

# SPRING 2005 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**

Hit Control-F to find your  
name or paper.

Corrections in red did not  
make the printed version.

Last updated on February 27<sup>th</sup>



Hosted by

**The Department of Physics and Astronomy**

**Stephen F. Austin State University  
Nacogdoches, TX**

**March 3-5, 2005**

*<http://www.physics.sfasu.edu/springmeeting.html>*

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### **David W. Donnelly** - Zone Councilor

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### **Ashley Johnson** - Associate Zone Councilor

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# Meeting Schedule

Thursday, March 3	Event	Location	Page
6:00 pm - 9:00 pm	Registration and Reception	University Center Twilight Ballroom	3
7:00 pm - 10:00 pm	SPS Reception - BBQ, Movie, Gaming	Science Building - 334, 318, 315	3
7:00 pm - 9:00 pm	TSAAPT Executive Committee Meeting	University Center - 2 <sup>nd</sup> Floor Stone Fort Room	3
7:00 pm - 9:00 pm	TSAPS Executive Committee Meeting	University Center - 2 <sup>nd</sup> Floor Pine Log Room	3

Friday, March 4	Event	Location	Page
7:30 am - 8:30 am	<b>Two-Year College Teacher Breakfast</b>	Fredonia Hotel	3
8:00 am - 12:00 pm	<b>Registration</b>	Cole Auditorium	3
8:30 am - 8:45 am	<b>Welcome</b> Tito Guerrero III, SFA President Harry Downing, SFA Host	Cole Auditorium	3
8:45 am - 9:30 am	<b>Plenary Session</b> <i>From EPR to Quantum Eraser: The Role of Observation and the Observer in the Quantum Micro Cosmos</i> Marlan O. Scully Texas A&M University Princeton University	Cole Auditorium	6
9:30 am - 9:45 am	<i>Coffee Break</i>	Cole Auditorium	6
9:45 am - 10:30 am	<i>Taking Einstein's Ethics Into the Twenty-First Century: 'Remember Your Humanity'</i> Dwight E. Neuenschwander SPS/ΣΠΣ Publications Editor Southern Nazarene University	Cole Auditorium	6
10:30 am - 11:15 am	<i>Mars Exploration Rover: Following the Water</i> Mark T. Lemmon Texas A&M University	Cole Auditorium	6
11:30 pm - 12:30 pm	<b>Luncheon</b>	University Center - 2 <sup>nd</sup> Floor Twilight Ballroom	3
12:00 pm - 12:30 pm	<b>Business Meetings</b>	University Center - 2 <sup>nd</sup> Floor Twilight Ballroom	3

<b>Friday, March 4</b>	<b>Event</b>	<b>Location</b>	<b>Page</b>
12:45 pm - 1:30 pm	<b>Physics Demonstrations</b> <i>Everyone is invited to bring a demo.</i>	Science Building - 335	11
1:30 pm - 5:00 pm	<b>Registration and Exhibits</b>	Science Building - 322, 321	21
1:30 pm - 5:00 pm	<b>Contributed Paper Sessions</b>		
	AAPT and SPS	Science Building - 335, 334	11,13
	APS I and II	Science Building - 234, 323	7, 9
	Poster Session	Science Building - 316 Hallway	15
2:30 pm - 4:30 pm	<b>TSAAPT Workshops (W1-W3)</b>	Science Building - Third Floor	19
7:00 pm - 9:00 pm	<b>Banquet</b> <i>Einstein and Picasso</i> Curtis C. Bradley Texas Christian University	University Center - 2 <sup>nd</sup> Floor Grand Ballroom	16
9:00 pm - 10:30 pm	<b>Planetarium Show</b> 'Ring World' or 'Oceans in Space'	Math Building - Room 102	16
9:00 pm - 10:30 pm	<b>Observatory Tour</b> Sponsored by SPS at SFA	Bus at Stone Fort Museum	16

<b>Saturday, March 5</b>	<b>Event</b>	<b>Location</b>	<b>Page</b>
9:00 am - 12:00 pm	<b>Exhibits and Registration</b>	Science Building - 321, 322	21
9:00 am - 9:45 am	<b>Plenary Session</b> <i>Cosmology after Einstein</i> Wolfgang Rindler University of Texas at Dallas	Science Building - 335	17
10:00 am - 12:00 pm	<b>Contributed Paper Session</b>		
	AAPT/SPS	Science Building - 334	18
	APS	Science Building - 335	17
10:00 am - 12:00 pm	<b>TSAAPT Workshops (W4-W6)</b>	Science Building - Third Floor	19
12:30 pm - 2:30 pm	<b>TSAAPT Workshops (W7-W9)</b>	Science Building - Third Floor	19

# Session Schedules

Friday	
8:30-8:45 am	<b>Welcome</b> (Cole Auditorium)
8:45-9:30 am	<b>Plenary 1</b> (Cole Auditorium)
9:30-9:45 am	<b>Coffee Break</b> (Cole Auditorium)
9:45-10:30 am	<b>Plenary 2</b> (Cole Auditorium)
10:30-11:15 am	<b>Plenary 3</b> (Cole Auditorium)
11:30-12:30 pm	<b>Lunch and Business Meetings</b> (University Center, Second Floor, Twilight Ballroom)
12:30 pm-12:45 pm	<b>Move to Science Building</b>
12:45 pm-1:30 pm	<b>Physics Demonstrations</b> (Science Building, Room 335)

Sessions	APS I - Room 234	APS II - Room 323	AAPT - Room 335	SPS - Room 334	Posters	Workshops
1:30 pm	AA-1	AB-1	AAPT-1	SPS-1		
1:42 pm	AA-2	"	AAPT-2	SPS-2		
1:54 pm	AA-3	AB-3	AAPT-3	SPS-3		
2:06 pm	AA-4	AB-4	AAPT-4	SPS-4		
2:18 pm	AA-5	AB-5	AAPT-5	SPS-5		
2:30 pm	AA-6	AB-6	AAPT-6	SPS-6	All Posters 2:30 pm to 4:00 pm Hallway	Workshops 2:30 pm to 4:30 pm W1 - Rm 315 W2 - Rm 316 W3 - Rm 317
2:42 pm	AA-7	AB-7	Break for Posters and Refreshments	SPS-7		
2:54 pm	Break for Posters and Refreshments	AB-8	AAPT-7	SPS-8		
3:06 pm		Break for Posters and Refreshments	AAPT-8	SPS-9		
3:18 pm	AA-8		AAPT-9	Break for Posters and Refreshments		
3:30 pm	AA-9	AB-9	AAPT-10	SPS-10		
3:42 pm	AA-10	AB-10	AAPT-11	SPS-11		
3:54 pm	AA-11	AB-11	AAPT-12	SPS-12		
4:06 pm	AA-12	AB-12	AAPT-13	SPS-13		
4:18 pm	AA-13	AB-13	AAPT-14	SPS-14		
4:30 pm	AA-14	AB-14	AAPT-15	SPS-15		
4:42 pm	AA-15	AB-15				

7:00-9:00 pm	<b>Banquet</b> (University Center, 2 <sup>nd</sup> Floor, Grand Ball Room)
9:00-10:30 pm	<b>Your Choice: Observatory Tour</b> or <b>Planetarium Show</b>

Saturday				
9:00-9:45 am	<b>Plenary 4</b> (Science Building, Room 335)			
9:45-10:00 am	<b>Coffee Break</b>			
Sessions	APS III - Room 335		SPS - Room 334	Workshops
10:00 am	BA-1		AAPT-16	Workshops 10:00 am to 12:00 pm W4 - Rm 317 W5 - Rm 315 W6 - Rm 316
10:12 am	"		AAPT-17	
10:24 am	"		SPS-16	
10:36 am	BA-3		SPS-17	
10:48 am	BA-4		SPS-18	
11:00 am	BA-5		SPS-19	
11:12 am	BA-6		SPS-20	
11:24 am	BA-7		SPS-21	
11:36 am	BA-8		SPS-22	
11:48 am	BA-9		SPS-23	
12:00 pm			SPS-24	Workshops 12:30 pm to 2:30 pm W7 - Rm 317 W8 - Rm 316 W9 - Rm 315
12:30 pm				
1:00 pm				
1:15 pm				
1:30 pm				
1:45 pm				
2:00 pm				
2:15 pm				
2:30 pm				

- 8:45 am - 9:30 am    **PL-1**    **From EPR to Quantum Eraser: The Role of Observation and the Observer in the Quantum Micro Cosmos**  
Marlan O. Scully  
*Inst. for Quantum Studies and Depts. Of Physics, and Chemical and Electrical Engineering, Texas A&M University*  
*Inst. For Materials Science and Depts. Of Mechanical and Aerospace Engineering and Chemistry, Princeton University, scully@tamu.edu*
- 9:45 am - 10:30 am    **PL-2**    **Taking Einstein's Ethics into the Twenty-First Century: 'Remember Your Humanity'**  
Dwight E. Neuenschwander  
*SPS/Sigma Pi Sigma Publications Editor*  
*Southern Nazarene University, DNeuensch@snu.edu*
- 10:30 am - 11:15 am    **PL-3**    **The Mars Exploration Rovers: Following the Water**  
Mark T. Lemmon  
*Texas A&M University, lemmon@tamu.edu*
- 11:30 am - 12:30 pm    **Luncheon and Business Meetings**  
University Center, 2<sup>nd</sup> Floor  
Twilight Ball Room

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## Group Meetings

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### PRTR Group

The Texas A&M Physics Teaching Resource Agents (PTRA) group is planning to have its follow-up session in conjunction with the March meeting at SFA. This group will meet in room 318 of the Science Building from 8:30 am to 4:30 pm on Friday and from 8:30 am to 3:30 pm Saturday. (Contact: Lewis Ford, Texas A&M, ford@physics.tamu.edu)

### QuOp Group

The Quantum Optic group is planning to have breakfast for all two-year college teachers at the Fredonia Hotel between 7:30am and 8:30 am on Friday morning. The Quantum Optics group is part of an Advanced Technological Education Program for two-year college physics faculty members and is sponsored by Texas A&M University, Lee College, and the National Science Foundation (NSF).

### TECP Group

The Texas Electronic Coalition for Physics (TECP) group will **either** meet at 5:00 pm on Friday **or 12:30 pm on Saturday** in room 323 of the Science Building. (Contact: Daniel Suson, chairman of TECP, daniel.suson@tamuk.edu)

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- 1:30 pm AA-1 **Production and Decay of Ultracold Feshbach Molecules in Bosonic and Fermionic Species**  
E. Hodby, S. Thompson, C. Regal, M. Greiner, A. Wilson, D.S. Jin, E.A. Cornell, C.E. Wieman  
*University of Colorado, ehodby@jilau1.colorado.edu*
- 1:42 pm AA-2 **Measurement of Index of Refraction using Low-Coherence Interferometry**  
Joshua Dickerson, Dhiraj Sardar  
*University of Texas at San Antonio, jdickers@lonestar.utsa.edu*
- 1:54 pm AA-3 **Fluorescence and Absorption Spectra and Potential Energy Surfaces of 1,3-Benzodioxole and Coumaran in Their  $S_0$  and  $S_1(\pi, \pi^*)$  States**  
Katsuhiko Okuyama, Kevin Morris, Martin Wagner, Juan Yang, Jaan Laane  
*Texas A&M University, kokuyama@mail.chem.tamu.edu*
- 2:06 pm AA-4 **Experimental and *Ab Initio* Spectra of 3-Methylindole in the Gas Phase**  
Kathleen McCann, Amanda Combs, Daniel Autrey, Jaan Laane, Stacy Overman, George Thomas, Jr.  
*Texas A&M University, kmccann@mail.chem.tamu.edu*
- 2:18 pm AA-5 **Ultraviolet Cavity Ringdown Spectra of 2-Cyclohexen-1-one**  
Mohamed Rishard, Jaebum Choo, Daniel Autrey, Jaan Laane, Stephen Drucker, Emily Giles  
*Texas A&M University, rishard@mail.chem.tamu.edu*
- 2:30 pm AA-6 **Infrared, Raman, Ultraviolet Absorption, Fluorescence Excitation and Single Vibronic Level Fluorescence Spectra and *Ab Initio* Calculations of 1,4-Benzodioxan**  
Juan Yang, Martin Wagner, Daniel Autrey, Jaan Laane  
*Texas A&M University, jyang@mail.chem.tamu.edu*
- 2:42 pm AA-7 **Femtosecond CARS on Organic Molecules**  
Dmitry Pestov, Miaochan Zhi, Robert Murawski, Alexei Sokolov, Nikolai Kalugin, Yuri Rostovtsev, Zoe Sariyanni, Vladimir Sautenkov, Marlan Scully  
*Texas A&M University, dmip@neo.tamu.edu*
- 2:54 pm **Break for Posters (Hallway near room 316)**

- 3:18 pm **AA-8** **Switchable Diffraction Gratings Holographically Formed in Polymer-Dispersed Liquid Crystal Cells Using He-Ne Laser**  
Robert Ramsey, Suresh Sharma  
*University of Texas at Arlington, robertramsey@uta.edu*
- 3:30 pm **AA-9** **UV-Ozone Oxidation of Ultra Thin Ru Layers**  
ChangDuk Lim, Vaishali Ukirde, Oliver Chyan, Mohamed El Bouanani  
*University of North Texas, cl0107@unt.edu*
- 3:42 pm **AA-10** **Interfacial Stability of RuO<sub>2</sub> On Hf<sub>x</sub>Si<sub>1-x</sub>O<sub>2</sub>/Si**  
Vaishali Ukirde, Changduk Lim, Manuel Quevedo-Lopez, Mohamed El Bouanani  
*University of North Texas, vaishali@unt.edu*
- 3:54 pm **AA-11** **Drell-Yan Physics at Fermilab: Past and Future**  
L. Donald Isenhower  
*Abilene Christian University, isenhowe@acu.edu*
- 4:06 pm **AA-12** **An Investigation of the Canis Major Dwarf Galaxy**  
William Lee Powell, Jr., Ron Wilhelm, Amy Westfall, Adam Lauchner, Abel Diaz  
*Texas Tech University, William.L.Powell@ttu.edu*
- 4:18 pm **AA-13** **Possible Applications and Limitations of Multi-Walled Carbon Nanotubes to Solar Energy Conversion**  
Robert Friedfeld  
*Stephen F Austin State University, rfriedfeld@sfasu.edu*
- 4:30 pm **AA-14** **Study of the Acridine Labeled Short DNA-Duplexes by Means of Rotational Depolarization of Fluorescence**  
Alexey Chugreev, Alexander Ogrodnik  
*Texas A&M University, chugreev@tamu.edu*
- 4:42 pm **AA-15** **Oxidation of Hafnium as Studied by X-Ray Photoelectron Spectroscopy**  
A Chourasia, Richard Miller  
*Texas A&M University-Commerce, Anil\_Chourasia@tamu-commerce.edu*
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- 1:30 pm    **AB-1**    **Invited Talk: Euclidean, Lorentzian, and Physical Time**  
Roland Allen, Zorawar Wadiasingh  
*Texas A&M University, allen@tamu.edu*
- 1:54 pm    **AB-3**    **Temperature Difference Induced Entanglement of a Two-Level Atom and a Thermal Field**  
Han Xiong, Fuli Li and M. S. Zubairy  
*Texas A&M University, hxiong@tamu.edu, flli@tamu.edu*
- 2:06 pm    **AB-4**    **Cavity QED Implementation of Three Qubit Quantum Phase Gate**  
Juntao Chang, Suhail Zubairy  
*Texas A&M University, jchang@physics.tamu.edu*
- 2:18 pm    **AB-5**    **Generation of Arbitrary Two-Qubit Entangled States in Cavity QED**  
Tiegang Di, M. Suhail Zubairy  
*Texas A&M University, tiegang-di@neo.tamu.edu*
- 2:30 pm    **AB-6**    **Propagation of Broad Spectrum Pulse in EIT Medium**  
Qingqing Sun, Yuri Rostovtsev, Jonathan Dowling, M. Suhail Zubairy  
*Texas A&M University, qsun@physics.tamu.edu*
- 2:42 pm    **AB-7**    **Preservation of Non-Classicality in the Continuous-Variable Quantum Teleportation**  
FuLi Li, Tiegang Di, M. Suhail Zubairy  
*Texas A&M University, flli@physics.tamu.edu*
- 2:54 pm    **AB-8**    **“Magic-Angle” Technique for Suppression of Inhomogeneous Broadening of Mössbauer Spectra**  
Petr Anisimov, Yury Rostovtsev, Olga Kocharovskaya  
*Texas A&M University, petr@tamu.edu*
- 3:06 pm               **Break for Posters (Hallway)**

- 3:30 pm **AB-9** **Control of Ionization Rates of H<sub>2</sub><sup>+</sup> By Single Cycle Pulses Timed with Respect to Molecular Motion**  
Andrea Burzo, Alexei Sokolov  
*Texas A&M University, andrea@physics.tamu.edu*
- 3:42 pm **AB-10** **Ab Initio Calculations for the Structure, Vibrational Frequencies, and Barrier to Planarity of Cyclopentene**  
Abdulaziz Al-Saadi, Jaan Laane  
*Texas A&M University, al-saadi@mail.chem.tamu.edu*
- 3:54 pm **AB-11** **Debye Model of Step Wandering**  
Howard Richards, Amber Benson, T.L. Einstein  
*Texas A&M-Commerce, Howard\_Richards@tamu-commerce.edu*
- 4:06 pm **AB-12** **Principle of Least Action and Gauge Compatibility for a Charged Particle in an Electromagnetic Field**  
Donald H. Kobe  
*University of North Texas, kobe@unt.edu*
- 4:18 pm **AB-13** **On the Physical Origin of the Earth's Electric Field**  
Wayne M. Saslow  
*Texas A&M University, wsaslow@tamu.edu*
- 4:30 pm **AB-14** **Kink Stability of Isothermal Spherical Self-Similar Flow**  
Anzhong Wang, Yumei Wu  
*Baylor University, Anzhong\_Wang@baylor.edu*
- 4:42 pm **AB-15** **Nuclear Collisions Induced by Single-Cycle Laser Pulses: Molecular Approach to Fusion**  
Miaochan Zhi, Alexei Sokolov  
*Texas A&M University, mczhi@neo.tamu.edu*
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- 12:45 pm **Demo**    **Physics Demonstrations**  
Everyone is invited to bring and/or describe their favorite physics demonstration.  
Chair: Walter Trikosko
- 1:30 pm    **AAPT-1**    **The Development of a Curriculum Specifically for the Introductory Algebra-Based Physics Course**  
Beth Ann Thacker  
*Texas Tech University, beth.thacker@ttu.edu*
- 1:42 pm    **AAPT-2**    **SPS Chapter Lures 300+ H.S. Students onto 2-yr College Campus with Trebuchet**  
Eric Peterson, Nick Koehn, Chris Williams, Chris Petta, Ben Morhardt, Jauhar Khalid  
*Highland Community College, epeterson@highland.edu*
- 1:54 pm    **AAPT-3**    **What I've Learned in Three Years of Teaching Physics to Music Majors**  
Lionel D. Hewett  
*Texas A&M University-Kingsville, L-Hewett@tamuk.edu*
- 2:06 pm    **AAPT-4**    **Teaching Physics in Korea**  
Steven Ball  
*LeTourneau University, stevenball@letu.edu*
- 2:18 pm    **AAPT-5**    **Physics on the Border**  
Martha Casquette, Adrienne Rodriguez-Zermeno  
*University of Texas at Brownsville, mcasquette@utb.edu*
- 2:30 pm    **AAPT-6**    **What Middle and High School Students Perceive Physics to be**  
Manuela Ortiz, Eric Hagedorn  
*University of Texas at El Paso, ehagedorn@utep.edu*
- 2:42 pm                    **Break for Posters (Hallway)**

- 3:06 pm **AAPT-7** **A Pre-service Teacher Preparation Program for Middle School Science**  
Thomas O. Callaway; John Moore  
*Stephen F. Austin State University, tcallaway@sfasu.edu*
- 3:18 pm **AAPT-8** **It's About Time: Relativity and Mark Twain's "My Watch"**  
Hugh Henderson  
*Plano Senior High School, hhender@pisd.edu*
- 3:30 pm **AAPT-9** **Building Telescopes with an Undergraduate Class**  
David Craig  
*West Texas A & M University, dcraig@mail.wtamu.edu*
- 3:42 pm **AAPT-10** **Use of a Remote Observatory in Survey Astronomy Laboratories**  
Mike Fanelli  
*University of North Texas, fanelli@unt.edu*
- 3:54 pm **AAPT-11** **Gender Differences in Teachers' Representations of Electric Circuits**  
Jill Marshall  
*University of Texas, Science & Math Ed., marshall@mail.utexas.edu*
- 4:06 pm **AAPT-12** **Science Wall: A Portable Stereoscopic Projection System for Education and Outreach**  
Phillip Dukes, Adrienne Rodriguez-Zermeno  
*University of Texas at Brownsville and Texas Southmost College, pdukes@utb.edu*
- 4:18 pm **AAPT-13** **Evaluating the Use of Physlets in the Laboratory**  
Adrienne Rodriguez-Zermeno, Phillip Dukes  
*University of Texas at Brownsville, arodriguez@utb.edu*
- 4:30 pm **AAPT-14** **Electronic Classroom Assessment Techniques (eCAT) for Physics**  
Sam Matteson  
*University of North Texas, Matteson@unt.edu*
- 4:42 pm **AAPT-15** **Theory of the Split-Ring Resonator**  
Wayne M. Saslow  
*Texas A&M University, wsaslow@tamu.edu*
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- 1:30 pm    **SPS-1**    **MHD Boat Propulsion --- I**  
Mitchell George, Taylor Kirkland, Lewis Pollock and Ken Taylor  
*Lake Highlands High School, ken.taylor@risd.org*
- 1:42 pm    **SPS-2**    **MHD Boat Propulsion --- II**  
Kyle P. Johnson, Eric J. Mirochna, M. Collin Zreet and Ken Taylor  
*Lake Highlands High School, ken.taylor@risd.org*
- 1:54 pm    **SPS-3**    **Lift Generated by Simulated Airfoils**  
F. Andrew Beal  
*Stephen F. Austin State University, michael\_654@yahoo.com*
- 2:06 pm    **SPS-4**    **Chaos Theory**  
Andrew Moore  
*Stephen F. Austin State University, pollux.andrewmoore@gmail.com*
- 2:18 pm    **SPS-5**    **Methods to Improve Track Fit Parameters in the PHENIX Muon Arms**  
Oluwasoji Omotunde Omiwade  
*Abilene Christian University, ooo00a@acu.edu*
- 2:30 pm    **SPS-6**    **A Modulation-Free Method for Stabilizing Lasers**  
Larry Isenhower  
*Abilene Christian University, ldi00a@acu.edu*
- 2:42 pm    **SPS-7**    **Annealing Effects of CIS and CIGS Thin Films**  
Jason McDonald  
*Stephen F. Austin State University, jasongregorymcdonald@hotmail.com*
- 2:54 pm    **SPS-8**    **Superconductors**  
Albert Koether  
*Stephen F. Austin State University, adk42@hotmail.com*
- 3:06 pm    **SPS-9**    **Study of Effects of the Heat Treat Time on the Crystal Structure of the Copper-Sheathed MgB<sub>2</sub> Superconducting Wires**  
D. Katz, S. Keith, and G. Liang  
*Sam Houston State University, stddak11@shsu.edu, phy\_gnl@unx1.shsu.edu*
- 3:18 pm                    **Break for Posters (Hallway)**

- 3:42 pm    **SPS-10**    **Synthesis of Ozone from Titanium Dioxide**  
Daniel Backlund  
*Angelo State University, dbacklund@yahoo.com*
- 3:54 pm    **SPS-11**    **Investigation of a Novel Production Method to Fabricate Porous Silicon**  
A. N. Robason, T.D. Sauncy  
*Angelo State University, andrea\_robason@hotmail.com*
- 4:06 pm    **SPS-12**    **A "Sabre Saw" Electric Generator**  
J. D. Campbell, Gregory Coutant, Jeffrey Lewis, Wilson Tenney, and Ken Taylor  
*Lake Highlands High School, ken.taylor@risd.org*
- 4:18 pm    **SPS-13**    **Magnetically Driven Mass-Spring Oscillations**  
Craig M. Birch, Kevin J. Brown, Stephanie A. Brown, Mia Ovcina, Ken Taylor  
*Lake Highlands High School, ken.taylor@risd.org*
- 4:30 pm    **SPS-14**    **Hydroelectric Energy**  
Yvette Bass  
*Stephen F. Austin State University, ymb518@aol.com*
- 4:42 pm    **SPS-15**    **Magnetic Levitation**  
Jefferson Jackson  
*Stephen F. Austin State University, roadkilljack@aol.com*
-

- AC-1**     **The Power of Inverse Adding-Doubling (IAD) Method to Determine Optical Scattering and Absorption of Biological Media**  
Guang-Yin Swanland, Raylon Yow, Dhiraj Sarda  
*The University of Texas at San Antonio, dsardar@utsa.edu*
- AC-2**     **Electron Microscopic Studies of the Charge-Ordered Structures of the Bilayered Colossal Magnetoresistive (CMR) Manganite  $\text{La}_{2-2x}\text{Sr}_{1+2x}\text{Mn}_2\text{O}_7$**   
Zhiping Luo  
*Texas A&M University, luo@mic.tamu.edu*
- AC-3**     **Phase Identification for Cu-sheathed  $\text{MgB}_2$  Superconducting Wires**  
Gan Liang, David Katz, Hui Fang, Kamel Salama, Zhongjia Tang  
*Sam Houston State University*  
*Phy\_gnl@unx1.shsu.edu, stddak11@shsu.edu, hfang@uh.edu, Zhonjia.tang@mail.uh.edu*
- AC-4**     **Calibration of a Radio Telescope for Teaching**  
Paul L. Fisher  
*West Texas A&M University, plfisher@mail.wtamu.edu*
- AC-5**     **Einstein: His Predecessors and Successors**  
Donald H. Kobe and Samuel E. Matteson  
*University of North Texas, kobe@unt.edu*
- AC-6**     **QuickField Finite Element Method Software for Undergraduate Physics Education**  
James R. Claycomb  
*Houston Baptist University, jclaycomb@hbu.edu*
- AC-7**     **What is comPADRE? Using the AAPT's Pre-College Portion of the NSDL Project**  
Cathy Mariotti Ezrailson, Bruce Mason, Thad Lurie  
*Texas A&M University, ezrailson@yahoo.com, bmason@ou.edu, tlurie@aapt.org*
- AC-8**     **Electrochromic Blue Shift in Polymer Dispersed Liquid Crystal Cells**  
Robert A. Ramsey and Suresh C. Sharma  
*University of Texas at Arlington, robertramsey@uta.edu*
- AC-9**     **Hydrogen Spectroscopy of Hydrogen in Halfium Silcate**  
Jose Martinez  
*Stephen F. Austin State University, adema\_25@hotmail.com*
- AC-10**    **Interplay of Adsorbate Ordering and Step-Step Interactions on Vicinal Crystal Surfaces**  
Jennifer A. Zandstra, Michael J. Drake, and Howard L. Richards  
*Texas A&M University-Commerce, jennyzandstra@gmail.com*
- AC-11**    **Radio Interferometry of 1420 MHz at the Stephen F. Austin Observatory**  
Andrew Wagers  
*Stephen F. Austin State University, ajwagers@yahoo.com*
-

# Banquet

7:00 pm - 9:00 pm

**Einstein and Picasso**

Curtis C. Bradley

*Texas Christian University, C.Bradley@tcu.edu*

Grand Ball Room on the Second Floor of the University Center

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# Special Events

12:45 pm - 1:30 pm

**Physics Demonstrations**

Everyone is invited to bring and/or describe their favorite physics demonstration.

Chair: Walter Trikosko

Science Building - 334

7:00 pm - 9:00 pm

**Banquet: Einstein and Picasso**

Curtis C. Bradley

*Texas Christian University, C.Bradley@tcu.edu*

Grand Ball Room of the University Center

9:00 pm - 10:30 pm

**Observatory Tour**

Starting from the Stone Fort Museum (see campus map), a bus will travel 11 miles north to tour the SFA Observatory. Saturn will be among the targets for the telescopes if the sky is clear.

*<http://www.observatory.sfasu.edu>*

9:00 pm - 10:30 pm

**Planetarium Show**

There will be a planetarium show on campus in room 102 of the Math Building (see campus map). Either 'Ring World' or 'Oceans in Space' will be shown.

*<http://www.physics.sfasu.edu/planetarium/index.htm>*

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9:00 am - 9:45 am **PL-4** **Cosmology after Einstein**  
Wolfgang Rindler  
*University of Texas at Dallas, rindler@utdallas.edu*

- 10:00 am **BA-1** **Invited Talk: Designing a Nuclear Device as a Learning Exercise**  
David Kahl, Chad Huibregtse, Steve Abbott, Elizabeth Boatman, Elon Candea, Sarah Johns, Jason Marmon, Jared Nance, Eric Stall, John Stierna, Loren Warmington  
*Beloit College, kahld@stu.beloit.edu*
- 10:36 am **BA-3** **Modeling of Copper Indium/Gallium Diselenide Superlattices**  
Steven Scurlock, Robert Friedfeld  
*Stephen F. Austin State University, sps9999@sbcglobal.net*
- 10:48 am **BA-4** **Alternative Approach to Dimensional Scaling**  
Robert Murawski, Anatoly Svidzinsky, Marlan Scully  
*Texas A&M University, rmurawski@physics.tamu.edu*
- 11:00 am **BA-5** **Isoscaling Parameters for Light Projectile and Heavy Target Central HIC**  
Armando Barranon, Jorge Lopez  
*Universidad Autonoma Metropolitana - Azcapotzalco, Mexico City, bca@correo.azc.uam.mx*
- 11:12 am **BA-6** **Quantum Control of the Normal Modes of Benzene with Ultrafast Laser Pulses**  
Petra Sauer, Yusheng Dou, Ben Torralva, Roland Allen  
*Texas A&M University, psauer@physics.tamu.edu*
- 11:24 am **BA-7** **Quantum Potential and Chaos of the Kicked Rotor**  
Yindong Zheng, Donald H. Kobe  
*University of North Texas, r75023@yahoo.com*
- 11:36 am **BA-8** **Computing Energy Spectra for Quantum Systems Using the Feynman-Kac Path Integral**  
N.G. Fazleev, J.M. Rejcek, J.L. Fry  
*University of Texas at Arlington, fazleev@uta.edu*
- 11:48 am **BA-9** **Searching for Lorentz Violation in Astrophysics**  
Seiichirou Yokoo, Roland Allen  
*Texas A&M University, seiichirouyokoo@cside.com*
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- 10:00 am    **AAPT-16**    **Pre-Service Teachers' Understanding of Static of Fluids**  
Milijana Suskavcevic  
*University of Texas at El Paso, Physics Department, milijana@utep.edu*
- 10:12 am    **AAPT-17**    **The Ups and Downs of the Falling Shot Lab**  
Bill Franklin  
*PTRA A&M Rural Institute, physicsnerd@yahoo.com*
- 10:24 am    **SPS-16**        **ITER: The Future of Fusion**  
Bryan McLane  
*Stephen F. Austin State University, bryan.mclane@us.army.mil*
- 10:36 am    **SPS-17**        **Special Relativity**  
Thomas Bunch  
*Stephen F. Austin State University, pyre96@hotmail.com*
- 10:48 am    **SPS-18**        **Electromagnetic Pulses**  
Daniel Topping  
*Stephen F. Austin State University, drtopp@cox-internet.com*
- 11:00 am    **SPS-19**        **Anomalously Blue Elliptical Galaxies in the Sloan Survey**  
Curtis Mitchell (UNT), Mike Fanelli (UNT), Pam Marcum (TCU)  
*University of North Texas, fanelli@unt.edu*
- 11:12 am    **SPS-20**        **Seeking Chemical and Kinematic Correlations in the Carina Dwarf Spheroidal Galaxy**  
Gigi Nevils, Derek Koger, C. Renee James, Matteo Monelli, Mario Nonino  
*Sam Houston State University, gknevils@shsu.edu*
- 11:24 am    **SPS-21**        **SFA Planet Finder**  
Kellie Fletcher  
*Stephen F. Austin State University, kelliefletcher@hotmail.com*
- 11:36 am    **SPS-22**        **The Effects of a Total Solar Eclipse on the Low-Latitude Ionosphere at Two Different Altitudes**  
S. Zandstra and K. H. West  
*Texas A&M University-Commerce, Keith\_West@tamu-commerce.edu*
- 11:48 am    **SPS-23**        **Gravity Probe B**  
Billy Albert  
*Stephen F. Austin State University, billyj81@yahoo.com*
- 12:00 pm    **SPS-24**        **SpaceShipOne**  
Chris Pierce  
*Stephen F. Austin State University, chrisp82\_01@yahoo.com*
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# TSAAPT Workshops

Organizer: Thomas O’Kuma, *tokuma@lee.edu*

## FRIDAY AFTERNOON: 2:30pm - 4:30pm

- W1 “Incorporating Inquiry in Kinematics”** presented by Mark Kinsey, Clements High School  
Participants will use inquiry and curve fitting concepts to derive kinematics equations of motion for constant acceleration using computer interfacing technology. PASCO equipment will be used, but it can be easily adapted to fit any other data acquisition equipment such as Vernier  
**Limited to 24 participants - 2 hours - Cost \$2.00** **Room 315**
- W2 “Ranking Tasks: An Alternative Way of Approaching Concepts in Physics”** presented by Tom O’Kuma, Lee College.  
Ranking Tasks are an innovative type of conceptual exercise that asks students to make comparative judgments about a set of variations on a particular physical situation. They frequently elicit students’ natural ideas, rather than a memorized response, about the behavior of a given physical system. This workshop will provide classroom tested examples and ideas on how to construct and use them. **Limited to TAMU RPTRA only.**  
**Limited to 24 participants - 2 hours - Cost of \$2.00** **Room 316**
- W3 “Inexpensive Light Activities”** presented by Regina Barrera, Lee College  
Prove Snell’s Law using a Petri dish, Jell-O, a CD, and a Laser Pointer. Determine Planck’s constant using LEDs, battery, volt meter, and spectroscope. This and others will be presented in this workshop. Most materials are make and take.  
**Limited to 18 participants - 2 hours - Cost \$10.00** **Room 317**

## SATURDAY MORNING: 10:00 am - 12:00 pm

- W4 “Introduction to Modeling Tools/Discourse”** presented by Dwain Desbien, Estrella Mountain Community College  
This workshop will introduce participants to tools used in the modeling curriculum and classroom management techniques used with them. Participants will practice with the tools using traditional and non-traditional problems, while experiencing first hand the classroom management styles used in modeling.  
**Limited to 30 participants - 2 hours - Cost \$2.00** **Room 317**
- W5 “Bring Physics to Life”** presented by April Varnado, PASCO Scientific  
Find out how probeware can increase student understanding of complex physics concepts including Newton’s Third Law, the Law of Conservation of Energy, Kinematics and Voltage/Current relationships. Using sensors, software and dataloggers, you’ll see for yourself how students’ grasp of physics concepts can be improved in a way not easily accomplished using more traditional methods. And, come see PASCO’s new Xplorer GLX!  
**Limited to 24 participants - 2 hours - Cost \$2.00** **Room 315**
- W6 “Polarization Using the LabPro”** presented by Regina Barrera and Tom O’Kuma, Lee College  
Now you can show how Intensity depends on the angle of a polarizer using light sources (flash light, LED light source, and a laser pointer) and how other materials shift the intensity (scotch tape, plastic, wax paper, and calcite). The LabPro interface with a light sensor and a rotary motion probe will be used to show how this is possible.  
**Limited to 18 participants - 2 hours - \$4.00** **Room 316**

**SATURDAY AFTERNOON: 12:30 pm - 2:30 pm**

**W7 “Introduction to the Modeling Methodology of Instruction in Physics Part II: Deployment Applications and Relationship to TEKS & TAKS for Texas High School Physics”** presented by Stan Hutto, Alamo Heights High School

This workshop will be a continuation of the ideas presented in the Introduction to Modeling tools/discourse Workshop. Participants will practice and view various exploratory/paradigm labs, deployment exercises and activities and will discuss advantages and disadvantages associated with the modeling methodology in relationship to the TEKS and TAKS for Texas high school physics classes.

**Limited to 30 participants - 2 hours - Cost of \$4.00**

**Room 317**

**W8 “As the ‘Coil Turns’ Using the LabPro”** presented by Regina Barrera and Tom O’Kuma, Lee College

Need to become more familiar with the LabPro interface and other activities on the topic of magnetism? In this workshop, we will show how you can determine the number of coils in a solenoid by measurement of length, diameter, material, and temperature. You can then compare this by using the LabPro interface, the magnetic field sensor, and the rotary motion probe.

**Limited to 18 participants - 2 hours - Cost \$2.00**

**Room 316**

**W9 “Animating Physics Principles”** presented by W. L. Trikosko, SFASU Physics Dept.

Learn how to demonstrate physical principles like traveling waves, superposition of waves, standing waves, phase and group velocity, phasors, reflections from fixed and open boundaries, Doppler effect, Fourier series, etc. using easy to construct Excel spreadsheet animations.

**Limited to 18 participants - 2 hours - Cost \$2.00**

**Room 315**

# Exhibitors

**Society of Physics Students**

Ali Piran, [apiran@sfasu.edu](mailto:apiran@sfasu.edu)

<http://www.physics.sfasu.edu/>

**Teach Spin**

Suzanne Neary

[sneary@teachspin.com](mailto:sneary@teachspin.com), <http://www.teachspin.com/>

**University of Texas at Brownsville,**

Martha Casquette

[mcasquette@UTB.edu](mailto:mcasquette@UTB.edu)

**Tarleton State University - Engineering Program**

Jason Jacks

[jacks@tarleton.edu](mailto:jacks@tarleton.edu)

**PASCO scientific**

April Varnado, Mark Kinsey, Renee Most

[varnado@pasco.com](mailto:varnado@pasco.com), [Mark.Kinsey@fortbend.k12.tx.us](mailto:Mark.Kinsey@fortbend.k12.tx.us), [most@pasco.com](mailto:most@pasco.com)

**Society of Physics Students at UT Arlington - Undergraduate and Graduate Research**

Judy Posner

[jposner05@yahoo.com](mailto:jposner05@yahoo.com)

**Texas A&M University**

Roland Allen

[allen@tamu.edu](mailto:allen@tamu.edu), <http://www.physics.tamu.edu/>

# Meeting Abstracts

Friday, March 4, 2005

## Plenary Session

8:45 am - **PL-1 - From EPR To Quantum Eraser: The Role of Observation and the Observer in the Quantum Micro Cosmos**, Marlan O. Scully, *Inst. for Quantum Studies and Depts. Of Physics, and Chemical and Electrical Engineering, Texas A&M University, Inst. For Materials Science and Depts. Of Mechanical and Aerospace Engineering and Chemistry, Princeton University*. Einstein, Podolsky, and Rosen (EPR) provide us with deep questions concerning and insights into quantum mechanics. For example, when an object such as a photon or atom is observed, its behavior is radically altered. Nobel Laureate Eugene Wigner has connected this aspect of quantum weirdness with consciousness, i.e., the mind of the observer. More recently we have asked whether the altered state of the photon or atom is further changed if the memory of the observer is erased. The following quotes from Newsweek<sup>1</sup> tell the story: "Knowledge [of the photon path] is the reason why interference is lost. It is as if the photon knows it is being watched . . . But now we discover that: Erasing the knowledge of the photon path brings interference back." In his recent book, *The Fabric of the Cosmos*, Brian Greene sums up beautifully the counterintuitive nature of these results, he says: "These experiments are a magnificent affront to our conventional notions of space and time. Something that takes place long after and far away from something else nevertheless is vital to our description of that something else. By any classical-commonsense-reckoning, that's, well, crazy. Of course, that's the point: classical reckoning is the wrong kind of reckoning to use in a quantum universe . . . For a few days after I learned of these experiments, I remember feeling elated. I felt I'd been given a glimpse into a veiled side of reality. Common experience-mundane, ordinary, day-to-day activities-suddenly seemed part of a classical charade, hiding the true nature of our quantum world." In the present lecture, we will explain the way in which the "mere presence" of an observer changes the nature of the object being observed via EPR type correlations. Furthermore, erasing the knowledge acquired by the observer can change things back to their original, preobservation, condition! In the words of Newsweek: "No Wonder Einstein was confused."

<sup>1</sup> Newsweek, June 19, 1995, p. 68.

<sup>2</sup> B. Greene, *The Fabric of the Cosmos*, (Alfred A. Knopf, New York, 2004).

9:45 am - **PL-2 - Taking Einstein's Ethics Into the Twenty-First Century: 'Remember Your Humanity'**, Dwight E. Neuenschwander, *SPS/Sigma Pi Sigma Publications Editor, and Department of Physics, Southern Nazarene University, Bethany, DNeuensch@snu.edu*. With the observation in 1919 of his predicted deflection of starlight by the Sun, Albert Einstein became an international celebrity. He used his fame to speak out on thoughtfully, forcefully, and continuously on matters of justice and human dignity, including war and peace, arms control, religion, personalities, civil rights, life and death, moral

trends, education, economics, international relations. Whether his views were popular or not was never Einstein's concern. In his life Einstein faced many ethical dilemmas, as when, for example, as a pacifist on the eve of war he was asked to solicit President Roosevelt's support for the development of nuclear weapons. In this century the familiar ethical dilemmas will be joined by new ones, such as genetic technologies that could make possible a posthuman future. What can Einstein's ethics tell us about wisely addressing the ethical dilemmas of the twenty-first century?

10:30 am - **PL-3 - The Mars Exploration Rovers: Following the Water**, Mark T. Lemmon, *Texas A&M University*. The big science question for the Mars Exploration Rovers is how past water activity on Mars has influenced the red planet's environment over time. While there is no liquid water on the surface of Mars today, the record of past water activity on Mars can be found in the rocks, minerals, and geologic landforms, particularly in those that can only form in the presence of water. That's why the rovers are specially equipped with tools to study a diverse collection of rocks and soils that may hold clues to past water activity on Mars. The rovers will offer unique contributions in pursuit of the overall Mars science strategy to "Follow the Water." Understanding the history of water on Mars is important to meeting the four science goals of NASA's long-term Mars Exploration Program: (1) Determine whether Life ever arose on Mars, (2) Characterize the Climate of Mars, (3) Characterize the Geology of Mars, and (4) Prepare for Human Exploration.

## Session AA

1:30 pm - **AA-1 - Production and Decay of Ultracold Feshbach Molecules in Bosonic and Fermionic Species**, E. Hodby, *ehodby@jilau1.colorado.edu*, S. Thompson, *thompsst@colorado.edu*, C. Regal, *regal@jilau1.colorado.edu*, M. Greiner, *mgreiner@jilau1.colorado.edu*, A. Wilson, *acwilson@jila.colorado.edu*, D.S. Jin, *jin@jilau1.colorado.edu*, E.A. Cornell, *cornell@jila.colorado.edu*, C.E. Wieman, *cwieman@jila.colorado.edu*, *JILA, Boulder, Colorado, 80309-0440*. We investigate the production efficiency of weakly-bound, ultracold molecules in bosonic <sup>85</sup>Rb and also fermionic <sup>40</sup>K when the magnetic field is swept across a Feshbach resonance [1]. For adiabatic sweeps of the magnetic field, our novel model shows that the conversion efficiency of *both* species is solely determined by the phase space density of the atomic cloud, in contrast to a number of theoretical predictions. In the non-adiabatic regime our measurements of the <sup>85</sup>Rb molecule conversion efficiency follow a Landau-Zener model. The spontaneous dissociation of these <sup>85</sup>Rb molecules has also been observed [2]. The molecular lifetime shows a strong dependence on magnetic field, varying by three orders of magnitude between 155.5 G and 162.2 G. Our measurements are in good agreement with theoretical predictions in which molecular dissociation is driven by inelastic spin relaxation [3]. Molecule lifetimes of tens of milliseconds can be achieved close to resonance. [1] Cond-

mat/0411487 [2] Phys. Rev. Lett. **94**, 020401 (2005) [3] Phys. Rev. Lett. **94**, 020402 (2005)

1:42 pm - **AA-2 - Measurement of Index of Refraction using Low-Coherence Interferometry\***, Joshua Dickerson, *jdickers@lonestar.utsa.edu*, Dhiraj Sardar, *dhiraj.sardar@utsa.edu*, University of Texas at San Antonio.

The indices of refraction of various materials were measured in a Michelson interferometer using several low-coherence light sources and compared to the values measured by other methods. This measurement technique yielded a value of  $n = 1.47$  for quartz and  $n = 1.33$  (660 nm) and  $n = 1.32$  (940 nm) for water. The effects of dispersion in thick samples and other sources of error were also modeled and investigated. This technique will be used to measure the indices of refraction of various ocular tissues and compared with those available in the literature. \* This work was supported by the NSF sponsored Center for Biophotonics Science and Technology (CBST) at UC Davis. \* The support by the UTSA Faculty Development Leave is duly acknowledged. \* This work was also supported by NIH MARC-U\*STAR Grant: GM07717.

1:54 pm - **AA-3 - Fluorescence and Absorption Spectra and Potential Energy Surfaces of 1,3-Benzodioxole and Coumarin in Their  $S_0$  and  $S_1(\pi,\pi^*)$  States**, Katsuhiko Okuyama, *kokuyama@mail.chem.tamu.edu*, Kevin Morris, Martin Wagner, Juan Yang, Jaan Laane, *laane@mail.chem.tamu.edu*, Department of Chemistry, Texas A&M University, College Station, TX 77843-3255. The fluorescence excitation spectra and dispersed fluorescence spectra of jet-cooled molecules along with ultraviolet and far-infrared absorption spectra of the bicyclic molecules 1,3-benzodioxole and coumarin have been recorded. These spectra have allowed us to determine the two-dimensional potential energy surfaces for the ring-puckering and ring-flapping vibrations for the  $S_0$  and  $S_1(\pi,\pi^*)$  electronic states. Both molecules are bent with barriers to planarity in both their ground and excited states. The bent structures for coumarin result from -CH<sub>2</sub>-CH<sub>2</sub>- torsional forces while those for 1,3-benzodioxole are caused by the anomeric effect.

2:06 pm - **AA-4 - Experimental and *Ab Initio* Spectra of 3-Methylindole in the Gas Phase**, Kathleen McCann, *kmccann@mail.chem.tamu.edu*, Amanda Combs, Daniel Autrey, Jaan Laane, *laane@mail.chem.tamu.edu*, Department of Chemistry, Texas A&M University, College Station, TX 77843-3255, Stacy Overman, George Thomas, Jr., *thomasgj@umkc.edu*, School of Biological Sciences, University of Missouri-Kansas City, Kansas City, MO 64110-2499. 3-Methylindole (3MI), a structural model for the tryptophan side chain in proteins, has been investigated using vapor-phase infrared and Raman spectroscopy. The vapor Raman spectrum identifies the signature of the indolyl moiety free of intermolecular interaction. We have also utilized *ab initio* calculations to refine and extend previous vibrational assignments. The present results provide an improved basis for assessing the dependence of the indolyl Raman signature on the local environment of the tryptophan side chain of proteins. The vapor Raman bands at 3506, 1585, 1409, 1349/1341 (Fermi doublet) and 881 cm<sup>-1</sup> differ greatly from their counterparts in the spectrum of the liquid and thus serve as spectral markers of

the intermolecular interactions of the indolyl ring environment. The maximum value of the Fermi doublet intensity ratio (3.0) is observed for 3MI vapor, while the minimum value (0.43) is observed for 3MI in CHCl<sub>3</sub> solution.

2:18 pm - **AA-5 - Ultraviolet Cavity Ringdown Spectra of 2-Cyclohexen-1-one**, Mohamed Rishard, *rishard@mail.chem.tamu.edu*, Jaebum Choo, Daniel Autrey, Jaan Laane, *laane@mail.chem.tamu.edu*, Department of Chemistry, Texas A&M University, College Station, TX 77843-3255, Stephen Drucker, Emily Giles, Department of Chemistry, University of Wisconsin-Eau Claire, Eau Claire, WI 54702-4004. The cavity ringdown spectrum of 2-cyclohexenone vapor has been recorded in the vicinity of the  $S_0$  band, which is at 26 089.1 cm<sup>-1</sup>. Several low-frequency fundamentals and overtones have been observed using this very sensitive technique which also allows even weak bands to be detected. The inversion of the six-membered ring  $\nu_{39}$  occurs at 99.0 cm<sup>-1</sup>. With the help of far-infrared and Raman spectra, the frequencies for  $\nu_{38}$  and  $\nu_{37}$  have also been determined. The barrier to the inversion potential was found to be 1900±300 cm<sup>-1</sup>, which is very different from previously reported values of 935 and 3379 cm<sup>-1</sup>. Density functional calculations give a barrier of 2090 cm<sup>-1</sup> when the B3LYP/6-311+G(d,p) basis set is used. The frequencies calculated by the density functional methods agree very well with the experimental values obtained by liquid and vapor Raman spectra and also with the mid-IR experiments. Investigation of the  $T_1(n,\pi^*)$  is currently underway.

2:30 pm - **AA-6 - Infrared, Raman, Ultraviolet Absorption, Fluorescence Excitation and Single Vibronic Level Fluorescence Spectra and *Ab Initio* Calculations of 1,4-Benzodioxan**, Juan Yang, *jyang@mail.chem.tamu.edu*, Martin Wagner, Daniel Autrey, Jaan Laane, *laane@mail.chem.tamu.edu*, Department of Chemistry, Texas A&M University, College Station, TX 77843-3255. The 1,4-benzodioxan molecule is expected to have a twisted C<sub>2</sub> structure due to the CH<sub>2</sub>-CH<sub>2</sub> torsional interaction in the electronic ground state and MP2 calculations confirm that. Mid-infrared (IR) and Raman spectra of this molecule in both liquid and vapor phases were recorded and assigned. Density functional theory (DFT) calculations were carried out to predict the vibrational frequencies. The calculated frequencies, after proper scaling, agreed very well with the experimental values. Ultraviolet (UV) absorption, fluorescence excitation (FES) and single vibronic level fluorescence (SVLF) spectra were also obtained and assigned. From those spectra several energy levels of the ring-bending and ring-twisting vibrations in both the electronic ground and excited states were determined.

2:42 pm - **AA-7 - Femtosecond CARS on organic molecules**, Supported by the Office of Naval Research, the Air Force Research Laboratory (Rome, NY), Defense Advanced Research Projects Agency - QuIST, Texas A&M University Telecom. and Inform. Task Force (TITF) Initiative, and the Robert A. Welch Foundation, Dmitry Pestov, *dmip@neo.tamu.edu*, Miaochan Zhi, Robert Murawski, Alexei Sokolov, Nikolai Kalugin, Yuri Rostovtsev, Zoe Sariyanni, Vladimir Sautenkov, Marlan Scully, Department of Physics and Institute for Quantum Studies, Texas A&M University. Quantum coherence dynamics on vibrational transitions in organic molecules is studied by means of

femtosecond Coherent Anti-Stokes Raman Scattering (CARS) technique. CARS signal profiles for high-frequency Raman transitions in methanol and ethanol, as representative simple organic substances, are obtained. The detailed, good-visibility profiles, spanning six decades in signal magnitude, show clear low-frequency oscillations, attributed to quantum beats, and make it possible to extract decoherence time constants. Non-trivial dependence of these constants on methanol/ethanol concentration in water solution is observed. Coherent response from a saturated solution of dipicolinic acid, which has much more complex molecular structure, is also demonstrated.

3:18 pm - **AA-8 - Switchable Diffraction Gratings Holographically Formed in Polymer-Dispersed Liquid Crystal Cells Using He-Ne Laser**, Robert Ramsey, *robertramsey@uta.edu*, Suresh Sharma, *sharma@uta.edu*, *University of Texas at Arlington*. We report on the holographic formation of switchable diffractive transmission gratings in polymer-dispersed liquid crystal cells by using the 632.8 nm wavelength of He-Ne laser. We present results for the micro-structure, diffraction efficiency and switching characteristics for gratings utilizing E8 liquid crystal along with monomers having varying values of functionality and chemical makeup. For monomers having high values of functionality we note a large increase in diffraction efficiency up to 67% while at the same time an increase in the switching fields required to have a switchable grating are 8 MV/m.

3:30 pm - **AA-9 - UV-Ozone Oxidation of Ultra Thin Ru Layers**, ChangDuk Lim, *cl0107@unt.edu*, Vaishali Ukirde, *vaishali@unt.edu*, *Dept. of Materials Science, University of North Texas*, Oliver Chyan, *Dept. of Chemistry, University of North Texas*, Mohamed El Bouanani. Ruthenium and its oxides and nitrides are potential candidates for number of advanced applications in Silicon based semiconductor technology such as metal-based gate electrodes and diffusion barriers for copper interconnects. This is due to their good thermal stability, low resistivity, suitable work function and diffusion barrier properties. Physico-chemical and electrical properties of Ru oxides are intimately dependent on the oxide preparation method mainly due to the resulting microstructure, oxidation state and impurities/contaminants. 5 to 7 nm Ru films were deposited on Si and SiO<sub>2</sub> substrates by DC magnetron sputtering in Ar atmosphere. The films were then exposed to UV/Ozone radiation and oxygen at room temperature for a duration ranging from 15 min to 60 min. *In-situ* X-ray photoelectron spectroscopy (XPS) is used to investigate Ru oxidation rate and the bonding environment. A comparison with Ru oxide prepared via reactive DC sputtering in an Ar/O<sub>2</sub> mixture will be presented.

3:42 pm - **AA-10 - Interfacial Stability of RuO<sub>2</sub> on Hf<sub>x</sub>Si<sub>1-x</sub>O<sub>2</sub>/Si**, Vaishali Ukirde, *vaishali@unt.edu*, Changduk Lim, Manuel Quevedo-Lopez, Mohamed El Bouanani, *Dept. of Materials Science, University of North Texas*. Alternative metal-based gate electrodes are currently under consideration as a replacement of Poly-Si gates. Metal gates are required to maintain scaling and performance of future CMOS devices. Ru based compounds are potential gate electrode candidates for future metal-oxide-semiconductor (MOS) devices. RuO<sub>2</sub>, with thickness of 500Å were deposited on Hf<sub>x</sub>Si<sub>1-x</sub>O<sub>2</sub>/Si structures by DC sputtering. These structures were annealed in flowing N<sub>2</sub> atmosphere at temperatures ranging from 800 °C to 1000 °C.

The thermal stability and interfacial diffusion and reaction of RuO<sub>2</sub> on Hf<sub>x</sub>Si<sub>1-x</sub>O<sub>2</sub>/Si gate dielectric were investigated using Rutherford Backscattering Spectrometry (RBS) and SEM. An overview of RuO<sub>2</sub>/ Hf<sub>x</sub>Si<sub>1-x</sub>O<sub>2</sub>/Si interface integrity and pinhole formation issues will be presented.

3:54 pm - **AA-11 - Drell-Yan Physics at Fermilab: Past and Future**, L. Donald Isenhower, *isenhowe@acu.edu*, *Abilene Christian University*. The study of the Drell-Yan process has yielded a number of important results that have improved our understanding of the light quark sea of the proton. Fermilab E866/NuSea performed the first measurements of the absolute Drell-Yan cross section in proton-proton collisions over a broad kinematic region, and the most extensive study to date of the Drell-Yan cross section in proton-deuterium collisions. It also made the first measurement of this cross section ratio of proton-proton to proton-deuterium collisions over a large kinematic range, allowing the extraction of the ratio of anti-down to anti-up quark in the proton. After reviewing E866 results and their contributions to various areas, such as structure function calculations, the plans for E906, which will utilize the Fermilab Main Injector will be discussed. The lower energy of the Main Injector provides a higher Drell-Yan cross section, allowing the extension of to higher Bjorken-x where E866 hints of possible continued departure from unity of the d/u anti-quark ratio. Other important physics questions that E906 will pursue will also be discussed.

4:06 pm - **AA-12 - An Investigation of the Canis Major Dwarf Galaxy**, William Lee Powell Jr., *William.L.Powell@ttu.edu*, Ron Wilhelm, *Ron.Wilhelm@ttu.edu*, Amy Westfall, Adam Lauchner, Abel Diaz, *Texas Tech University*. Martin et al. (2004) uncovered evidence for a remnant dwarf galaxy in Canis Major. Martin, *et al.* discovered an overdensity of M-giant stars using 2MASS colors. The spatial distribution of the M-giants indicate that Canis Major is an extended, and likely disrupted, group of stars that that are centered at a distance moduli of (m-M) = 15.8 and extending over roughly 30 degrees. This discovery is not without controversy. Momany et al. (2004) found that the proper motions of the M-giants in the direction of Canis Major are consistent with the thick disk of the Galaxy, but also found modeled number densities for these stars that are consistent with the warp and flaring of the outer disk of our Galaxy. This led Momany et al. to the conclusion that Martin et al. were actually observing the outer warp of our Galaxy. We made a photometric survey to find candidates of the Canis Major galaxy which could belong to the horizontal branch of the galaxy. We then obtained spectroscopy of these stars in order to determine luminosity class, metal abundance and distance estimates. The goal was to find a group of horizontal branch stars, as is expected for an old population, in the Canis Major dwarf. This would have ramifications for our understanding of the thick disk population in our Galaxy.

4:18 pm - **AA-13 - Possible Applications and Limitations of Multi-Walled Carbon Nanotubes to Solar Energy Conversion**, Robert Friedfeld, *rfriedfeld@sfasu.edu*, Stephen F Austin State University. Recent experimental work has shown that multi-walled carbon nanotubes (MWCNT) can behave like receiving antennas for visible light [1]. One possible application for this newly observed behavior for carbon nanotubes might be

for solar energy conversion. Potential applications and limitations of this technology to solar energy conversion will be discussed. 1. Y. Wang *et al.*, Applied Physics Letters, Vol. 85, No. 13, 2004.

4:30 pm - **AA-14 - Study of the Acridine Labeled Short DNA-Duplexes by Means of Rotational Depolarization of Fluorescence**, Alexey Chugreev, *chugreev@tamu.edu*, Texas A&M University, Alexander Ogrodnik, *alexander.ogrodnik@ch.tum.de*, Technical University of Munich. Dye-DNA compounds have attracted much interest in the quest of potentialities for cancer treatment and serve as very versatile workbenches for exploring the basics of molecular wire technology. For such studies exact positioning of a dye within the sequence is crucial, and can be achieved by a flexible covalent link. Proper intercalation of such a dye can be tested by monitoring the inclination angle of the transition moment with the spinning axis of short DNA double helices by means of rotational depolarization of the dye fluorescence. For 9-amino-6-chloro-2-methoxyacridine attached with a tetramethylene linker at an abasic L-threoninol site we found this angle to be larger than 70 degrees. Since the fluorescence is quantitatively quenched in sequences with guanine neighboring the linker site, these results suggest complete intercalation of the dye.

4:42 pm - **AA-15 - Oxidation of Hafnium as Studied by X-ray Photoelectron Spectroscopy**, Supported by Organized Research, TAMU-Commerce, A Chourasia, *Anil\_Chourasia@tamu-commerce.edu*, Richard Miller, *Anil\_Chourasia@tamu-commerce.edu*, Texas A&M Univ-Commerce. Thin films of hafnium were deposited on stainless steel substrate at various temperatures in an oxygen atmosphere. The technique of X-ray photoelectron spectroscopy was used to study the oxidation of hafnium. The zirconium anode (energy = 2042.4 eV) was used as the source of excitation. The 3d core levels of hafnium (energy ~1660 eV) and the x-ray excited MNN Auger region of hafnium were investigated. The Auger parameter was determined from the core levels and the main peak in the Auger region. The data are correlated with the oxidation of hafnium as a function of the temperature. The thickness of the oxide films were determined by using the QUASES software. The dependence of the film thickness on the substrate temperature will be presented.

## Session AB

1:30 pm - **AB-1 - Euclidean, Lorentzian, and Physical Time**, Roland Allen, *allen@tamu.edu*, Zorawar Wadiasingh, *zorawar@neo.tamu.edu*, Texas A&M University. Lorentzian time is the time which occurs in the standard equations of physics, with a different status than a spatial coordinate  $x$ . Euclidean time is obtained from Lorentzian time by a Wick rotation in the complex  $t$  plane, and enters into the resulting equations exactly in the same way as a spatial coordinate  $x$ . It seems obvious that the physical time we experience must be Lorentzian time, and that Euclidean time is just a mathematical artifice which we employ for convenience in calculations. However, Hawking has suggested, in both his popular book ("A Brief History of Time") and in a more technical context ("Euclidean Quantum Gravity") that exactly the opposite may be true: Euclidean time may be more fundamental, making quantum

mechanics formally identical to statistical mechanics, and Lorenzian time is introduced by human observers because it is more convenient for calculations. We present an argument, based on the path integral formulation of quantum mechanics, which supports this latter point of view. In addition, we propose that the breaking of the symmetry between space and time has a simple cosmological origin.

1:54 pm - **AB-3 - Temperature Difference Induced Entanglement of a Two-Level Atom and a Thermal Field**, Han Xiong, *hxiong@tamu.edu*, Fuli Li, *flli@tamu.edu*, M.S. Zubairy, *zubairy@physics.tamu.edu*, Institute for Quantum Studies and Department of Physics, Texas A&M University, Texas 77843, USA. The interaction of a two-level atom and a field which are both initially prepared in thermal states has been studied by use of the Jaynes-Cummings model. We show that entanglement between the atom and the field can arise when the temperature difference between them are sufficiently large. This entanglement cannot be created when the atom and the field are in thermal equilibrium, however, a unitary transformation can always be applied on the atom to destroy the thermal equilibrium and thus create entanglement.

2:06 pm - **AB-4 - Cavity QED Implementation of Three Qubit Quantum Phase Gate**, Juntao Chang, *jchang@physics.tamu.edu*, Suhail Zubairy, Department of Physics and Institute for Quantum Studies, Texas A&M University. We describe a three qubit quantum phase gate in which the three qubits are represented by the photons in a three-modes optical cavity. This gate is implemented by passing a four-level atom in a cascade configuration through the cavity. We shall discuss the application of such a quantum phase gate to quantum searching.

2:18 pm - **AB-5 - Generation of Arbitrary Two-Qubit Entangled States in Cavity QED**, Tiegang Di, *tiegang-di@neo.tamu.edu*, M. Suhail Zubairy, *zubairy@physics.tamu.edu*, Department of Physics and Institute for Quantum Studies, Texas A&M University. We propose how to prepare arbitrary two-mode entangled photon states using atomic interactions with classical fields and quantized cavity fields.

2:30 pm - **AB-6 - Propagation of Broad Spectrum Pulse in EIT Medium**, Qingqing Sun, *qsun@physics.tamu.edu*, Yuri Rostovtsev, *rost@physics.tamu.edu*, Department of Physics, Texas A&M University, Jonathan Dowling, *jdowling@phys.lsu.edu*, Department of Physics & Astronomy, Louisiana State University, M. Suhail Zubairy, *zubairy@physics.tamu.edu*, Department of Physics, Texas A&M University. We investigate the possibility of broad spectrum pulse propagation in an electromagnetically induced transparency (EIT) medium without large distortion. The pulse is separated into different spectrum bands. Each band propagates in an EIT window whose center is adjusted to the band center. After proper phase compensations these bands are recombined. The outgoing pulse suffers little distortion and absorption, compared to the propagation in one EIT window. Using this method we can remove the restriction to pulse width in slow light experiments.

2:42 pm - **AB-7 - Preservation of Non-Classicality in the Continuous-Variable Quantum Teleportation**, FuLi Li, *flli@physics.tamu.edu*, Tiegang Di, *Tiegang-di@neo.tamu.edu*, M. Suhail Zubairy, *Department of Physics and Institute for Quantum Studies, Texas A&M University*. The relation between the P-functions of the input and output states in the protocol of quantum teleportation of continuous variables of an optical field is established. Based on this relation, we find a condition involving the squeezing parameter and the detector efficiency, under which the P-function of the output state becomes the Q-function of the input state such that any non-classical features in the input state will be eliminated in the teleported state. In particular, we notice that if the homodyne detection efficiency is less than 0.5 the teleported field must be classical even if the entanglement in the quantum channel is perfect.

2:54 pm - **AB-8 - "Magic-Angle" Technique for Suppression of Inhomogeneous Broadening of Mössbauer Spectra**, Petr Anisimov, *petr@tamu.edu*, Yury Rostovtsev, Olga Kocharovskaya, *Texas A&M University*. In this work, we demonstrate "magic-angle" technique with respect to Mössbauer spectroscopy. The case of dipole interaction of  $^{57}\text{Fe}$  is analyzed. Floquet-state perturbation theory for the RF modulation of the Mössbauer resonance and the concept of effective magnetic field is used to calculate the spectra of the 14.4 keV  $^{57}\text{Fe}$  nuclear transition. Our analysis provides physical insight into the technique and defines necessary range of parameters for an experimental realization.

3:30 pm - **AB-9 - Control of Ionization Rates of  $\text{H}_2^+$  by Single Cycle Pulses Timed with Respect to Molecular Motion**, Andrea Burzo, *andrea@physics.tamu.edu*, Alexei Sokolov, *sokol@tamu.edu*, *Department of Physics and Institute for Quantum Studies, TAMU*. Photo-ionization with single-cycle pulses is a first step toward studying atomic dynamics on the time scale of electronic motion. Previous work has shown that it is possible to produce a train of identical single cycle pulses, perfectly synchronized with molecular motion and separated by an integer (4 or 9) of molecular periods. These pulse trains can be used for studying multiphoton ionization on a few femtosecond timescale. If the input field frequencies are a multiple of their frequency difference, then processes of different order will interfere, leading to a complex dependence of ions signal for different sub-cycle pulse shapes. We are studying how the ionization probability will change as a result of different time delays between the laser pulses and molecular motion. As a result, one can control the ionization rates by adjusting the arrival of the pulses with respect to the molecular motion.

3:42 pm - **AB-10 - Ab Initio Calculations for the Structure, Vibrational Frequencies, and Barrier to Planarity of Cyclopentene**, Abdulaziz Al-Saadi, *al-saadi@mail.chem.tamu.edu*, Jaan Laane, *laane@mail.chem.tamu.edu*, *Department of Chemistry, Texas A&M University, College Station, TX 77843-3255*. *Ab initio* and DFT calculations have been carried out for the cyclopentene molecule in order to analyze its structure and vibrational frequencies. The structure was calculated with MP2/6-311++G\*\* and MP2/cc-pVTZ basis sets and these predicted puckering angles of  $27.1^\circ$  and  $26.1^\circ$ , respectively, as compared to the experimental far-infrared value of  $26^\circ$ . The barrier to

planarity was calculated to be  $247\text{ cm}^{-1}$ , slightly higher than the  $233\text{ cm}^{-1}$  far-infrared value. The calculated vibrational frequencies from DFT-B3LYP/cc-pVTZ were compared to the experimental values for the  $\text{d}_0$ ,  $\text{d}_1$ ,  $\text{d}_4$ , and  $\text{d}_8$  isotopomers and several vibrational reassignments were made.

3:54 pm - **AB-11 - Debye Model of Step Wandering**, Howard Richards, *Howard\_Richards@tamu-commerce.edu*, *Dept. of Physics, Texas A&M-Commerce*, Amber Benson, *Texas A&M-Commerce, Mississippi State University*, T.L. Einstein, *Dept. of Physics, University of Maryland, College Park*. The stiffness of steps on vicinal crystal surfaces is often determined by fitting experimental step wandering functions to a theoretical form, which is based on a harmonic approximation to the potential experienced by the step. This approximation is analogous to the Einstein model of solids, and it can likewise be improved by a "Debye model" in which the spatial dependence is implicit through the relative positions of neighboring steps. The form of the resulting wandering function will be presented and compared with numerical simulations of the terrace-step-kink model for a range of step interactions.

4:06 pm - **AB-12 - Principle of Least Action and Gauge Compatibility for a Charged Particle in an Electromagnetic Field**, Donald H. Kobe, *kobe@unt.edu*, *University of North Texas*. The Principle of Least Action is used for a single nonrelativistic charged particle in an external electromagnetic field. The Hamiltonian used requires a choice of gauge for the vector and scalar potentials. The trial wave function used requires a choice of a space- and time-dependent phase that is a gauge choice for the wave function. These two gauge choices may not be compatible. We generalize the original trial function by multiplying it by an arbitrary space- and time-dependent phase factor. When this generalized wave function is used in the principle of least action and the action is varied with respect to the phase, we obtain an equation of continuity. From this equation of continuity we can determine the new phase that is compatible with the gauge of the Hamiltonian. Equivalently, we can determine a new gauge for the potentials in the Hamiltonian that is compatible with the gauge of the original wave function. We apply the method to a charge particle in the electric dipole approximation with a real trial wave function and a Hamiltonian in the Coulomb gauge. For a real trial wave function, the Hamiltonian must have new potentials that are in the electric field gauge. For a Hamiltonian in the Coulomb gauge, the phase of the trial wave function is determined. When the Hamiltonian is time independent and the trial wave function has only time dependence  $E t$  in its phase, the principle of least action reduces to the energy variational principle.

4:18 pm - **AB-13 - On the Physical Origin of the Earth's Electric Field**, Wayne M. Saslow, *wsaslow@tamu.edu*, *Texas A&M University*. Although the earth's atmosphere is by no means in equilibrium, it does have certain steady-state properties. This leads one to hope that these properties may be described in the language of irreversible thermodynamics. The physical origin of the earth's electric field then may reside in a thermoelectric effect between the atmosphere and the earth's surface, although other disequilibria besides temperature (pressure, electrochemical potentials of certain constituents of the atmosphere) could also be responsible for the earth's electric field. Lightning then appears as a discharge phenomenon

associated with atmospheric fluctuations, rather than as a source of the earth's electric field.

4:30 pm - **AB-14 - Kink Stability of Isothermal Spherical Self-Similar Flow**, Anzhong Wang, *AnzhongWang@baylor.edu*, Yumei Wu, Baylor University. The problem of kink stability of isothermal spherical self-similar flow in Newtonian gravity is revisited. Using distribution theory we first develop a general formula of perturbations, linear or non-linear, which consists of three sets of differential equations, one is in each side of the sonic line, and the other is along it. By solving the equations along the sonic line we find explicitly the stability criterion for the self-similar solutions. When the solutions are smoothly across the sonic line, our results reduce to those of Ori and Piran. To show such obtained perturbations can be matched to the ones in other regions, we study the linear perturbations outside of the sonic line, by taking the solutions obtained along the line as the boundary conditions. After properly imposing other boundary conditions in the space we are able to show that linear perturbations outside the sonic line, satisfying all the boundary conditions, exist for any given  $k$ , where  $k$  denotes the spectrum of the perturbations obtained along the sonic line. As a result, the complete treatment of perturbations in the whole space does not alter the spectrum obtained by considering only the perturbations along the sonic line.

4:42 pm - **AB-15 - Nuclear Collisions Induced by Single-Cycle Laser Pulses: Molecular Approach to Fusion**, Miaochan Zhi, *mczhi@neo.tamu.edu*, Alexei Sokolov, *mczhi@neo.tamu.edu*, Texas A&M University. Fusion occurs when light nuclei of hydrogen (H), deuterium (D), or tritium (T), join together to produce helium, neutrons, and energy. The two present techniques for controlled fusion all rely on hot plasma. We propose a "new method" which doesn't require preparation and confinement of hot and dense plasma, but works in a molecular gas. It uses the fact that nuclei in a molecule are pre-aligned in front of each other and can be driven into each other by the very strong and ultra-short laser pulse since the nuclei of different masses will acquire different velocities when driven by the same electric field. The nuclei may collide with high kinetic energy needed to overcome the Coulomb Barrier. These collisions may lead to fusion. Realization of this technique will require ultrashort (few-femtosecond, single-cycle) laser pulses with field intensities approaching  $10^{23}$  W/cm<sup>2</sup>. We have performed a classical simulation of nuclear motion under the action of the Coulomb repulsion and a strong laser field. We have also done a quantum calculation. From the classical calculation, we can see that collision will occur on a sub-attosecond time scale. On that timescale the nuclei will experience large acceleration and emit zeptosecond bursts of light. The quantum calculation coincides well with the classical one for the 1-d case and reveal more information for the 2-d case.

## Session AAPT

1:30 pm - **AAPT-1 - The Development of a Curriculum Specifically for the Introductory Algebra-Based Physics Course**, Beth Ann Thacker, *Texas Tech University*, *beth.thacker@ttu.edu*. We discuss a curriculum that has been developed specifically for the introductory algebra-based

physics course, taking into account the needs, backgrounds, learning styles and career goals of the students in that class. The course is designed to be taught in a laboratory-based, "Workshop Physics" style environment, however parts of the materials can be used in other settings. As instructors we found ourselves drawing on materials developed for the calculus-based course and for other populations (materials developed for pre-service teachers, for example), parts of which were appropriate, but not a complete curriculum as we would like to teach it, developed specifically for students in the introductory algebra-based physics course. So we have modified and adapted parts of existing materials and integrated them with our own new units and our own format, creating a course aimed specifically at these students.

1:42 pm - **AAPT-2 - SPS Chapter Lures 300+ H.S. Students Onto 2-Yr College Campus With Trebuchet**, Eric Peterson, Nick Koehn, Chris Williams, Chris Petta, Ben Morhardt and Jauhar Khalid, *Highland Community College*, *epeterson@highland.edu*. Enrollments in Engineering Physics have been down considerably over the past decade at our institution. Interest in science and technology seemed to be flagging within the local district. Annually since the mid-90's, the Statics and Dynamics classes have built projectile launchers. This year the class offered to combine their efforts into one large 44 foot behemoth and employ the assistance of the SPS Chapter they were all members of, to: assemble; market; and deliver a very successful program. Details of of this event and the club's role in it will be explored.

1:54 pm - **AAPT-3 - What I've Learned in Three Years of Teaching Physics to Music Majors**, Lionel D. Hewett, *Texas A&M University-Kingsville*, *L-Hewett@tamuk.edu*. This paper describes some of the interesting highlights of what I have learned during the past three years of teaching physics to music majors. Among the topics discusses are the purpose and philosophy of such a course, the problems in choosing a text, the motivation and conceptual problems of students, the course curriculum, the classroom setup, and the laboratory component.

2:06 pm - **AAPT-4 - Teaching Physics in Korea**, Steven Ball, *LeTourneau University*, *stevenball@letu.edu*. I will describe my experience teaching physics last fall at Handong Global University, a partner school with LeTourneau University. Interesting aspects of student-professor interaction and other differences in the Korean University setting allow for an enriching and rewarding exchange

2:18 pm - **AAPT-5 - Physics on the Border**, Martha Casquette, Adrienne Rodriguez-Zermeno, *University of Texas at Brownsville*, *mcasquette@utb.edu*. Celebrating the World Year of Physics helps to create enthusiasm and interest in science and provides children of all ages with positive role models. Our outreach efforts reinforce basic concepts covered in the Texas science core curriculum and the National Science Education Standards while keeping the science motivating. The work inspiring young scientist started with a Kellogg Foundation grant, in partnership with the Houston Endowment Foundation. This created the Brownsville Alliance for Science Education ENLACE center that partners the community and the local school districts to create excitement about science in

Brownsville. One of the outreach activities, the Physics Circus, is expanding this year with the support of the American Physical Society - Physics on the Road Program to reach limited experience students along the lower U.S. Mexico border.

2:30 pm - **AAPT-6 - What Middle and High School Students Perceive Physics to be**, Manuela Ortiz, Eric Hagedorn, *University of Texas at El Paso, ehagedorn@utep.edu*. In order to increase the number of students prepared for and willing to take physics in high school, we have been investigating the perceptions of pre-physics high school and middle school about what they believe physics to be. Fifty-eight middle school students and 130 high school students responded to the prompt: "Briefly write what you think physics is about." Responses were sorted and coded using the TextSmart software package. Percentages for the various categories are provided as well as interpretation, theoretical explanations and possible educational implications.

3:06 pm - **AAPT-7 - A Pre-service Teacher Preparation Program for Middle School Science**, Thomas O. Callaway; John Moore, *Stephen F. Austin State University, tcallaway@sfasu.edu*. The College of Sciences and Mathematics at Stephen F. Austin has developed a successful undergraduate program to train middle school science teachers. This presentation will describe the process that our team has utilized in order to provide an effective instructional program that provides both content and "hands-on" experience in science. We will include in our discussion our strategy for preparing students to meet the Texas state standards and assessment for middle school science teaching.

3:18 pm - **AAPT-8 - It's About Time: Relativity and Mark Twain's "My Watch"**, Hugh Henderson, *Plano Senior High School, hhender@pisd.edu*. Around 1870, over three decades before Einstein's annis mirabilis, Mark Twain wrote a humorous essay entitled "My Watch," which makes an excellent springboard for introducing students to relativity. This talk is based on my article which will appear in *The Physics Teacher* later this year.

3:30 pm - **AAPT-9 - Building Telescopes with an Undergraduate Class**, David Craig, *West Texas A & M University, dcraig@mail.wtamu.edu*. In 2004, 8 small Dobsonian telescopes were constructed with an undergraduate astronomy class at Delta State University. A combination and modification of two readily available sets of online telescope plans were used. Information on the construction and use of these telescopes with a class will be presented, along with suggestions for anyone wishing to implement a similar project.

3:42 pm - **AAPT-10 - Use of a Remote Observatory in Survey Astronomy Laboratories**, Mike Fanelli, *University of North Texas, fanelli@unt.edu*. The University of North Texas (UNT) is developing an automated off-campus observatory for use in our large survey astronomy courses. The UNT Monroe Observatory is located at a dark site near the Texas - Oklahoma border, 45 miles from campus. It contains four, independently-controlled observing stations, each with a 14-16 inch telescope positioned by a Paramount ME robotic telescope mount, attached to a pier assembly designed in-house. The telescopes are equipped with

an Apogee Instruments CCD camera, an automated filter wheel and auto-focuser. Guiding is accomplished off-axis using a 4" co-aligned telescope with a separate CCD camera. To accommodate multiple telescopes, we chose a roll-off roof design for the enclosure. For remote operation, we commissioned a roof control system, operated using a standard PC under visual basic. Each telescope is operated using two dedicated PCs; communication is via a T1 line, which allows the control computers to appear as if they are connected to the campus network. Imagery from these telescopes will provide the centerpiece to an integrated astronomy laboratory curriculum, including digital image analysis, multimedia planetarium labs, direct observations of the sky, and PC-based (CLEA) labs. This remote observatory will permit large numbers of students, majoring in disciplines other than the natural sciences, to conduct individualized experiments in a manner parallel to those employed in astronomical research. Graduate students operate the telescopes from campus, providing a diverse set of images for the survey astronomy students to access via a Web-interface. We will elaborate on the status of the facility, ideas for implementing digital images into the lab curriculum, and plans for public outreach. The UNT Observatory has been funded in part through the National Science Foundation's CCLI grant program, #9950630, and the University of North Texas.

3:54 pm - **AAPT-11 - Gender Differences in Teachers' Representations of Electric Circuits**, Jill Marshall, *University of Texas, Science & Math Ed., marshall@mail.utexas.edu*. For this study I examined the ways in which pre-service and in-service teachers in a Physics by Inquiry class represented electrical circuits with drawings. Preliminary findings indicate differences in the way male and female students represent circuits that cannot be immediately attributed to differences in experience with formal circuit diagrams. Further, some students appear to encode information in their drawings in ways that are at variance with unstated but accepted coding schemes for standard circuit diagrams. These findings may have implications for equitable instruction.

4:06 pm - **AAPT-12 - Science Wall: A portable stereoscopic projection system for education and outreach**, Phillip Dukes, Adrienne Rodriguez-Zermeno, *University of Texas at Brownsville and Texas Southmost College, pdukes@utb.edu*. We will demonstrate and describe a portable low-cost stereoscopic projection system being used for general science education and outreach in the Brownsville, TX area. Our system is an adaptation of a passive 3D GeoWall using polarized light. Examples from planetary science and astronomy will be demonstrated.

4:18 pm - **AAPT-13 - Evaluating the Use of Physlets in the Laboratory**, Adrienne Rodriguez-Zermeno, Phillip Dukes, *University of Texas at Brownsville, arodriguez@utb.edu*. This presentation will cover research done in the algebra-based introductory physics laboratory. In one of the laboratory sections several traditional laboratory exercises were replaced with Physlet-based labs. Student's performance on pre/post test assessment on these concepts was compared. This research is an extension of the research done by Anne J. Cox at Echerd College applying it to an open enrollment Hispanic serving institution.

4:30 pm - **AAPT-14 - Electronic Classroom Assessment Techniques (eCAT) for Physics**, Sam Matteson, *Department of Physics, University of North Texas, Matteson@unt.edu*. Electronic wireless response technology has made it possible for real time classroom assessments techniques (CAT) to be implemented in a large physics lecture hall setting. At UNT an application of the technology has been in use for nearly a year in several large format physics classes. The author presents the knowledge gained in the process of implementation and roll-out, including the rationale, benefits, challenges/costs and prospects of this promising pedagogical technique. The system in operation will be demonstrated.

4:42 pm - **AAPT-15 - Theory of the Split-Ring Resonator**, Wayne M. Saslow, *Texas A&M University, wsaslow@tamu.edu*. Recently it has been proposed that artificial materials consisting of a high density of small devices (relative to the appropriate wavelength) can be devised in order to obtain negative dielectric constant and magnetic permeability (at finite frequency). Such materials would support electromagnetic radiation but with the cross-product of E and B pointing opposite the wave-vector. One such device is the split-ring resonator, which we will describe and whose operation we will explain at the level of upper-division undergraduates.

## Session SPS

1:30 pm - **SPS-1 - MHD Boat Propulsion --- I**, Mitchell George, Taylor Kirkland, Lewis Pollock and Ken Taylor, *Lake Highlands High School, ken.taylor@risd.org*. A model boat driven by a MHD propulsion system is described. The paper discusses the effects of using multiple channels, differing channel geometry and, of course, the basic physics of MHD propulsion. (This is the first of two presentations describing MHD systems.)

1:42 pm - **SPS-2 - MHD Boat Propulsion --- II**, Kyle P. Johnson, Eric J. Mirochna, M. Collin Zreet and Ken Taylor, *Lake Highlands High School, ken.taylor@risd.org*. This second part, of two presentations discussing a MHD propulsion system for a model boat, will discuss the impact of electrode material and water conductivity on the motion of the boat. Both sodium chloride (NaCl) and copper sulfate (CuSO<sub>4</sub>) are used for enhancing the conductivity of the water.

1:54 pm - **SPS-3 - Lift generated by Simulated Airfoils, F.** Andrew Beal, *Stephen F. Austin State University, michael\_654@yahoo.com*. Using FoilSim to generate simulated data for a Jawouski airfoil at various angles of attack. Includes a basic introduction to Aerodynamics.

2:06 pm - **SPS-4 - Chaos Theory**, Andrew Moore, *SFASU Student, pollux.andrewmoore@gmail.com*. An introduction to Chaos Theory.

2:18 pm - **SPS-5 - Methods to Improve Track Fit Parameters in the PHENIX Muon Arms**, Oluwasoji Omotunde Omiwade, *Abilene Christian University, ooo00a@acu.edu*. During the summer of 2003, several problems in the muon tracking chambers of the PHENIX experiment at Brookhaven National

Laboratory's Relativistic Heavy Ion Collider (RHIC) were addressed. A brief introduction to the PHENIX detector with special attention to the muon tracking chambers that are the largest cathode strip chambers ever built will be given. This presentation will discuss how the inclusion of cathode strips that have been scratched causes problems for chamber alignment issues and for correct track reconstruction. The work for track reconstruction involved two major steps: First, we gathered raw data, which was obtained using the muon tracker calibration system. Pulses were then sent to selected anode wires through the high-voltage distributions system, and the data were converted into a format that the CERN ROOT program could manipulate. The set of software scripts greatly reduced the work required so that more time could be spent looking at the results of the analysis to improve other software. The ROOT macros and C++ programs written were essential for handling the job. As a result, a small portion of the presentation will cover how this software sped up the task of analyzing the data that were used to find broken cathode strips on one of the muon tracker stations. This has resulted in more accurate tracking and better mass resolution for the muon arms in the PHENIX experiment.

2:30 pm - **SPS-6 - A Modulation-Free Method for Stabilizing Lasers**, Larry Isenhower, *Abilene Christian University, ldi00a@acu.edu*. Over the last decade atomic trapping and cooling through the use of lasers has become a very important way to study quantum mechanical effects. In order to cool atoms the laser frequency must be stabilized to guarantee that the atoms can interact with the laser in the desired manner. Currently the most popular methods require expensive instruments and add an undesired modulation to the laser frequency. This new method uses an acousto-optic modulator to generate two laser beams of slightly different frequencies, both of which pass through a saturated absorption apparatus. These two beams then strike separate photodiodes, and the resulting signals are subtracted to perform a derivative of the atomic lineshape, thus providing a signal that may be interpreted by electronics to provide feedback to the laser. This feedback keeps the laser's frequency from drifting away from the desired value. This method has the ability to maintain the laser's 385 THz center frequency to within 1 MHz of the desired value.

2:42 pm - **SPS-7 - Annealing Effects of CIS and CIGS Thin Films**, Jason McDonald, *Stephen F. Austin State University, jasongregorymcdonald@hotmail.com*. Cu(In,Ga)Se<sub>2</sub> (CIGS) and CuInSe<sub>2</sub> (CIS) are two materials that have shown great potential for solar cell applications. Annealing CIGS and CIS polycrystalline films improves the films by minimizing secondary phases in the crystal structure and increasing crystal grain size. Annealing consists of heating the film to high temperatures, which varies between several hundred degrees Celsius up to 500 degrees Celsius. Films are annealed in a time frame from several minutes to several hours. Annealing is used to improve the crystallinity and morphology of CIS and CIGS thin films, and is used to form the Cu(In,Ga)Se<sub>2</sub> compound. Early results of this research will be presented.

2:54 pm - **SPS-8 - Superconductors**, Albert Koether, *SFASU, adk42@hotmail.com*. A brief history of superconductors and current record holder for high temperature.

3:06 pm - **SPS-9 - Study of Effects of the Heat Treat Time on the Crystal Structure of the Copper-Sheathed MgB<sub>2</sub> Superconducting Wires**, D. Katz, S. Keith, and G. Liang, *Sam Houston State University*, *stddak11@shsu.edu*, *phy\_gnl@unx1.shsu.edu*. The recently discovered MgB<sub>2</sub> superconductor is very promising for future large-scale applications. In this presentation, we report the X-ray diffraction measurement result for a series of copper sheathed MgB<sub>2</sub> wires which were heat treated at 725 °C for different times: 1, 3, 5, 7, 10, and 30 minutes. We have the following two amazing findings: (1) the superconducting MgB<sub>2</sub> phase can be formed with a heat treat time as short as 3 minutes; (2) the impurity Mg<sub>1+y</sub>Cu<sub>3z</sub> phase is only seen in the sample heat treated for 5 minutes, not for other samples. These findings will be very useful for fabrication of MgB<sub>2</sub> wires with high current density.

3:42 pm - **SPS-10 - Synthesis of Ozone from Titanium Dioxide**, Daniel Backlund, *Angelo State University*, *dbacklund@yahoo.com*. It is known that ozone can be synthesized from the direct exposure of ultraviolet light to the surface of titanium dioxide (Kittel). The goal of our research is to see what frequencies and energies of ultraviolet light can be used to produce amounts of ozone sufficient for sterilization procedures from a titanium dioxide sample surface. The titanium dioxide samples were enclosed in a sealed chamber outfitted with pressure and temperature monitors that allowed for detection of gases produced by the ozone reaction. Spectral analysis of light sources, along with optical power calculations was performed. Preliminary results indicate that production of ozone using this process is minimal

3:54 pm - **SPS-11 - Investigation of a Novel Production Method to Fabricate Porous Silicon**, A. N. Robason, T.D. Sauncy, *Angelo State University*, *andrea\_robason@hotmail.com*. Porous silicon thin films are of current interest due to their potential in silicon-based optoelectronic devices. Crystalline silicon samples have been chemically etched while illuminated by a helium-neon laser. According to published reports, this sample processing technique results in a thin matrix of voids on the surface of the crystal. Several processing parameters have been studied in order to find an optimal method for the contactless production of porous silicon thin films. Thus far, the techniques have shown minimal success. After processing, the samples are characterized using optical spectroscopy and electrical measurements to determine variations in the electronic properties with processing. The successes and limitations of the process will be discussed.

4:06 pm - **SPS-12 - A "Sabre Saw" Electric Generator**, J. D. Campbell, Gregory Coutant, Jeffrey Lewis, Wilson Tenney, and Ken Taylor, *Lake Highlands High School*, *ken.taylor@risd.org*. A sabre saw with permanent magnets mounted to a pseudo blade is used to induce an emf in a variety of coil configurations. The output power, and other characteristics of the electric generator formed by this interesting combination, are described. The results of this research project can be used as a guide in developing demonstrations that introduce students to the ideas of electromagnetic induction.

4:18 pm - **SPS-13 - Magnetically Driven Mass-Spring Oscillations**, Craig M. Birch, Kevin J. Brown, Stephanie A.

Brown, Mia Ovcina, Ken Taylor, *Lake Highlands High School*, *ken.taylor@risd.org*. This paper describes the behavior of a mass-spring system when excited by the attractive magnetic force between its turns when a current is flowing through the spring. Techniques for introducing and controlling the current are presented. In addition, damping of the oscillator and its resonance response to the driving force are discussed. This experiment can be used for demonstration purposes or as a laboratory experiment in introductory physics.

4:30 pm - **SPS-14 - Hydroelectric Energy**, Yvette Bass, *Stephen F. Austin State University*, *yvb518@aol.com*. The Hoover dam operation and construction.

4:42 pm - **SPS-15 - Magnetic Levitation**, Jefferson Jackson, *Stephen F. Austin State University*, *roadkilljack@aol.com*. Magnetic Levitation of trains.

## Poster Session

### 2:30 - 4:00 pm

**AC-1 - The Power of Inverse Adding-Doubling (IAD) Method to Determine Optical Scattering and Absorption of Biological Media**, Guang-Yin Swanland, Raylon Yow, Dhiraj Sarda. The IAD method is a numerical approach to determine the optical properties of biological tissue samples by using the measurements of total diffuse reflectance and total diffuse transmittance in conjunction with the index of refraction and the thickness of a homogeneous slab of turbid media. It can be used on slabs within or without slide glass, including slabs surrounded by a medium with a different index of refraction. The turbid slabs can have any optical thickness, albedo, or phase function. The IAD method obtains the optical properties of the slab by repeatedly using an adding-doubling method to solve the radiative transport equation until those derived properties are the closest match to the measured values. The IAD method has the advantages of accuracy and flexibility in regard to the sample.

**AC-2 - Electron Microscopic Studies of the Charge-Ordered Structures of the Bilayered Colossal Magnetoresistive (CMR) Manganite La<sub>2-2x</sub>Sr<sub>1+2x</sub>Mn<sub>2</sub>O<sub>7</sub>**, Zhiping Luo, *Microscopy and Imaging Center, Texas A&M University*, *luo@mic.tamu.edu*. The charge-ordered structures in the bilayered colossal magnetoresistive (CMR) manganite La<sub>2-2x</sub>Sr<sub>1+2x</sub>Mn<sub>2</sub>O<sub>7</sub> at the electronic doping levels of x = 0.6 and x = 0.67 respectively, have been proposed based on the *in-situ* electron microscopic studies. In sharp contrast to the three-dimensional perovskite manganite, evidence of charge-ordered structures with bi-stripe models has been found. A new face-centered charge-ordered superstructure was observed at x = 0.6. This structure is composed of bi-stripes of Mn<sup>3+</sup>O<sub>6</sub> and paired Mn<sup>4+</sup>O<sub>6</sub> rows alternatively stacking along the ordering direction, which is assembled from the building blocks of the charge-ordered phase at x = 0.5. Taking into account of the systematic absence of reflections with the face-centered symmetry, its modulation vector was deduced as **q** = (1/10, 1/10, 0). Moreover, for another charge-ordered phase identified at x = 0.67 with **q** = (1/6, 1/6, 0), again only the bi-stripe model fits the existing data over the Wigner-crystal model.

**AC-3 - Phase Identification for Cu-sheathed MgB<sub>2</sub> Superconducting Wires**, Gan Liang, *Phy\_gnl@unx1.shsu.edu*, David Katz, *stdak11@shsu.edu*, Sam Houston State University, Hui Fang, *hfang@uh.edu*, Kamel Salama, Zhongjia Tang, *Zhongjia.tang@mail.uh.edu*, University of Houston. X-ray diffraction (XRD) and SEM measurements have been performed for Cu-sheathed MgB<sub>2</sub> wires fabricated using ultra-fine Mg and B precursor and powder-in-tube method. Thirteen samples sintered at temperatures ranging from 450 °C to 875 °C, each for five minutes, were measured. It is found that MgB<sub>2</sub> phase can be formed in all these samples. From 400 °C to 550 °C, the fraction of the Mg<sub>2</sub>Cu phase increases with sintering temperature while the Mg-phase decreases. Between 550 °C and 725 °C, the Mg<sub>2</sub>Cu phase disappears, only MgB<sub>2</sub> and MgCu<sub>2</sub> phase co-exist. At or above 725 °C, Mg<sub>2</sub>, MgB<sub>4</sub>, and Mg<sub>1+y</sub>Cu<sub>32+δ</sub> phase coexist, and the fraction of the Mg<sub>1+y</sub>Cu<sub>32+δ</sub> phase increases with sintering temperature while the other two phases decrease. With the help of the measured XRD pattern for standard compound MgCu<sub>2</sub>, the MgCu<sub>2</sub> phase in the Cu-sheathed MgB<sub>2</sub> wire samples can be clearly identified. We also for the first time identify a new phase, the Mg Mg<sub>1+y</sub>Cu<sub>32+δ</sub> phase, in Cu-sheathed MgB<sub>2</sub> wires. The XRD results are analyzed together with SEM and current density (J<sub>c</sub>) measurement results.

**AC-4 - Calibration of a Radio Telescope for Teaching**, Paul L. Fisher, *West Texas A&M University*, *plfisher@mail.wtamu.edu*. We are building a simple radio telescope for use by students. The radio telescope is constructed from commercially available components. This presentation describes checkout and calibration procedures which can be performed as part of initial observations by students.

**AC-5 - Einstein: His Predecessors and Successors**, Donald H. Kobe and Samuel E. Matteson, *University of North Texas*, *kobe@unt.edu*. A century ago Einstein wrote three remarkable papers: one on the special theory of relativity, another on the photoelectric effect, and a third on Brownian motion. Ninety years ago Einstein formulated the general theory of relativity, which is a field theory of gravity. Our poster displays time lines showing portraits and contributions of some physicists who have contributed to the fields of relativity, gravitation, quantum theory, and statistical mechanics before or after Einstein. Most of these portraits and others are on permanent display in the Gallery of Distinguished Physicists in the Physics Building at the University of North Texas.

**AC-6 - QuickField Finite Element Method Software for Undergraduate Physics Education**, James R. Claycomb, *Houston Baptist University*, *jclaycomb@hbu.edu*. We report on the use of the QuickField Finite Element Method (FEM) solver for teaching electromagnetism in advanced undergraduate physics courses. Initial testing of the software in a senior level special topics course taught at Houston Baptist University was promising. QuickField features a user friendly model builder with automatic mesh generation and an extremely fast algorithm capable of solving 2D planar or axially symmetric problems in electrostatics, magnetostatics, time harmonic and transient magnetics, ac and dc current flow, as well as thermal and stress analysis modules capable of coupling with the electromagnetic solvers. The software provides a medium whereby students may

develop an intuitive understanding of electromagnetic fields and forces resulting from a variety of sources and boundary conditions in dielectric, conducting and permeable media. QuickField demonstrations and sample laboratories will be discussed for modeling superconductors in external fields and eddy current induction in conducting media. QuickField examples suitable for implementing in introductory physics labs will also be discussed.

**AC-7 - What is comPADRE? Using the AAPT's Pre-College Portion of the NSDL Project**, Cathy Mariotti Ezrailson, *Texas A&M University*, *Pre-college Managing Editor*, *ezrailson@yahoo.com*, Bruce Mason, *Oklahoma University*, *comPADRE PI and Editor*, *bmason@ou.edu*, Thad Lurie, *comPADRE Lead Programmer*, *tlurie@aapt.org*. ComPADRE is the cooperative effort of the American Association of Physics Teachers, the American Astronomical Society, the American Institute of Physics (Society of Physics Students), and the American Physical Society. Funding is provided by the National Science Foundation, as a part of the National Science Digital Library project. The pre-college collection of the National Science Digital Library Project is called ThePhysicsFront and is available online for new, cross-over and veteran teachers alike. All entry items and links are peer-reviewed and described, linked to other collections and resources and span the breadth from in-service opportunities to national and state standards. There are activities, labs, lesson plans and more. Search the site at <http://ThePhysicsFront.org> to find curriculum support or suggest your favorite resources for our repository. Discussion forums and soon mentor links are added features. There is a new teacher corner and lesson plan central as well as timely news items featured. A description of the site, hints to resources and explanations of features will be displayed. comPADRE is funded by grant #DUE-0226129 from the National Science Foundation.

**AC-8 - Electrochromic Blue Shift in Polymer Dispersed Liquid Crystal Cells**, Robert A. Ramsey and Suresh C. Sharma, *University of Texas at Arlington*, *robertramsey@uta.edu*. Electrochromic blue shift in the absorption band of polymer dispersed liquid crystal cells is reported as a function of applied electric field. The changes in the peak absorption wavelength, absorption broadening and their possible relationships with the non-linear optical properties of polymer dispersed liquid crystal cells are discussed.

**AC-9 - Hydrogen Spectroscopy of Hydrogen in Halfium Silcate**, Jose Martinez, *adema\_25@hotmail.com*.

**AC-10 - Interplay of Adsorbate Ordering and Step-Step Interactions on Vicinal Crystal Surfaces**, Jennifer A. Zandstra, Michael J. Drake, and Howard L. Richards, *Dept. of Physics, Texas A&M University-Commerce*, *jennyzandstra@gmail.com*. Many properties of surfaces are strongly affected by the strong electric fields generated by the drop in electric potential across the double layer. Inspired by a 2001 paper by Koper et al.,\* in this work we neglect the effects on the energy needed to produce a kink in a step and the elastic interactions between steps in order to concentrate on the effects due to changes in coverage by adsorbates. We model the adsorbates with simple, nearest-neighbor antiferromagnetic lattice gases and the steps with the terrace-step-kink model. In preliminary work,† we have seen

that one-dimensional lattice gases (with interactions perpendicular to the average step direction) cause step bunching near half coverage, but that the resulting change in the cyclic voltammogram is small. The corresponding change in the coverage itself is much too small to be observed experimentally. Here we present those results, together with preliminary work on a two-dimensional lattice gas. \* M. T. M. Koper, J. J. Lubckien, N. P. Lebedeva, J. M. Feliu, and R. A. van Santen, *Surf. Sci.* 478 (2001) L 339-6344. † M. J. Drake, Honor's Thesis, Texas A&M University-Commerce, 2004.

**AC-11 - Radio Interferometry of 1420 MHz at the Stephen F. Austin Observatory**, Andrew Wagers, *Stephen F. Austin State University*, [ajwagers@yahoo.com](mailto:ajwagers@yahoo.com). The theory of radio interferometry is discussed with applications to sun and hydrogen emission observations. Observations from the SFA Observatory will be discussed along side theoretical predictions.

## Saturday, March 5, 2005

### Plenary Session

9:00 am - **PL-4 - Cosmology after Einstein**, Wolfgang Rindler, *University of Texas at Dallas*, [rindler@utdallas.edu](mailto:rindler@utdallas.edu). Modern cosmology, one of the great showcases of Einstein's General Relativity, nevertheless stands to remind us that even a genius can slip. Perhaps the only one of the truly groundbreaking ideas that Einstein had within his grasp but did not seize is the expansion of the universe. We shall here report on where cosmology is heading these days.

### Session BA

10:00 am - **BA-1 - Designing a Nuclear Device as a Learning Exercise**, The authors would like to thank the illustrious Professor Patrick Polley, David Kahl, [kahld@stu.beloit.edu](mailto:kahld@stu.beloit.edu), Chad Huibregtse, [huibregt@stu.beloit.edu](mailto:huibregt@stu.beloit.edu), Also presenting author Steve Abbott, [abbotts@stu.beloit.edu](mailto:abbotts@stu.beloit.edu), Elizabeth Boatman, [boatmane@stu.beloit.edu](mailto:boatmane@stu.beloit.edu), Elon Candea, [candea@stu.beloit.edu](mailto:candea@stu.beloit.edu), Sarah Johns, [johnss@stu.beloit.edu](mailto:johnss@stu.beloit.edu), Jason Marmon, [marmonj@stu.beloit.edu](mailto:marmonj@stu.beloit.edu), Jared Nance, [nancej@stu.beloit.edu](mailto:nancej@stu.beloit.edu), Eric Stall, [stalle@stu.beloit.edu](mailto:stalle@stu.beloit.edu), John Stiernaj, [stiernaj@stu.beloit.edu](mailto:stiernaj@stu.beloit.edu), Loren Warmington, [warmingt@stu.beloit.edu](mailto:warmingt@stu.beloit.edu), *Beloit College*. The goal of this project was to examine in detail the difficulties involved in designing and constructing a nuclear weapon. The research was initiated as a class project in a course on nuclear physics. The workload was divided into three primary sections: Acquisition and Enrichment of Fissile Materials; Bomb Physics; and Bomb Effects. Using only publicly available materials, we were able to successfully devise a step-by-step design for building a 20 KT uranium bomb, as well as detailing the processes for uranium refinement and the results of its detonation. Our work is relevant to the broader scientific community because it demonstrates that the major difficulty encountered in building an atomic weapon is acquiring fissile material.

10:36 am - **BA-3 - Modeling of Copper Indium/Gallium Diselenide Superlattices**, Steven Scurlock,

[sps9999@sbcglobal.net](mailto:sps9999@sbcglobal.net), Robert Friedfeld, *Stephen F. Austin State University*. The copper indium/gallium diselenide superlattice is investigated numerically for different layer lengths of this particular lattice matched crystal. The main emphasis is on applying the Kronig-Penny model for the relevant band gap energies. By varying the sizes of the layers, the region where superlattice behavior should exist is determined.

10:48 am - **BA-4 - Alternative Approach to Dimensional Scaling**, Supported by DARPA, ONR, and Welch Foundation, Robert Murawski, [rmurawski@physics.tamu.edu](mailto:rmurawski@physics.tamu.edu), Anatoly Svidzinsky, [asvid@jewel.tamu.edu](mailto:asvid@jewel.tamu.edu), Marlan Scully, [scully@tamu.edu](mailto:scully@tamu.edu), *Texas A&M University*. We will present a comparison between the D-scaling approach of Herschbach/Witten and an alternative form. The new approach is far less computationally expensive and introduces quantum numbers in a natural way, thus allowing one to calculate excited states without going to a 1/D expansion. The two approaches will be tested on the excited states of helium.

11:00 am - **BA-5 - Isoscaling Parameters for Light Projectile and Heavy Target Central HIC**, Armando Barranon, [bca@correo.azc.uam.mx](mailto:bca@correo.azc.uam.mx), *Dept. of Basic Sciences, Universidad Autonoma Metropolitana - Azcapotzalco, Mexico City*, Jorge Lopez, [jorgelopez@utep.edu](mailto:jorgelopez@utep.edu), *Dept. of Physics, The University of Texas at El Paso*. Several heavy ion collisions have been simulated bombarding heavy targets with light projectiles and using LATINO dynamical model, where a Pandharipande potential replicates binary interaction and fragments are identified via an Early Cluster Recognition Algorithm. Isoscaling parameters in the experimental range were obtained, confirming that Isoscaling relation holds for equilibrated compound nuclear sources as well as nuclear systems produced by dynamical fragment formation. Authors acknowledge financial support from Grant 2-4570.5 of the Swiss National Science Foundation and access to the computational resources of UAM-A and UTEP.

11:12 am - **BA-6 - Quantum Control of the Normal Modes Of Benzene with Ultrafast Laser Pulses**, Supported by Robert A. Welch Foundation (Grant A-0929), Petra Sauer, [psauer@physics.tamu.edu](mailto:psauer@physics.tamu.edu), *Texas A&M University*, Yusheng Dou, [yusheng.dou@nicholl.edu](mailto:yusheng.dou@nicholl.edu), *Nicholls State University*, Ben Torralva, [torr@cmspop.llnl.gov](mailto:torr@cmspop.llnl.gov), *Livermore National Laboratory*, Roland Allen, [allen@tamu.edu](mailto:allen@tamu.edu), *Texas A&M University*. Remarkable innovations in laser technology have made it possible to create laser pulses with ultrashort durations (below 100 femtoseconds) and ultrahigh intensities (above one terawatt per cm<sup>2</sup>). To understand the behavior of complex molecules and materials in this new regime of physics, chemistry, biology, and materials science requires innovative techniques which complement experiment and standard theory, and which can treat situations in which conventional approximations like the Born-Oppenheimer approximation, the Franck-Condon principle, and Fermi's golden rule are no longer valid. In this talk we describe a method that we are developing, semiclassical electron-radiation-ion dynamics (SERID), which can be used to perform simulations of the coupled dynamics of electrons and nuclei in an intense radiation field. We have employed this technique in studying the normal modes of benzene, and the possibility of controlling these modes by

optimizing the laser pulses that are applied to the molecule. Animations will be shown of particular normal modes, including the breathing and beating modes, illustrating their symmetries and other properties, and of the photodissociation of benzene when the laser pulse exceeds a threshold intensity.

11:24 am - **BA-7 - Quantum Potential and Chaos of the Kicked Rotor**, Supported by ONR N00014-03-1-0639/TAMU TEES 53494, Yindong Zheng, *r75023@yahoo.com*, Donald H. Kobe, *kobe@unt.edu*, *University of North Texas*. The de Broglie-Bohm approach to quantum mechanics implies trajectories similar to classical trajectories determined by classical forces, except that these quantum trajectories also have an additional quantum force. These quantum trajectories can be used to treat quantum chaos in a manner similar to the treatment of classical chaos. A quantum Lyapunov exponent can be calculated in a manner similar to a classical Lyapunov exponent. The quantum force is the negative gradient of a quantum potential. We show that the quantum potential is a fictitious potential in the sense that it is part of the quantum kinetic energy. Consequently, the quantum force is also a fictitious force. The results of the de Broglie-Bohm approach to quantum chaos agree with standard quantum mechanics only when the quantum potential happens to be zero. We apply the de Broglie-Bohm approach to study the quantum chaos of the kicked rotor. For this bounded system we use the method of Benettin, et al. to calculate both classical and quantum Lyapunov exponents as a function of the control parameter  $K$ . In addition to the stability regions in the chaotic sea for even multiples of  $\pi$  associated with accelerator mode islands, we find new stability regions at odd multiples of  $\pi$  associated with oscillating modes. We examine these regions both classically and quantum mechanically.

11:36 am - **BA-8 - Computing Energy Spectra for Quantum Systems Using the Feynman-Kac Path Integral**, N.G. Fazleev, *fazleev@uta.edu*, J.M. Rejcek, J.L. Fry, *University of Texas at Arlington*. A method for calculating the first few energy eigenvalues for quantum systems using the Feynman-Kac path integral is presented. The exact analytical solution of the Feynman-Kac path integral for the infinite square well is presented and compared with numerical simulations approximated by random walk simulations on a discrete grid. Using the Laplace transform of the Feynman-Kac path integral and knowing the form of the eigenvalue expansion of the integral, it is possible to calculate the first few energy eigenvalues within an estimated uncertainty. The method provides exact values in the limit of infinitesimal step size and infinite time for the ground state.

11:48 am - **BA-9 - Searching for Lorentz Violation in Astrophysics**, Seiichirou Yokoo, *seiichirouyokoo@cside.com*, Roland Allen, *allen@tamu.edu*, *Texas A&M University*. Astrophysical, terrestrial, and space-based searches for Lorentz violation are briefly reviewed. Such searches are motivated by the fact that all superunified theories (and other theories that attempt to include quantum gravity) have some potential for observable violations of Lorentz invariance. We also review some new predictions of a specific Lorentz-violating theory: If a fundamental energy in this theory lies below the usual GZK cutoff, the cutoff is shifted to infinite energy; i.e., it no longer exists. On the other hand, if the fundamental energy lies above the GZK cutoff, there is a high-energy branch of the fermion

dispersion relation which provides an alternative mechanism for super-GZK cosmic-ray protons. We also consider the dark matter problem from a new perspective: In Lorentz-violating supergravity, sfermions have spin 1/2 and other unusual properties. If the dark matter consists of such particles, there is a natural explanation for the apparent absence of cusps and other small scale structure: The Lorentz-violating dark matter is cold because of the large particle mass, but still moves at nearly the speed of light. Although the R-parity of a sfermion, gaugino, or gravitino is +1 in the present theory, these particles have an "S-parity" which implies that the LSP is stable and that they are produced in pairs. On the other hand, they can be clearly distinguished from the superpartners of standard supersymmetry by their highly unconventional properties.

## Session AAPT/SPS

10:00 am - **AAPT-16 - Pre-Service Teachers' Understanding of Static of Fluids**, Milijana Suskavcevic, *University of Texas at El Paso, Physics Department, milijana@utep.edu*. An assessment tool containing items that address concepts of density, buoyancy, and Archimedes principle was constructed, validated, and used to evaluate pre-service teachers' understanding of static of fluids concepts. The preliminary results indicate that the teaching approach involving students' use of manipulatives, teacher's instruction, and use of video demonstrations is capable of enhancing students' conceptual understanding of static of fluids. Strengths and weaknesses in students' understanding of these concepts will be discussed.

10:12 am - **AAPT-17 - The Ups and Downs of the Falling Shot Lab**, Bill Franklin, *PTRA A&M Rural Institute, physicsnerd@yahoo.com*. Demonstration of an apparatus for measuring the conversion of gravitational potential energy into thermal energy using falling metal shot in which timing is an important variable.

10:24 am - **SPS-16 - ITER: The Future of Fusion**, Bryan McLane, *SFASU Department of Physics and Astronomy, bryan.mclane@us.army.mil*. A brief overview of fusion reactions and a look at the International Tokamak Experimental Reactor.

10:36 am - **SPS-17 - Special Relativity**, Thomas Bunch, *Stephen F. Austin State University, pyre96@hotmail.com*. Relevant historical development and basic theoretical discussion of Special Relativity.

10:48 am - **SPS-18 - Electromagnetic Pulses**, Daniel Topping, *Stephen F. Austin, drtopp@cox-internet.com*. A brief history and effect of electromagnetic pulses.

11:00 am - **SPS-19 - Anomalously Blue Elliptical Galaxies in the Sloan Survey**, Curtis Mitchell (UNT), Mike Fanelli (UNT), Pam Marcum (TCU), *University of North Texas, fanelli@unt.edu*. Recently, several extremely isolated elliptical galaxies were found to have unusual blue colors (Marcum, et al., *Astronomical Journal* 127, 3213), indicating current or recent massive star formation. To further explore the evolutionary paths

which lead to isolated early-type galaxies, we will be using the Sloan Digital Sky Survey to search for other anomalously blue elliptical galaxies. We will compare the characteristics of these galaxies with those of the isolated systems previously studied.

11:12 am - **SPS-20 - Seeking Chemical and Kinematic Correlations in the Carina Dwarf Spheroidal Galaxy**, Gigi Nevils, *gknevils@shsu.edu*, Derek Koger, *stddl12@shsu.edu*, C. Renee James, *phy\_crj@shsu.edu*, *Sam Houston State University*, Matteo Monelli, *monelli@mporzio.astro.it*, *Osservatorio Astronomico di Roma*, Mario Nonino, *nonino@ts.astro.it*, *INAF-Trieste*. In this study, we have analyzed low-resolution spectra of a large sample of Carina stars to seek correlations between the kinematic properties and the abundance profiles in an effort to constrain both the chemical and dynamical history of this intriguing object. Most notably, we have found the following: Stars overlapping on the CMD can possess vastly different radial velocities and different chemical abundances, indicating that they are possibly not from the same generation; the hottest star possesses a metallicity well above the solar [Fe/H] ratio; although there exists a wide spread in metallicity and alpha-capture abundances, the spread does not at first glance appear to be related to the kinematic properties.

11:24 am - **SPS-21 - SFA Planet Finder**, Kellie Fletcher, *Stephen F. Austin State University*, *kelliefletcher@hotmail.com*. SFA Planet Finder is a Visual Basic program designed to streamline the process for finding solar system planets at the SFA Observatory.

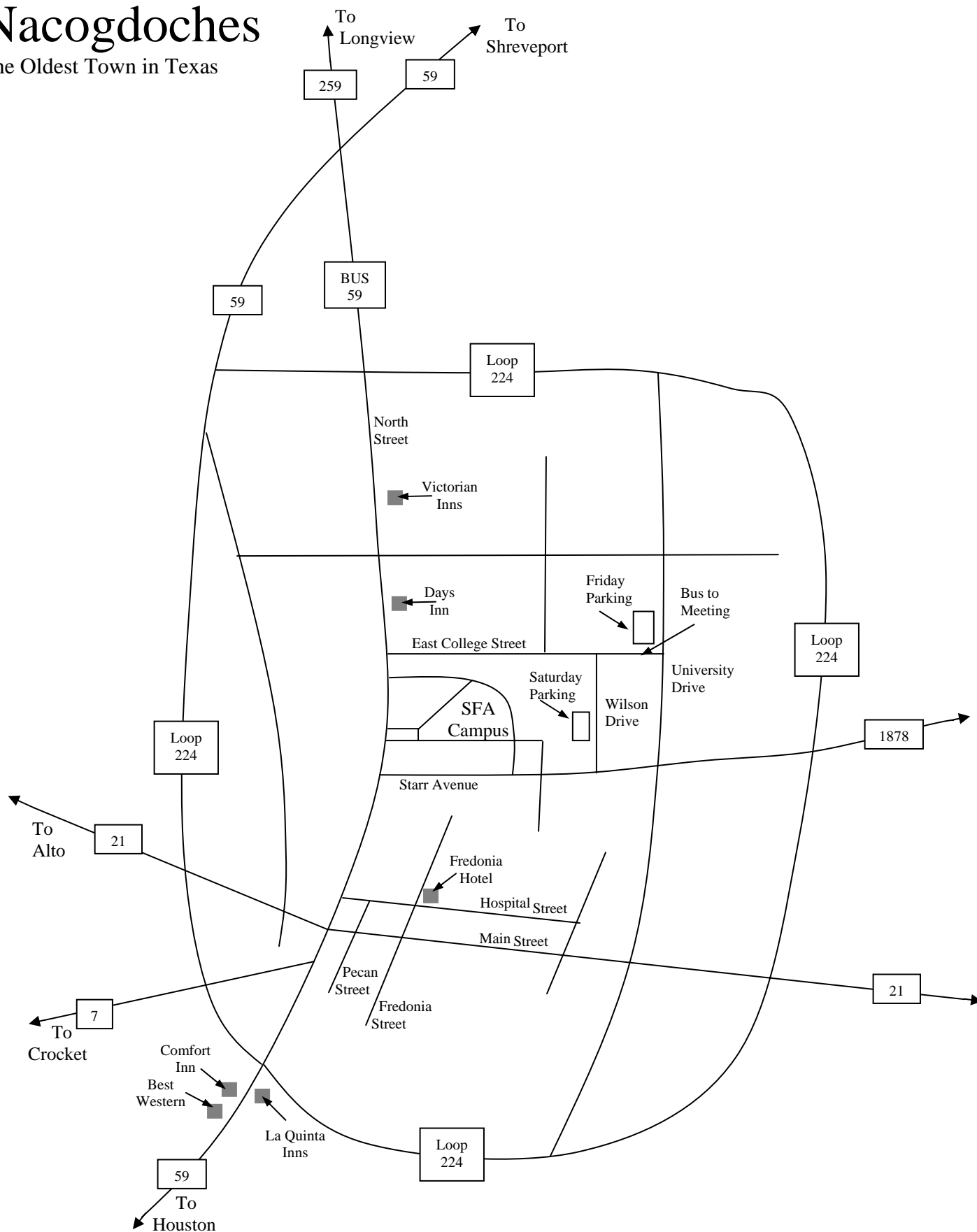
11:36 am - **SPS-22 - The Effects of a Total Solar Eclipse on the Low-Latitude Ionosphere at Two Different Altitudes**, S. Zandstra and K. H. West, *Texas A&M University-Commerce*, *Keith\_West@tamu-commerce.edu*. A total solar eclipse perturbs the ionosphere by temporarily decreasing or eliminating the photoproduction of plasma in a small portion of the ionosphere, as well as decreasing the heating of the atmosphere in that region. Ground based radar studies have shown that the effects of this perturbation vary with altitude. In this study the effects of two solar eclipses on plasma composition and temperature are examined using data taken in situ by instruments on board spacecraft in the Atmospheric Explorer and Defense Meteorological Satellite Program campaigns.

11:48 am - **SPS-23 - Gravity Probe B**, Billy Albert, *Stephen F. Austin State University*, *billyj81@yahoo.com*. Efforts to test theoretical phenomena resulting from Einstein's Theory of General Relativity using a state of the art satellite are in motion. Gravity Probe B is the satellite and has been in orbit since April 2004.

12:00 pm - **SPS-24 - SpaceShipOne**, Chris Pierce, *Stephen F. Austin State University*, *chrisp82\_01@yahoo.com*. Information on the Ansari X-Prize and SpaceShip One: the first privately funded spacecraft to leave the Earth's atmosphere.

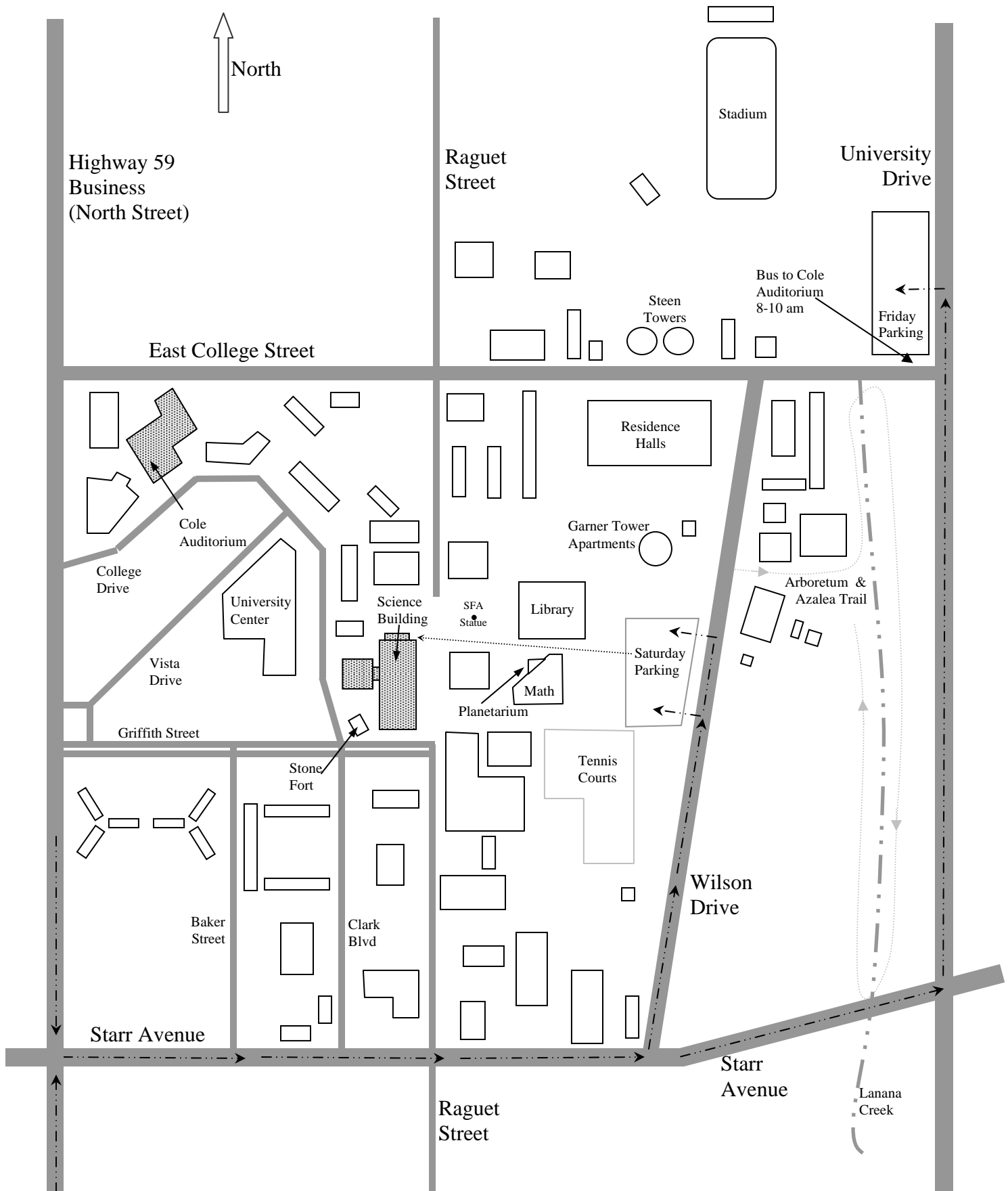
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# Stephen F. Austin State University

## Campus Map ----- Driving Directions



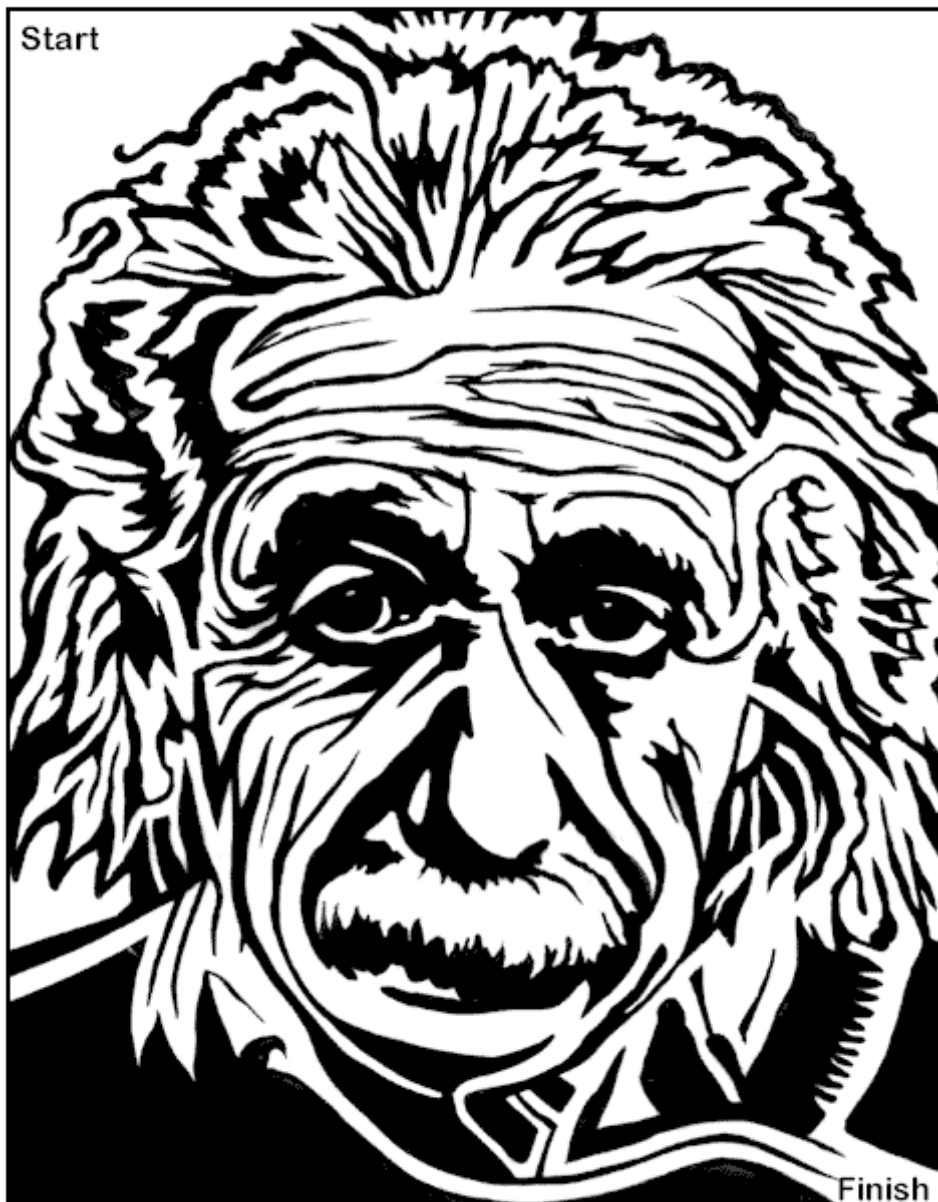
# Meeting Notes

**The World Year of Physics 2005** is a United Nations endorsed, international celebration of physics. Events throughout the year will highlight the vitality of physics and its importance in the coming millennium, and will commemorate the pioneering contributions of Albert Einstein in 1905. Through the efforts of a worldwide collaboration of scientific societies, the World Year of Physics brings the excitement of physics to the public and will inspire a new generation of scientists. -- <http://www.physics2005.org/>



## Mazed™ "Einstein"

by Isaac Thayer



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