

# Fall 2002 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

National Society of Hispanic Physicists



Hosted by  
The Department of Physics and Astronomy

The University of Texas at Brownsville and Texas Southmost College  
Brownsville, TX

October 10-12, 2002

<http://www.phys.utb.edu/aps2002>

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# Meeting Schedule

Thursday October 10, 2002

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5:30 pm – 8:00 pm	<b>Registration</b>	SETB Foyer
6:00 pm – 8:30 pm	<b>Reception</b>	SETB Foyer
7:00 pm - 8:30 pm	<b>TSAPS Executive Committee Meeting</b>	SETB 1.350
7:00 pm – 8:30 pm	<b>TSAAPT Executive Committee Meeting</b>	SETB 3 <sup>rd</sup> Floor
8:30 pm	<b>Joint Meeting of Executive Committees of TSAPS, TSAAPT, Zone 13 SPS</b>	SETB 3 <sup>rd</sup> Floor

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Friday October 11, 2002

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8:00 am – 4:00 pm	<b>Registration</b>	SETB Foyer
8:00 am – 5:00 pm	<b>Exhibits</b>	SETB Foyer
8:00 am – 8:30 am	<b>Welcome</b>	SETB Lecture Hall
8:30 am - 9:30 am	<b>Plenary Session</b> “Functional Photonic Crystal Nanostructures and Left Handed Meta-materials” Anvar Zakhidov, The University of Texas at Dallas and the Nano-Tech Institute	SETB Lecture Hall
9:30 am - 10:30 am	<b>Plenary Session</b> “Charmed Baryon Spectroscopy at CLEO” Akhtar Mahmood, The University of Texas- Pan American	SETB Lecture Hall
10:30 am – 11:00 am	<b>Break</b>	
11:00 am – 12:00 pm	<b>Plenary Session</b> “Grids for Data Intensive Science” Paul Avery, University of Florida	SETB Lecture Hall
12:00 pm – 2:00 pm	<b>Lunch</b>  <b>Business Meeting of Texas Section of the American Physical Society</b>  <b>Business Meeting of the Texas Section of the American Association of Physics Teachers</b>  <b>Business Meeting of the Society of Physics Students, Zone 13</b>	Student Union Grand Salon
1:00 pm - 2:00 pm	<b>"Physics Circus"</b> Demo for high school/middle school students El Paso SPS	SETB Lecture Hall
2:00 pm – 4:30 pm	<b>Contributed Paper Sessions</b> Grid Computing Nano Science Theoretical and Computational Physics Physics Education / AAPT	SETB 2.336 SETB 1.336 SETB 3 <sup>rd</sup> Floor LHSB 1.104

Friday October 11, 2002

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2:00 pm – 4:30 pm	<b>AAPT Workshops</b>	
	“Physlets for Beginners”	SETB 1.352
	“Physics for New Teachers or Humor and Comic Demos as a Survival Mechanism”	SETB 1.208
	“Newton is Not Just Numbers. See the Laws, Be the Laws with PASCO Probes”	SETB 2.236
3:00 pm – 5:00 pm	<b>Break Available</b>	SETB Foyer
4:30 pm – 6:00 pm	<b>Contributed Paper Sessions</b>	
	SPS	SETB 2.236
	Poster Session	SETB 2 <sup>nd</sup> Floor Physics Wing
4:30 pm	<b>Meeting NSHP</b>	SETB 1.350
6:30 – 7:30 pm	<b>NSHP Reception</b>	Student Union Gardenia Room
7:30 – 10:00 pm	<b>Banquet</b>	Student Union Grand Salon
	Physics Education	
	Ramon Lopez, University of Texas El Paso	

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Saturday October 12, 2002

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8:00 am – 10:00 am	<b>Registration</b>	SETB Foyer
8:30 am - 9:30 am	<b>Plenary Session</b>	SETB Lecture Hall
	“Recent results in Solar Neutrino Physics”	
	Josh Klein The University of Texas at Austin and The Sudbury Neutrino Observatory Institute	
9:30 am - 10:30 am	<b>Plenary Session</b>	SETB Lecture Hall
	“QCD, strings and black holes: The large N limit of field theories and gravity”	
	Juan Maldacena Institute for Advanced Studies, Princeton	
10:30 am – 11:00 am	<b>Break</b>	
11:00 am – 12:00 pm	<b>Plenary Session</b>	SETB Lecture Hall
	“How LIGO is searching for gravitational waves”	
	Peter Saulson, Syracuse University and LIGO	
12:00 pm – 2:00 pm	<b>Lunch (On Your Own)</b>	
12:30 pm – 4:30 pm	<b>AAPT Workshops</b>	
	“Make and Take Resonance Demonstrators”	SETB 1.208
	“Using the Web in Physics”	SETB 1.352
	“Take (Your) Work Out of (Their) Homework”	SETB 2.260
2:00 pm – 5:00 pm	<b>Contributed Paper Sessions</b>	
	Gravity Phys	SETB 3rd Floor
	Biophysics	SETB 1.336
	High Energy Physics	SETB 2.336
3:00 pm – 4:00 pm	<b>Break Available</b>	SETB Foyer

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## Session Schedules

<b>Friday</b>					
8:20 – 8:30 am	<b>Welcome</b> (SETB Lecture Hall)				
8:30 – 9:30 am	<b>Plenary 1</b> (SETB Lecture Hall)				
9:30 – 10:30 am	<b>Plenary 2</b> (SETB Lecture Hall)				
10:30 – 11:00 am	<b>Break</b>				
11:00 – 12:00 pm	<b>Plenary 3</b> (SETB Lecture Hall)				
12:00 pm	<b>Lunch</b> (Student Union Grand Salon)				
1:00 – 2:00 pm	<b>Physics Circus by El Paso SPS for Middle School / High School Students</b> <b>SETB Lecture Hall</b>				
	Session A1 Grid Computing SETB 2..236	Session A2 Nano Science SETB 1.336	Session A3 Theoretical and Computational SETB 3 <sup>rd</sup> Floor	Session A4 Physics Education / AAPT LHSB 1.104	AAPT Workshops
2:00 pm	A1-1	A2-1	A3-1	A4-1	W1 SETB 1.352 2:00 – 4:00 pm
2:15 pm	A1-2	A2-2	A3-2	A4-2	
2:30 pm	A1-3	A2-3	A3-3	A4-3	
2:45 pm	A1-4	A2-4	A3-4	A4-4	
3:00 pm	A1-5	A2-5	A3-5	A4-5	W2 SETB 1.208 2:00 – 4:30 pm
3:15 pm	A1-6	A2-6	A3-6	A4-6	
3:30 pm		A2-7	A3-7	A4-7	W3 SETB 2.236 2:00 – 4:30 pm
3:45 pm		A2-8	A3-8	A4-8	
4:00 pm		A2-9	A3-9	A4-9	
4:15 pm		A3-10	A3-10	A4-10 A4-11	
	Session B1 SPS SETB 2.236	Session B2 Posters SETB 2 <sup>nd</sup> Floor			
4:30 pm	B1-1	B2 – 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11			
4:45 pm	B1-2				
5:00 pm	B1-3				
5:15 pm	B1-4				
5:30 pm	B1-5				
6:30 – 7:30 pm	<b>NSHP Reception</b> (Student Union Gardenia Room)				
7:30 – 10:00 pm	<b>Banquet Plenary 4</b> (Student Union Grand Salon)				

<b>Saturday</b>					
8:20 – 8:30 am	<b>Welcome</b> (SETB Lecture Hall)				
8:30 – 9:30 am	<b>Plenary 1</b> (SETB Lecture Hall)				
9:30 – 10:30 am	<b>Plenary 2</b> (SETB Lecture Hall)				
10:30 – 11:00 am	<b>Break</b>				
11:00 – 12:00	<b>Plenary 3</b> (SETB Lecture Hall)				
12:00 pm	<b>Lunch</b>				
	Session C1 Gravity Phys SETB 3rd Floor	Session C2 Biophysics SETB 1.336	Session C3 High Energy Physics SETB 2.336		AAPT Workshops
2:00 pm	C1-1	C2-1	C3-1		W4 SETB 1.208 12:30 – 3:30 pm
2:15 pm	C1-2	C2-2	C3-2		
2:30 pm	C1-3	C2-3	C3-3		W5 SETB 1.352 12:30 – 4:30 pm
2:45 pm	C1-4	C2-4	C3-4		
3:00 pm	C1-5	C2-6	C3-5		
3:30 pm	C1-7	C2-7	C3-6		
4:00 pm	C1-8	C2-8	C3-7		W6 SETB 2.260 12:30 – 3:30 pm
4:15 pm	C1-9		C3-8		
4:30 pm	C1-10				
4:45 pm					

# Plenary

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8:30 am - 9:30 am	<b>PL-1</b>	<b>Functional Photonic Crystal Nanostructures and Left Handed Meta-materials</b> <i>Anvar Zakhidov, The University of Texas at Dallas and the Nano-Tech Institute</i>
9:30 am - 10:30 am	<b>PL -2</b>	<b>Charmed Baryon Spectroscopy at CLEO</b> <i>Akhtar Mahmood, The University of Texas-Pan American</i>
11:00am – 12:00pm	<b>PL -3</b>	<b>Grids for Data Intensive Science</b> <i>Paul Avery, University of Florida</i>

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# A1

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2:00 pm	<b>A1-1</b>	<b>Hardware Infrastructure for Practical Implementation of Grid for DO Experiment</b> <i>Karthik Gopalratnam, Anand Balasubramanian, Prashant Bhamidipati, Mark Sosebee, Kaushik De, David Levine, Yu Jaehoon, University of Texas at Arlington, Drew Meyer, Meyer Systems Inc., Fort Worth, TX, James Reggio, Liberty Christian School, Flower Mound, TX</i>
2:15 pm	<b>A1-2</b>	<b>Experiences for the US-ATLAS Computing Testbed in DC1 production</b> <i>Patrick Mcguigan, Kaushik De, Mark Sosebee, David Levine, University of Texas at Arlington</i>
2:30 pm	<b>A1-3</b>	<b>Framework for the Control and Monitoring of Grid based Data-Intensive Applications</b> <i>Anand Balasubramanian, Jaehoon Yu, David Levine, Mark Sosebee, Kaushik De, Karthik Gopalrathinam, Prashant Bhamidipati-University of Texas at Arlington, DREW MEYER, Meyer Systems Inc., JAMES REGGIO, Liberty Christian School</i>
2:45 pm	<b>A1-4</b>	<b>Development of Interface to Grid for Job Submission for DO Experiment</b> <i>James Reggio, Liberty Christian School, Flower Mound, TX, Karthik Gopalratnam, Anand Balasubramanian, Prashant Bhamidipati, Mark' Sosebee, Kaushik De, David Levine, Jaehoon Yu, University of Texas at Arlington, Drew Meyer, Meyer Systems Inc., Art Worth, TX</i>
3:00 pm	<b>A1-5</b>	<b>Practical Use of Computational Grid for Do Experiment</b> <i>Karthik Gopalratnam, Anand Balasubramanian, Prashant Bhamidipati, Mark Sosebee, Kaushik De, David Levine, Jaehoon Yu, University of Texas at Arlington, Drew Meyer, Meyer Systems Inc., Art Worth, TX James Reggio, Liberty Christian School, Flower Mound, TX</i>
3:15 pm	<b>A1-6</b>	<b>Grid Computing at UTB</b> <i>Manuela Campanelli, Sean Morris and Jose Zamora University of Texas at Brownsville</i>

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- 2:00 pm      **A2-1      Chemical Mechanical Planarization of Cu: Nanoscale Processes**  
*Michael Arthur, Kelly Fishbeck, Kara Muessig, James McDonald, Christine Williams, Daniel White, Deborah Koeck (Department of Physics, Southwest Texas State University), Scott Perry (Department of Chemistry, University of Houston), Heather Galloway (Department of Physics, Southwest Texas State University)*
- 2:15 pm      **A2-2      Planarization of Low-k Dielectrics**  
*Christine Williams, Michael Arthur, Kelly Fishbeck, Kara Muessig, James McDonald, Daniel White, Deborah Koeck (Department of Physics-Southwest Texas State University), Perry Scott (Department of Chemistry, University of Houston), David Donnelly, Heather Galloway (Department of Physics-Southwest Texas State University)*
- 2:30 pm      **A2-3      Study of Cu-doped Ge clathrate structure**  
*Ji Chi, Yang Li, Joe Ross (TAMU)*
- 2:45 pm      **A2-4      NMR Study on Type-I Copper-doped Germanium Clathrate**  
*Weiping Gou, Yang Li (Department of Physics, TAMU), Joseph H. Ross (Affiliation) NMR Study on Type-I Copper-doped Germanium Clathrate Weiping Gou, Yang Li and Joseph H. Ross, Jr. Department of Physics, Texas A&M University, College Station, TX 77843-4242*
- 3:00 pm      **A2-5      Hollow Colloidal Rods formed on a Viral Template**  
*Preston B. Landon (University of Texas at Dallas, Dept. of Physics and Nano Tech Institute), Ray Baughman (University of Texas at Dallas, Nano Tech Institute), Anvar Zakhidov (University of Texas at Dallas, Dept. of Physics and Nano Tech Institute), Rockford Draper (University of Texas at Dallas, Dept. of Biology), R. Glosser (University of Texas at Dallas, Dept. of Physics), Jennifer Synowczynski, Samuel G. Hirsch (Weapons and Materials Research Directorate, Army Research Laboratory, Aberdeen Proving Grounds)*
- 3:15 pm      **A2-6      Strain profiles of Ba<sub>0.5</sub>Sr<sub>0.5</sub>TiO<sub>3</sub> thin films**  
*F.Z. Amir, W. Donner, S. Moss (Physics Department-University of Houston), M. Aspelmeyer (Institute of Experimental Physics-University of Vienna), B. Noheda (Brookhaven National laboratory), X.X Xi (Pennsylvania state university)*
- 3:30 pm      **A2-7      Grazing –incidence measurement of amorphous structure modulation in thin film SiO<sub>2</sub> on Si(001)**  
*M. Castro-Colin<sup>1</sup>, W. Donner<sup>1</sup>, S. C. Moss<sup>1, 1</sup> Dep. Of Physics, University of Houston, Texas, 77204-5005, R. J. Nemanich<sup>2, 2</sup> Dep. of Physics, N. Carolina State Univ., N. Carolina 27695, Z. Islam<sup>3, 3</sup>, S. K. Sinha<sup>3, 3</sup> XFD/APS Argonne Nat. Lab., 9700 South Cass Av., Argonne, Illinois 60439*
- 3:45 pm      **A2-8      X-Ray Magnetic Circular Dichroism from HoFe<sub>2</sub>**  
*Lindomar Carvalho, University of Houston*

4:00 pm	<b>A2-9</b>	<b>Zero-Bias Features in Self-Assembling Tunnel Junctions</b> <i>Marcus Teague, Zhiqiang Peng, Glenn Agnolet, Department of Physics, Texas A&amp;M University, College Station, TX</i>
4:15 pm	<b>A2-10</b>	<b>Absolute Doubly Differential Bremsstrahlung Cross Sections of Rare Gases</b> <i>Sal Portillo, C . A. Quarles (Department of Physics and Astronomy, Texas Christian University, Fort Worth TX 76129)</i>

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Contributed Papers  
Theoretical and  
Computational Physics

# A3

Friday Afternoon  
SETB 3<sup>rd</sup> Floor  
Chair: Jorge Lopez

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2:00 pm	<b>A3-1</b>	<b>Energy of a Charged Particle in an External Electromagnetic Field</b> <i>Donald H. Kobe (University of North Texas, Denton)</i>
2:15 pm	<b>A3-2</b>	<b>Gauge invariance of a quantum particle in a time-dependent electromagnetic field</b> <i>Donald H. Kobe (University of North Texas, Denton, TX), Kuo-Ho Yang (St. Ambrose University, Davenport, IA)</i>
2:30 pm	<b>A3-3</b>	<b>Calculations of the excited states of quantum systems using the Feynman-Kac path integral method</b> <i>J.M. Rejcek, N.G. Fazleev, J.L. Fry (University of Texas at Arlington)</i>
2:45 pm	<b>A3-4</b>	<b>Frequency determination of relativistic harmonic oscillator using action variable</b> <i>M.K. Balasubramanya (Texas A&amp;M University-Corpus Christi)</i>
3:00 pm	<b>A3-5</b>	<b>Alfven Waves in Three Dimensions: Similarity Reductions of the 3D-DNLS Equation</b> <i>Robert Hamilton (Department of Physics, Angelo State University)</i>
3:15 pm	<b>A3-6</b>	<b>An Overview of Ritz's Theory of Electromagnetism</b> <i>James Espinosa (West Texas A&amp;M University)</i>
3:30 pm	<b>A3-7</b>	<b>Statistical analysis of air and sea temperature anomalies</b> <i>Nicola Scafetta (Duke University), Timothy Imholt, Paolo Grigolini, Jim Roberts (University of North Texas Center for Nonlinear Science)</i>
3:45 pm	<b>A3-8</b>	<b>Participant Region Limit Temperature dependency on Residual Size for Ni+Ni HIC</b> <i>Armando Barranon (Dept. of Basical Sciences, UAM-A, Mexico City, Mexico.), Jorge A. Lopez (Dept. of Physics, The University of Texas at El Paso, TX., USA.), Claudio Dorso (Dept. of Physics, Universidad de Buenos Aires, Argentina), Latino Collaboration</i>
4:00 pm	<b>A3-9</b>	<b>Some Properties of Selected Diatomics</b> <i>Steven Alexander (University of Texas Pan American), R.L. Coldwell (University of Florida), Sumita Datta (Indian Association for the Cultivation of Science)</i>
4:15 pm	<b>A3-10</b>	<b>Gravothermal catastrophe in N-body simulations</b> <i>Bruce Miller (Texas Christian University), Peter Klinko</i>

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2:00 pm	<b>A4-1</b>	<b>Using Daily Quizzes to Pace a Tree-Structured Internet Course</b> <i>Lionel D. Hewett (Texas A&amp;M University-Kingville)</i>
2:15 pm	<b>A4-2</b>	<b>The Texas Electronic Coalition for Physics--Building a Virtual Department</b> <i>Daniel J. Suson (Texas A&amp;M University-Kingsville)</i>
2:30 pm	<b>A4-3</b>	<b>Kirlian Photography as a Teaching Tool of Physics</b> <i>Andy Terrel, Dr. Beth Ann Thacker (Texas Tech University)</i>
2:45 pm	<b>A4-4</b>	<b>Peer Instruction in the Community College Physics Class</b> <i>Susan Cable (Central Florida Community College)</i>
3:00 pm	<b>A4-5</b>	<b>Applied Learning Physics</b> <i>Denise Gordon (The Applied Learning Academy FWISD)</i>
3:15 pm	<b>A4-6</b>	<b>The Application Portfolio as a Tool to Enhance Motivation and Assessment</b> <i>Kastro M. Hamed (University of Texas at El Paso)</i>
3:30 pm	<b>A4-7</b>	<b>So What is TIPER?</b> <i>Tom O'Kuma (Lee College)</i>
3:45 pm	<b>A4-8</b>	<b>Research Experiences for Undergraduates in Physics and Astronomy at the University of Wisconsin--Madison</b> <i>Keivan G. Stassun, Robert Benjamin (University of Wisconsin - Madison)</i>
4:00 pm	<b>A4-9</b>	<b>"Starshine Satellites"--Student Participation in Solar Effects Research</b> <i>Bobette Doerrie ( )</i>
4:15 pm	<b>A4-10</b>	<b>Incorporating Business Education into Professional Master's Degrees in Applied and Industrial Physics: What Works and What Doesn't</b> <i>Alaina G. Levine (The University of Arizona)</i>
4:30 pm	<b>A4-11</b>	<b>El Universo s Sus Pies: A New Resource for Teaching Astronomy to Spanish-Speaking Audiences</b> <i>Keivan G. Stassun (The Astronomical Society of the Pacific)</i>

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- 4:30 pm      **B1-1**      **Spectroscopic Study of Ni and Co Silicides**  
*Anita Acevedo, David Donnelly*
- 4:45 pm      **B1-2**      **FTIR Spectroscopy of Optical Fibers**  
*Jeff Mestayer, David Donnelly (Southwest Texas State University)*
- 5:00 pm      **B1-3**      **Spectroscopic and Topographic Characterization of Laser Shacked  
Hafnium Oxide Films**  
*Roman Gomez, David Donnelly (Southwest Texas State University)*
- 5:15 pm      **B1-4**      **Nanowires: Molecular Modeling for Self-Assembly of Diblock  
Copolymers**  
*Francine Abrego, Ben Stotts, James McDonald, Gary Bealle, Debbie  
Koeck, Heather Galloway, David Donnelly (Southwest Texas State  
University)*
- 5:30 pm      **B1-6**      **Critical Phenomena In Nuclear Reactions**  
*Manuel Ramos, Cristian Escudero, Ázael Avalos, Jesus Escamilla,  
Jorge López*
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- B2-1**      **Optimal Phase Match Study on Optical Parametric Amplification with  
Biaxial Crystal**  
*Jiahui Peng (Department of Physics, Texas A&M University, College  
Station, TX 77843, U.S.A), Zhizhan Xu, Xiaodong Yang, Shiqi Jin  
(Laboratory for High Intensive Optics, Shanghai Institute of Optics and  
Fine Mechanics, CAS, China)*
- B2-2**      **Electrical Measurements and Nanomechanics Using Scanning Probe  
Microscopy**  
*Yong Chang (Texas A&M University, Physics Dept.)*
- B2-3**      **Development of Microelectromechanical System Using Ultra Deep X-  
Ray Lithography**  
*Yongjun Zhai (Center for Advanced Microstructures and Devices,  
Louisiana State University, Baton Rouge, LA 70806)*
- B2-4**      **Modulated Light Scattering for Detection of Microscale Particles**  
*G. W. Sherman, C. C. Bradley (Texas Christian University)*
- B2-5**      **SR and GR gpb predictions.**  
*Russell L. Collins (retired, U.T. Austin)*
- B2-6**      **Scopes for Schools: A Program of Minority Outreach and Teacher  
Professional Development in Astronomy**  
*Keivan G. Stassun (University of Wisconsin - Madison)*

- B2-7 Detecting Elementary Particles at CLEO from Large Datasets**  
*Hector Moscoca, Akhtar Mahmood (University of Texas - Pan American)*
- B2-8 Ion Beam Analysis of Interconnect Layers for Electronic Applications**  
*Daniel Marble, Bryan Miller (Department of Mathematics, Physics, and Engineering, Tarleton State University), Chad Bircher (Department of Physics, Abilene University), Jerome Duggan, Floyd McDaniel (Department of Physics, University of North Texas)*
- B2-9 Experimental Test of Three-Color Resonance Ionization of Bismuth**  
*Daniel Marble, Marsalee Burrus (Department of Mathematics, Physics, and Engineering, Tarleton State University), Duncan Weathers (Department of Physics, University of North Texas)*
- B2-10 Deposition and characterization of Al/Ni multilayer thin films**  
*Deeder Aurongzeb (Dept. of Physics, Texas Tech University), Mark Holtz (Dept. Of Physics, Texas Tech University), Jordan Berg, Mike Daugherty (Mechanical Engineering, Texas Tech University)*
- B2-11 Recoil Spectrometry Analysis of Hydrogen Evolution Thermally Processed Gate Dielectrics**  
*Jose Martinez, Mario Borunda, Muhamed El-Bouanani (Stephen F. Austin State University)*

Invited Speaker  
 Physics Education

# Plenary

Friday Evening  
 Student Union Grand Salon  
 Chair: Warren Anderson

Banquet

- PL-4 Physics Education**  
*Ramon Lopez, University of Texas El Paso*

Invited Speakers

# Plenary

Saturday Morning  
 SETB Lecture Hall  
 Chair: Warren Anderson

- 8:30 am - 9:30 am    **PL -5 QCD, strings and black holes: The large N limit of field theories and gravity**  
*Juan Maldacena Institute for Advanced Studies, Princeton*
- 9:30 am - 10:30 am    **PL-6 Recent results in Solar Neutrino Physics**  
*Josh Klein The University of Texas at Austin and The Sudbury Neutrino Observatory Institute*
- 11:00am – 12:00pm    **PL-7 How LIGO is searching for gravitational waves**  
*Peter Saulson, Syracuse University and LIGO*

- 2:00 pm            **C1-1**    **Stability properties of black holes in self-gravitating nonlinear electro-dynamics**  
*Claudia Moreno (The University of Texas at Brownsville, Department of Physics and Astronomy, 80 Fort Brown, Brownsville TX, 78520-4993)*
- 2:15 pm            **C1-2**    **Testing Binary Black Hole codes using Cosmological Space-times**  
*David Garrison (University of Houston-Clear Lake)*
- 2:30 pm            **C1-3**    **Old VLBI Data Shed New Light on Superluminal Controversy**  
*D.H. Hough (Trinity University), S.T. Myers (NRAO), R.P. Linfield (Ball Aerospace)*
- 2:45 pm            **C1-4**    **Hyperbolicity of the BSSN system of Einstein evolution equations**  
*Olivier Sarbach (Louisiana State University)*
- 3:00 pm            **C1-5**    **Modeling gravitational radiation from coalescing binary black holes**  
*Lazarus Team*
- 3:15                **C1-7**    **Constraint-preserving boundary conditions in numerical relativity**  
*Gioel Calabrese, Luis Lehner, Manuel Tiglio (Louisiana State University)*
- 3:30 pm            **C1-8**    **Computing the gravitational self-force on a compact object plunging into a Schwarzschild black hole**  
*Carlos Lousto (Department of Physics and Astronomy, The University of Texas at Brownsville, 80 Fort Brown, Brownsville TX, 78520-4993), Leor Barack (Albert Einstein Institut, Golm, Germany)*
- 3:45 pm            **C1-9**    **Using Resonant Bars and Interferometers to Search for Stochastic Gravitational Waves**  
*John T. Whelan (Loyola University New Orleans)*
- 4:00 pm            **C1-10**   **Quantum Gravity:Covariant Formalisms**  
*Kanokkuan Chaichedsakul (Univ. of Texas at Austin)*
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- 2:00 pm            **C2-1    Optimizing Giant Unilamellar Vesicle Growth in a Physiological Buffer**  
*Geoffrey Lambright, Juyang Huang (TTU)*
- 2:15 pm            **C2-2    Detection Of Cholesterol Saturation Limit In Lipid Bilayers**  
**By Light Scattering And Fluorescence measurements**  
*Keith Miles (), Juhang Huang (Texas Tech University)*
- 2:30 pm            **C2-3    A model for nucleosome loading on DNA templates**  
*Francisco J. Solis (University of Texas at El Paso.)*
- 2:45 pm            **C2-4    Low group velocity of Stokes component in resonant four-wave.**  
*Eugeniy Mikhailov, Yuri Rostovtsev, George Welch (Department of Physics,  
Texas A&M University, College Station, Texas 77843-4242)*
- 3:00 pm            **C2-6    Optical absorption coefficients of pure water**  
*ZHENG LU, XIANZHEN ZHAO, EDWARD S. FRY (Department of Physics,  
Texas A & M University, College Station, TX 77843)*
- 3:15 pm            **C2-7    Deformable Mirror for a Unique Laser**  
*XINMEI QU, ZHENG LU, EDWARD S. FRY (Department of Physics, Texas  
A & M University, College Station, TX 77843)*
- 3:30 pm            **C2-8    Efficient Fiber Amplifier at 1064nm Without Polarization Fluctuations**  
*John Stewart, Texas A&M University, Thomas Walther, Texas A&M  
University*
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|---------|-------------|---|
| 2:00 pm | <b>C3-1</b> | <b>Positron surface states and positron annihilation characteristics at the reconstructed (100) surface of GaAs</b><br><i>Nail G. Fazleev, John L. Fry, Alex H. Weiss (University of Texas at Arlington)</i>  |
| 2:15 pm | <b>C3-2</b> | <b>ZooFinder at CDF</b><br><i>Matthew C. Cervantes, Dave Toback, Sung Won Lee (Texas Aamp;M)</i>  |
| 2:30 pm | <b>C3-3</b> | <b>Fast Neutron Flux Measurement through Neutron Activation</b><br><i>Jim Ferguson (Texas Aamp;M University, Department of Physics)</i>   |
| 2:45 pm | <b>C3-4</b> | <b>A spin paradox in quarkonium</b><br><i>Paul H. Cox (Texas Aamp; M Univ.-Kingsville), L. Clavelli, T. Gajdosik (Univ. of Alabama)</i>   |
| 3:00 pm | <b>C3-5</b> | <b>Search for supersymmetric top in the decay of the top quark</b><br><i>Yan Song, Kaushik De (the University of Texas at Arlington), UTA Team</i>  |
| 3:15 pm | <b>C3-6</b> | <b>Intercalibration of Photomultiplier Tube Test Benches for ATLAS</b><br><i>Barry Spurlock, Kaushik De (University of Texas at Arlington)</i>  |
| 3:30 pm | <b>C3-7</b> | <b>Development of Digital Hadron Calorimeter Using GEM</b><br><i>Shahnour Habib, Venkatesh Kaushik, Jia Li, Mark Sosebee, Andrew Brandt, Kaushik De, Andrew White, Jaehoon Yu (University of Texas at Arlington), UTA High Energy Physics Team</i>                                    |
| 3:45 pm | <b>C3-8</b> | <b>Energy Flow Alrogorithm Development for a Digital Hadron Calorimeter Using GEM</b><br><i>Venkatesh Kaushik, Shahnour Habib, Jia Li, Mark Sosebee, Andrew Brandt, Kaushik De, Andrew White, Jaehoon Yu (University of Texas at Arlington), UTA - High Energy Physics Group Team</i> |

# Meeting Abstracts

## **Session A1. Grid Computing.**

### **Oral Session. Friday afternoon, 2:00 pm, SETB 2.236**

#### **[A1.001] Hardware Infrastructure for Practical Implementation of Grid for D0 Experiment**

*Karthik Gopalratnam, Anand Balasubramanian, Prashant Bhamidipati, Mark Sosebee, Kaushik De, David Levine, Yu Jaehoon (University of Texas at Arlington), Drew Meyer (Meyer Systems Inc., Fort Worth, TX), James Reggio (Liberty Christian School, Flower Mound, TX), TAU - High Energy Physics Team*

DO experiment is a high energy physics experiment at the Fermi Accelerator Laboratory in Batavia, Illinois. It uses the particles resulting from the collisions of protons and antiprotons to understand forces in nature. One of the primary goals of the experiment is searching for the Higgs particle which are thought to be the result of the mechanism that gives mass to particles in the universe. The anticipated volume of data from the DO Experiment, a high energy physics experiment at Fermi National , approaches. 4-6 Peta Bytes at the end of its anticipated data taking run in the year 2007. This immense amount of data poses issues for effectively sharing data within the collaboration. This talk presents an architecture, called DO Remote Analysis Model, to address this issue at the DO experiment and its implementation plan.

#### **[A1.002]Experiences for the US-ATLAS Computing Testbed in DC1 production**

*Patrick McGuigan, Kaushik De, Mark Sosebee, David Levine (University of Texas at Arlington)*

The Atlas experiment, currently under construction at the Large Hadron Collider (LHC) at CERN (Geneva, Switzerland), is scheduled to commence operation sometime in 2007. Already large-scale simulation efforts are being carried out at several Atlas collaborating institutions. These simulations are used for both detector development and to study the physics potential the LHC will offer once data collection begins. A Grid-based approach has been employed for the generation of the Monte Carlo simulations, thereby taking advantage of the collective computing resources of the participating Atlas sites. We describe the software tools developed to submit simulation jobs into the system and monitor their status, as well as transfer their results to a mass storage facility at the job's conclusion. We include statistics on data production and system utilization, along with prospects for future computing needs.

#### **[A1.003] Framework for the Control and Monitoring of Grid based Data-Intensive Applications**

*Anand Balasubramanian, Jaehoon Yu, David Levine (University of Texas at Arlington), Drew Meyer (Meyer Systems Inc.), Mark Sosebee, Kaushik De, Karthik Gopalrathinam (University of Texas at Arlington), James Reggio (Liberty Christian School), Prashant Bhamidipati (University of Texas at Arlington)*

Data-intensive applications involve the processing of petabytes of data that are distributed geographically among multiple data storage systems. Processing such large amounts of data places extreme demands on the computational resources available today. A 'computational grid' provides the processing capabilities required for data-intensive applications by harnessing the services offered by collections of computational resources spread across multiple local and wide

area networks. Several existing grid technologies provide the basic functionalities required to tap the services of such resources. A control program that makes use of these basic functionalities is necessary to direct and monitor the applications running on the grid. This paper presents a modular framework for such a control program to efficiently manage any kind of data-intensive application. A detailed description of the individual modules in the framework is presented. We conclude by describing an application of this framework to computational problems in High Energy Physics.

#### [A1.004] **Development of Interface to Grid for Job Submission for D0 Experiment**

*James Reggio (Liberty Christian School, Flower Mound, TX), Karthik Gopalratnam, Anand Balasubramanian, Prashant Bhamidipati, Mark Sosebee, Kaushik De, David Levine, Jaehoon Yu (University of Texas at Arlington), Drew Meyer (Meyer Systems Inc., Fort Worth, TX), UTA - High Energy Physics Team*

We present a web based user interface for job submission to computational grids in high energy physics. The backend of this interface will create a file describing the job, using specific definition language for D0 experiment. The D0 experiment is a high energy physics experiment at the Fermi Accelerator Laboratory in Batavia, Illinois. The amount of data from the experiment is expected to exceed multiple petabytes. This immense amount of data poses issues for effectively sharing data within the collaboration. The interface covered in this talk is expected to provide easy access to the computational grid for the researchers submitting D0 specific computing applications.

#### [A1.005] **Practical Use of Computational Grid for D0 Experiment**

*Karthik Gopalratnam, Anand Balasubramanian, Prashant Bhamidipati, Mark Sosebee, Kaushik De, David Levine, Yu Jaehoon (University of Texas at Arlington), Drew Meyer (Meyer Systems Inc., Fort Worth, TX), James Reggio (Liberty Christian School, Flower Mound, TX), UTA - High Energy Physics Team*

High energy physics uses computer simulation of physical processes for research. Due to the large volume of necessary simulated data set, D0 experiment has many computer clusters for mass production of the data set. The D0 experiment is a high energy physics experiment at the Fermi Accelerator Laboratory in Batavia, Illinois. It uses the particles resulting from the collisions of protons and antiprotons to understand forces in nature. Computational grid can be utilized for mass production of simulated data set, exploiting all available compute resources residing in geographically distributed environment. We present the first attempt of actual use of Grid software in coordinated mass production effort of D0 simulated data, across the cluster boundary.

#### [A1.006] **Grid Computing at UTB**

*Manuela Campanelli, Sean Morris, Jose Zamora (University of Texas at Brownsville)*

The University of Texas at Brownsville is participating in two large grid physics projects, GriPhyN and iVDGL, with the scope of enhancing grid-related research into physics experiments. Here we describe the progress made in grid enabling our 96-node Linux cluster to serve for research in gravitational wave data analysis and numerical source simulation for LIGO.

## **Session A2. Nanoscience and Solid State Physics.**

### **Oral Session. Friday afternoon, 2:00pm, SETB 1.336**

#### **Chemical Mechanical Planarization of Cu: Nanoscale Processes**

*Michael Arthur, Kelly Fishbeck, Kara Muessig, James McDonald, Christine Williams, Daniel White, Deborah Koeck (Department of Physics, Southwest Texas State University), Scott Perry (Department of Chemistry, University of Houston), Heather Galloway (Department of Physics, Southwest Texas State University)*

Interconnect lines in state of the art integrated circuits are made of copper in a process that requires the repeated planarization of the copper layer. During this process the material is subjected to an aqueous slurry containing active chemicals, corrosion inhibitors and abrasive particles. A model slurry buffered to pH2, pH4 and pH6, contained nitric acid, silica particles and benzotriazole (BTA) as a corrosion inhibitor. The degree of copper planarization was investigated as a function of slurry composition and pH using atomic force microscopy. Chemical surface changes can be explained by the effect of slurry composition on the charge at the material surface. This surface charge controls the amount of friction between the abrasive and the surface which, in turn, effects the global planarization of the material. Experiments using a macroscopic polishing system with AFM characterization along with the microscopic interaction of the AFM tip and sample provide insights into the fundamental mechanisms of a planarization process.

#### **[A2.002] Planarization of Low-k Dielectrics**

*Christine Williams, Michael Arthur, Kelly Fishbeck, Kara Muessig, James McDonald, Daniel White, Deborah Koeck (Department of Physics-Southwest Texas State University), Perry Scott (Department of Chemistry, University of Houston), David Donnelly, Heather Galloway (Department of Physics-Southwest Texas State University)*

As the scale of integrated circuits has decreased, the need to reduce the dielectric constant of the material used between metal lines has increased. The International Technology Roadmap for Semiconductors calls for these low-k materials to have dielectric constants of 2.2-2.7 as of 2004 with lower constants desired in the future. As these materials are used alongside the metal lines usually consisting of Cu they will also be subject to the planarization along with the metal lines. This will expose the low-k materials to an aqueous environment. We have investigated the effects of common polishing agents on a selection of potential low-k materials to determine what changes are caused in these materials.

#### **[A2.003] Study of Cu-doped Ge clathrate structure**

*Ji Chi, Yang Li, Joe Ross (TAMU)*

Pure phase samples of type I Cu-doped germanium clathrate with nominal compositions  $Ba_8Ge_{44}Cu_2$  and  $Ba_8Ge_{40}Cu_6$  were synthesized by direct melting at 950 °C and then by solid-state reaction at 700 °C for one week. Samples obtained were analyzed by x-ray diffraction measurements at room temperature. Structure refinement of the powder x-ray diffraction data was carried out by Rietveld refinement (GSAS). The analysis results show that Cu atoms occupy the 6c site of Ge network. Besides the Ba vacancy on the cage center of the Ge network, and there also occur vacancies of Cu in 6c sites. We will discuss the effect of vacancies on the magnetic behavior and NMR measurement.

#### [A2.004] NMR Study on Type-I Copper-doped Germanium Clathrate

*Weiping Gou, Yang Li (Department of Physics, TAMU), Joseph H. Ross (Affiliation)*  
*NMR Study on Type-I Copper-doped Germanium Clathrate Weiping Gou, Yang Li and Joseph H. Ross, Jr. Department of Physics, Texas A&M University, College Station, TX 77843-4242*

Germanium clathrates are new materials containing a network of nanometer-size cages, in which a wide variety of electronic and magnetic behavior is observed. We have prepared a single-phase clathrate of the composition  $\text{Ba}_8\text{Ge}_{44}\text{Cu}_2$ ,  $\text{Ba}_8\text{Ge}_{42}\text{Cu}_4$  and  $\text{Ba}_8\text{Ge}_{40}\text{Cu}_6$ . From  $^{63}\text{Cu}$  nuclear magnetic resonance (NMR) we have identified two distinct sites, and we associate these sites with random occupancy of 6c sites on the Ge network, giving different local environments for Cu atoms. We identify a large paramagnetic Knight shift for these NMR lines, and a measure of the spin-lattice relaxation time ( $T_1$ ) shows that the Korringa ratio is obeyed. We will discuss the current understanding of this behavior.

#### [A2.005] Hollow Colloidal Rods formed on a Viral Template

*Preston B. Landon (University of Texas at Dallas, Dept. of Physics and Nano Tech Institute), Ray Baughman (University of Texas at Dallas, Nano Tech Institute), Anvar Zakhidov (University of Texas at Dallas, Dept. of Physics and Nano Tech Institute), Rockford Draper (University of Texas at Dallas, Dept. of Biology), R. Glosser (University of Texas at Dallas, Dept. of Physics), Jennifer Synowczynski, Samuel G. Hirsch (Weapons and Materials Research Directorate, Army Research Laboratory, Aberdeen Proving Grounds)*

The Tobacco Mosaic Virus (TMV) is a plant virus that infects tobacco, tomato and over a 100 know other plants. TMV is harmless to humans and is present in nearly every commercial tobacco product. Like most viruses TMV is a monodisperse colloidal particle. TMV is an 18 nanometer wide, 300 nanometer long, hollow cylinder with a 4nm wide hole passing through the center of the cylinder along it length. This cigarette shaped virus is extremely efficient at having it's host replicate identical copies of TMV particles. Tomato plants infected with TMV can be identified by the presence of strange colors visible on the tomato surface. These colors arise from thousands of TMV particles self assembling as ridged rods into ordered structures. Recently, there has been an effort to synthetically grow metal, titanium dioxide and uniform colloidal rod shaped particles of various materials. We have coated TMV with a thin layer of gold by a chemical method in aqueous solutions. These and other uniform virus particles have promise as natural templates to create hollow monodisperse colloidal particles. Hollow colloidal particles have potential application as building blocks for photonic band gap materials and for cell specific drug carriers.

#### [A2.006] Strain profiles of $\text{Ba}_{0.5}\text{Sr}_{0.5}\text{TiO}_3$ thin films

*F.Z. Amir, W. Donner, S. Moss (Physics Department-University of Houston), M. Aspelmeyer (Institute of Experimental Physics-University of Vienna), B. Noheda (Brookhaven National laboratory), X.X Xi (Pennsylvania state university)*

Ferroelectric Thin films find technological applications as piezo-electric actuators, microwave-shifters, electro-optical devices or non-volatile memories. For all these applications it is important to know the lattice strain and the polarization as a function of depth. We applied High-Resolution Crystal truncation Rod Diffraction to laser ablation grown  $\text{BaSrTiO}_3$  films on  $\text{SrTiO}_3(001)$  substrates. Scans along the surface normal exhibit asymmetric thickness fringes with a beating on the high-q side. We analyse these data with a strain profile model and argue that misfit dislocations at the interface to the substrate are responsible for the strain.

Measurements have been performed at the beamline X22C of the National Synchrotron Light Source.

**[A2.007] Grazing-incidence measurement of amorphous structure modulation in thin film SiO<sub>2</sub> on Si(001)**

*M. Castro-Colin, W. Donner, S.C. Moss (Dep. of Physics, University of Houston, Texas, 77204-5005), R.J. Nemanich (Dep. of Physics, N. Carolina State Univ., N. Carolina 27695), Z. Islam, S.K. Sinha (XFD/APS Argonne Nat. Lab., 9700 South Cass Av., Argonne, Illinois 60439)*  
X-ray synchrotron radiation enabled us to obtain the amorphous structure factor of a 100 Å SiO<sub>2</sub> thin film grown on Si(001). The signal exhibits a four-fold modulation in the first sharp diffraction peak in the structure factor. Thickness, roughness, and density measurements are obtained through X-ray reflectivity. The results altogether suggest that SiO<sub>4</sub> tetrahedral units align themselves with the <110> diagonal of the Si substrate forming an interfacial structure.

**[A2.008] X-Ray Magnetic Circular Dichroism from HoFe<sub>2</sub>**

*Lindomar Carvalho (University of Houston)*

We present here the results of an experiment using XMCD performed at the Advanced Photon Source (APS) by a group of students in the last NSXN at Argonne National Laboratory. We will emphasize some advantages of the technique used to measure the magnetism from HoFe<sub>2</sub>. We will show that the overall magnetization in this ferrimagnetic alloy is dominated by the contribution from the transition metal.

**[A2.009] Zero-Bias Features in Self-Assembling Tunnel Junctions**

*Marcus Teague, Zhiqiang Peng, Glenn Agnolet (Department of Physics, Texas A&M University, College Station, TX)*

We have been studying the zero-bias feature (ZBF) in the conductance of self-assembling tunnel junctions using a crossed-wire technique in which the tunnel barrier consists of an adsorbed neon film. We have observed that the shape of the ZBF changes dramatically with the overall conductance of the junction suggesting that the mechanism may be that of a Fano resonance. To explore this possibility, we plan to introduce impurities on the metal electrodes as well as into the barrier gas film. This work is supported by the National Science Foundation, the Texas Advanced Research Program, and the Robert A. Welch Foundation.

**[A2.010] Absolute Doubly Differential Bremsstrahlung Cross Sections of Rare Gases**

*Sal Portillo, C. A. Quarles (Department of Physics and Astronomy, Texas Christian University, Fort Worth TX 76129)*

The first absolute doubly differential bremsstrahlung cross sections for electron bombardment of free atoms have been measured for 28 and 50 keV electrons on gas targets of Ne, Ar, Kr and Xe. The cross sections are differential with respect to photon energy and emission angle. A Si(Li) detector measured the data at 90 degrees to the beam line. The major error is statistical. The total systematic error arising from target thickness, solid angle, detector efficiency, photon absorption, and background subtraction is less than 6% the two theories: (1) normal bremsstrahlung; and (2) a recent calculation that includes the additional contribution of polarization bremsstrahlung to the total bremsstrahlung spectrum in the so-called stripping approximation. The data are in better agreement with the stripping approximation and definitely

demonstrate the contribution of polarization bremsstrahlung, which had been neglected in earlier normal bremsstrahlung theory. However, the data are precise enough to demonstrate some disagreement with the photon energy dependence predicted by the stripping approximation model in the region of lower photon energy.

Session A3 - Theoretical and Computational Physics.  
ORAL session, Friday afternoon, SETB 3<sup>rd</sup> Floor

**[A3.001] Energy of a Charged Particle in an External Electromagnetic Field**

*Donald H. Kobe (University of North Texas, Denton)*

For a classical nonrelativistic charged particle in an external time-dependent electromagnetic field, the particle's energy is not, in general, the particle's Hamiltonian. A gauge-invariant energy is defined as the sum of the kinetic energy and the conservative potential energy. The time rate of change of the particle's energy is equal to the power supplied to the particle by the external time-dependent electromagnetic field. The Hamiltonian is gauge dependent, so it cannot be an observable. The particle's energy is its Hamiltonian minus the scalar potential of the time-dependent electromagnetic field (times the charge of the particle).

**[A3.002] Gauge invariance of a quantum particle in a time-dependent electromagnetic field**

*Donald H. Kobe (University of North Texas, Denton, TX), Kuo-Ho Yang (St. Ambrose University, Davenport, IA)*

The Schroedinger equation for a single charged particle in a time-dependent electromagnetic field is form invariant under gauge transformations on the wave function, vector and scalar potentials. In general, the Hamiltonian is not the energy operator, which is the Hamiltonian minus the scalar potential of the time-dependent field. The time rate of change of the energy operator gives the power operator. The sum of the energy of the particle and the energy of the electromagnetic field is conserved. The eigenvalue problem for the energy operator gives the energy eigenstates and energy eigenvalues. Time-dependent probability amplitudes for each energy eigenstate are gauge invariant. Transitions between energy eigenstates are induced by matrix elements of the power operator times a characteristic time for each transition. This gauge invariant approach is used to resolve the controversy in the electric dipole approximation between the E.r and the A.p interactions in favor of the former interaction.

**[A3.003] Calculations of the excited states of quantum systems using the Feynman-Kac path integral method**

*J.M. Rejcek, N.G. Fazleev, J.L. Fry (University of Texas at Arlington)*

Group theory considerations and properties of a continuous path are used to define a failure tree procedure for finding numerically eigenvalues of the Schrödinger equation using the Feynman-Kac path integral method. The procedure is used to calculate the lowest excited state eigenvalues of the eigenfunctions of the Hamiltonian that possess anti-symmetric nodal regions in the configuration space. Within this method the solution of the imaginary time Schrödinger equation is approximated by random walk simulations on a discrete grid constrained only by symmetry considerations of the Hamiltonian associated with a given irreducible representation. The method provides exact eigenvalues of excited states in the limit of infinitesimal step size and infinite time. The developed numerical method is applied to compute eigenvalues of the

lowest excited states of the hydrogenic atom. Numerical results are compared with exact analytical results.

**[A3.004] Frequency determination of relativistic harmonic oscillator using action variable**

*M.K. Balasubramanya (Texas A&M University-Corpus Christi)*

We demonstrate the use of the action variable to find the frequency of oscillation of a classical relativistic harmonic oscillator. Using the canonical nature of coordinate and momentum we illustrate two methods of constructing the action variable using contour integrals.

**[A3.005] Alfven Waves in Three Dimensions: Similarity Reductions of the 3D-DNLS Equation**

*Robert Hamilton (Department of Physics, Angelo State University)*

The Derivative Nonlinear Schrodinger (DNLS) equation describes the nonlinear evolution of small amplitude Alfven waves. Although this equation has long been known to be integrable by the inverse scattering transformation, little is known regarding the integrability, or other properties, of the 3D-DNLS which describes the evolution of small amplitude Alfven waves in three dimensions. Similarity reductions of the 3D-DNLS are reported along with insights they give for the possible dynamics of higher dimensional Alfven waves.

**[A3.006] An Overview of Ritz's Theory of Electromagnetism**

*James Espinosa (West Texas A&M University)*

At the beginning of the twentieth century, the world of physics underwent revolutionary changes. Both quantum theory and Einstein's theory of relativity were born at this time. Several competing theories also met their demise during this period. One of the strongest competitors of Einstein's ideas was a theory of electromagnetism proposed by Walter Ritz in 1909. It received much attention from such distinguished physicists such as Richard C. Tolman. Unfortunately, Ritz passed away the same year that he published his theory. Many graduate textbooks on electromagnetism make brief mention of his theory in chapters about Einstein's theory of relativity, failing to explain why physicists such as Tolman would have so much interest in Ritz's theory. In order to help remedy this problem, a brief overview of this alternative theory of electromagnetism will be given. We will present Ritz's derivation of a force formula that explains most of the same phenomena as Maxwell's theory. This derivation will be reviewed in detail. A brief derivation of the analogous field-based Lienard-Schwarzschild force formula will then be given. The two force formulas will be compared and contrasted with respect to electromagnetic experiments. A brief outline will then be presented of further possible work that Ritz suggested in his final paper.

**[A3.007] Statistical analysis of air and sea temperature anomalies**

*Nicola Scafetta (Duke University), Timothy Imholt, Paolo Grigolini, Jim Roberts (University of North Texas Center for Nonlinear Science)*

This paper presents a Global air and sea temperature anomalies analysis based upon a combination of the wavelet multiresolution analysis and the scaling analysis methods of a time series. The wavelet multiresolution analysis decomposes the two temperature signals on a scale-by-scale basis. The scale-by-scale smooth and detail curves are compared and the correlation coefficients between each couple of correspondent sets of data evaluated. The scaling analysis is

based upon the study of the spreading and the entropy of the diffusion generated by the temperature signals. Therefore, we adopt two analysis methods: Diffusion Entropy Analysis (DEA) and the Standard Deviation Analysis (SDA). The joint use of the two scaling analysis methods allows to establish better the nature of the signals, as well as their scaling, and the discovery of a slight Levy component in the two temperature data sets. Finally, the DEA and SDA are used to study the wavelet residuals of the two temperature anomalies. The temporal regions of persistence and antipersistence of the signals are determined and the non-stationary effect of the 10-11 year solar cycle upon the temperature is studied. The temperature monthly data cover the period from 1860 to 2000 A.D.E.

**[A3.008] Participant Region Limit Temperature dependency on Residual Size for Ni+Ni HIC**

*Armando Barranon (Dept. of Basic Sciences, UAM-A, Mexico City, Mexico.), Jorge A. Lopez (Dept. of Physics, The University of Texas at El Paso, TX., USA.), Claudio Dorso (Dept. of Physics, Universidad de Buenos Aires, Argentina), Latino Collaboration*

LATINO dynamic semiclassical model uses Pandharipande potential to reproduce binary internucleonic forces and an Early Cluster Recognition Algorithm that performs an optimization in phase space. Ground States are obtained applying a frictional method to a randomly generated configuration. Kinetic Theory is applied to the participant region in order to obtain the system temperature. Limit temperature decreases when residual size is increased, in agreement with recent experimental data studies. Molecular dynamics trajectories in phase diagram show event-by-event limit temperatures confirming this tendency. Computations were carried out at UAM Supercomputing Lab and UT-El Paso facilities. Authors acknowledge financial support from NSF through PHYS-96-00038 grant and hospitality from IF-UNAM.

**[A3.009] Some Properties of Selected Diatomics**

*Steven Alexander (University of Texas Pan American), R.L. Coldwell (University of Florida), Sumita Datta (Indian Association for the Cultivation of Science)*

Using variational Monte Carlo we have computed a number of properties of the first row diatomic molecules Li<sub>2</sub>, Be<sub>2</sub>, C<sub>2</sub>, N<sub>2</sub>, O<sub>2</sub> and F<sub>2</sub> including elastic and inelastic electron scattering cross sections. For our trial wavefunctions we use the explicitly correlated multi-determinant functions optimized by Filippi and Umrigar. These trial wavefunctions capture a large percentage of the correlation energy using only 50-100 adjustable parameters.

**[A3.010] Gravothermal catastrophe in N-body simulations**

*Bruce Miller (Texas Christian University), Peter Klinko*

We investigate the long-time dynamical evolution of gravothermal catastrophe in a model of a spherical gravitational cluster where an additional integral of motion, the sum of the angular momentum squares, is also taken into account. In the N-body simulations, we use the three dimensional rotating spherical shell system, including internal angular momentum exchange, that was shown to share an equivalent thermodynamics with the spherically symmetric point-mass system in the mean field limit. Depending on the strength of the angular momentum exchange between shells and total energy, the system starts to relax to a locally stable state in good agreement with the mean field predictions. This is followed by gravothermal collapse with

the development of a core-halo structure. The simulation results clearly show that gravothermal catastrophe is also present in small-size systems, and that core-collapse is accompanied by the presence of oscillations in the core with increasing amplitude that persist over the entire simulation. These oscillations arise purely from the gravothermal instability without including any extra heat source (e.g. binary heating) and are governed by discreteness effects resulting from the small size of the core.

## **Session A4 - Physics Education and TSAAPT. ORAL session, Friday afternoon, LHSB 1.104**

### **[A4.001] Using Daily Quizzes to Pace a Tree-Structured Internet Course**

*Lionel D. Hewett (Texas A&M University-Kingville)*

Most students encounter difficulty studying tree-structured material in an Internet physics course. Daily quizzes can help guide such students as to what to study when, thereby maintaining an acceptable pace of learning the material.

### **[A4.002] The Texas Electronic Coalition for Physics--Building a Virtual Department**

*Daniel J. Suson (Texas A&M University-Kingsville)*

The Texas Electronic Coalition for Physics is a coalition of five institutions that have grouped together to form a virtual department. The experiences of the first year are reviewed from the chair's perspective, with particular attention on the administrative lessons learned.

### **[A4.003] Kirlian Photography as a Teaching Tool of Physics**

*Andy Terrel, Dr. Beth Ann Thacker (Texas Tech University)*

There are a number of groups across the country working on redesigning introductory physics courses by incorporating physics education research, modeling, and making the courses appeal to students in broader fields. We spent the summer exploring Kirlian photography, a subject that can be understood by students with a basic comprehension of electrostatics but is still questioned by many people in other fields. Kirlian photography's applications have captivated alternative medicine but still requires research from both physics and biology to understand if it has potential as medical tool. We used a simple setup to reproduce the physics that has been done to see if it could be used in an educational setting. I will demonstrate how Kirlian photography can be explained by physics but also how the topic still needs research to completely understand its possible biological applications. By incorporating such a topic into a curriculum, one is able to teach students to explore supposed supernatural phenomena scientifically and to promote research among undergraduate students.

### **[A4.004] Peer Instruction in the Community College Physics Class**

*Susan Cable (Central Florida Community College)*

Presenting the results of using Peer Instruction Methods for the first time in a calculus-based physics course.

#### [A4.005] **Applied Learning Physics**

*Denise Gordon (The Applied Learning Academy FWISD)*

“Applied Learning Physics” focusing on how physics can be “applied” at the high school/middle school level. Step away from the textbook to see what the local community has to offer in the field of physics.

#### [A4.006] **The Application Portfolio as a Tool to Enhance Motivation and Assessment**

*Kastro M. Hamed (University of Texas at El Paso)*

In an effort to bring real life to physics and physics to real life, and as a response to the repeatedly arising question: “Why are we studying physics when none of us wants to be a physics major?” In my Physics for Biological Sciences course, I came up with a learner-centered pedagogical tool. I called this pedagogical tool “The Application Portfolio Assignment.” It was designed to help the students see the answers to why they were in a physics class even though many of them did not want to be, and to provide an alternative assessment item. In this talk I intend to share with you the details about this tool, the way it worked, and the output as measured by students’ performance, students’ evaluation comments, and the colleagues’ remarks.

#### [A4.007] **So What is TIPER?**

*Tom O’Kuma (Lee College)*

Examples of Tasks Inspired by Physics Education Research (TIPER) will be given and student results discussed. TIPERs include ranking tasks, working backwards problems and many others.

#### [A4.008] **Research Experiences for Undergraduates in Physics and Astronomy at the University of Wisconsin--Madison**

*Keivan G. Stassun, Robert Benjamin (University of Wisconsin - Madison)*

We describe the Research Experiences for Undergraduates (REU) program in physics and astronomy at the University of Wisconsin--Madison. The ten-week summer program provides a stipend, meals/lodging, and travel expenses. Mentors in a variety of areas of physics and astronomy are available for research projects, including: neutrinos, star formation, galaxies, cosmology, neutron stars, x-ray and gamma-ray astrophysics, and others. The program is committed to the participation of women and members of underrepresented groups. Additional information is available at the program's website: <http://wisp11.physics.wisc.edu/~simreu>

#### [A4.009] **“Starshine Satellites”--Student Participation in Solar Effects Research**

*Bobette Doerrie ( )*

School children are involved in polishing mirrors for satellites and collecting data for the effects of solar activities on the atmosphere. This talk describes the Starshine program.

**[A4.010] Incorporating Business Education into Professional Master's Degrees in Applied and Industrial Physics: What Works and What Doesn't**

*Alaina G. Levine (The University of Arizona)*

In 2000, the University of Arizona (UA) launched a Professional Master's Degree Program in Applied and Industrial Physics with the goal of specifically preparing students for scientific careers in industry. In addition to the scientific component of the degree program, we created a model incorporating business coursework, industrial colloquia, internships in industry, and networking opportunities. Since its inception, we have coordinated a successful partnership with the UA Eller College of Business and Public Administration, created an external board of advisors, and graduated four students.

Our idea of what a "professional master's degree" should be and the needs of industry coincide, and we have successfully created a balance between science and business that meets the needs and interests of both industry partners and students alike. This talk will outline our successful business and professional model, and provide advice to universities who are thinking of implementing similar programs. Case studies of new graduates will be incorporated.

**[A4.011] El Universo a Sus Pies: A New Resource for Teaching Astronomy to Spanish-Speaking Audiences**

*Keivan G. Stassun (The Astronomical Society of the Pacific)*

I will demonstrate a hands-on activity for teaching astronomy at the K-12 level, using the new "El Universo a Sus Pies" teaching resource guide. Written entirely in Spanish and reviewed by a multi-national group of Spanish-speaking educators and astronomers, "El Universo a Sus Pies" is a collection of over 60 exemplary hands-on activities for teaching astronomy in the bi-lingual or Spanish classroom or youth group. "El Uviverso a Sus Pies" is accompanied by an English version, "The Universe at Your Fingertips" facilitating presentations to bi-lingual audiences.

**Session B1 - Society of Physics Students Session.  
ORAL session, Friday afternoon, SETB 2.236**

**[B1.001] Spectroscopic Study of Ni and Co Silicides**

*Anita Acevedo, David Donnelly*

This abstract not available.

**[B1.002] FTIR Spectroscopy of Optical Fibers**

*Jeff Mestayer, David Donnelly (Southwest Texas State University)*

This abstract not available.

**[B1.003] Spectroscopic and Topographic Characterization of Laser Shacked Hafnium Oxide Films**

*Roman Gomez, David Donnelly (Southwest Texas State University)*

This abstract not available.

**[B1.004] Nanowires: Molecular Modeling for Self-Assembly of Diblock Copolymers**

*Francine Abrego, Ben Stotts, James McDonald, Gary Bealle, Debbie Koeck, Heather Galloway, David Donnelly (Southwest Texas State University)*

This abstract not available.

**[B1.006] Critical Phenomena In Nuclear Reactions**

*Manuel Ramos, Cristian Escudero, Ázael Avalos, Jesus Escamilla, Jorge López*

This project studies the possibility of having critical phenomena in nuclear reactions. The study is done by means of computer codes to simulate collisions between nuclei at different energies and impact parameters. Information corresponding to different stages of the collision will be recorded in the form of momenta and position of all the protons and neutrons of the colliding nuclei. This information will be then analyzed using a second code based on Montecarlo techniques to identify the information of fragments during the produced breakup. The resulting data will be listed as clusters of given mass, charge, momenta and position as a function of time, and it will be examined in terms of distribution of masses of fragments to look for critical events. These events have a mass distribution which varies with size as a power law. Once the critical events are extracted, they will be used to obtain the so-called critical exponents. These exponents, in principle universal to many (non-nuclear) systems, will be compared to other exponents to test the vality of the universal assumption.

**Session B2 - Poster Session.**

**POSTER session, Friday afternoon, SETB 2<sup>nd</sup> Floor Physics Wing**

**[B2.001] Optimal Phase Match Study on Optical Parametric Amplification with Biaxial Crystal**

*Jiahui Peng (Department of Physics, Texas A&M University, College Station, TX 77843, U.S.A), Zhizhan Xu, Xiaodong Yang, Shiqi Jin (Laboratory for High Intensive Optics, Shanghai Institute of Optics and Fine Mechanics, CAS, China)*

Optical Parametric Amplification (OPA), the second order nonlinear optics phenomena, is one of the practical tunable laser sources. Recently, it shows much attraction with the improvement of laser pulse power and the invention of new crystals. The Optical Parametric Chirped Pulse Amplification (OPCPA) combines both the OPA and CPA technology, which is new concept for the development of laser. That is a great development for the laser technology, which can not only will improve the laser pulse power, but also will develop a new tunable ultra-short and ultra-intensive light source. The concept of OPCPA was first raised in 1992, and have drawn much attention since 1997. We have built an OPCPA system in Laboratory for High Intensity

Optics, Shanghai Institute of Optics and Fine Mechanics, CAS. As we know that during the Optical Parametric Amplification process the gain is sensitive to the phase match condition. To maximize the gain of the OPA process, the Optimal Phase Match is most important. In order to do so, we have done several research work. First, as we know that the phase match in biaxial crystal is much complex than uniaxial crystal. On the other hand the phase match angles in biaxial crystal are much more than ones in uniaxial crystal. While the effective nonlinear coefficient has relationship with the angle of the crystal. So it is much convenient to select the phase match angle with maximum effective nonlinear coefficient to get gain as much as possible. Second, commonly there are two main kinds phase match in nonlinear optics, critical phase match and noncritical phase match. According our stimulation that the critical phase match is too sensitive to the phase match condition, a little change will cause great decrease of the gain. While it is much better for noncritical phase match. So we have done some calculation for that, and find it will be more stable to combine these two phase match technical together. Means we first location crystal as the critical phase match angle, and then we can adjust the system by temperature. Not only can we get stable OPA system, also we can maximize the gain spectrum through this way to sustain the ultra-fast laser pulse. Third, it is well known that the walk off of the light in crystal for the double refraction. The reason is that the waver vector and Poynting vector travel at different angle. So we derive the walk off angle equation, and which help us to decide the effective crystal length to be useful. Also it is important to decide the noncolline phase match angle. Finally, we can combine with all these factors to maximize the gain in OPCPA process.

#### [B2.002] **Electrical Measurements and Nanomechanics Using Scanning Probe Microscopy**

*Yong Chang (Texas A&M University, Physics Dept.)*

In the early 1980s, G. Binnig et al. invented the Scanning Tunneling Microscopy (STM) [1], making it possible to obtain atomic resolution images of conducting surfaces. After that, many different types of Scanning Probe Microscopy (SPM) were invented and some of the most useful representatives are Atomic Force Microscopy (AFM) [2], Electrostatic Force Microscopy (EFM) [3] and Kelvin Probe Force Microscopy (KPFM) [4,5]. In 1985, G. Binnig et al. [2] invented the AFM, which now is used as a fundamental tool in many fields of research. Developed from AFM, Y. Martin et al. [3] invented EFM in 1987. The development of AC mode AFM allows the detection of weak long-range forces. EFM has also been used to study other systems and phenomena, such as thin liquid films on solid surfaces [6], electrically stressed gold nanowires [7], and spatial charge distribution in quantum wires [8]. In 1991, M. Nonnenmacher et al. [5] invented Kelvin Probe Force Microscopy. KPFM is used to study any property that affects the tip-surface Contact Potential Difference (CPD), such as voltage signals in integrated circuits (IC) [9], charged grain boundaries in polycrystalline silicon [10] and surface potential variations in multilayer semiconductor devices [11]. The aim of this poster is to discuss the application of SPM to electrical measurements. The theory of SPM was presented. The AFM was firstly introduced as it was developed before the other two. The design and theory were discussed. The force-distance curve was introduced. After this EFM was presented. EFM was developed from AC mode AFM. The technique was achieved by applying a DC voltage between the tip and the sample. The design, theory and features of it were surveyed. KPFM was also discussed. KPFM was developed from EFM. The central part of this technique is to measure the CPD. Experimental measurements of SPM were described after theory part. Research work using AFM was presented. The newest technique of AFM, UHV-AFM has been used in investigating the nano-mechanical properties of different materials. Normally common AFM has shortcomings as it has either strict limit resolution or difficulties in interpreting the

data from the measurements. In order to solve these problems, Ultra High Vacuum (UHV) conditions were applied to acquire quantitative results. A typical UHV-AFM uses a cantilever whose spring constant is relatively high ( $>100$  N/m) to obtain high-resolution image. Experimental measurements using KPFM was presented after AFM. Researchers are using KPFM to acquire the topography and measuring the CPD of semiconductor or metal surfaces. Similarly as in AFM, KPFM works best in UHV environment. A typical UHV-KPFM also uses a cantilever whose spring constant is relatively high. A UHV-KPFM may be able to achieve a high resolution in CPD images. In the past 20 years many different kinds of SPM were invented and used. AFM, EFM, and KPFM are representatives of them. Researchers are still developing new techniques. However, in recent years, they pay more attention in improving the measurement accuracy instead of trying to invent new SPM. These three SPM continue to be frequently used. The current capabilities of SPM do not satisfy us completely. We still can't measure the Electrical field directly. We actually measure the capacitance gradient. There are also some other questions. This is because the electrostatic force depends very strongly on the geometry of the probe at all length scales, so any model is subject to two big problems. First, the geometry is not known with complete accuracy; and second, the tip shape can change during an experiment due to wear. In the future, maybe the problems could be overcome by using a tip with a very well defined shape, such as a carbon nanotube, for which a realistic geometrical model could be more easily constructed, and the wear could be avoided or reduced.

#### **[B2.003] Development of Microelectromechanical System Using Ultra Deep X-Ray Lithography**

*Yongjun Zhai (Center for Advanced Microstructures and Devices, Louisiana State University, Baton Rouge, LA 70806)*

Ultra Deep X-Ray Lithography (UDXRL) allows the production of high aspect ratio micro(HARM) polymer structures with quasi roughness. These HARM structures can then be used as templates to mass-produce microparts made out of a large variety of metals, alloys or ceramics. It brings a wide variety of potential application in the field of microelectromechanical system (MEMS), fibre and integrated optics, microfluidic devices and interconnection technology. Patterning of HARM structures in UDXRL requires the careful control of materials and process parameters. In this paper, the basic properties relevant for the UDXRL process are described. This paper will also discuss Ultra Deep X-Ray Lithography (UDXRL) setup at the Center for Advanced Microstructures and Devices (CAMD) of Louisiana State University. A review of the UDXRL latest research progress will also be discussed in this paper.

#### **[B2.004] Modulated Light Scattering for Detection of Microscale Particles**

*G. W. Sherman, C. C. Bradley (Texas Christian University)*

In science and industry, there is need for real-time detection, tracking, and categorization of microscopic and nanoscale particles. We are developing a method for detecting small particles using a set of spatially scanned laser standing wave probes. A particle crossing a probe region will scatter light that is modulated via the sweep of the standing wave. From this modulated light we will be able to electronically detect and sort particles of widely varying sizes in real-time. As a demonstration, we have used this technique to study thin, microscopic wires of various size (3.5 to 25 microns) and composition (tungsten, copper and carbon). We will compare experimental results with a theoretical model of the light-scattering and subsequent signal processing. We will discuss experimental goals and practical limits relating to particle

composition and the desired detection bandwidth. In addition, we will report our progress in applying the technique to the detection and spatial tracking of freely moving microscopic and nanoscale particles.

**[B2.005] SR and GR gpb predictions.**

*Russell L. Collins (retired, U.T. Austin)*

The Stanford gpb will launch in low polar orbit on April 24, 2003. Its near-perfect gyroscopes will probe relativistic effects. Measured in arcsec/yr, GR predicts the axis of a gyroscope will precess 6.6 in-plane (geodetic) and 0.042 out-of-plane (Lense-Thirring, or frame-dragging). SR also predicts geodetic precession, of the same nominal magnitude but oppositely directed. This SR study expects no frame-dragging, and re-directs the sun's .019 perturbation to out-of-plane. In-plane and out-of-plane, GR predicts: +6.580 and +.042; this study (SR) predicts: -6.561, and -.019. Time will tell, after the gpb flies. The SR geodetic precession follows from the differential shrinkage of circumference of circles bracketing the orbiting body. Gravity plays no role, other than creating the orbital velocity whose square is  $GM/r$ . The close analogy between geodetic precession and Thomas precession has been resolved. When the object undergoing Thomas precession is larger than a geometric point, the rate is three times as large as was found in 1926. This poses no great difficulty for spin-orbit coupling, since it merely reverses the sign of the net Larmor precession. A rotating-field spin resonance experiment could decide whether  $g=2$  or  $g=-2$  for the electron.

**[B2.006] Scopes for Schools: A Program of Minority Outreach and Teacher Professional Development in Astronomy**

*Keivan G. Stassun (University of Wisconsin - Madison)*

The Scopes for Schools program is a low-cost, field-tested model for physicists and astronomers to conduct outreach, curriculum development, and teacher professional development in astronomy. The program is aimed at minority and other underserved students (but all students may participate), with an emphasis on curriculum development and on professional development for teachers.

Teacher participants benefit from:

- inservice workshops which enhance astronomy content knowledge, and pedagogical content knowledge;
- curriculum materials (activities) and hardware (telescopes and digital cameras) for bringing hands-on astronomy to the classroom; and
- a long-term partnership with University scientists for ongoing curriculum and pedagogical development.

Student participants benefit from astronomy activities that are inquiry- and standards-based, and from a hands-on experience building and using telescopes and digital cameras.

**[B2.007] Detecting Elementary Particles at CLEO from Large Datasets**

*Hector Moscoca, Akhtar Mahmood (University of Texas - Pan American)*

We will present an analysis for the confirmation of two elementary particles, the  $\Xi_{c+/-}$  and the  $\Xi_{c0}$  Charmed baryons using the CLEO dataset. The CLEO experiment located at Cornell University's CESR Accelerator facility has accumulated one of the largest amount of experimental data containing the Charm quark. Mass measurements of Charmed Baryons are crucial for our understanding of the dynamics of Heavy quarks inside the Hadrons.

**[B2.008] Ion Beam Analysis of Interconnect Layers for Electronic Applications**

*Daniel Marble, Bryan Miller (Department of Mathematics, Physics, and Engineering, Tarleton State University), Chad Bircher (Department of Physics, Abilene University), Jerome Duggan, Floyd McDaniel (Department of Physics, University of North Texas)*

Future electronic systems will face a myriad of technological challenges that require the development of new materials. Some these challenges include replacing SiO<sub>2</sub> gate oxides in memory devices with high-k dielectrics, improved diffusion barriers, and the use of low k-dielectric for interconnects to reduce RC time constants. The development of these emerging materials requires analytical techniques capable of measuring film thickness, stoichiometry, and other important device parameters. Our research on the development of important emerging materials and the use of both Rutherford Back Scattering (RBS), and Particle Induced X-Ray Emission (PIXE) to analyze materials will be presented.

**[B2.009] Experimental Test of Three-Color Resonance Ionization of Bismuth**

*Daniel Marble, Marsalee Burrus (Department of Mathematics, Physics, and Engineering, Tarleton State University), Duncan Weathers (Department of Physics, University of North Texas)*

Ion beam sputtering is a powerful technique for depositing multi-component thin films provided the relative sputtering yields are known. Since few models accurately predict sputtering yields for multi-component targets, these relative sputtering yields must usually be determined experimentally. One potential method of determining relative sputtering yields is sputter-initiated resonance ionization spectroscopy (SIRIS) provided a suitable resonance ionization scheme for the element of interest exists. Our present work involves the measuring of sputter yields from a segregated Bi and Ga sample using SIRIS and a recently proposed but previously unverified three-color Bi ionization scheme.

**[B2.010] Deposition and characterization of Al/Ni multilayer thin films**

*Deeder Aurongzeb (Dept. of Physics, Texas Tech University), Mark Holtz (Dept. Of Physics, Texas Tech University), Jordan Berg, Mike Daugherty (Mechanical Engineering, Texas Tech University)*

Combustion synthesis studies the creation of new and useful materials from known reactants. The reactants, in this study, include individual alternating layers of Ni and Al. This study focuses on the effect of layer thickness, surface morphology and optical properties of NickelAlumide synthesized product. Phase segregation in multilayer thin films, especially for the ferromagnetic case, are also a focus of this study. We describe deposition of thin multilayer films by e-beam evaporation. We examine the effects of laser heating and arc discharge on our samples, especially how their physical and optical

properties change due to sudden change in energetics at the surface. Results of these studies will be presented and discussed.

**[B2.011] Recoil Spectrometry Analysis of Hydrogen Evolution Thermally Processed Gate Dielectrics**

*Jose Martinez, Mario Borunda, Muhamed El-Bouanani (Stephen F. Austin State University)*

This abstract not available.

**Session C1 - Gravitation and Astrophysics.  
ORAL session, Saturday afternoon, SETB 3rd Floor**

**[C1.001] Stability properties of black holes in self-gravitating nonlinear electrodynamics**

*Claudia Moreno (The University of Texas at Brownsville, Department of Physics and Astronomy, 80 Fort Brown, Brownsville TX, 78520-4993)*

We analyze the dynamical stability of black hole solutions in self-gravitating nonlinear electrodynamics with respect to arbitrary linear fluctuations of the metric and the electromagnetic field. In particular, we derive simple conditions on the electromagnetic Lagrangian which are sufficient for linear stability outside the event horizon. We show that these conditions hold for several of the regular black hole solutions found by Ayón-Beato and Garcia.

**[C1.002] Testing Binary Black Hole codes using Cosmological Space-times**

*David Garrison (University of Houston-Clear Lake)*

In order to further our understanding of the instabilities which develop in numerical relativity codes, I study vacuum solutions of the cosmological type ( $T^3$  topology). Specifically, I focus on the 3+1 ADM formulation of Einstein's equations. This involves testing the numerical code using the following non-trivial periodic solutions, Kasner, Gowdy, Bondi and non-linear "gauge" waves. I look for constraint violating and gauge mode instabilities as well as numerical effects such as convergence, dissipation and dispersion. I will discuss techniques developed to investigate the stability properties of the numerical code.

**[C1.003] Old VLBI Data Shed New Light on Superluminal Controversy**

*D.H. Hough (Trinity University), S.T. Myers (NRAO), R.P. Linfield (Ball Aerospace)*

We report old 2.8cm VLBI observations at 0.5-mas resolution of 6 sources (5 quasars) using telescopes at Effelsberg, Haystack, Green Bank, Fort Davis, Owens Valley, and Hat Creek. Correlation and reduction were done with the Caltech Mark-II processor and VLBI software. An epoch 1985.29 image of 1156+295 shows a 2.0-Jy core and a 0.1-Jy jet knot at 1.4 mas in PA 15 degrees (and a weak knot at 2.5 mas in PA 40). Comparison with the 1987.72 image of McHardy et al. (MNRAS, 1990, 246, 305) yields a proper motion of  $\sim 0.3$  mas/yr, or a superluminal speed of  $\sim 7c$  ( $H_0 = 100$  km/s/Mpc,  $q_0 = 0.5$ ), close to that of Piner and Kingham (1997, ApJ, 485, L61) and ruling out the extreme value of  $26c$  in McHardy et al. (MNRAS, 1993, 261, 464). A 1984.60 image of 1923+210 (no optical ID) shows a 0.8-Jy core and jet knots of 0.5 Jy at 0.5 mas in PA 251, 0.2 Jy at 1.4 mas in PA 255, and 0.1 Jy at 2.4 mas

in PA 251. A 1983.78 image of 2037+511 shows a  $\sim 1.2$ -Jy core and jet knots of  $\sim 0.2$  Jy at 0.8 mas in PA 205 and  $\sim 0.1$  Jy at 1.4 mas in PA 215. A 1982.44 observation of 4C19.44 shows amplitudes from  $\sim 0.7$  to  $\sim 1.5$  Jy and non-zero closure phases, indicative of resolved, asymmetric structure. The sources 0221+276 and 4C34.47 went undetected at 1983.78 and 1982.44, respectively.

#### [C1.004] **Hyperbolicity of the BSSN system of Einstein evolution equations**

*Olivier Sarbach (Louisiana State University)*

We discuss an equivalence between the Baumgarte-Shapiro-Shibata-Nakamura (BSSN) formulation of the Einstein evolution equations and strongly hyperbolic formulations with fixed densitized lapse and shift. This allows us to show under which conditions the former defines a well posed initial value problem. Possible applications on the implementation of constraint preserving boundary conditions for BSSN like systems are also discussed.

#### [C1.005] **Modeling gravitational radiation from coalescing binary black holes**

*Lazarus Team*

With the goal of bringing theory, particularly numerical relativity, to bear on an astrophysical problem of critical interest to gravitational wave observers we introduce a model for coalescence radiation from binary black hole systems. We build our model using the Lazarus approach, a technique that bridges far and close limit approaches with full numerical relativity to solve Einstein equations applied in the truly nonlinear dynamical regime. We specifically study the post-orbital radiation from a system of equal-mass non-spinning black holes, deriving waveforms which indicate strongly circularly polarized radiation of roughly 3% of the system's total energy and 12% of its total angular momentum in just a few cycles. Supporting this result we first establish the reliability of the late-time part of our model, including the numerical relativity and close-limit components, with a thorough study of waveforms from a sequence of black hole configurations varying from previously treated head-on collisions to representative target for "ISCO" data corresponding to the end of the inspiral period. We then complete our model with a simple treatment for the early part of the spacetime based on a standard family of initial data for binary black holes in circular orbit. A detailed analysis shows strong robustness in the results as the initial separation of the black holes is increased from 5.0 to 7.8M supporting our waveforms as a suitable basic description of the astrophysical radiation from this system. Finally, a simple fitting of the plunge waveforms is introduced as a first attempt to facilitate the task of analyzing data from gravitational wave detectors.

#### [C1.007] **Constraint-preserving boundary conditions in numerical relativity**

*Gioel Calabrese, Luis Lehner, Manuel Tiglio (Louisiana State University)*

We consider spherically symmetric black hole spacetimes in vacuum or with a minimally coupled scalar field, within the Einstein-Christoffel (EC) symmetric hyperbolic formulation of Einstein's equations. By exploiting the characteristic propagation of the main variables and constraints, we are able to single out the only free modes at the outer boundary for these problems. In the vacuum case a single free mode exists which corresponds to a gauge freedom, while in the matter case an extra mode exists which is associated with the scalar field. We make use of the fact that the EC formulation has no

superluminal characteristic speeds to excise the singularity. We present a second-order, finite difference discretization to treat these scenarios, where we implement constraint-preserving boundary conditions, and are able to evolve the system for essentially unlimited times (i.e., limited only by the available computing time). As a test of the robustness of our approach, we allow large pulses of gauge and scalar field to enter the domain through the outer boundary. We reproduce expected results, such as trivial (in the physical sense) evolution in the vacuum case (even in gauge-dynamical simulations), and the tail decay for the scalar field.

**[C1.008] Computing the gravitational self-force on a compact object plunging into a Schwarzschild black hole**

*Carlos Lousto (Department of Physics and Astronomy, The University of Texas at Brownsville, 80 Fort Brown, Brownsville TX, 78520-4993), Leor Barack (Albert Einstein Institut, Golm, Germany)*

We compute the gravitational self-force (or "radiation reaction" force) acting on a particle falling radially into a Schwarzschild black hole. Our calculation is based on the "mode-sum" method, in which one first calculates the individual  $l$ -multipole contributions to the self-force (by numerically integrating the decoupled perturbation equations) and then regularizes the sum over modes by applying a certain analytic procedure. We demonstrate the equivalence of this method with the  $z$ -function scheme. The convergence rate of the mode-sum series is considerably improved here (thus reducing computational requirements) by employing an analytic approximation at large  $l$ .

**[C1.009] Using Resonant Bars and Interferometers to Search for Stochastic Gravitational Waves**

*John T. Whelan (Loyola University New Orleans)*

A stochastic background of gravitational waves (SBGW) may result from gravitational waves emitted in the early universe (e.g., during inflation) or from a superposition of many unresolved astrophysical sources. Pairs of resonant bar detectors, as well as pairs of prototype interferometers, have been used to set limits on SBGW strength by looking for correlations between the random signals in the two detectors, and data from the two LIGO interferometers are being analyzed right now for this purpose. I will describe a parallel analysis being carried out to look for SBGW-induced correlations between the LIGO detector in Livingston, LA and the ALLEGRO resonant bar detector in Baton Rouge, LA.

**[C1.010] Quantum Gravity: Covariant Formalisms**

*Kanokkuan Chaicherdsakul (Univ. of Texas at Austin)*

The Schwinger-DeWitt techniques, heat kernel and closed time path formalism, are presented and applied in Yang-Mills and quantum gravity. The quantum effective action will be constructed while manifest covariance is still maintained during and after quantization. The result will be real, causal, and gauge condition independent. To investigate the strong gravitational field regime, such as black hole collapse and back reaction problem, in-in formalism might be the way of solution.

Session C2 - Biophysics/Atomic Physics/Optical Physics.  
ORAL session, Saturday afternoon, SETB 1.336

**[C2.001] Optimizing Giant Unilamellar Vesicle Growth in a Physiological Buffer**

*Geoffrey Lambright, Juyang Huang (TTU)*

Liposomes of 40 to 70 microns in diameter are good model systems for microscopy study of biomembrane heterogeneity. They also have a potential to be incorporated into biosensors. We search for the optimum condition to produce large numbers of giant unilamellar vesicles (GUV) in a physiological buffer. A thin lipid film is first dried on a test tube, and then slowly hydrated by water vapor before a buffer solution is added. We found that the yield of GUVs can be significantly influenced by the surface characteristics of the test tubes. By selecting the material of test tubes and optimizing other experimental conditions, we have increased the GUV yield more than ten fold.

**[C2.002] Detection Of Cholesterol Saturation Limit In Lipid Bilayers  
By Light Scattering And Fluorescence measurements**

*Keith Miles (), Juhang Huang (Texas Tech University)*

Lipid bilayers have limitations on the amount of cholesterol that they can contain within the bilayers. When this threshold is reached, excess Cholesterol precipitate and form cholesterol monohydrate crystals. The value of these limits reveals the fundamental molecular interactions between cholesterol and phospholipids. Our samples are prepared by the low temperature trapping (LTT) method to ensure thermodynamic phase equilibrium. We measured the solubility limits of (16:0,18:1)PC, (di18:1C9)PC, and (di18:1C6)PC using light scattering, fluorescence anisotropy, and fluorescence resonance energy transfer techniques. Our data indicate that the solubility limits strongly depend on the position of double bond on phospholipid acyl chain, which is consistent with our Umbrella Model predictions.

**[C2.003] A model for nucleosome loading on DNA templates**

*Francisco J. Solis (University of Texas at El Paso.)*

Recent experiments have measured the statistical distribution of the number of nucleosome units loaded into short DNA templates under different reconstitution conditions (J. G. Yodh, et al. *Biochemistry*, 38, 15756(1999)). These distributions have been obtained for different concentrations of DNA and histones, different lengths of DNA, and for acetylated and non-acetylated histones. This talk presents an analysis of these experiments based on a simple statistical mechanic model. This method allows the determination of the difference in the association free energies, between the acetylated and non-acetylated cases.

**[C2.004] Low group velocity of Stokes component in resonant four-wave.**

*Eugeniy Mikhailov, Yuri Rostovtsev, George Welch (Department of Physics, Texas Aamp;M University, College Station, Texas 77843-4242)*

We report significant slowing of the group velocity of both anti-Stokes and generated Stokes components in resonant four-wave mixing process in optically dense Rb vapor. Various dependences on density, laser power, and detuning are reported.

**[C2.006] Optical absorption coefficients of pure water**

*ZHENG LU, XIANZHEN ZHAO, EDWARD S. FRY (Department of Physics, Texas A & M University, College Station, TX 77843)*

The integrating cavity absorption meter(ICAM), which is independent of scattering effect, is used to measure the absolute values of small optical absorption coefficients of liquid. A modified ICAM is being used to measure the absorption of water in the wavelength range 300 to 700 nm. The ultrapure water produced by a two-stages water purification system reaches Type I quality. This is equal to or better than ASTM,CAP and NCCLS water quality standards. To avoid the fact that dissolved oxygen absorbs ultraviolet light due to the photochemical effect, the water sample is delivered through a nitrogen sealed system which will prevent the sample from contacting with oxygen. A comparison of our absorption spectrum with other existing data is given.

**[C2.007] Deformable Mirror for a Unique Laser**

*XINMEI QU, ZHENG LU, EDWARD S. FRY (Department of Physics, Texas A & M University, College Station, TX 77843)*

We designed a Deformable Mirror (DM) with closely spaced actuators. The DM surface is made of a thin membrane type glass with a thickness of 250 microns. It is coated around 770nm. The membrane is supported by a series of piezoelectric actuator bars with a square grid spacing of 1mm. Each actuator is connected to the membrane by a small steel ball interfacing between them for desirable deformation characteristics. The other side of the actuator is also bonded to a base in order to get the deformation only in the membrane direction. The piezo bars are cut from the same piece to get the uniform properties. Each piezo bar is 2.312 inch long, 0.015 inch thick and 0.030 inch wide. With this design, an actuator could be capable of up to 5 microns of displacement with respect to neighboring actuators. We use this DM to correct the wavefront aberrations in the laser beam to improve the beam quality.

**[C2.008] Efficient Fiber Amplifier at 1064nm Without Polarization Fluctuations**

*John Stewart, Texas A&M University, Thomas Walther, Texas A&M University*

In another experiment single-pass amplified light was used for an absorption based OH sensor. The sensor requires stable intensity, but polarization fluctuations in turn produce intensity fluctuations. A double-pass fiber amplifier in combination with a faraday mirror is proposed to cancel polarization fluctuations. This setup will look much like a single-pass amplifier with the exception that the pump will be co-propagating. This method should avoid fluctuations without compromising final out power, jeopardizing the ruggedness, or tenability, of its counterpart.

**Session C3 - High Energy and Nuclear Physics.**  
**ORAL session, Saturday afternoon, SETB 2.336**

**[C3.001] Positron surface states and positron annihilation characteristics at the reconstructed (100) surface of GaAs**

*Nail G. Fazleev, John L. Fry, Alex H. Weiss (University of Texas at Arlington)*

The high-resolution PAES spectrum from a compound semiconductor GaAs(100) displays six As and three Ga Auger peaks below 110eV corresponding to M<sub>4,5</sub>VV, M<sub>2</sub>M<sub>4</sub>V, M<sub>2,3</sub>M<sub>4,5</sub>M<sub>4,5</sub> Auger transitions for As and M<sub>2,3</sub>M<sub>4,5</sub>M<sub>4,5</sub> Auger transitions for Ga, including a strong As M<sub>4,5</sub>VV peak at 28eV and a less intense Ga M<sub>2,3</sub>M<sub>4,5</sub>M<sub>4,5</sub> peak at 53eV. PAES data is analyzed by performing first-principles calculations of positron surface and bulk states and positron annihilation characteristics. Calculations are performed for both As and Ga rich (100) surfaces of GaAs with different reconstructions taking into account charge redistribution effects at the surface. Estimates of positron surface-state binding energies and work functions are provided. Stable positron surface states have been found to exist for both Ga and As rich reconstructed (100) surfaces of GaAs. Annihilation probabilities of surface trapped positrons with As 3d and 3p and Ga 3p core-level electrons are computed and compared with the ones estimated from the measured Auger peak intensities.

**[C3.002] ZooFinder at CDF**

*Matthew C. Cervantes, Dave Toback, Sung Won Lee (Texas A&M)*

The Fermilab Tevatron is currently the world's highest energy proton anti-proton accelerator. In this talk we present a new data acquisition monitoring program for the CDF detector, called ZooFinder. ZooFinder is designed to look at events in as close to real time as possible and searches for unusual events which could be indicative of detector or readout malfunctions, or possible hints of new physics. The objectives and benefits of the ZooFinder are presented.

**[C3.003] Fast Neutron Flux Measurement through Neutron Activation**

*Jim Ferguson (Texas A&M University, Department of Physics)*

Neutron activation of various materials is often used to detect the fluence from a neutron source. In this report silver sleeves were placed around individual Geiger-Mueller tubes, and set in a polyethylene box to measure the neutron flux from a D-D fusion pinch. The silver is neutron activated from the DPF neutrons which are moderated by the polyethylene box, and further undergoes beta decay which is detected by the GM tubes. Here, the calibration techniques of the detector set (polyethylene box, detector geometry, etc.) are discussed, and "On-the-Fly" calculations for a one-minute count are described.

**[C3.004] A spin paradox in quarkonium**

*Paul H. Cox (Texas A&M Univ.-Kingsville), L. Clavelli, T. Gajdosik (Univ. of Alabama)*

In QCD a quarkonium meson consisting of a heavy quark-antiquark pair is often considered as a superposition of pairs of Dirac-equation eigenstates. The angular momentum of the meson can be measured for any axis, but a Dirac eigenstate can be a spin eigenstate only for a spin axis  $n$  which is orthogonal to its momentum  $p$ . It thus appears that a meson of definite spin with nonzero internal kinetic energy can only include quarks moving perpendicular to the spin axis,

which contradicts the three-dimensional extent of actual wavefunctions. We investigate and, we believe, resolve this paradox.

**[C3.005] Search for supersymmetric top in the decay of the top quark**

*Yan Song, Kaushik De (the University of Texas at Arlington), UTA Team*

The 81.23 pb<sup>-1</sup> of data collected by the D0 detector at the Tevatron between 1994 and 1995 was analyzed. The data corresponds to 1.8 TeV  $\sqrt{s}$  collision. This analysis searched for top decays to stop and neutralino. The stop was subsequently assumed to decay into a charm quark and neutralino. The observable final state is 4 jets and missing Et. We searched over one million events and found no evidence for this signature over background. Details of the signal, calculation of background and the analysis technique used will be presented. We set limit to exclude certain parameter space of stop mass vs. neutralino mass.

**[C3.006] Intercalibration of Photomultiplier Tube Test Benches for ATLAS**

*Barry Spurlock, Kaushik De (University of Texas at Arlington)*

The ATLAS experiment is being built by an international collaboration of physicists at the CERN Collider (Geneva, Switzerland) to discover the Higgs particle and probe the Standard Model. Testing the large number of photomultiplier tubes used in the ATLAS detector has necessitated the use of a number of test benches in various locations around the world. At these sites, the photomultiplier tubes are tested by comparison with a control photodiode. In order to make the tests at different locations comparable, we have designed, constructed, and tested a compact photodiode test unit. Our results will be presented.

**[C3.007] Development of Digital Hadron Calorimeter Using GEM**

*Shahnoor Habib, Venkatesh Kaushik, Jia Li, Mark Sosebee, Andrew Brandt, Kaushik De, Andrew White, Jaehoon Yu (University of Texas at Arlington), UTA High Energy Physics Team*

Linear colliders are future electron-positron collider accelerators in high energy particle physics. The physics goals at the future linear colliders demand high jet energy resolution. Energy flow algorithm allows for dramatic improvement of hadronic jets by utilizing momenta measured in tracking systems. However the success of energy flow algorithm depends significantly on higher granularity of hadronic calorimeters. The higher granularity requires large number of readout channels that could potentially drive the cost of such a calorimeter to a prohibitive level. Digital hadron calorimeter is one of possible solutions. In this talk I will report on a digital hadron calorimeter development effort using Gas Electron Multiplier as the sensitive gap.

**[C3.008] Energy Flow Algorithm Development for a Digital Hadron Calorimeter Using GEM**

*Venkatesh Kaushik, Shahnoor Habib, Jia Li, Mark Sosebee, Andrew Brandt, Kaushik De, Andrew White, Jaehoon Yu (University of Texas at Arlington), UTA - High Energy Physics Group Team*

Linear colliders are future accelerators for high energy particle physics. The linear colliders use the collisions of electrons and positrons for research. Since the physics goals at these colliders demand high jet energy resolution, an energy flow (EF) algorithm provides a good solution for dramatic improvement of hadronic jets by utilizing momenta measured in tracking systems.

Finer granularity of calorimeter cells is crucial for the success of EF algorithm. Consequently the necessary level of granularity requires large number of readout channels that could make such a calorimeter very expensive. Digital hadron calorimeter is a possible solution for this issue. This talk will cover EF algorithm development effort for a digital hadron calorimeter using GEM as the sensitive gap.

## **TSAAPT Teacher Workshops**

### **W1 "Physlets for Beginners"**

*Scott Schultz, Delta College, Michigan and David Weaver, Chandler-Gilbert Community College, Arizona.*

Physlets are physics simulations that can be run over the World Wide Web. They are often written to promote thinking and discourage the plug and chug method of problem solving that students so readily rely on. Although it is certainly possible to create one's own Physlets, this workshop will focus on how to move Physlets already created back to your own site so you and your students can then use them.

SETB 1.352 2:00pm – 4:00pm

Limited to 22 participants - 2 hours - Cost \$2.00

### **W2 "Physics for New Teachers or Humor and Comic Demos as a Survival Mechanism"**

*Brian Self, Allen HS and K.J. Lowry, University of North Texas.*

Demonstrations that capture attention through unexpected and humorous results that can be used to introduce or illustrate basic concepts in high school physics. "The physics behind..." and "How to ..." sheets will be provided for all demos, as well as materials for some.

SETB 1.208 2:00 pm – 4:30 pm

Limited to 20 participants – 2.5 hours – Cost \$10.00

### **W3 "Newton is Not Just Numbers...See the Laws, Be the Laws with PASCO Probes"**

*April Moore, PASCO SCIENTIFIC*

Even the most fundamental physics concepts can be hard for many students to comprehend. PASCO's probeware and software together increase student understanding of complex physical concepts like Newton's Third Law of Motion and the Law of Conservation of Energy. Using PASCO probes, students can develop more sophisticated mental models of physics phenomena through data visualization. When meshed with PASCO's standards-based explorations, physics can really come to life. Attend the workshop, experience science, receive a complementary lesson plan and take home an educator's gift. You may even win your own Temperature Lab!

SETB 2.236 2:00 pm – 4:30 pm

Limited to 20 participants – 2.5 hours - Cost of \$2.00

**W4** **“Make and Take Resonance Demonstrators”** presented by Phillip Dukes, University of Texas at Brownsville.

Participants will build two motorized resonance demonstrators following instructions due to Bill Franklin. One produces a standing wave on a string and the other produces standing waves on cantilevered rods.

SETB 1.208 12:30pm – 3:30pm

Limited to 24 participants – 3 hours – Cost \$2.00

**W5** **“Using The Web in Physics”**

*John Griffith, Linn-Benton Community College, Albany, OR.*

In this workshop, participants will learn how to make a very basic web page and also how to take files they have previously created using Microsoft products and convert them for use in the web. By the end of the workshop, each participant will have created a web page complete with a self-photo. Throughout the workshop we will talk about issues related to instructional use of the web. No knowledge of HTML is assumed, and the workshop is not a course in HTML programming. Rather, the emphasis is on how to use Microsoft software applications with which the user has experience to create web pages.

SETB 1.352 12:30 pm – 4:30 pm

Limited to 20 participants – 4 hours - Cost \$5.00

**W6** **“Take (Your) Work Out of (Their) Homework”**

*Patsy McDonald, University of Texas at Austin; Phyllis Whittaker, McAllen HS; and Michael Padgett, McAllen HS*

Participants will be instructed on accessing and using the UT Homework Service, a free web-based service for physics, chemistry, physical science, and mathematics problems that can reduce grading time and allow more time for instruction. The problems are both multiple choice and algorithmic ranging from high school level through AP to college freshman level. Your only cost is some printing and minimal connect time.

SETB 2.260 12:30 pm – 3:30 pm

Limited to 24 participants - 3 hours - Cost of \$7.00