of implementation.

Posters **Poster Session - Go to the Third Floor Hallways of the STEM Building**
Friday 3:30-3:54 PM

AAPT-11 **A Rubric for Assessing Thinking Processes in FreeResponse Exam Problems**
Friday 3:54 PM
BETH THACKER, Texas Tech University — We designed a rubric to assess free-response exam problems in order to compare thinking processes evidenced in exams in classes taught by different pedagogies. The rubric is designed based on Bloom's taxonomy. We have data on a number of classes taught by the same instructor, one class more traditionally and one taught in an inquiry-based, laboratory-based setting with Socratic questioning pedagogy. We discuss the instrument, present results and present plans for future research.

AAPT-12 **Testing for Quality of Temperature Scale, and Eliminating Clausius's Jigs and Jags**
Friday 4:06 PM
WAYNE M. SASLOW, Texas A&M University — If, at the extremes of temperature, where temperature scales are uncertain, two experimentalists claim that they have the best temperature scale, it is important to be able to test which is more accurate -- and how accurate. We show how this may be done using the single-valued nature of the entropy. We also discuss how to go from the most general set of Carnot processes, as in the Clausius construction which leads to a jagged curve on any scale in p-V space, to non-jagged curves in p-V space.

AAPT-13 **A Comparison Study between Action-at-a-Distance Electrodynamics and Maxwellian Field Theory**
Friday 4:18 PM
JAMES ESPINOSA, Weatherford College — Maxwell's equations are universally taught in physics courses; they form the ideal field theory in classical physics. In older textbooks, Ritz's emission theory is mentioned briefly but not in any detail. We will give a more detailed examination of this theory since it is the ideal action at a distance theory of electromagnetism. Experiments will be used to compare these two approaches. It will be shown that a modified Ritzian theory can account for more phenomena than Maxwell's.

Invited-1 **Kilonova: A New Era in Astronomy**
Friday 4:30 PM to 5:00 PM
STEVEN BALL, LeTourneau University — The recent announcement of a kilonova event observed by over 70 telescopes and 3 separate gravitational wave detectors has ushered in a new era for modern astronomy. Prior to August 17, 2017, four separate gravitational wave signals seen in the LIGO and Virgo detectors originated from merging binary black holes, over a billion light-years distant, with no accompanying optical signals. The GW signals observed on August 17, 2017 lasted over 100 seconds compared to less than a second, suggesting the slower merging of a lighter binary system. Just 1.7 seconds after the peak GW signal the Fermi Space Telescope observed a gamma ray burst and localized the source to the same region of the sky. Within 10 hours, the first optical observation was made by the Swope Telescope in Chile, locating the source inside the galaxy NGC 4993 in the constellation Hydra, about 130 million light-years away. In the following days, x-ray, radio, UV, IR and numerous optical telescopes provided critical data. Subsequent analysis indicated this was the merger of two neutron stars with a combined mass of 2.7 solar masses. The implications are extensive. Short duration GRBs are produced by merging neutron stars. These events are favorable to r-process neutron capture

nucleosynthesis and produce heavy metals such as gold, platinum and uranium. The combined data also provides an independent measure of the Hubble expansion rate and tests for modifications to Einstein's general relativity. An exciting new chapter has begun for astronomy.

SPS-1 Friday 1:30 PM

An undergraduate research project on the use of a Lock-In amplifier for the measurements of low-level ac signals

BLAKE NEPTUNE, SURESH SHARMA, University of Texas at Arlington — This presentation covers the basic principle of phasesensitive detection and lock-in amplifier to extract low-level ac signals from data consisting of relatively high levels of noise.[1] We discuss the use of a Stanford Research Systems Model-SR830 lock-in amplifier for the measurements of optical, electrical, and dielectric properties of materials.[2] Representative data will be presented on the optical and electrical properties of selected thin film samples.

[1]https://www.thinksrs.com/downloads/pdfs/applicationnotes/AboutLIAs.pdf

[2]S. C. Sharma and R. A. Ramsey, Physica B, 405, 499-506 (2010)

SPS-2 Friday 1:42 PM

Thin-film property measurement and analysis system using LabView

DOUGLAS ZINN, VIVEK KHICHAR, SURESH SHARMA, University of Texas at Arlington — We present the architecture of a thin-film measurement and analysis system using LabView[1], well-known engineering software that can be used for synergistic operation of instruments to perform measurements and analysis of thin-film properties. Our system integrates instruments for the measurements of the electrical conductivity and optical properties of thin films. It consists of Signatone four-point probe, closed-cycle liquid helium Displex cryostat (10-300K), Keithley Model-2400 Source Meter, and LabView software. It also consists of a high-resolution JY-Horiba optical spectroscopy system for obtaining wavelength dependent reflectivity data. We will discuss representative data obtained for thin-film samples. [1]National Instruments, Austin, Texas, http://www.ni.com/en-us.html

SPS-3 Friday 1:54 PM

Modeling the Excited Hydrogen Molecule using Newtonian Mechanics

SAMIA SHUCHI, SHANNON PERRY, JAMES ESPINOSA, Weatherford College — It is universally taught that classical physics cannot describe microscopic processes. We will present the results of a simulation that uses a modified Ritzian theory that allows electrons to attract each other in special situations and allows for the stability of matter. Building on the unpublished results of an applied mathematician Dr. Greenspan, the correct frequency and bond length of the first excited state of the hydrogen molecule will be reproduced by a Visual Python code.

SPS-4 Friday 2:06 PM

Kepler K1 and K2: Missions, Predicaments, and Results

ASHLEY CATES, Stephen F. Austin State University — The NASA Kepler spacecraft has run two successful missions over a period of 9.6 years in the search for exoplanets in the Milky Way Galaxy utilizing the Transit Method for discovering planets orbiting other stars. The use of reaction wheels were utilized for stabilization of the spacecraft allowing the spacecraft to take continuous exposures of one small region of space between the constellations Cygnus and Lyra until two wheels become nonfunctional, resulting in the spacecraft no longer being capable of remaining focused on one area of space. Using a combination of thrusters and the remaining two wheels, the spacecraft was able to canvas stars along the ecliptic, allowing it to search for more exoplanets around the Celestial Sphere until the remaining fuel was depleted and the Kepler spacecraft was retired.

SPS-5 Friday 2:18 PM

The Science Behind The Kepler Mission

IAN HOUSMAN, Stephen F. Austin State University — The Kepler mission, launched by NASA in 2009, is designed to search for Earth-like planets that revolve around Sun-like stars. These exoplanets will hopefully orbit within their star's habitable zone, the area around a star with just the right temperature for liquid water to exist. Using just a fractional dip in brightness from the planet's star as the planet transits, we can calculate the exoplanets orbital period, orbital radius, and planetary radius. Learn how to calculate all of these parameters and more for the exoplanet Kepler-452b, the planet most similar to Earth found yet. The search for extraterrestrial life continues with the TESS mission and the James Webb Space Telescope. When these missions launch, we will be able to observe an exoplanets atmosphere, weather conditions, rotation, presence of vegetation, and more. We are closer than ever to answering the question: Are we alone in the universe, or is there life somewhere out there?

SPS-6 **Deuterium-Tritium Nuclear Fusion and the ITER Project**

Friday 2:30 PM

CARLTON MCINTYRE, Stephen F. Austin State University — Nuclear Fusion is a process that primarily occurs in the stars and generates energy. Humans have been trying to understand this process for decades. In recent years, advancements have been made in research and technology that encourages the continuation of these studies. Projects such as the ITER Tokomak and discoveries involved in controlling Edged Localized Modes, have increased the probability that nuclear fusion could be a primary source of energy in the future. This presentation will focus on simulating nuclear fusion with the Deuterium-Tritium reaction, magnetic confinement and future/on-going projects.

SPS-7 **Three Phase Sinusoidal Voltage from a DC Input Voltage**

Friday 2:42 PM

ROBYN LOGAN, HECTOR OCHOA, Stephen F. Austin State University — Three-phase systems are one of the most interesting topics in advanced Linear Circuit Analysis courses. It exposes students with many of the technologies used in our current power distribution networks. However, demonstration and experimentation are typically not part of the course, due to the lack of three-phase generators that can be used in the course. For that reason, in this presentation the fabrication of a low-cost three-phase generator will be discussed. The generator was designed using a Wien Bridge Oscillator to produce the AC signal, a smoothing op-amp to remove irregularities in the signal, and buffering/phase-shifting op-amps for splitting the signal into the three different phases. Furthermore, the challenges and problems faced during the design process will be discussed, including removal of signal irregularities and achieving stable 60Hz waveforms. By the end of the presentation, a functional final design will be presented, which includes the design and fabrication of a custom Printed Circuit Board (PCB) with all the necessary output ports.

SPS-8 **The Study of Twisted Coiled Polymer Actuators at Stephen F Austin State University.**

Friday 2:54 PM

VICTOR ORTIZ, HECTOR OCHOA, COLLIN TIMMONS, MICHAEL LYNN, Stephen F. Austin State University — In robotics linear actuators are great devices when linear motion is desired. However, current linear actuator technology requires large motors, or heavy pumps to achieve the desired results. For that reason, researchers have been working for years in developing a new breed of linear actuators. Twisted Coiled Polymer Actuators (TCPAs) are one of the most promising solutions to these problems. By super twisting a nylon 6,6 filament into a coil and applying heat, it is possible to achieve linear displacement based on its physical characteristics. Here at SFA these devices are also being fabricated, studied, and analyzed. Previously, these muscles were fabricated in a manual process that produced inconsistent results. In order to achieve higher quality samples, an automatic twister and its corresponding circuitry were designed and fabricated. The muscles fabricated using the twister under varying tensions have shown to have different physical characteristics such as differing coil diameters. In an effort to better characterize these TCPAs, an environmental test chamber along with a linear variable differential transformer (LVDT) will be used to analyze the actuation of the muscles in varying temperatures.

Posters **Poster Session - Go to the Third Floor Hallways of the STEM Building**

Friday 3:06-3:30 PM

APS-01
Friday
1:30 PM

Constraining the Equation of State of Neutron Stars using Nuclear Fragmentation Reactions
JOSILYN VALENCIA, CARLOS BERTULANI, Texas A&M University, Commerce — After a brief introduction to the structure of neutron stars, we will discuss the main physics inputs in the equation of state (EOS) governing the massradius relation of neutron stars. We will show that fragmentation reactions in high energy nuclear collisions can be used to constrain the symmetry energy part of the EOS. We make predictions for cross sections of numerous planned experiments in radioactive nuclear beam facilities, namely, RIKEN/Japan and GSI/Germany.

APS-02
Friday
1:42 PM

Propagation of Light in a Stellar Medium
SAMINA MASOOD, University of Houston, Clear Lake — Propagation of light in a stellar medium is studied to learn about the electromagnetic properties of a stellar medium and its possible impact on the interpretation of observational results.

APS-03
Friday
1:54 PM

The Next Generation Very Large Array
THOMAS J. MACCARONE, Texas Tech University — The Very Large Array has been the workhorse for radio astronomy for about 40 years. It was originally designed with 1970s era electronics that enabled only small bandwidth observations. About a decade ago, the electronics were upgraded to allow nearly the whole bandwidth accessible to any receiver to be used. The next step forward in sensitivity thus requires putting more antennas on the ground. In doing so, it is also a major goal to increase the baseline lengths between antennas, and allow for higher angular resolution observations, meaning that the array will include antennas within the state of Texas. I will discuss the Next Generation Very Large Array project, in terms of the scientific goals, the scope of the project and the process for the project to move forward.

APS-04
Friday
2:06 PM

Perturbative Effect o Weak Magnetic Field on Cellular Growth
SAMINA MASOOD, University of Houston, Clear Lake — We study the perturbative effect of week magnetic field on cellular growth and use these results to understand the effect of weak fields on protein structure.

APS-05
Friday
2:18 PM

Influence of drop deposition on the pinning of drops sliding on solid surfaces[1]
RAFAEL DE LA MADRID, FABIAN GARZA, JUSTIN KIRK, HUY LUONG, LEVI SNOWDEN, JONATHAN TAYLOR, BENJAMIN VIZENA, Lamar University — In [R. Tadmor et al, Phys. Rev. Lett. 103, 266101 (2009)], it was reported that a pendant drop (which hangs from a solid surface) is more pinned to the surface than a sessile drop (which rests on top of the surface). In this talk, we will present a simple experiment that suggests a simple explanation of such effect.
[1]Supported by a Lamar Presidential Fellowship

APS-06
Friday
2:30 PM

Waveguide-coupled $Ag/HfO_2/Au$ tapered nanostructures for high-resolution surface plasmon resonance sensor applications
HUSSEIN AKAFZADE, SURESH SHARMA, University of Texas at Arlington, NADER HOZHABRI, Nanotechnology Research Center, Shimadzu Institute — High resolution surface plasmon resonance(SPR) sensors are utilized for variety of applications in physics, chemistry, biotechnology, etc. These sensors respond to changes in the refractive index of analytes with remarkably high sensitivity and resolution.[1] Recently, we have investigated series of SPR sensors fabricated by using noble metals and waveguide-coupled nanostructures, $Ag/Si_3N_4/Au$ and $Ag/HfO_2/Au$, by utilizing computer simulations and attenuated total reflection spectroscopy. We present results from COMSOL simulations for SPR sensors using thin-film noble metals and multilayer nanostructures. [1]S. C. Sharma, in Advances in Sensors: Reviews' Book Series, http://www.sensorsportal.com/HTML/BOOKSTORE/Advances in Sensors Reviews Vol 5.pdf, edited by S. Y. Yurish (IFSA Publishing, Barcelona, Spain, 2018), Vol. 5, p. 25-77.

APS-07
Friday
2:42 PM

Magnetic imaging of functional materials using in-situ electron holography
ARTURO PONCE, PRAKASH PARAJULI, University of Texas at San Antonio — Electron holography is one of the most reliable access for solving the phase problem in transmission electron microscopy (TEM). Phase reconstruction from holograms is a complex method that requires a workflow to determine optimal conditions to register the modulation of the electron wave due to physical properties of materials, e.g. magnetic and electric fields. The analysis of magnetic properties in materials and their evolution under external magnetic fields can be addressed by using live phase reconstruction electron holography. In-situ TEM magnetization can be applied to materials using the main objective lens of the electron microscope. In this presentation, the study

of ferromagnetic behavior in nanostructured materials (nanoparticles and nanowires) will be included. The magnetic analysis of the images can be correlated with the crystal orientations at the internal structure of the nanomaterials by using the automatic scanning crystal orientation methodology assisted with precession electron diffraction. The combination of electron holography and crystalline orientation provides the full understanding of the magnetic properties of materials at nanometric scale.

APS-08 Friday 2:54 PM

Design Optimization and Fabrication of a two stage HV-LV SuperCDMS style detector

HIMANGSHU NEOG, RUPAK MAHAPATRA, MARK PLATT, NADER MIRABOLFATHI, Department of Physics and Astronomy, and the Mitchell Institute for Fundamental Physics and Astronomy, Texas A&M University — SuperCDMS interleaved Z-sensitive Ionization and Phonon(iZIP) detectors have shown great success in discrimination of electronic and nuclear recoils, while the High Voltage (HV) detectors have been reaching to lower and lower energy thresholds by sacrificing that discrimination. This work introduces a two-stage High Voltage Low Voltage(HV-LV) design to retain both the excellent threshold performance of the HV detector and maintain the iZIP discrimination. We tried to optimize the geometry of the two-stage setup using COMSOL electric field simulations to minimize surface events and charge traps on detector surfaces. One optimized version of the detector has been fabricated and the fabrication steps are summarized.

APS-09 Friday 3:06 PM

Femtosecond optical curing of SU-8 photoresist at wavelengths transparent to silicon

CHRISTOPHER B. MARBLE, KASSIE S. MARBLE, SEAN BLAKLEY, CHRISTOPHER VINCENT, VLADISLAV V. YAKOVLEV, Texas A&M University — SU-8 photoresist is used in numerous three-dimensional (3D) applications ranging from micro/nanoelectromechanical systems to microfluidics. Its biocompatibility and resistance to chemical attack has led to its use in tissue engineering and cell manipulation. SU-8 photoresist is commonly patterned via exposure to UV radiation; however, other exposure methods such as direct laser writing (DLW) via two photon absorption have been employed in 3D applications. Understanding DLW in SU-8 is complicated by competing nonlinear processes. By choosing to expose SU-8 at 1.7 μm, we avoid multiphoton absorption and reliably polymerize SU-8 via the ionization of hot, nonequilibrated electrons. This process provides the opportunity for high aspect ratio patterning at wavelengths where silicon is optically transparent.

Posters Friday 3:18-3:42 PM

Poster Session - Go to the Third Floor Hallways of the STEM Building

APS-10 Friday 3:42 PM

New Particle Detector Development with Single-molecule magnet

HAO CHEN, Texas A&M University — Both detection of dark matter and observation of coherrent neutrino scattering call for low threshold detectors. Single molecule magnet (SMM) has long been discovered and researched, one of its interesting phenomenon is the magnetic avalanche. Recently there was a theoretic proposal which utilizes magnetic avalanche to create a new way to detect dark matter particles with masses ranging from 0.001 eV to 10 eV. It was named as magnetic bubble chamber. In our lab, we tested this idea with Mn12-acetate and showed that magnetic avalanche is able to be triggered by nuclear recoils. The experiment was operated in a cryogenic fridge which currently can reach as low as 1.5 Kelvin. With the long list of different kinds of SMM, and the ability to synthesize new kinds according to our needs, it will be a promising way to detect dark matter or neutrinos.

APS-11 Friday 3:54 PM

Role of polarons in hybrid perovskites for non-linear optical processes

ERIC WELCH, ALEX ZAKHIDOV, Texas State University — Organic lead halide hybrid perovskites (HPs) is a novel promising class of materials for the low-cost printed solar cells (record power conversion efficiency - 23.7%), photodetectors, LEDs, sensors and other optoelectronic devices. Yet, the nature of light-matter interaction in HPs is still debated. Benchmark CH3NH3PbI3 perovskite is reported to have a structure with inversion symmetry. Yet, Bulk Photovoltaic Effect (BPVE) [1] and Second Harmonic Generation (SHG)[2] non-linear optical effects recently reported for this material require the inversion symmetry breaking. In our recent work we presented the Density Functional Theory (DFT) with +U Hubbard correction computational model that predicts the existence of polarons in HPs.[3] We argue that breaking of bulk inversion symmetry in these experiments can be caused by light-induced polarons, which lead to the collective distortion of the crystal lattice. In fact, the presence or absence of polarons in the MAPI films may explain the controversial reports on MAPI polarity. The reported effects may enable third generation perovskite solar cells with efficiency that exceed the Shockley–Queisser limit. Our observations also open new venues for perovskite spintronics and tunable THz sources. [1]. P.A. Obraztsov, et al., Comm. Physics 1, 14 (2018). [2]. A.A. Popkova, et al., OSA Technical Digest JW3A.49 (2018). [3]. E. Welch, et al., AIP Advances 6, 125037 (2016).

*We thank NSF(#1721884, Dr. Anna Brady-Estevez), ACS PRF (#UNI656095-UNI6, Dr. AskarFahr), and ONR (#W911NF-16-1-0518, Dr. Paul Armistead) for partial support of this work.

APS-12 Friday 4:06 PM

Barium Tagging and Fluorescence Imaging Using NEXT Chemical Dyes

NICHOLAS BYRNES, JACQUELINE BAEZA-RUBIO, FRANK FOSS JR, DENISE HUERTA, BENJAMIN JONES, AUSTIN MCDONALD, DAVID NYGREN, PAWAN THAPA, ALENA TRINIDAD, KATHERINE WOODRUFF, University of Texas Arlington — Neutrinoless Double-Beta Decay, the process by which two neutrinos annihilate upon production during a double beta decay event, is currently the best theory to test the Majorana behavior of Neutrinos i.e. that they are their own antiparticles. In the development of a detection technique for the barium daughter of a Xe-136 Neutrinoless Double-Beta Decay, significant steps are planned to improve the reliability and repeatability of methods previously used at The University of Texas Arlington. A new series of barium tagging molecules; mono-aza18c6, mono-aza15c5, and mono-aza21c7, henceforth referred to as NEXT-1, NEXT-2, and NEXT-3, have been developed using different fluorophores, and are currently being improved upon. The NEXT molecules act as a switch that, when exposed to barium, trigger the fluorescent response used to image the molecules. This fluorescent response is detected through the use of TIR-SMFI (Total Internal Reflection Single Molecule Fluorescence Imaging) on an Olympus IX70 inverted microscope. To combat any hygrophilic behavior of the dry NEXT molecules, a novel microscope gas flow apparatus has been developed to flow dry nitrogen or argon over the deposited chemicals and keep them from drawing moisture out of the atmosphere while being analyzed. This allows for the imaging of the barium-enriched molecules in the dry phase, a previously unattainable step.

APS-13 Friday 4:18 PM

Photon Detector with SIPMs on an Acrylic Disk (SIPM Wheel)

ILKER PARMAKSIZ, University of Texas at Arlington — SIPM Wheel is an new form of photon detectors that is meant to be used in Liquid Argon or High Pressurized Xenon Gas Environments. It has an acrylic circular disk coded with TPB UV wavelength shifter, and its radius is 14.5 inches. 16 SIPMs are placed symmetrically on the edges of disk with slightly touching position. The optimum goal is to estimate the position of light source by comparing the number of the photons seen in each SIPMs. Comparison of the Data has been going on between the Simulation and Real Detector.

APS-14 Friday 4:30 PM

Basic Easier to Understand Equations Calculate Nuclear and Atomic Properties, Constants, and Patterns from Electron Orbits to Cosmic Size Scales

ROB L. ALLEN, Retired — Basic Easier to Understand Equations Calculate Nuclear and Atomic Properties, Constants, and Patterns from Electron Orbits to Cosmic Size Scales. Name: Rob L. Allen Semiretired Senior Scientist, TX 77318, USA Complex computations for a great many physical constants can be simplified for high school physics students. Properties of hexagon rings will be shown to accurately calculate force ratios, particle masses, and constants from the sub nuclear to macro scales. Masses of many particles from muons to the very heavy Higgs form orderly patterns with similarities to tables of aromatic organic compounds having hexagon rings. Also, slides show induction patterns from the COBE Big Bang scale down to electron orbits with common mathematics from ring properties. A few examples are the integer number of electron masses in a proton and antiproton pair =3672=6X6X6X(6X6/2-1). Electron masses equaling the Higgs are about 244794=((6X3-1)X4)X6X6X(6+4)X(6+4)-6. A muon/electron mass=206.77=(6X3-1)X6X2+natural log of (6X3-2). The Stephan-Boltzmann Constant=17/C=(6X3-1)/C. C=the speed of light. The Inverse Fine Structure Constant equals 137.036=6X6+(6+(6-2))X(6+(6-2))+1+(6X6/((6+(6-2))X(6+(6-2))X(6+(6-2)))). Between a positron and an electron, Electromagnetism/Gravity= ((((6X3-1)X(6X3-2)+1))^(6X3-1)X(6X3-2). Poorly known constants are derived. Biography Rob L. Allen, has pioneered, improved, and developed many scientific systems evaluating radiation and electromagnetic, acoustic, and seismic signals. He has a BS Degree in Computer Science from Stephen F Austin University and has taken numerous extra electronics design and physics courses at Texas Tech and Long Beach State. He managed research groups and computer centers. Major roles were management and allocating large grants from corporations to research groups including Stanford, Berkeley, and Texas A&M. Much of his work has been highly restricted, but he has published twelve papers in reputed journals and presented at many conferences. Biography: Rob L. Allen, has pioneered, improved, and developed many scientific systems evaluating radiation and electromagnetic, acoustic, and seismic signals. He has a BS Degree in Computer Science from Stephen F Austin University and has taken numerous extra electronics design and physics courses at Texas Tech and Long Beach State. He managed research groups and computer centers. Major roles were management and allocating large grants from corporations to research groups including Stanford, Berkeley, and Texas A&M. Much of his work has been highly restricted, but he has published twelve papers in reputed journals and presented at many conferences.

APS-15 Friday

[CANCELED] Boundary and interface effects on charge relaxation dynamics

XUEWEI ZHANG, Texas A&M University-Kingsville — Charge relaxation has generally been treated as a

4:42 PM

transient process during which the electric quantities in the bulk attenuate exponentially with the characteristic time defined as the ratio of the medium's permittivity and conductivity. There have been studies on the non-exponential charge relaxation in complex media with heterogeneous, anisotropic, or 'fractal' physical properties. However, the effects of boundary and interface on charge relaxation has not been investigated systematically. This work attempts to fill this gap, starting with analytical solutions of 1-D charge relaxation in Ohmic media bounded by perfect insulators and/or conductors. Then extending to 2-D model, two sets of numerical results are presented. The first set is for a boundary mixed with conductors and insulators, and the second set is about charge crossing an irregular interface modeled as Koch curve between two media. The work will discuss these cases in which deviations from exponential behavior exist, as well as potential applications and implications of the results.

APS-16 Friday 3:30 PM

Image Processing and the Enhancement of IBALL (Informational Bio-effects Atlas of Laser Lesions)

MATTHEW MACASADIA, Texas Lutheran University, Engility, Air Force Research Laboratory 711 HPW/RHDO — Many studies have been conducted to learn more about retinal laser lesions. However, much of this data has not been processed for use. This led to the development of the Information Bio-effects Atlas of Laser Lesions (IBALL). This system was designed as an educational resource for the Department of Defense researchers and clinicians. Originally, IBALL was filled with a handful of images from one study, but we have sought to add more processed data to the system. Using Python and image processing techniques, we developed an automated methodology to process images from 4 different laser lesions study to add to the existing IBALL database. We will present our automated process and initial results.

APS-17 Friday 3:42 PM

Applied roughened ice particle models to multi-angle imaging satellite retrievals of ice cloud properties

YI WANG; PING YANG, Texas A&M University — Assuming different ice particle models in remote sensing retrieval techniques will significantly affect the ice cloud optical and microphysical property retrievals. Previous studies found roughing the ice particle surface by adding random tilts will improve the consistency between modeled and observed reflectances. However, the appropriate degree of roughness on the ice particle model and the geospatial distribution of roughness are still under discussion. In our work, we identified the best-fit degree of roughness using a fused satellite dataset, which provides a wider range of scattering angle measurements from multi-angle imaging sensors. The results suggest a latitudinal dependence in an optimal ice particle model and an additional dependence on the solar zenith angle at the time of the observations. Furthermore, the t, Reff, and ice water path (IWP) are retrieved with the identified best-fit model and compared to most common operational satellite retrievals (i.e., MC6 products). In general, the approach based on a best-fit model leads to greater consistency with the multi-angle satellite measurements and results in a larger t and smaller Reff and almost identical IWP in comparison with the MC6 model.

APS-18 Friday 3:54 PM

A new dark matter WIMP candidate, potentially observable by direct and indirect detection

REAGAN THORNBERRY, Texas A&M University — We propose a new dark matter WIMP candidate potentially observable by direct and indirect detection. This particle has well-defined mass and couplings and is similar to the proposed neutralino. It is charge neutral, with a spin of and R-parity of -1, making it stable, with an expected mass less than or equal to 125 GeV. We expect interactions via the Higgs boson to have cross-sections comparable to those of the neutralino. It follows that this proposed dark matter particle should be within the reach of emerging and proposed facilities in both direct and indirect experiments.

APS-19 Friday 4:06 PM

Dark Matter WIMP Detection Prospects at the LHC

MAXWELL THROM, REAGAN THORNBERRY, JOHN KILLOUGH, BRIAN SUN, GENTILL ABDULLA, BRETT BAYS, MICHAEL ERICKSON, DYLAN BLEND, GABE FROHAUG, Texas A&M University — Dark matter still has yet to be detected and there is ever-growing tension as to whether supersymmetry can provide a credible dark matter candidate. We suggest a new candidate with well-defined mass and couplings. It shares many properties with the neutralino, one of the more prominent candidates for dark matter, such as having spin 1/2 and only interacting with the weak force and gravity. Our particle has couplings to the Higgs boson, as well as the W and Z bosons, so that it is potentially observable at the Large Hardron Collider. With a mass of approximately 10-100 GeV, particles of this kind could have been created in the right abundance in the early universe to fit astronomical dark matter observations.

APS-20 Friday 4:18 PM

Emanation and Bulk Fluorescence in Liquid Argon from Tetraphenyl Butadiene Wavelength Shifting Coatings[1]

JONATHAN ASAADI, BENJAMIN JONES, AKSHAT TRIPATHI, ILKER PARMAKSIZ, HUNTER SULLIVAN, ZACHARY WILLIAMS, University of Texas at Arlington — Liquid argon time projection chambers (LArTPCs) play a central role in modern neutrino physics and dark matter searches. As well as being an excellent active medium for time projection chamber operation, liquid argon is also a bright scintillator, with a yield of tens of thousands of photons per MeV. This scintillation light is emitted in the vacuum ultraviolet (VUV) range (128 nm) which presents challenges for its detection. Although argon itself is highly transparent at this wavelength, the majority of commercially available optical detectors such as SiPMs and photomultiplier tubes are not sensitive in this spectral range. This problem has traditionally been solved in large-scale systems by employing a wavelength shifting coating to convert VUV light into a visible range where it can be detected by conventional sensors. One of the most commonly used fluors is the organic compound tetraphenyl butadiene (TPB). In this work we study the stability of TPB coatings in liquid argon. We present recent results demonstrating that TPB may not remain solidly affixed to

coating surfaces, and rather may become dissolved or suspended in the argon bulk, for several commonly used types of coating in neutrino detectors.

[1]We thank MicroBooNE, NEXT and DUNE programs for providing us with equipments used in this study and the Department of Energy (DOE) for supporting the UTA research group

APS-21 Friday 4:30 PM **Performance of the Pilot Dual-Phase and Prototype Detector for the Deep Underground Neutrino Experiment**

CRISTIAN GARCES, NICHOLAS LIRA, JAEHOON YU, CRISTOBAL GARCES, DOUGLAS ZENGER, JAKOB SCANTLIN, ARCHIT JAISWAL, MATTHEW RAPP, HECTOR CARRANZA, University of Texas at Arlington — The purpose of this paper is to understand the energy deposition of the pilot dual-phase detector at CERN and the prototype detector at Fermilab for the Deep Underground Neutrino Experiment (DUNE). Currently, the field cage at Fermilab is only single phase, with hopes to add double phase at a later time. I will briefly discuss the geometry of the time projection chamber (TPC) in this paper to fully understand how the TPC performs. Furthermore, I will present the experimental process and how data is collected and analyzed. With this data, we can analyze the performance of the detectors.

APS-22 Friday 4:42 PM **New Design for Deep Underground Neutrino Experiment Field Cage**

CRISTOBAL GARCES, JAEHOON YU, ANIMESH CHATTERJEE, DANIEL KOSS, DOUGLAS ZENGER, BENJAMIN SMITHERS, CRISTIAN GARCES, ARCHIT JAISWAL, NICHOLAS LIRA, MATHEW RAPP, ROMAN RENAZCO, HECTOR CARRANZA, JAKOB SCANTLIN, University of Texas at Arlington — UTA's HEP Group will collaborate in the design and construction of the Deep Underground Neutrino Experiment (DUNE) Dual-Phase field cage. The entirety of the field cage is 12 meters tall, 12 meters wide, and 60 meters long. The frame of the cage is made up of Fiber Reinforced Polymer (FRP) I-beams and is populated by aluminum profiles that will distribute an electric field throughout. The cage itself has undergone several changes that differ to the protoDUNE field cage that is currently stationed at CERN. Besides the size differences of the cages, the new FRP I-beams have been reduced in size and have changed in internal geometry. These new components are in need formal engineering drawings so that they will satisfy engineering standards for manufacturing before any further work can be done.

Poster-01
Friday
3:00-4:00 PM

Using an Arduino to Read Sensors in Introductory Labs[1]

WADE COOKSTON, CALVIN BERGGREN, Texas Lutheran University — The primary issues with buying prepackaged sensors to be used in introductory labs is that they are expensive and can obscure the way that the measurement is taken, which can be counterproductive in teaching experimental science. In order to combat this, I, under the supervision of Dr. Berggren, spent the summer developing a way to make our own cost efficient and functionally transparent sensors that could be used instead. Using the Arduino microcontroller platform, we were able to successfully develop a voltage sensor, and make progress towards developing a magnetic field sensor using a Hall Effect Sensor.

[1]The TLU Physics Department, Office of the VPAA, and The Budwine Foundation

Poster-02
Friday
3:00-4:00 PM

Fabrication and Characterization of Porous Silicon Thin Films[1]

JASON WILLIAMS, TONI SAUNCY, Texas Lutheran University — Porous Silicon (p-Si) refers to a thin film matrix structure of nanoscale crystalline Si, typically formed atop a bulk single crystal Si substrate. The p-Si structure has been fabricated on a wide range of Si substrates and is interesting because the porous silicon thin films exhibit optical emissions not possible in ordinary crystalline silicon. At TLU, we have fabricated a series of porous silicon thin films on p-type and n-type crystalline silicon substrates using an anodic etching cell technique. Wafers are prepared with a chemical cleaning process and then submerged in hydrofluoric acid and subjected to an electric field. Process time and current density were varied to examine the effect on the resulting optical emission, we can influence the resulting optical properties. Raman spectroscopy was used to ascertain the resulting crystalline structure of the material, and photoluminescence was measured from each of the prepared samples.

[1]TLU VPAA Summer Research Funding

Poster-03
Friday
3:00-4:00 PM

Measuring the Magnetic Properties of 3D Printed Materials Using the Vibrating Sample Magnetometer[1]

SAMUEL ZAMORA, WIM GEERTS, BINOD D.C., JOSELYN LESIKAR, Texas State University San Marcos — Texas State University has come into possession of a new Vibrating Sample Magnetometer (VSM) able to sweep from negative 2.3 Tesla to positive 2.3 Tesla using the vector option. We were compelled to measure dipole moments of 3D printed materials. We used a polylactic acid (PLA) filament loaded with soft magnetic thin films. Our 3D printed samples were created using an ORD ROVa3D 3D printer, using water cooling, Bowden extruders, and a printing temperature of 190 degrees Celsius. We used a Microsense VSM with a biaxial coil set to measure both magnetic moments parallel and perpendicular to the field so we could get a more complete picture of the magnetic reversal mechanism. Using the VSM, we sought to determine the magnetic fingerprint of the material, (=M-H curve). Note that M-H curves are often non-linear, and shall have hysteresis in them. Samples were measured using a range of -1500 to 1500 Oersted over a sweeping range of 140o of rotation. Samples were also measured for angular remanence under a 140o rotation with the same range of magnetic field. Samples were found to react differently based on orientation within the field, and displayed anisotropy.

[1]This work was supported by a DOD grant (HBCU/MI grant W911NF15-1-0394) and by an NSF grant via a DMR-MRI grant (award 1726970).

Poster-04
Friday
3:00-4:00 PM

Project Rhab: Establishing an Ongoing Research Program

MOSE BUTLER, BLAKE RATLIFF, GEORGE ROOK, LANDON SCHNEIDER, ANDREW WEINSTEIN, Austin Community College — The Austin Community College Chapter of the Society of Physics Students concieved, designed, launched, and recovered a high-altitude weather balloon. The aggregation and interpretation of high-altitude data sets provides a modern research opportunity, a replicable practical experiment, a team building exercise, and an effective outreach event. Our high-altitude prototype, project Rhab, was outfitted with an onboard Arduino supported sensor array to collect atmospheric data and a camera payload to record video of the flight. Our SPS chapter initiated the project to develop a collaborative research environment and complete a highly-technical, complex scientific experiment. Our launch was the first of a series of ongoing launches with the goal of creating a cache of valuable scientific information that will feed future data analysis projects. We shall present data from the first launch, our plans for future launches, and an overview of the many lessons learned.

Poster-05 **Application of Doppler Broadened Annihilation Gamma Spectroscopy to the study of Zeolites**
Friday 3:00-4:00 PM
S. LOTFIMARANGLOO, E. PEREZ, , R. W. GLADEN, V. A. CHIRAYATH , A. J. FAIRCHILD, A.R. KOYMEN, AND A.H. WEISS, University of Texas at Arlington,Department of Physics 502 Yates St. Arlington, TX, 76019 — In this presentation, I will discuss the possible use of low energy positrons (2 eV-20 eV) to solve some important problems faced during the characterization 3D/2D porous materials like Zeolite/2D porous oxides which play important role in heterogeneous catalysis. These novel materials are particularly difficult to study with surface science techniques like STM or XPS. This is because these techniques rely on probes and emergent signals that need an exposed surface to operate while the active sites at which chemical reactions occur are at the surfaces of internal pores. Here I will outline possible modalities in which the new positron beam system recently completed at the University of Texas at Arlington can be used to perform measurements using Doppler Broadened Annihilation Gamma Spectroscopy to characterize internal surfaces of pores in zeolites that is otherwise inaccessible to conventional surface science techniques. We will conclude with a discussion of future applications of the positron beam in the study of the inner surfaces of nano/micro porous materials that has under gone various processing conditions like thermal treatment and inner surface oxidation/reduction during catalysis.

Poster-06 **Building and Using Lehman Seismometers**
Friday 3:00-4:00 PM
BOUBACAR WANE, LUKE KRAFT, JAXON TAYLOR, TONY STEIN, WAYNE TRAIL, Southwestern Oklahoma State University — Seismometers are used to detect vibrations in the earth. They can be made extremely sensitive even with very simple and inexpensive parts. The most basic seismometers behave like horizontal pendulums, which are caused to swing when the earth undergoes small movements. The swinging motion is made to produce a tiny current, which we detect and record using a micro-controller. A few seismometers separated geographically allow one to triangulate to the location of the earthquake. We have built a few Lehman seismometers and are in the testing process. We are also working on different options for recording the data. We can have detected Earthquakes that register 2.5 on the Richter scale.

Poster-07 **The Dobsonian Telescope: An Outreach Exploration**
Friday 3:00-4:00 PM
CAMERON CINNAMON, DANIEL GASSEN, JAXON TAYLOR, WAYNE TRAIL, Southwestern Oklahoma State University — We are reclaiming optical equipment from some of our older unusable telescopes to incorporate into new portable Dobsonian telescopes, which we are building and hope to use for viewing sessions in more distant communities, and on trips. SWOSU has several old non-working telescopes that either broke (irretrievably), or were donated and unusable, but which have good to excellent optics and can be rescued from obsolescence with careful construction. We have begun with some of the smaller optical systems (6 inch diameter mirrors), but we will be making telescopes out of 10 inch, 12 inch, and 16 inch mirrors in the future. Considerable care has to be taken to make sure the telescopes move extremely smoothly and can be pointed very precisely—this is the challenge in building a usable (great) Dobsonian telescope. In addition to using them for oncampus observing sessions, we hope to use these telescopes as part of Physics Club community outreach by taking them to other towns.

Poster-08 **Automating the SWOSU Astronomical Observatory**
Friday 3:00-4:00 PM
JAXON TAYLOR, BOUBACAR WANE, TONY STEIN, WAYNE, Southwestern Oklahoma State University — Recent, low-cost, high-quality astronomical cameras have made it possible for us to use the SWOSU (Southwestern Oklahoma State Universtiy) 16 inch RitcheyCretien telescope to take very high quality images of faint astronomical objects like distant galaxies and nebulae. One challenge we have faced in this astrophotography is that these images often require long exposure times, as much as several hours. During this time the Earth is rotating so the telescope has to track its target across the sky over the course of the night. The SWOSU Observatory, which houses our telescope, consists of a 15-foot diameter dome with a closable slot the telescope looks through. So as the telescope tracks a target across the sky, the slot must be regularly adjusted (usually every several minutes) to keep the telescope looking through the slot. This part of the process is very tedious, particularly in the wee hours of the morning. In this work we use microcontrollers to allow the software that controls the direction the telescope is aimed to also correctly position the dome so that the astronomer doesn't have to.

Poster-09 **Using Defect Creation in Materials as a Potential Signature of Dark Matter**
Friday 3:00-4:00 PM
FEDJA KADRIBASIC, Texas A&M University — Many astrophysical observations indicate that about 85 percent of the universe's mass content could be nonbaryonic in the form of so-called dark matter. We use numerical simulations backed by density functional theory simulations and experiments to investigate whether the nonlinear energy loss to defect creation could be used as a signature for dark matter interactions. We expand on previous results using germanium ultra-low-threshold phonon detectors by simulating the expected

response with a silicon or carbon substrate, the latter of which gives a much larger signal than the others. This idea could be tested in future low energy calibrations using low energy neutron beams.

Poster-10
Friday
3:00-4:00 PM

Automatically Generating Linked Scatter Plots to Determine Rare Stellar Remnant Candidates[1]

ANDREW HAMILTON, Texas Lutheran University — There are only eight confirmed LowAccretion Rate Polars (LARPs) known at this time, all in the Northern Hemisphere. Finding and characterizing more of these rare stellar remnants will help us determine their evolution and relationship to other cataclysmic variables. We developed a program that utilizes Linked Scatter Plots to reduce a large sample of stars to a list of stars whose properties are similar to those of the known LARPs. We use SDSS, WISE, and XMM-Newton observations of the confirmed LARPs to automatically generate a set of filter conditions used for the Linked Scatter Plots to sort through the stellar data and identify LARP candidates. We will present updated results from our search for these candidates.

[1]TLU VPAA Summer Research Fund The Budwine Foundation

Poster-11
Friday
3:00-4:00 PM

Pole Figure Measurements on RF-Sputtered Ni0.8Fe0.2-Thin Films.[1]

BINOD D.C., Texas State University — Permalloy (Py) thin films have been extensively studied for a large variety of applications, including magnetic shielding, transformer laminations, magnetic recording head sensors, and telecommunication cables. The applicability of the Py originates because of its high magnetic permeability, small coercive force, nominal core losses, small remanence and magnetostriction. Here, we discuss how the texture of Py films can be affected by the application of a magnetic field during deposition. This method is often applied to induce an easy axis in this material. It is believed that the field induced easy axis originates from preferential orientations of the NiFe bonds with the magnetic field but also has strain contributions. Films were deposited by RF magnetron co-sputtering from Py targets (Ar-flow=30 sccm, T_{sub} =300K) on fused quartz 3" wafers in zero magnetic field or 1500 Oe Magnetic field. Pole figure measurements were made with a Rigaku Smart lab for the (111) and the (220) diffraction peaks. The measured pole figures of samples deposited in zero magnetic field showed the (111) crystallites to be tilted with respect to the film normal. The effect of a magnetic field on this conical texture will be discussed.

[1]This work was supported by a DOD grant (HBCU/MI grant W911NF15-1-0394).

Poster-12
Friday
3:00-4:00 PM

Strained Germanium Waveguide Simulations for Active Silicon Photonics

MD. SHAMIM REZA[1], KIRAN DASARI[2], MARK A. WISTEY[3], Texas State University — Wrapping a Ge waveguide with a silicon nitride stress liner creates strong tensile strain suitable for compact lasers and modulators on silicon. However, material properties such as bandgap and refractive index vary strongly with local strain. We used the Vienna ab-initio Simulation Package (VASP) to create a map of strained Ge refractive index as a function of in-plane and outof-plane strains and mapped that to a COMSOL Multi-Physics strain simulation. A Ge rectangular ridge waveguide with width 1μm and height between 1 - 3μmas wrapped with 1μm thick, 1 GPa SiNx stress liner in COMSOL. The stationary strain mode solution allows the SiNx to relax and expand, which induces tensile strain on the Ge waveguide. In turn, this reduces the bandgap of the Ge, increasing the refractive index. Our results show strong confinement of the optical mode well above the Si substrate, which is favorable for reducing leakage and crosstalk in on-chip optical interconnects. The increase in refractive index also provides stronger lateral confinement, which increases lateral packing density. Overlap integrals were used to calculate the expected gain and loss in lasers and modulators, respectively.

[1]Material Science Engineering and Commercialization

[2]Department of Physics

[3]Material Science Engineering and Commercialization; Department of Physics

Poster-13
Friday
3:00-4:00 PM

A saturated absorption locking technique based on a Dual-Frequency AOM

BENJAMIN EDWARDS, DR. LARRY ISENHOWER, Abilene Christian University — Electromagnetic waves are commonly used to manipulate Cesium atoms in a laser cooling technique called Magneto-Optical Trapping. This requires locking lasers near the atomic resonances. Many methods have been implemented for achieving this frequency locking. In this presentation a new method is proposed using an Acousto-Optic Modulator (AOM) driven by two frequencies. In this technique the AOM will create two beams of different frequencies. These are sent through a Cesium cell and are measured by photodiodes. By taking the difference of these signals a diffractive error signal will be produced because of the frequency offset of the two beams. We can use this error signal to lock on to the atomic transition. This system is part of an experiment where the eventual goals are to study highly excited Rydberg states and their interactions with each other and the environment.

Poster-14 Friday 3:00-4:00 PM

Partial densities of states and ion fractions during H-/H collisions with various copper surfaces

BOGDANA BAHRIM (1), JAMIE STAFFORD (2) AND BORIS MAKARENKO (3), 1. Physics Department, Lamar University; 2. Physics Department, University of Houston; 3. Chemistry Department, University of Houston — Negative hydrogen ions and neutral hydrogen scattered from different faces of copper yield very different results in terms of the negative ion/neutral fraction that "survives" the collision with the surface. This indicates a strong "crystal effect" on the ion fractions that originates from the different band structures of the copper faces, along the direction normal to the surface. These band structures feature energy band gaps along the surface normal that change the complex interactions between surface states, images states and projectile states. The study of partial density of states provides detailed information about the energy location and width of all the projectile and surface states involved in the ion-surface interaction. These are important factors that decide on the projectile survival. Partial densities of states are calculated for ion-surface distances up to 120 a.u. measured from surface. Ion fractions are reported for projectile energies up to 6 keV, and exit angles up to 90 degrees.

Poster-15 Friday 3:00-4:00 PM

Phase Matrices of Horizontally Oriented Ice Crystals and Their Applications in Atmospheric Sciences

MASANORI SAITO AND PING YANG, Texas A&M University — The single-scattering properties of ice crystals are fundamental for many applications in atmospher-ic sciences, which assume random orientations of ice crystals. However, some optical phenomena such as sundogs and tangential arcs indicate the presence of horizontally oriented ice crystals. A recently developed physical-geometric optics method (PGOM) efficiently computes the single-scattering properties of oriented large crystals. The PGOM first computes near electromagnetic field analytically based on the principles of geometric optics, and maps far field exactly from the near field through Maxwell's equations. In the presentation, we will show phase matrices of hori-zontally oriented hexagonal plates (HOPs) and columns (HOCs) computed with PGOM. Simula-tions of optical phenomena indicate the relevance of the single-scattering properties computation with PGOM for HOPs and HOCs. In addition, we will demonstrate lidar signal simulations im-proved based on the single-scattering properties of HOPs and HOCs.

Poster-16 Friday 3:00-4:00 PM

On the Convergence of Invariant Imbedding T-matrix Method in Computing Light Scattering by Nonspherical Dielectric Particles

JIACHEN DING AND PING YANG, Department of Atmospheric Sciences, Texas A&M University — The invariant imbedding T-matrix (IITM) is a numerical method to solve the electromagnetic volume integral which is derived from Maxwell's equations. The IITM method has been proved accurate and stable in computing light scattering by nonspherical dielectric particles such as ice crystal, dust aerosol and red blood cell. The IITM method computes the transition matrix (i.e. T-matrix) which relates the vector spherical wave function (VSWF) expansion coefficients of incident and scattered fields. As an initial-value problem, the T-matrix is computed iteratively from the largest inscribed sphere to the smallest circumscribed sphere of the particle. There are two parameters which significantly affect the accuracy and speed during the computation: the highest order of VSWF expansions, N, and the radial resolution of iteration, dr. N determines the dimension of the T-matrix. dr determines the number of iterations. The computational time is related to N to the fourth power, and linearly related to dr. N and dr must be chosen properly in the computation to obtain convergent and accurate result as well as saving computational resources. Proper N and dr values are related to the particle shape, refractive index and size parameter. In this presentation, as a preliminary result, we take a dust particle as an example to show the sensitivity and convergence of the computational results to the two parameters.

Poster-17 Friday 3:00-4:00 PM

Understanding sub-millimeter wavelength ice cloud property retrievals in the presence of mix phase clouds

ADAM BELL (1), PING YANG (2), AND D.L. WU (3), (1,2) Atmospheric Sciences Department, Texas A&M University, College Station, TX (3) Climate and Radiation Lab, NASA Goddard Space Flight Center, Greenbelt, MD — Accurate satellite retrievals of ice cloud properties such as ice water path (IWP) and ice particle effective diameter (Deff) are essential for characterization of the Earth's radiation budget. Ice cloud remote sensing techniques incorporating sub-millimeter (sub-mm) wave measurements have been developed over the past decade, and continue to gain popularity. One prominent advantage of this wavelength regime is that radiation reacts with ice particles primarily through scattering. Upwelling radiation from below the cloud is scattered out of the instrument line-of-sight, leading to a brightness temperature depression when compared to a clear sky. This cloud induced radiance (CIR) is sensitive to cloud ice mass, making sub-mm measurements attractive for inferring cloud ice mass (or IWP). Even with the benefits provided by sub-mm measurements, there are still uncertainties in retrievals due to assumptions that must be made. Most current ice cloud retrievals assume all clouds within the field of view are single layer, homogenous ice clouds. However, previous studies showed the presence of water clouds underlying ice clouds can introduce large errors in visible, infrared, and microwave retrievals of ice cloud properties. In this study, we explore the effects of underlying water clouds on

ice cloud signatures (in terms of CIR) in the sub-mm wave range, and subsequent retrievals of ice cloud properties. We also investigated and present here the usefulness of incorporating infrared measurements to constrain the retrieval and improve accuracy.

Poster-18
Friday
3:00-4:00 PM

Photothermal laser treatment of CHL-1 skin melanoma cells infused with gold nanoparticles

MADELINE CARTER, LAUREN MULLENIX, DR.BIRGIT MELLIS, AND DR. MICHELLE STEIGER, University of St. Thomas — We synthesize monodispersed, fluorescent gold nanoparticles with gallic acid based ligand shells at an average size of 5nm. We confirm the surface plasmon resonance peak with UV-Vis and their size and monodispersity via Dynamic Light Scattering. Our research focuses on exposing CHL-1cells, a cell line derived from human melanoma cells, infused with those gold nanoparticles to photothermal treatment near the peak SPR at 532nm. The laser light excites the gold nanoparticles, raising its temperature and consequently affecting the cell viability. After treatment, cells are incubated and submitted to two types of analysis (MTT Assay and Crystal Violet Staining) to evaluate cell viability. We present results on how the photothermal treatment over various time intervals affects the cell viability.

Poster-19
Friday
3:00-4:00 PM

Arrow of Time in Dimension of Information

HASSAN GHOLIBEIGIAN[1], Retired — Particle needs to know the information of the quantum state of its next position; said L. Susskind, director of the SITP. On the other hand, it seems that there is dimension of information in addition of space-time which is nested in each other, because the particle always needs to get its next quantum state's information instantly for analyzing and finding its path of motion [H. Gholibeigian, et. al. 2017APS..APR.F1038G, SAO/NASA ADS]. Therefore, information should be generated sooner than particle's motion. It means that the generated information in dimension of information should be ahead of time. In other words, the time's arrow may have two directions in dimension of information. The one direction is to its past (to us), which is the next step (position) of the particle in space-time, and the other direction is to its future, which is the generation of information for future (after next step) of the particle and everything. If we take a deeper look to the foundation of reality, we can see directionality of the time's arrow to the both; past, and the future in dimension of information. Here, we are in front of this deeper question too: "Is the origin of the time in dimension of information?" The answer may be yes, as a source, it is not out of mind.

[1]AmirKabir University of Technology

Friday Evening
Student Center
Twilight Ballroom

Banquet

Banquet and Awards
Chairs: Joe Musser
and Kimberly Childs

Banquet-1 **The Unknown Physics Teacher and Her Place in History**
Friday
6:30 PM

JILL A. MARSHALL, University of Texas at Austin — In the Texas Section we are, or should be, well aware of women who are known for their contributions to the teaching of physics: Melba Phillips, Maria Mitchell, Sarah Whiting, Katherine Mays, in addition to more recent contributors such as Lillian McDermott, Ruth Chabay, Mary Beth Monroe, Karen Jo Matsler, and others too numerous to mention. But many in our community are unaware of the contributions to the teaching of physics, particularly in pre-college and informal settings, by women whose names are largely lost to history. Before physics was designated as part of the accepted high school curriculum in the 1893 report of the Committee of Ten, these women worked to demonstrate, describe, and explain the concepts of natural science to children in homes and schools, as well as members of the public in lecture halls and salons. In the Nineteenth Century, the explication of science was largely the province of "the ladies."

Saturday Morning
Kennedy Auditorium

Plenary

APS, AAPT, and SPS
Chair: Joe Musser

Plenary-4
Saturday
9:00-9:45 AM

Innovations in Integrating Cavity Technology: Sensitive Detection in the Most Turbid Environments

JOHN D. MASON AND EDWARD S. FRY, Texas A&M University — Integrating cavities have been a staple in radiometric and photometric measurements since their inception in 1900. Since 1986, state-of-the-art commercial integrating cavities have been manufactured with a polytetrafluoroethylene (PTFE) based diffuse reflector called Spectralon which has a reflectance greater than 97.5% from near ultraviolet to near infrared wavelengths. Spectralon's reflectance is maximum for visible wavelengths where the reflectance can be as large as 99.2%. The recent characterization of a new highly reflective diffuse reflector, fumed silica, has led to the development of a new generation of integrating cavities with a greater reflectivity than Spectralon integrating sphere for ultraviolet and visible wavelengths. The high reflectivity combined with the nearly Lambertian reflection profile of the reflection from fumed silica has lead to the development of several highly sensitive inexpensive optical detection techniques that are independent of the scattering properties of the sample. The innovation of these fumed silica integrating cavities has been demonstrated to be a highly effective tool for detecting and characterizing many different light-matter interactions. This discussion will describe the different techniques that have been developed using these improved integrating cavities to characterize the optical properties of a number of different interdisciplinary samples including the ultraviolet absorption spectrum of pure water, the absorption spectrum of cells and tissue, the Raman signal from atmospheric gases, and the fluorescence signal from trace amounts of human waste in water.

Saturday Morning
STEM Room 401/402

APS

APS Contributed Papers
Chairs: Jim Adams and Christopher Aul

APS-23
Saturday
10:00 AM

Application of new linear force-free spheromak solution for interpretation of interplanetary magnetic clouds

E. ROMASHETS (1), M. VANDAS (2), 1. Lamar University, 2. Astronomical Institute, Prague, Czech Republic — A new solution for linear force-free magnetic field inside a sphere is found. It is constructed as a rotation of a cylinder with specific distribution of a magnetic field around an axis located at the distance R =0.805 r, where r is the radius of the cylinder. In terms of functions presented in Romashets (1993) only two non-zero coefficients e1=1 and e2=-1.6052 are in the sum. The sphere of radius R1=1.8685 r has practically zero normal component of the magnetic field on its boundary. In fact Bn on the boundary is less tha 0.0005 Bmax. The accuracy can be described in terms of deviation of separation surface from the sphere, which is less than 0.0005 R1. The resultant magnetic field distribution looks like a compact compressed toroid. The magnetic field magnitude and components profiles are smooth and can be used for interpretation of magnetic data on interplanetary magnetic clouds. Another applications of the new solution are: MHD modeling of CME propagation and a magnetic field configuration for magnetically closed structures in the solar atmosphere e.g. blobs.

APS-24
Saturday
10:12 AM

Frequency Multiplexing of Light Detection in Noble Element Experiments

NHAN PHAM, JONATHAN ASAADI, BENJAMIN JONES, AKSHAT TRIPATHI, JORDAN BAKER, University of Texas at Arlington — One of the central needs of large-scale noble element neutrino detectors such as argon and xenon time projection chambers (TPCs) is to maximize their light detection efficiency. The task can be accomplished through the deployment of large arrays of single photon sensitive light collection devices: photomultiplier tubes (PMTs) or arrays of multi-pixel photon counters (MPPCs) such as silicon photomultiplier (SiPM). These configurations are typically read out individually or in summed configurations by recording analog output voltage versus time. In contrary, increasing the number of individual light sensitive devices in the detector will considerably increase the cost of the detector, such as hardware and readout electronics, to cope with the corresponding devices being deployed. In this work, we propose a new solution to the puzzle of how to maximize the light detection efficiency while optimizing the total cost of the readout. This is accomplished by utilizing the readout technique known as Frequency-Domain Multiplexing (FDM). We will present the design, analysis, and measurements of the recent FDM application for liquid argon TPCs developed at the University of Texas at Arlington.

APS-25 **New High voltage divider board design for DUNE field cage**

Saturday 10:24 AM

JAKOB SCANTLIN, University of Texas at Arlington — Now that operation of the ProtoDUNE field cage is over, design proposals for the DUNE field cage are now being considered. The new dual-phase field cage will be 12x12x60 m and will be submerged in 40kT of liquid Argon. In order to distribute the electric field uniformly throughout the active volume within the field cage, high voltage divider boards need to be attached to the aluminum profiles on the cage in order to establish an electrical connection between them. In the DUNE HVDB design, we are considering two 5GΩ resistors in parallel, and in parallel with that, two varistors in series each with a 2kV clamping voltage. This component arrangement will be repeated at every gap between the profiles on the cage. The varistors are on the board so that whenever there's a surge on the cage, the excess current will flow through the varistors and not overheat the resistors, and the voltage across each gap should be about 3kV.

APS-26 **Results of ProtoDUNE's Dual-Phase High Voltage Divider Board Testing**

Saturday 10:36 AM

DOUGLAS ZENGER, University of Texas at Arlington, DEEP UNDERGROUND NEUTRINO EXPERIMENT COLLABORATION — The Deep Underground Neutrino Experiment (DUNE) is the international project detecting neutrinos with liquid argon. As the dual-phase module is being constructed, the high voltage divider board (HVDB) functionality is analyzed before installation. The boards allows the field cage to maintain a strong, uniform electric field to detect neutrinos resulting from its weak interactions with liquid argon. The board must provide an equal voltage drop among each aluminum ring in the dual-phase cage to create this uniform electric field. It will consist of two 2GΩ resistors in parallel and four varistors in series between two rings. Testing and quality assurance inspections ensure the board will uniformly drop the voltage to approximately 3kV at each ring. Testing examines effective resistance at each stage, durability of the boards, and consistency of resistance over time. All tests are performed in liquid nitrogen, which has a similar temperature to liquid argon. Boards are selected if all stages of the board have a 1% difference from the mean of all stages tested. Procedures used for these boards will be used to develop the design and testing of the next boards for the DUNE project.

APS-27 **Four-probe electrical resistivity measurements on metallic thin films**

Saturday 10:48 AM

VIVEK KHICHAR, DOUGLAS ZINN, HUSEIN AKAFZADE, SURESH SHARMA, UNIVERSITY OF TEXAS AT ARLINGTON, NADER HOZHABRI, Nanotechnology Research Center, Shimadzu Institute — Metallic thin films, in particular the noble metal thin films, are used in numerous high-tech applications; such as electronic devices, surface plasmon resonance sensors, and integrated photonic circuits. The electrical, mechanical, and optical properties of such films often vary with deposition method and post-growth treatments. In this work, we present electrical resistivity data on 10–50 nm thick Ag and Au films. Thin films were grown on quartz substrates by thermal evaporation and the electrical resistivity data were obtained by using *four-point probe* electrical resistivity system controlled by LabVIEW software. The surface topography and microstructure of the films were characterized by AFM and SEM measurements. Detailed results will be presented for IV characteristics, surface topography, and microstructure of the films.

AAPT-15 **Dr. Seuss taught Physics to encourage the Study of Physics**

Saturday 11:00 AM

SHANNON SCHUNICHT, Mnemonic Writings — The study of Physics is intimidating to most everyone, especially those without Physics aspirations. The multitudes of formulas for memory recollection come test time is the culprit! Although this author's memory was severely disabled (3 week coma), Microbiology was sought ('94 BA & BS Tx A&M). During studying, Physics was required for graduation at A&M. Doing so without a memory was difficult! For the reason an "Infinite WORLDLY recognized mnemonic technique was devised for recollected ease of formulas (fomplicated: Vowels:Mathematical Operations, i.e. a: multiplication for "@", o for division to mean "over", i for subtraction to signify minus, u for addition to represent "plus", and e for "equals". Most constants & variables are indeed consonants, i.e. c= speed of light, and z= altitude. ADDITIONAL LETTERS may be inserted to enhance a letter combination's intelligibility, but need be CONSONANTS only. Examples include an acronym for The Quadratic Equation: exCePT i buiLD rabbiTS 4 caTS oN 2 HaTS! Everyone remembers Dr. Seuss (Theodor Seuss Gessel)

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Daniel Morales
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TEXAS SECTION, AMERICAN ASSOCIATION OF PHYSICS TEACHERS
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Section Council at Large[4] ---------- Two-Year College Term expires Fall 2020	Regina Barrera Lee College Baytown, TX 77522 (281)425-6812 rbarrera@lee.edu

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1. Normally serves at Vice President of Physical Sciences of Texas Academy of Science
2. One-year term: in the two years following serves as President Elect and President
3. Four-year term
4. Three-year term

Standing Committees:

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Paul Williams, Chair
Tom O'Kuma
Dave Donnelly
Toni Sauncy

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Bill Waggoner, Chair
Jess Dowdy
Andra Petrean
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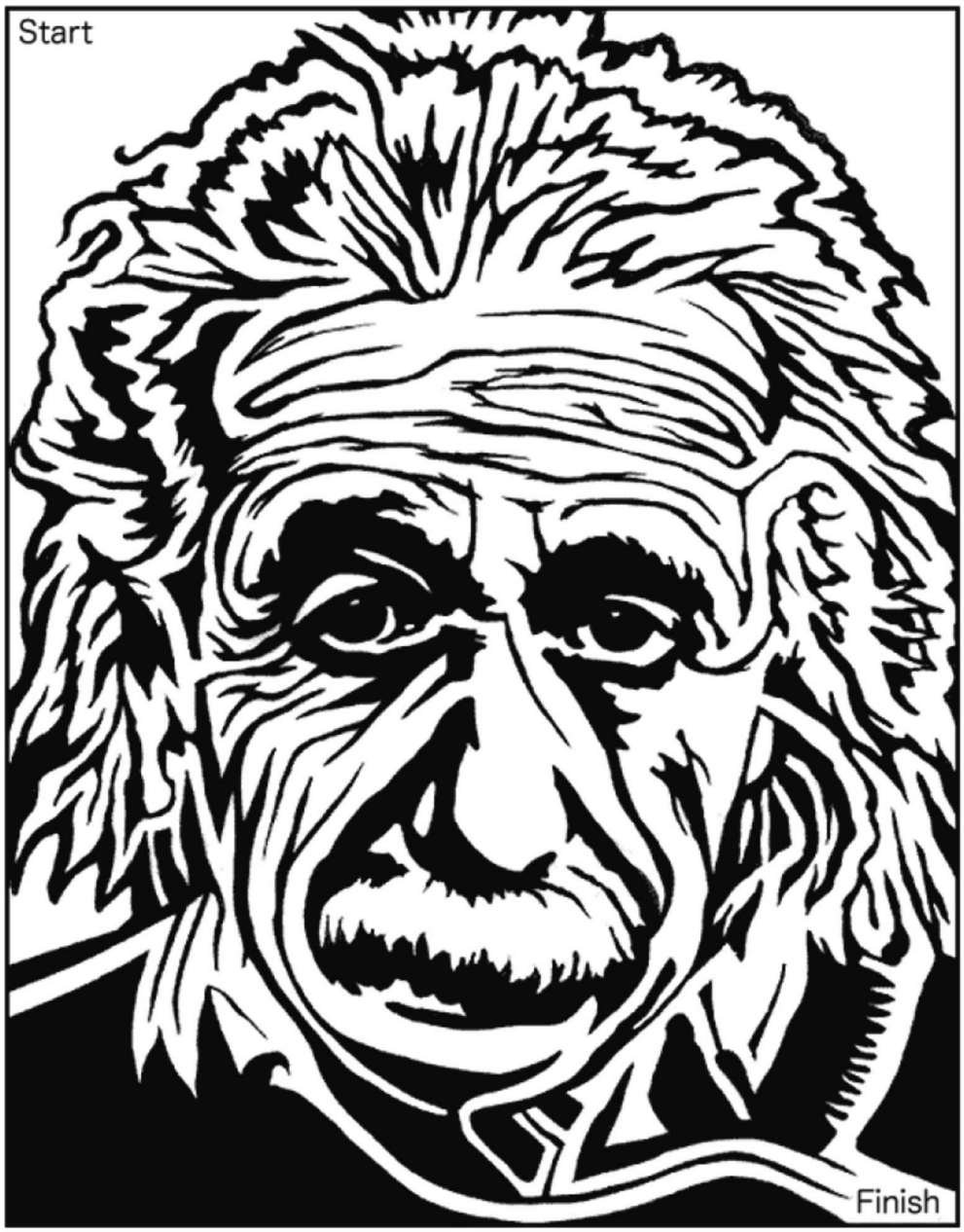
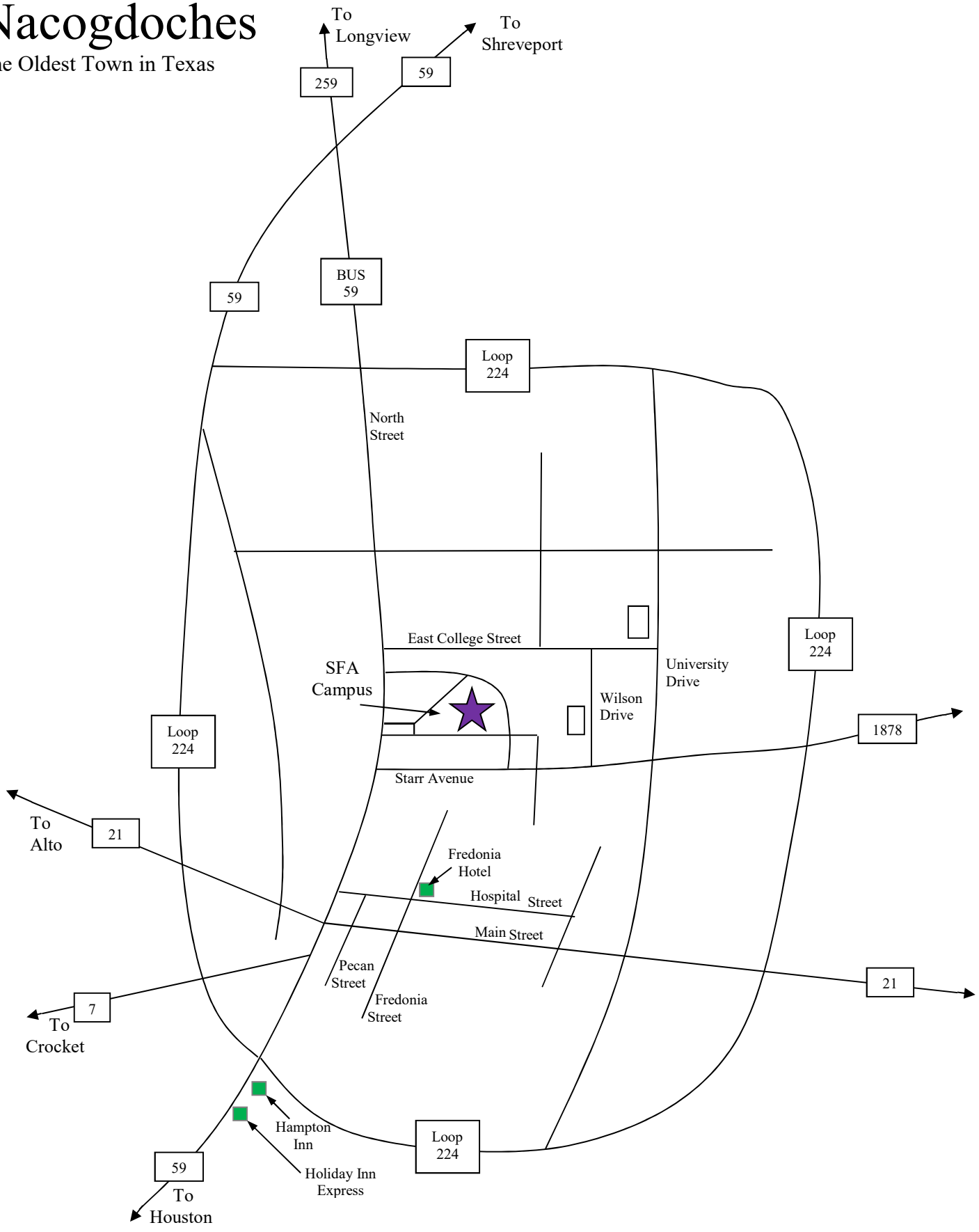


Nacogdoches

The Oldest Town in Texas



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Campus Map ---·---·--- Driving Directions