Enriching the Health of Physics Education

2008 AAPT Winter Meeting

Baltimore, MD

January 19–23

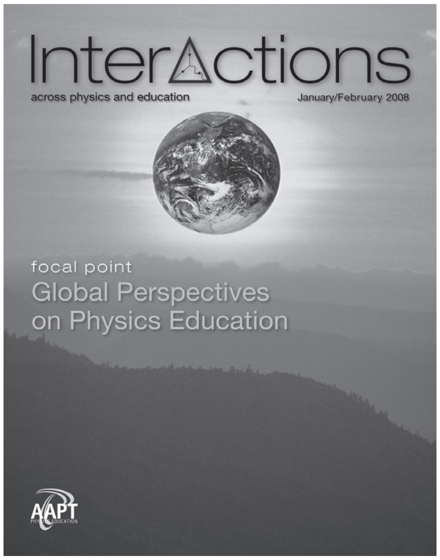
Baltimore Marriott
Waterfront Hotel

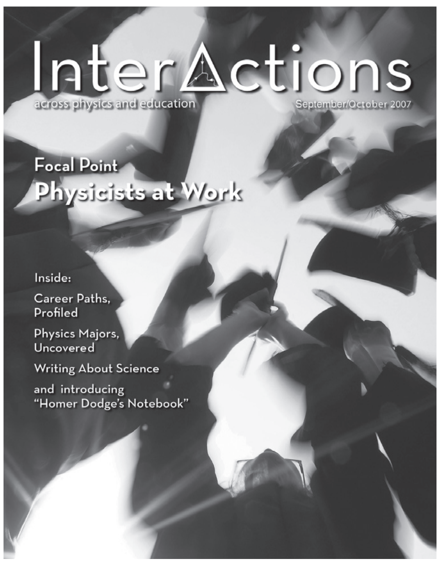
AAPT

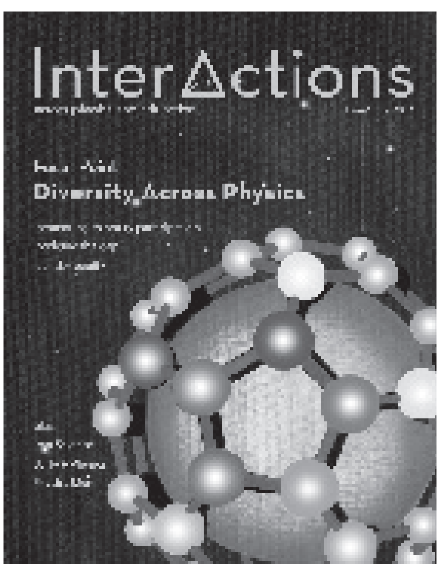
American Association of Physics Teachers
One Physics Ellipse
College Park, MD USA 20740-3845
301-209-3300, fax: 301-209-0845
meetings@aapt.org, www.aapt.org

InterActions

Makes Its Official Debut at the 2008 Winter Meeting



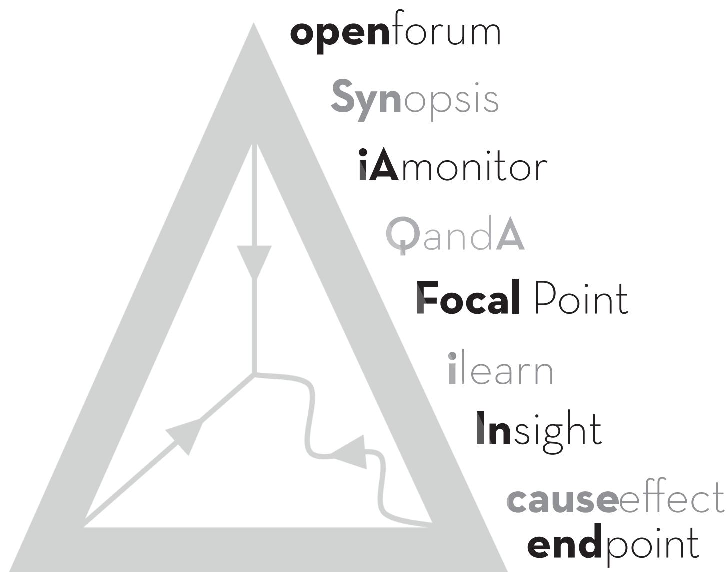




What Is InterActions?

– The people, places, programs and policies defining physics teaching and learning

– A glimpse Inside the physics education community



Inside InterActions

– human interest in physics

Welcome to Baltimore

Welcome to the AAPT Winter Meeting and the beautiful Baltimore Inner Harbor! If you can find some free time, be sure to go to the many attractions and great restaurants. I hope you have an enjoyable time.

Probably more important to you is the quality of the meeting. I hope you will later agree that this was a very strong meeting, starting with the workshops. No matter what your interests, you should find a workshop to satisfy your needs. AAPT is fortunate to have members who are willing to conduct these workshops and to share their expertise. They deserve our appreciation.

The heart of the meeting is the sessions and plenary lectures. On Monday there is the High School Physics Teachers Recognition Day. I would like to welcome all high school physics teachers and especially those from Maryland and the surrounding states. I hope you find this meeting exciting and will make AAPT your professional home if it isn't already. For those who are not high school teachers, there are other sessions of interest. I predict your main difficulty will be choosing among several that you want to attend, but do not forget the crackerbarrels and committee meetings. Everyone is invited to attend. Finally, there are strong plenary and award speakers. Be sure to put these on your list of events to attend.

I want to thank Steve Wonnell and John Hopkins University for all they did to support this meeting. A special thank you to John Layman for spearheading the High School Recognition Day. Thanks also to the paper sorters and Central Office staff, especially the Meetings team, who made this meeting possible.

Alex Dickison

AAPT Vice President and Program Chair
Seminole Community College
Sanford, Florida

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Special Thanks to:

– Steve Wonnell and Johns Hopkins University for help in setting up the meeting and hosting the workshops.
– John Layman, for spearheading High School Physics Teachers Recognition Day on Monday.
– The paper sorters: Patrick Callahan, Rachel Scherr, Patricia Sievert, David Sturm, and Alex Dickison.
– AAPT Meetings team: Tiffany Hayes, Janet Lane, Natasha Randall, Annette Colemen, and Laura Headrick
– Our Meeting Sponsors: W.H. Freeman, PASCO scientific, Johns Hopkins University Press, Marriott Waterfront Hotel, Herbert V. Friedman, Assoc., American Association of Physicists in Medicine, and Vernier Software

Dear Baltimore Meeting Attendee,

On behalf of the professional staff at the AAPT Central Office, I welcome you to Baltimore and to the 2008 AAPT Winter Meeting.

We hope that you will find the meeting's physics education content engaging, the networking opportunities valuable, and the facilities and organization of high quality. Many of us, staff and volunteers, have worked very hard to offer you during the next few days a very positive experience, both intellectually and socially.

This meeting is fully packed with workshops, plenaries, breakout sessions, committee meetings, a symposium, and a celebration of high school teachers, among other venues . . . all with the intent to enrich physics teaching and learning.

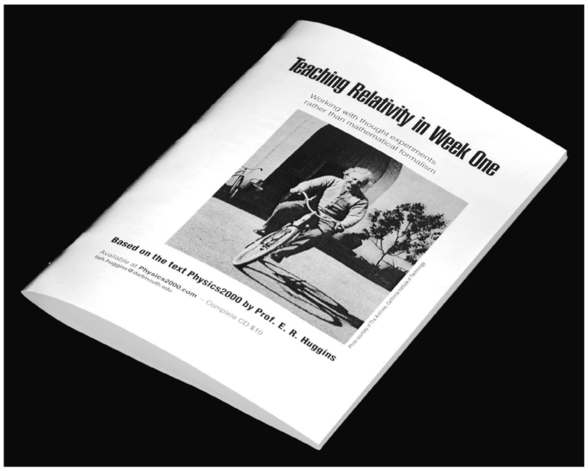
We thank you for being with us. And we thank our exhibitors, our sponsors, our volunteers, our colleagues at Johns Hopkins, and the hotel staff for making this meeting possible. We hope that, beyond possible, this meeting will be as successful as you desire it to be and as effective as we have endeavored to make it.

The AAPT staff is ready to assist you. Please let us know how we can be of service.

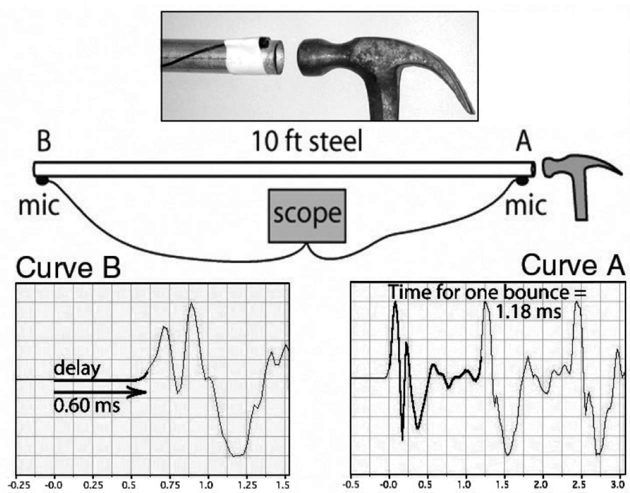
Wishing you a pleasant and rewarding meeting,

Toufic Hakim
Executive Officer

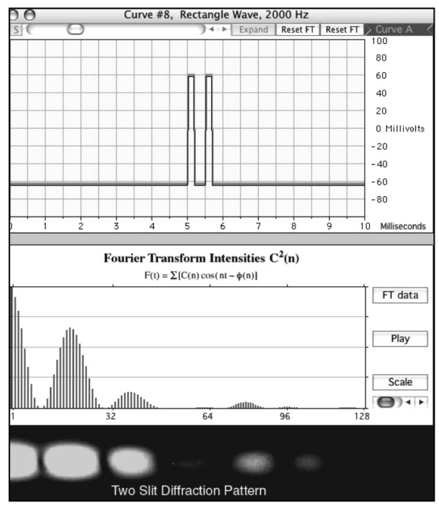
Free Workshop: Physics2000.com



Come to the popular Physics2000 workshop where you learn how to include 20th century physics in the basic Introductory Physics course. This is done by starting with special relativity in Week 1, using thought experiments rather than mathematical formalism. For example, you can easily show that, by combining the already familiar **Lorentz contraction** with **Coulomb's law,** you end up with the **Magnetic Force law**, **Maxwell's formula for the speed of light** and the **formula for the magnetic field of a current in a straight wire**.

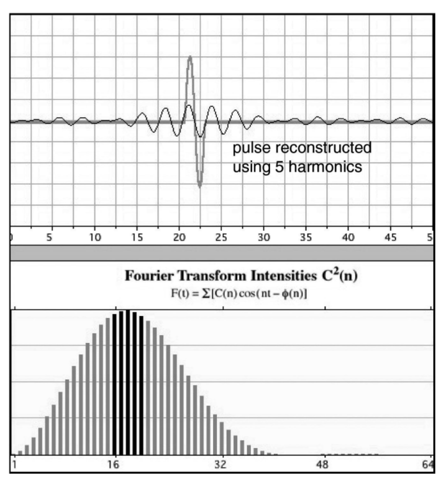


Speed of Sound in a Steel pipe
Using MacScope's stereo input, we find that a sound pulse travels down a 10 ft. (3.048m) steel pipe in .60 milliseconds. We get about the same speed for a compressional pulse in a fine steel guitar string. (Appearing in TPT, Jan 2008.)



Fourier Optics
The Fourier transform of a slit structure is proportional to the diffraction pattern produced by the slits. (See TPT Sept. 2007.)

As calculus is the backbone of classical physics, **Fourier analysis** plays a similar role in understanding **quantum mechanics**. We wrote the free audio oscilloscope program **MacScope II** (for Mac & Windows) to make it easy to use Fourier analysis in your introductory physics course. In the workshop we will show you how to use MacScope to measure the speed of sound in a steel pipe, study Fourier optics, and teach the time-energy form of the uncertainty principle.



Uncertainty Principle
Using MacScope's pulse Fourier transform, we study the harmonic structure of a short pulse. (See TPT, Jan. 2007.)

The workshop is more than free—attendees receive complimentary copies of the Physics2000 CD and volumes I & II of Physics2000.

Heron Room, Tuesday, Jan. 22, 4 p.m.

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2008 Winter Meeting Job Fair

This event is being held at the meeting and will be located in the Exhibit Hall—designed exclusively for organizations looking to hire high-level candidates in teaching physics, research and professional development at high schools, colleges, and universities. Hours for the onsite Job Fair are 10 a.m. –2 p.m. and 4–6 p.m. on Jan. 21; 9 a.m.–2 p.m. on Jan. 22. Many face to face interviews. Employers and job seekers must register online at http://www.aapt.org/Events/WM2008/jobfair.cfm.

Cyber Cafe

The AAPT Cyber Cafe will be available for checking email in the Exhibit Hall in Grand Ballroom IV, during Exhibit hours.

Speaker-Ready Room

There will be a speaker-ready room in the James Room where all presentations (invited and contributed) must be taken in advance.

The Speaker Ready room will be open during the following hours:

Sunday, Jan. 20: 4–9 p.m.

Monday, Monday, Jan. 21: 12–2 p.m.

Tuesday, Jan. 22: 12–2 p.m.

Wednesday, Jan. 23: 12–2 p.m.

Audiovisual Equipment

Audiovisual Equipment other than a computer and computer projector must be ordered 24 hours in advance by contacting Philip Castro at philip.castro@marriott.com.

Contact Information

AAPT Programs and Conferences Department

Staff: 301-209-3344 or 301-209-3040

Tiffany Hayes, Associate Director, thayes@aapt.org

Natasha Randall, Meetings Assistant, nrandall@aapt.org

Laura Headrick, Corporate Accounts Manager, lheadric@aapt.org

Annette Coleman, Programs Manager, acoleman@ aapt.org

Janet Lane, Programs Coordinator, jlane@aapt.org

Marriott Waterfront Hotel Information:
410-385-3000

Shuttle Service to Workshops at Johns Hopkins University

Bloomberg Center for Physics & Astronomy
Baltimore, MD
January 19–20, 2008

Workshop Shuttle Schedule for Johns Hopkins University:
MWH: ***Marriott Waterfront Hotel***
JHU: ***Johns Hopkins University – Bloomberg Center for Physics and Astronomy***

Saturday, January 19

AM & Full Day Workshop Schedule

1. Buses depart from MWH @ 7:30 and 7:45 a.m. to offsite AM & Full Day Workshops at JHU
2. Mid morning pick-up for workshop leaders at MWH @10:30 a.m. to offsite at JHU
3. Load bus at drop off location JHU at 12 p.m., AM Workshop ends
4. Depart JHU at 12:15 p.m. to MWH

PM Workshop Schedule

1. Buses depart from MWH @ 12:30 p.m. to PM Workshops at JHU
2. Load bus at drop off location JHU at 5 p.m., PM & All Day Workshop(s) end
3. Depart location JHU at 5:15 p.m. to MWH

Sunday, January 20

AM & Full Day Workshop Schedule

5. Buses depart from MWH @ 7:30 and 7:45 a.m. to offsite AM & Full Day Workshops at JHU
6. Mid morning pick-up for workshop leaders at MWH @10:30 a.m. to offsite at JHU
7. Load bus at drop off location JHU at 12 p.m., AM Workshop ends
8. Depart JHU at 12:15 p.m. to MWH

PM Workshop Schedule

1. Buses depart from MWH @ 12:30 p.m. to PM Workshops at JHU
2. Load bus at drop off location JHU at 5 p.m., PM & All Day Workshop(s) end
3. Depart location JHU at 5:15 p.m. to MWH.

Welcome to Baltimore– “Charm City“

Baltimore, nicknamed Charm City for its tradition and civic pride, is the 12th largest U.S. city and a major port on the East Coast. Since the redevelopment of the Inner Harbor in the late 1970s, Baltimore has set the standard for urban renewal and is now a major travel destination. The Inner Harbor, a scenic and popular waterfront area, has dozens of retail stores, restaurants and attractions. This, combined with Baltimore's easy accessibility, makes the city an ideal place to visit.

History

The city originated in the 1700s because of the economic needs of Maryland farmers. The location was blessed with a natural harbor on the Chesapeake Bay and a number of potential mill sites on flowing streams. A customs house was built in 1729, and the governor of the state approved Baltimore as a town that same year. It was named after the founding proprietor of the Maryland Colony, Lord Baltimore.

In response to what was seen as harassment from the British, America declared war in 1812. A British admiral said, “Baltimore is a doomed town.” The British were unsuccessful, however, thanks to the guns and heroism at Fort McHenry. Francis Scott Key's poetic commemoration of the bombardment was later set to music and became the national anthem.

Over the years Baltimore prospered as a port for foreign trading, especially in flour. The city helped to build B&O railroad as an overland link to the Midwest. The Civil War left Baltimore suffering, even though Maryland did not secede from the Union. It recovered eventually and remained an important point of entry for immigrants and displaced Southerners. A devastating fire in 1904 ruined much of the business district and many historic sites. It recovered rapidly and prospered through the First World War and into the ’20s until the Great Depression. After WWII, the city's population shrank as people moved to the outlying areas. In the ’70s the city came back with urban renewal and a revitalized downtown area that is still visible today.

Education

Johns Hopkins University, established in 1875, is one of oldest and most well-known schools in the city. Its Applied Physics Laboratory (APL) is a division of the university co-equal to the nine schools, but with a nonacademic mission. APL, located between Baltimore and Washington, is noted for contributions to national security, space exploration and other civilian research and development. Many other colleges and universities are located here, including the University of Baltimore, the University of Maryland-Baltimore, Morgan State University, Goucher College, Loyola College, and Coppin State University.

Things To Do in Baltimore

• *National Aquarium*

Located in the Inner Harbor, the aquarium is world-reknowned for its Dolphin Show and beautiful ceiling-to-ceiling tanks. Coming in December 2007 is Immersion Theater, including sights, sounds and smells. Order tickets in advance to avoid lines, www.aqua.org.

• *Maryland Science Center*

Especially kid-friendly, the science center features many interactive exhibits that focus on physics, as well as astronomy and marine biology. Among the more popular recent exhibits were three-dimensional nebula models and a giant meteor hanging from the ceiling of the main hall. Tickets can include IMAX movies. 601 Light St., at Inner Harbor. Go to www.mdsci.org

• *Fort McHenry National Monument*

The American flag flying over Fort McHenry during the War of 1812 inspired Francis Scott Key to write the ‘Star Spangled Banner.’ The restored barracks hold exhibits of military and historical artifacts, and a trail runs along the water's edge, offering spectacular views of ships entering and leaving the busy harbor. Open daily 8 am to 5 p.m. Go to www.nps.gov/fomc for directions.

• Baltimore's World Trade Center

Called the world's tallest pentagonal building. It offers spectacular views of the Inner Harbor and Baltimore's historic waterfront neighborhoods from its 27th floor observation deck. Inner Harbor at 401 E. Pratt St. Admission. Go to www.baltimore.to/TopOfWorld.

• U.S.S. Constellation

Commissioned in 1855, the U.S.S. Constellation was the last all-sail ship built by the U.S. Navy. The historic vessel lies at anchor in Baltimore's Inner Harbor, where visitors can climb aboard and learn about the ship's history. 301 E. Pratt St. Go to www.constellation.org.

• Fell's Point

Nearby historic Baltimore waterfront neighborhood, Fell's Point is a must see. It is especially known for its cobblestoned St.s, historic old buildings, many shops, bars and restaurants.

Nearby Restaurants

Capital Grille, Inner Harbor, 500 E. Pratt St.
Aldo's, Italian, Little Italy, 306 S. High St.
Pazo, Mediterranean, 425 Aliceanna St.
The Oceanaire, Seafood, 801 Aliceanna St.
Charleston, Fells Point, 1000 Lancaster St.
Flemings, Steakhouse, 720 Aliceanna St.
Ruths Chris Steakhouse, 711 Eastern Ave.
Legal Seafood, 100 E. Pratt St.
Roy's Hawaiian Fusion, 720-B Aliceanna St.
California Pizza Kitchen, 201 E. Pratt St.
Five Guys, 201 E. Pratt St.
Houlihan's, 621 E. Pratt St.
James Joyce, Irish, 616 S. President St.
Vellegia's, Little Italy, 829 E. Pratt St.
Chipotles, 621 E. Pratt St.
M&S Grille, Seafood, 201 East Pratt St.

Traveling to Baltimore

—By Air

Baltimore Washington International Thurgood Marshall Airport (BWI) is the closest airport. It is a Southwest Airlines hub, but has hundreds of flights each day. Security lines are longest in the mornings. Also, Ronald Reagan Washington National Airport in D.C., and Dulles Airport in Virginia are within driving distance.

—By Car

Travel to Baltimore via I-95. The Marriott Waterfront Hotel is located in the Inner Harbor East, at 700 Aliceanna St. AAPT has an arrangement through Avis Rent A Car—the discount code is J945158. Check the AAPT website (www.aapt.org) for more details.

—By Train

Amtrak service is available from Baltimore's Penn Station at 1515 North Charles St. and also from a station at BWI . Check the Amtrak schedules online, www.amtrak.com.

Lodging Information

AAPT has reserved a block of rooms at the Baltimore Marriott Waterfront Hotel, Inner Harbor East. It is steps from Inner Harbor restaurants and shopping, the National Aquarium, Maryland Science Center & USS Constellation. Reservations can be made online or by calling 1-800-228-9290.

Special Events

SUNDAY, Jan. 20

H.S. Share-a-thon	5–7 p.m.	Grand Ballroom VI
Section Officers' Exchange	5–6 p.m.	Kent
SPS/AAPT Poster Reception	5–7 p.m.	Laurel AB
Exhibits Opening	8–10 p.m.	Grand Ballroom IV
Welcome Reception	8–10 p.m.	Grand Ballroom VI

MONDAY, Jan. 21

First-Timers Gathering	7–8 a.m.	Harborside D
Retirees' Breakfast (ticket)	7–8 a.m.	Essex A
Exhibit Show	8 a.m–2 p.m. and 4–6 p.m.	Grand Ballroom IV
Poster Session I	8–9 a.m. and 8:30–10 p.m	Grand Ballroom IV
High School Physics Teachers Recognition Day	8 a.m.–7 p.m.	Grand Ballroom VI
AAPT Job Fair	10 a.m.–2 p.m.	Grand Ballroom IV
Plenary Speech Paul Hewitt	11:15 a.m.	Grand Ballroom VI
High School Physics Teachers Luncheon	12:15–1:45 p.m.	Laurel
Young Physicists Meet and Greet	12:15–1:45 p.m.	Harborside D
High School Physics Teachers Recognition Day Reception	5:30–7 p.m.	Grand Ballroom VI

TUESDAY, Jan. 22

Breakfast for Two-Year College Faculty and Friends (ticket)	7–8 a.m.	Harborside D
Exhibit Show	8 a.m–2 p.m. and 4-6 p.m.	Grand Ballroom IV
AAPT Job Fair	10 a.m.–2 p.m.	Grand Ballroom IV
Poster Session II	8–9 a.m. and 8–10:30 p.m.	Grand Ballroom IV
Oersted Medal: Mildred Dresselhaus	11:15 a.m.–12:15	Grand Ballroom VI
Multi-Cultural/ International Luncheon (ticket)	12:15–1:45 p.m.	Laurel
Symposium on Physics Education	1:45–3:45 p.m.	Grand Ballroom VI
Great Book Giveaway	5:15–6 p.m	Grand Ballroom IV
Awards: Richtmyer & Melba Newell Phillips	7:30–9 p.m.	Grand Ballroom VI

WEDNESDAY, Jan. 23

Plenary Speech Mario Livio	11:15 a.m.	Grand Ballroom VI
Screening of *Absolute Zero*	12:15–1:45 p.m.	Laurel
Awards Ceremony: Presidential Transfer, Distinguished Service Citations, & AIP Awards	2–3 p.m.	Grand Ballroom VI

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2008

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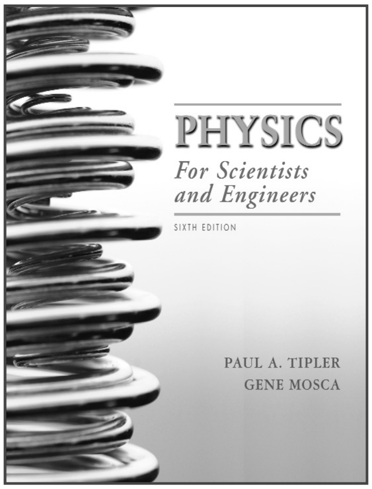

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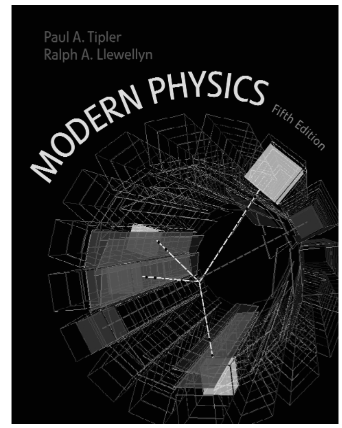

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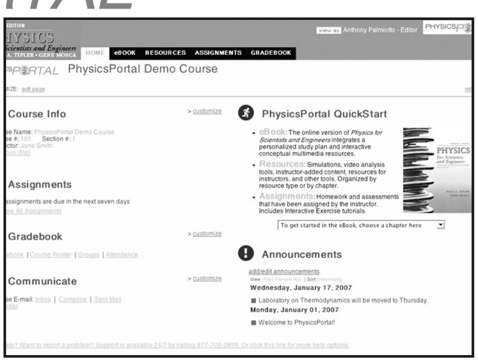

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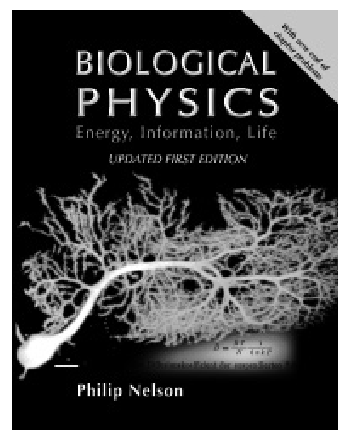

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Exhibitors

Exhibit Hall Hours: Sunday: 8–10 p.m.

Monday and Tuesday: 8 a.m.–2 p.m. and 4–6 p.m. (snack breaks 8–9 a.m. and 5–6 p.m.)

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AAPT Shared Book
Browse through featured titles from many publishers. The Great Book Giveaway will be held Tuesday at 5:15 p.m. when the books are raffled off. Purchase raffle tickets at the AAPT booth, Registration desk or Member lounge for 50 cents before Tuesday at 5 p.m. Proceeds benefit our Excellence in Education Fund.

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A display of artwork by artists whose work uses scientific principles, methodology, or imagery to directly inform the metaphorical basis of their work. The exhibit is curated by Craig Schaffer, a sculptor whose art has been shown at the American Center for Physics and the American Association for the Advancement of Science

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MRSEC-University of Maryland

Booth 213

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The Materials Research Science and Engineering Center (MRSEC) at the Univeristy of Maryland strives to meet the challenges that face science educators and K-16 students by enhancing sustainable practices and curriculum development in science, technology, engineering, and mathematics (STEM) education. The MRSEC booth will exhibit successful demonstrations, activity guides, and education outreach partnerships and programs desgined to inspire, teach, and guide students in the areas of science and engineering.

OP-TEC: National Center for Optics and Photonics Education

Booth 510

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OP-TEC: The National Center for Optics and Photonics Education, an NSF-ATE National Center of Excellence, is working with two-year college and industry partners in building a secondary-to-post-secondary pipeline of highly qualified students in photonics and the many technologies that are enabled by photonics. OP-TEC focuses on curriculum and instructional materials, assessment, faculty development and defining employer needs. The booth will feature curriculum materials, program planning guides, and career pathways information. To learn more about OP-TEC, visit their website at www.op-tec.org.

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Booth 402

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PTEC—Physics Teacher Education Coalition—a joint effort of APS, AAPT, and AIP, that addresses the critical need for producing more and better prepared physics and physical science teachers. The Coalition disseminates and promotes elements of successful teacher education programs.

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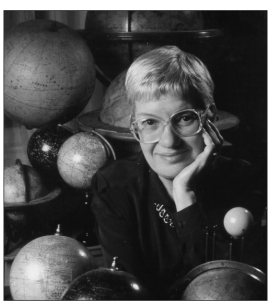
Mildred Dresselhaus

Oersted Medal—"Expanding the Audience for Physics Education," Mildred Dresselhaus, Institute Professor of Electrical Engineering and Physics at MIT, Cambridge, MA, *Tuesday, Jan. 22, 11:15 a.m., Grand Ballroom*

Mildred Dresselhaus was born and grew up in New York City where she received her undergraduate education at Hunter College. After a year of study at Cambridge University, and a year at Harvard University, she completed her A.M. degree at Radcliffe College/Harvard University. She completed her Ph.D. degree at the University of Chicago, with her Ph.D. thesis in 1958 on the subject of microwave properties of superconductors in a magnetic field. Following her doctoral studies, Dresselhaus spent two years at Cornell University as an NSF postdoctoral fellow, and then seven years as a staff member of the MIT Lincoln Laboratory in the Solid State Physics Division. It was during this period that she started her experimental studies on the electronic structure of graphite. She joined the MIT faculty in the Department of Electrical Engineering and Computer Science in 1967 and the Department of Physics in 1983. During this period she and her students established the presently accepted electronic structure of graphite, and went on to study graphite intercalation compounds leading to the study of carbon nanostructures. After she was named an Institute Professor in 1985, she started her studies on fullerenes and then on carbon nanotubes (1991) and today is back working on graphene, where it all started 45 years ago. In 2000-2001, she served as the Director of the Office of Science at the U.S. Department of Energy. During this time, on weekends, the focus of her research work was on the Raman spectroscopy of individual single wall carbon nanotubes.

Although Dresselhaus started college with the intention of teaching school children, she has made her academic career teaching physics to talented engineering students and expanding the horizons of women in physics. She is a member of the National Academy of Sciences, the National Academy of Engineering, the American Philosophical Society, and a Fellow of the American Academy of Arts and Sciences, the American Physical Society, the IEEE, the Society of Women Engineers, the American Association for the Advancement of Science, and the American Carbon Society.

Dresselhaus has served as President of the American Physical Society, Treasurer of the National Academy of Sciences, and President of the American Association for the Advancement of Science (AAAS). She is currently the Chair of the Governing Board of the American Institute of Physics. Dr. Dresselhaus has received numerous awards, including the National Medal of Science (1990). She also was the North American L'Oreal-UNESCO Laureate for Women in Science (2007) and was the recipient of the Buckley Prize of the American Physical Society (2008). She has 24 honorary doctorates and is the co-author of four books on carbon science. For relaxation, she is an enthusiastic chamber music player, where she plays either violin or viola, and enjoys spending time with her husband, four children, and four grandchildren.



Vera Rubin

Richtmyer Memorial Award— "Rotating Galaxies and Dark Matter," Vera Rubin, senior fellow, Carnegie Institution of Washington

Tuesday, Jan. 22, 7:30 p.m., Grand Ballroom

Vera Rubin is an observational astronomer who has studied the motions of gas and stars in galaxies and motions of galaxies in the universe for 75% of her life. Her work was influential in discovering that most of the matter in the universe is dark. She is a graduate of Vassar College, Cornell University, and Georgetown University (Ph.D.); George Gamow was her thesis professor. After 10 years as a researcher and faculty member at Georgetown, she moved in 1965 to the Department of Terrestrial Magnetism, Carnegie Institution of Washington, where she is now a Senior Fellow.

She is a member of the National Academy of Sciences, and the Pontifical Academy of Sciences. President Clinton awarded her the National Medal of Science in 1993.

Rubin has also received honorary degrees from Harvard, Yale, Princeton, and Smith College, among others. In 1996, she received the Gold Medal of the Royal Astronomical Society (London); the previous woman to receive this medal was Caroline Herschel in 1828. Rubin is active in encouraging and supporting women in science. Her husband and their four children are Ph.D. scientists.

ABOUT THE AAPT AWARDS:

- **Oersted Medal, established in 1936:** The Oersted Medal recognizes those who have had an outstanding, widespread, and lasting impact on the teaching of physics.
- **Richtmyer Memorial Award, established in 1941:** The Richtmyer Memorial Award recognizes outstanding contributions to physics and its communication to physics educators.
- **Melba Newell Phillips Medal, established in 1981:** The Melba Newell Phillips Medal is presented to an AAPT leader whose creative leadership and dedicated service have resulted in exceptional contributions within AAPT.


photo credit, Ken Cole

Judy Franz

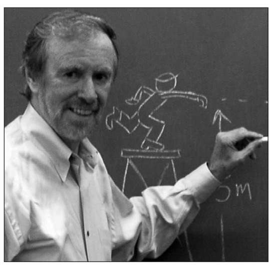
Melba Newell Phillips Medal — *Judy Franz,* Exec. Officer, American Physical Society, College Park, MD, *Tuesday, Jan. 22, 8:15 p.m., Grand Ballroom*

Judy Franz is a condensed matter physicist and has served as the Executive Officer of APS since 1994. In her current position, she is actively involved in the education, outreach, diversity, public affairs, and international programs of the APS. Before joining APS, she was a professor of physics at Indiana University, Bloomington; West Virginia University; and the University of Alabama, Huntsville. Throughout her professional career, she has been active in trying to improve physics education. She chaired the APS Committee on education in 1983-85 and served as President of AAPT in 1990.

In addition to her work at APS, Franz is the Secretary General of the International Union of Pure and Applied Physics (IUPAP), the international organization of physicists with more than 50 member countries. She is currently a member of the Governing Board and Executive Committee of the American Institute of Physics and is a representative to the U.S. National Committee to UNESCO.

In the past, she has served on the AAAS Council, as well as advisory committees for the Department of Energy, Los Alamos National Laboratory, the Office of Naval Research, and NSF.

Franz received her BA in physics from Cornell University and her MS and Ph.D. degrees from the University of Illinois, Urbana-Champaign. She is a fellow of APS, AAAS, and the American Association for Women in Science.



Paul Hewitt

Plenary Speaker — "Developing Conceptual Physics," Paul Hewitt, author, *TPT* column editor; *Monday, Jan. 21, 11:15 a.m., Grand Ballroom*

A silver-medalist boxing champion at 17, a cartoonist, a commercial artist, a soldier during the Korean War, a uranium prospector, and a sign painter—Paul Hewitt's passion for physics was amplified at the age of 26 while painting signs in Miami, FL. Fellow sign painter and science buff, Burl Grey, lit a fire in Hewitt that still glows today. Hewitt returned to his home in Massachusetts, applied for the GI Bill, and after three semesters at Newman Preparatory School in Boston, four years at Lowell Technological Institute, and two years at Utah State University, he began his 36-year teaching career in 1964 at City College of San Francisco (CCSF).

Five years into teaching, at the time of the first lunar landing, he wrote "Conceptual Physics." He tailored it to his nonscience physics class and was able to teach a broad span of physics by omitting numerical problem solving. By removing what most students saw as a roadblock to physics, his course attracted more than a thousand students, semester after semester, the largest elective course at CCSF.

In 1982, Hewitt's former student David Vasquez asked if he could bring a couple of video cameras into Hewitt's class for a semester. Teaching interpretations with video excerpts provided Vasquez his master's degree thesis in media arts. In 1989, while teaching at the University of Hawaii at Manoa, Hewitt was asked to teach his course in the campus TV studio as part of an experimental inter-island teaching program. DVDs of the CCSF and Hawaii lectures are popular today in classrooms well beyond San Francisco and Hawaii.

Hewitt has enjoyed guest teaching in various high schools in California and Hawaii. In addition, he has guest lectured at both the Manoa and Hilo campuses of the University of Hawaii and at the Berkeley and Santa Cruz campuses of the University of California. And for a decade he taught physics Wednesday evenings at San Francisco's Exploratorium. He retired from full-time teaching in 2000.

Hewitt's teaching has been recognized by AAPT's Millikan Award (1982) and the Exploratorium's Outstanding Educator Award (2000). Now retired, he is as busy as ever keeping his books current while enjoying the good life in Florida and California.

Mario Livio

Plenary Speaker — "Symmetry: From Human Perception to the Laws of Nature," *Mario Livio*, Head, Office of Public Outreach, Space Telescope Science Institute, Baltimore, MD; *Wednesday, Jan. 23, 11:15 a.m., Grand Ballroom*

Mario Livio is a senior astrophysicist and Head of the Office of Public Outreach at the Space Telescope Science Institute (STScI), the institute that conducts the scientific program of the Hubble Space Telescope. He received his Ph.D. in theoretical astrophysics from Tel Aviv University in Israel, was a professor in the Physics Department of the Technion-Israel Institute of technology from 1981 to 1991, and joined STScI in 1991. Livio has published more than 400 scientific papers and received numerous awards for research, for excellence in teaching, and for his books.

His interests span a broad range of topics in astrophysics, from cosmology to the emergence of intelligent life. He has done much fundamental work on the topic of accretion of mass onto black holes, neutron stars, and white dwarfs, as well as on the formation of black holes and the possibility to extract energy from them. During the past nine years his research focused on supernova explosions and their use in cosmology to determine the rate of expansion of the universe, and the nature of the "dark energy" that causes the cosmic expansion to accelerate.

In addition to his scientific interests, he is a self-proclaimed "art fanatic" who owns thousands of art books. In the past few years, he combined his passions for science and art in three popular books: "The Accelerating Universe," which appeared in 2000, "The Golden Ratio," which appeared in 2002, and "The Equation that Couldn't Be Solved," that has appeared in September 2005. The first book discusses "beauty" as an essential ingredient in fundamental theories of the universe. The second tells the story of the amazing appearances of the peculiar number 1.618... in nature, the arts, and psychology. The third book explores the role of symmetries in human perception, in science, in visual arts and music, and even in the selection of mates.

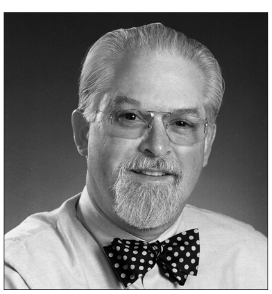
He lectures very frequently to the public and has given more than 20 full-day seminars to the public at the Smithsonian Institution in Washington, D.C. During the past few years, he has given public lectures at the Hayden Planetarium in New York, The Maryland Institute College of Art, the Cleveland Museum of Natural History, the Berlin Planetarium, the Edinburgh Planetarium, and many more.

His book "The Golden Ratio" won him the Peano Prize (2003) and the International Pythagoras Prize (2004) as the best popular book on mathematics.

Distinguished Service Citations

Wednesday, Jan. 23, 2–3 p.m., Grand Ballroom

Established in 1953, these citations are presented to persons in recognition of their exceptional contributions (e.g., committee, section, or editorial work) to physics teaching.



Dewey Dykstra

Dewey Dykstra has been attending AAPT meetings as a college professor since 1979. He has held Section Rep positions in the AOK and the ID-UT sections and chaired section meetings in both sections. He participated in the establishment of the ID-UT section. He has served a term on the Executive Board of AAPT. At national meetings he has been a member of the Computer, Pre-HS, Research in Physics Education, and Teacher Prep committees and chaired several of them. He helped establish the Pre-HS committee. He has also been a member of a number of ad hoc committees for AAPT. He has served as workshop leader at national meetings for workshops on single-board computers, Apple II interfacing, using spreadsheets, image formation by lenses, Powerful Ideas in Physical Science (PIPS), and Piaget beyond "Piaget." He has given many contributed and invited presentations at AAPT meetings, as well as, organized many sessions over the years. He has also contributed to several AAPT sponsored or sanctioned projects, such as the PIPS Project and the Conference on Computers in Physics Teaching. He is list-owner of PhysLrnR, the Physics Learning Research list.

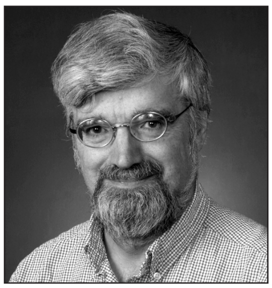
A high school physics teacher originally, Dr. Dykstra is currently professor of physics at Boise State University. His doctoral thesis was in the area of solid-solid phase transitions. As a member of the NSTA Audit Team for NCATE, he participates in making accreditation decisions on Science Teacher preparation programs across the country. His primary teaching focus is on inducing change in understanding about the phenomena studied. He applies this focus to the teaching of nonscience majors and courses for science teacher candidates. His grants and publications are developed out of the research he has conducted studying conceptual change from 4th grade on up to college age.

Distinguished Service Citations, Wednesday, Jan. 23


Andrew Graham

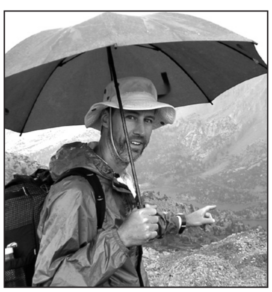
Andrew Jackson "Andy" Graham, Jr. earned his BS in Physics and Mathematics from Appalachian State University (ASU) in 1979. He completed his MS in Mathematics from ASU in 1989 and earned a Ph.D. in Theoretical Physics from Wake Forest University in 1999. Andy served as Associate Editor of the *The Physics Teacher* from 2000–2004. He has been a charter member of PIRA from the beginning of PIRA in 1984 to present day. Andy was also involved in getting TapL off the ground. He is currently employed as Director of Laboratories at ASU.

Andy has been married to Pamela Graham for 12 and a half years. He has two children and two grandchildren. Andy's oldest, Catherine, has a son Michael (14 years old) and a daughter Christine (8 years old). Andy's son Jackson has one daughter, Kayleigh, who is 15 years old. Andy's hobbies are playing racquet ball and practicing genealogy. He has been working on becoming a certified genealogist and hopes to do this in his spare time after he retires.


Tom Senior

Tom Senior came to teaching by a nonstandard route. He earned a BS in electrical engineering from Rutgers in 1970, and worked for Western Electric in Reading, PA, for two years before being laid off. The following several years allowed him the opportunity to explore alternative careers. Substitute teaching gave him an experience in teaching and brought him into the profession. Tom finished his Master's in Education at Temple University in 1976 while teaching physics at Radnor High School. After 13 years teaching in Pennsylvania, he moved to Illinois and has been teaching at New Trier High School since. While in Pennsylvania, Tom became active in the local AAPT section and served in several leadership positions. Since moving to Illinois, Tom has been president of the Chicago Section, served as host for the local physics teacher alliance meetings (ISPP and PNW).

In 1988 he became active in the Physics Teacher Resource Agent (PTRA) program, leading several workshops locally and at the summer meetings and co-authoring three workshop manuals. Tom has served on the Examinations Committee of AAPT and is presently serving on the Apparatus Committee and as secretary for PIRA.

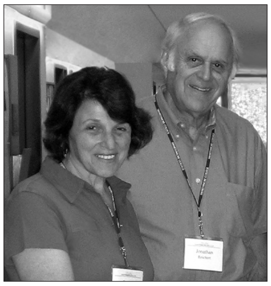

Chuck Stone

Chuck Stone has a BS in Nuclear Engineering from North Carolina State University, an MS in Nuclear Engineering from the University of Wisconsin, and a Ph.D. in Applied Plasma Physics and Fusion Engineering from UCLA. In 1991 he joined General Atomics to design nuclear reactor cores that produced special materials for nuclear weapons. In 1996 he launched a new career in higher education teaching physics and astronomy at both Forsyth Technical Community College and Winston-Salem State University. In 2001 he received Forsyth Tech's Excellence-in-Teaching Award. In 2002 he accepted a position at North Carolina A&T State University to teach physics and serve as the physics teacher education coordinator to the School of Education. From 2003 to 2006, Chuck was a member of the Executive Board of the AAPT. In 2005 he chaired the AAPT Committee on the World Year of Physics.

In addition to his work in industry and academia, Chuck has held posts as a U.S. Department of Energy Fellow at the Sandia National Labs and as a Visiting Scientist at the Arecibo Observatory. He is a manuscript referee for *The Physics Teacher* magazine, and has reviewed textbooks and developed curricula for several major physics and astronomy publishers. He has worked with nonprofit organizations to improve pre-service science teacher education programs, assist crossover teachers, and improve core science and general science curricula within our nation's K-12 schools. Chuck has been actively involved in efforts to improve the recruitment, retention, and graduation of minority students in science, technology, engineering, and mathematics programs. He has also developed several science outreach programs dubbed Communicating Science to Kids, Dr. Chuck's Amazing Astronomy Show, and Dr. Chuck's Physics Show, each designed to introduce elementary and middle school students to the magical wonders of science.

In 2007 Chuck joined the Colorado School of Mines as a Senior Lecturer in the Department of Physics, complementing the Mines curriculum and research programs that are geared toward responsible stewardship of the Earth and its resources. He strives to be a positive role model for the faculty, staff, and students who embody the School of Mines' ethics of hard work, technical proficiency, and self-reliance. In daily life, Chuck strives to integrate and balance what he calls "The Three A's: Academics, Arts, and Athletics." Each single area inspires the other two, and together, they help him maintain a positive, upbeat attitude toward his work, hobbies, and play. He is an avid bicyclist, climber, long-distance hiker, runner, and skier.

Distinguished Service Citations, Wednesday, Jan. 23

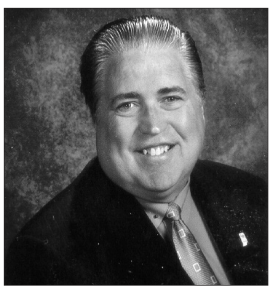


Barbara Wolf and Jonathan Reichert

For **Barbara Wolf** and **Jonathan Reichert**, what began as an avocation became a shared passion and AAPT was part of it every step of the way. Wolf and Reichert met at the 1991 AAPT summer meeting. Jonathan had always wanted to create a Pulsed NMR designed for teaching. During the honeymoon sabbatical year at Barbara's home in New Jersey, Jonathan reconnected with former student Norm Jarosik at an AAPT conference at Princeton. Together, they began building that first PNMR. Barbara had a grand time showing it off at TeachSpin's maiden vendor exhibit. In 1999, Jonathan left the University at Buffalo to give the growing company his full attention.

In 2000, Barbara moved from high school teaching to full-time marketing and began a telephone campaign to introduce TeachSpin to people teaching the advanced lab, first here in the United States, then throughout the world. TeachSpin soon became an informal network, connecting people new to advanced lab instruction with experienced practitioners. Through collaborations, we were able to take undergraduate laboratory experiments designed by masters in the field for their own schools and make them available worldwide.

A whole new level of involvement in the advanced lab community came after Jonathan's *AJP* guest editorial which prompted a suggestion that we help organize a new physics association devoted exclusively to advanced experimental instruction. With encouragement from both AAPT and APS, and financial and administrative resources provided by TeachSpin, ALPhA is under way with more than 100 members. We hope we have helped to put a spotlight back onto advanced experimental instruction.

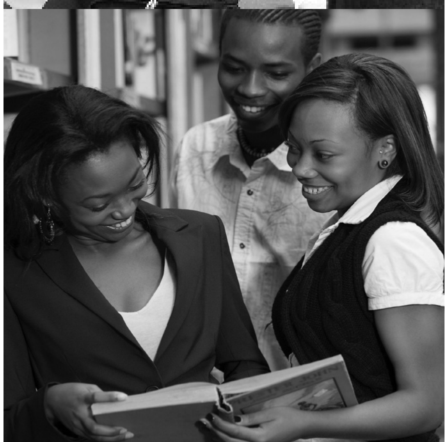


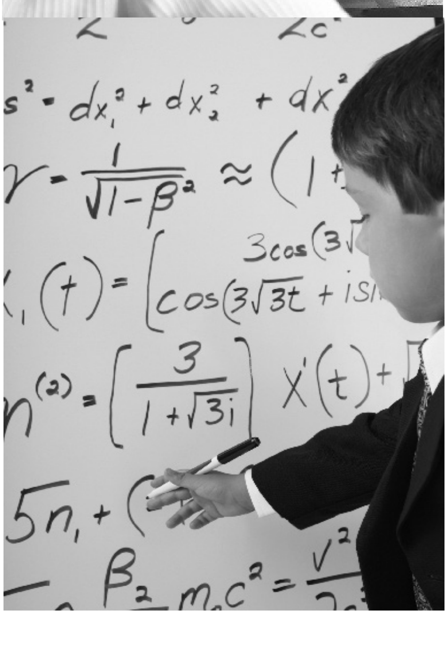
Mike Wolter

Mike Wolter spent his career teaching in the Muncie Indiana Community Schools. He spent one-year (2003-04) as the Teacher-in-Residence (TIR) at Ball State University. Mike was also an adjunct faculty member for Ivy Tech Community College in Muncie and in the Department of Physics and Astronomy at Ball State University. He was passionate about physics teaching and supporting the learning of his students at all levels.

Ball State University and Mike were associated with the AAPT/AIP/APS PhysTEC project. Mike took a major leadership role in the creation of the Induction and Mentoring component of the PhysTEC project and assured a scholarly level for the professional development program. Mike's leadership was recognized when he was appointed TIR representative for the PhysTEC Leadership Council. His work within PhysTEC had a national influence.

Mike served as President of and Section Representative for the Indiana Section of AAPT. As the AAPT Teacher Preparation Committee emerged Mike was always ready to organize a session or make a presentation, and also served as a member of the committee. Mike made presentations at every AAPT meeting from 2002 to 2007, including several invited talks. He was a co-leader in the PSSC Laboratory Exhibit at the summer meeting in Syracuse, NY Mike died on September 20, 2007, a week after he had received Distinguished Service Citations from the Indiana Section and the National AAPT, which were presented to him in his home.

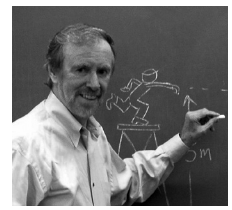


High School Physics Teachers Recognition Day

Monday, Jan. 21

8 a.m.–7 p.m. Grand Ballroom VI

- Plenary Address by Paul Hewitt, "Developing *Conceptual Physics*"



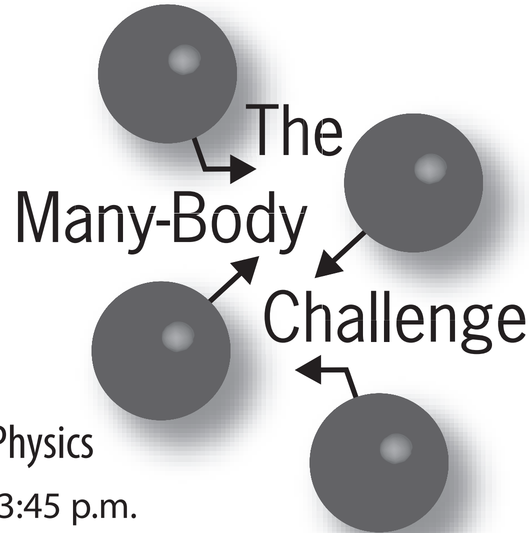
- Mike Neuschatz of the AIP Statistical Research Center, "The Central Atlantic Region: Leading Edge in High School Physics"
- Robert Morse, "Experimenting Along with Volta: From Electrostatics to Electric Current"
- Presentations on Physics First
- Celebratory Luncheon for high school physics teachers
- Reception for all attendees, 5:30–7 p.m.

John Layman, Session Chair

Welcome Remarks: James Stith, AIP
Harvey S. Leff, AAPT President
Lila Adair, AAPT President Elect

Second Annual

SYMPOSIUM on Physics Education



The Many-Body Challenge

The Full-Community Solution for Strengthening Teacher Recruitment, Preparation, and Retention in Physics

At the AAPT Winter Meeting • Jan. 22, 2008 • 1:45-3:45 p.m.
Baltimore Marriott Waterfront Hotel • Grand Ballroom VI

A strong STEM education is essential for securing knowledgeable workers and informed citizens for today's and tomorrow's highly technical world.

A strong STEM education starts in our schools and depends on a large supply of highly qualified teachers.

Physics stands at the base of STEM education.

Ensuring that we have a highly prepared and ready "workforce" of pre-college science and physics teachers requires the consistent and joint efforts of many sectors in our community: universities and school districts; corporations and foundations; and the federal, state, and local governments. Each has a crucial role to play; collaboration among the various groups is critical to our collective ability to recruit, prepare, and retain teachers of physics. With a serious shortage, high attrition, and anticipated high rates of retirement, the crisis needs our immediate and creative attention.

Leaders in teacher education within the sciences from business, schools and universities will address key questions:

- What is expected of a school district, a particular school, or an assistant principal regarding leadership, mentorship, new-teacher induction, support, and in-service opportunities?
- What can universities successfully do to attract students to teacher education in physics? Who is and should be responsible for these programs? What are the hallmarks of a strong district-university or state-university partnership?
- What should the role of industry be in advancing teacher education? What are some successful examples of corporate involvement?
- What have been the effect of federal legislation and the role of government (federal/state) in the area of teacher preparation: Funding, assessment, and certification issues?

New data will be unveiled at the Symposium about teacher preparation and readiness by the American Institute of Physics.

Featuring

Special AAPT Award Presentations

Speakers

Michael Lach, Officer of Teaching and Learning, Chicago Public Schools
Maura Banta, Director, Transition to Teaching Program; IBM *(invited)*
Patrick Callahan, Executive Director, CalTeach; University of California Office of the President
Marilyn Decker, Senior Program Director, Science; Boston Public Schools *(invited)*
Patrick Mulvey, Statistical Research Center, American Institute of Physics

The Symposium is organized by the American Association of Physics Teachers (AAPT).

BALTIMORE
AAPT 2008

Committee Meetings

SUNDAY, Jan. 20

Publications Committee	8–11 a.m.	Essex A
Area Chair Orientation	8 a.m.–12 p.m.	Kent
Meetings Committee	8 a.m.–12 p.m.	Laurel A
Resource Letters Editorial Board	11:30 a.m.–2 p.m.	Dover C
International Education Committee	1–3 p.m.	Laurel C
History and Philosophy Committee	1–3 p.m.	Iron
Women in Physics Committee	1–3 p.m.	Heron
Space Science and Astronomy Committee	1–3 p.m.	Dover A
Graduate Education Committee	1–3 p.m.	Dover B
Interest of Senior Physicists Committee	3–5 p.m.	Essex B
Minorities in Physics Committee	3–5 p.m.	Iron
Teacher Preparation Committee	3–5 p.m.	Laurel C
Section Officers' Exchange	5–6 p.m.	Kent
Programs Committee I	5–7 p.m.	Dover
Section Representatives	6–8 p.m.	Kent

MONDAY, Jan. 21

Apparatus Committee	8–9 a.m.	Harborside D
Undergraduate Education Committee	9–10:30 a.m.	Laurel A
Educational Technologies Committee	12:15–1:45 p.m.	Essex BC
Science Education for the Public Committee	12:15–1:45 p.m.	Dover C
Council Meeting	8–10 p.m.	Dover
Awards Committee	9–10 p.m.	Essex C
Bauder Fund	9–10 p.m.	Kent A
RIPE (Research In Physics Education)	9–10 p.m.	Essex A
RQEHSPT	9–10 p.m.	Essex B

TUESDAY, Jan. 22

Membership and Benefits Committee	7:30–9 a.m.	Essex BC
Venture Fund	8–9 a.m.	Essex A
Lotze Scholarship Committee	8–9 a.m.	Harborside E
Chesapeake Section Papers and Business Meeting (CSAAPT)	9–11 a.m.	Harborside D
Investment Advisory Committee	9:30–10:30 a.m.	Harborside E
PTRA Advisory Committee	12:15–1:45 p.m.	Harborside D
Two-Year College Committee	9–10 p.m.	Essex B
High School Committee	9–10 p.m.	Kent
Laboratories Committee	9–10 p.m.	Laurel AB
Pre-High School Committee	9–10 p.m.	Laurel CD
SI Units & Metric Education Committee	9–10 p.m.	Essex A
Professional Concerns Committee	9–10 p.m.	Dover C

WEDNESDAY, Jan. 23

Programs Committee II	7–9 a.m.	Kent
The Physics Bowl Advisory Group Meeting	7:30–9 a.m.	Heron

Meeting-at-a-Glance

Meeting-at-a-Glance includes committee meetings and other events, including snack breaks, plenary sessions, and receptions. Unless the room says JHU, all meeting rooms are in the Marriott Waterfront Hotel.

Friday, Jan. 18

6–8 p.m.		Pre-Registration Pick-up	Marriott Waterfront Hotel

Saturday, Jan. 19

7 a.m.–4:30 p.m.		Registration	Marriott, 3rd fl. Reg. Desk
8 a.m.–12 p.m.	T01	Online, Inquiry-Based Physics Courses, Virtual Labs – Really?	JHU-BC 168
8 a.m.–12 p.m.	T02	Tutorial: Mining the Internet	JHU-BC 278
8 a.m.–12 p.m.	W01	Teaching Assistant Training	JHU-BC 274
8 a.m.–12 p.m.	W02	Franklin and Electrostatics	JHU-BC 361
8 a.m.–12 p.m.	W03	Video-Based Motion Analysis for Homework & Classroom Use	JHU-BC 165D
8 a.m.–12 p.m.	W04	Seeing the Invisible Universe	JHU-BC 478 (front)
8 a.m.–12 p.m.	W05	Project CLEA	JHU-BC 165B
8 a.m.–5 p.m.	W06	High Performance Computing Education and Physics	JHU-BC 462
8 a.m.–5 p.m.	W07	New Teacher Handbook	JHU-BC 478H
8 a.m.–5 p.m.	W08	Physics by Design	JHU-BC 475
1–3 p.m.	T03	Building a Physics Exchange with International Teachers	JHU-BC 272
1–5 p.m.	W09	Exploring Beyond the Solar System	JHU-BC 278
1–5 p.m.	W10	Inquiry Based Learning for High School Teachers	JHU-BC 165A
1–5 p.m.	W11	Haunted Physics Laboratory	JHU-BC 165C & 165D
1–5 p.m.	W12	Building Physics Teachers Pedagogical Content Knowledge	JHU-BC 274

Sunday, Jan. 20

7 a.m.–4:30 p.m.		Registration	Marriott, 3rd fl. Reg. Desk
8–10 a.m.	T04	Civic Engagement and Service Learning: The SENCER Project	JHU-BC 272
8–11 a.m.		Publications Committee	Essex A
8 a.m.–12 p.m.		Meetings Committee	Laurel A
8 a.m.–12 p.m.		Area Chair Orientation	Kent
8 a.m.–12 p.m.	W14	Modeling Mechanics from Free Fall to Chaos	JHU-BC 475
8 a.m.–12 p.m.	W15	Preparing Pre-college Teachers to Teach Physics by Inquiry	Laurel D
8 a.m.–12 p.m.	W16	Environmental Physics	JHU-BC 462
8 a.m.–5 p.m.	W17	Using Research-Based Curricula	JHU-BC 165A
8 a.m.–5 p.m.	W18	Research-based Alternatives to Problems in Intro Physics	JHU-BC 176
11:30 a.m.–12:30 p.m.		Executive Board Luncheon	Faukland
11:30 a.m.–2 p.m.		Resource Letters Editorial Board	Dover C
12:30–4:30 p.m.		Executive Board II	Faulkland
1–3 p.m.		History and Philosophy Committee	Iron
1–3 p.m.		Women in Physics Committee	Heron
1–3 p.m.		Space Science and Astronomy Committee	Dover A
1–3 p.m.		Graduate Education Committee	Dover B
1–3 p.m.		International Education Committee	Laurel C
1–3 p.m.	T05	comPADRE	JHU-BC 274
1–5 p.m.	W13	Make and Take Elihu-Thompson Coil (PIRA 5k20.30)	JHU-BC 165D
1–5 p.m.	W19	Laboratories with Biomedical Applications	JHU-BC 165B
1–5 p.m.	W20	Recruiting Females into High School Physics Teaching	JHU-BC 361
1–5 p.m.	W21	TIPERS (Newtonian Tasks Inspired by Physics Education)	JHU-BC 276
1–5 p.m.	W22	Art of Approximation in Science and Engineering	JHU-BC 272
1–5 p.m.	W23	PER-based Tutorials	JHU-BC 475
1–5 p.m.	W24	Designing a Diagnostic Environment in Pre-College Classroom	JHU-BC 462
1–5 p.m.	W25	Tutorials in Introductory Physics	Essex A
1–5 p.m.	W26	Fluid Instabilities in the Kitchen and Ocean	JHU-BC 478H
1–5 p.m.	W27	The Physics of Toys: Force, Motion, Light and Sound	JHU-BC 478 (front)
1–5 p.m.	W28	Physics and Everyday Thinking (PET)	JHU-BC 278
3–5 p.m.		Interest of Senior Physicists Committee	Essex B
3–5 p.m.		Minorities in Physics Committee	Iron
3–5 p.m.		Teacher Preparation Committee	Laurel C
5–6 p.m.		Section Officers' Exchange	Kent
5–7 p.m.		Programs Committee I	Dover
5–7 p.m.		High School Share-a-Thon	Grand Ballroom VI

5–7 p.m.		SPS/AAPT Poster Reception	Laurel AB
5–7 p.m.		Crackerbarrel: A Physics on the Road Web Resource	Essex A
5–7 p.m.		SPS Poster Session and Reception	Laurel A
6–8 p.m.		Section Representatives	Kent
7–9 p.m.		Registration	3rd Floor
8–10 p.m.		Grand Opening of Exhibit Hall	Grand Ballroom IV
8–10 p.m.		Welcome Reception	Grand Ballroom VI

Monday, Jan. 21

7–8 a.m.		First-Timers Gathering	Harborside D
7–8 a.m.		Retirees Breakfast (ticket)	Essex A
7:30–5 p.m.		Registration	3rd Floor Registration
8 a.m.–7 p.m.		High School Physics Teachers Recognition Day	Grand Ballroom VI
8–9 a.m.		Apparatus Committee	Harborside D
8–9 a.m.	PST1	Poster Session 1 – Lectures/ Classroom & Astronomy	Grand Ballroom IV
8–9 a.m.	AA	High School Physics Teachers Recognition Day	Grand Ballroom VI
8–9:30 a.m.	CW3	Cenco Physics – from Sargent Welch	Iron
8–9:30 a.m.	CW7	It's About Time–Active Physics	Heron
8 a.m.–2 p.m.		Exhibit Show	Grand Ballroom IV
8–9 a.m.		Exhibit Show with snacks	Grand Ballroom IV
9–10 a.m.	AGG	The National Aquarium as a Physics Resource	Dover C
9–10:30 a.m.		Undergraduate Education Committee	Laurel A
9–11 a.m.	AB	Physics First Book Review	Grand Ballroom VI
9–11 a.m.	AC	Research Experiences for High School Teachers	Laurel AB
9–11 a.m.	AD	Gender Issues in High Schools	Laurel CD
9–11 a.m.	AE	Physics in America and Russia	Essex BC
9–11 a.m.	AF	Teacher Preparation	Kent
9–11 a.m.	AI	Cutting Edge Research in Simple English	Harborside D
9–11 a.m.	AJ	SPS Oral Session	Essex A
9–11:30 a.m.	AG	Placing Computational Physics in Undergraduate Curricula	Dover AB
9:45–11:15 a.m.	CW2	Arbor Scientific – A New Twist on Rotational Inertia	Heron
9:45–11:15 a.m.	CW4	Cenco Physics – from Sargent Welch	Iron
10–11:20 a.m.	AH	Teaching Physics Around the World	Dover C
10 a.m.–2 p.m.		AAPT Job Fair, Exhibit Hall	Grand Ballroom IV
11:15–12:15 p.m.	AK	Plenary – Paul Hewitt	Grand Ballroom VI
12:15–1:45 p.m.		Educational Technologies Committee	Essex BC
12:15–1:45 p.m.	BA	Crackerbarrel: Professional Development	Kent
12:15–1:45 p.m.	BAA	Crackerbarrel: For TYC Faculty	Essex A
12:15–1:45 p.m.	BB	Crackerbarrel: Professional Concerns of PER Grad Students	Dover AB
12:15–1:45 p.m.	CW8	JHU Center for Talented Youth	Heron
12:15–1:45 p.m.	CW15	WebAssign – And You Thought it Was About Homework	Iron
12:15–1:45 p.m.		Science Education for the Public Committee	Dover C
12:15–1:45 p.m.		High School Physics Teachers Recognition Day Luncheon	Laurel
12:15–1:45 p.m.		Young Physicists Meet and Greet (Gen Xers mix and mingle)	Harborside D
1:45–3:15 p.m.	BBB	APS Plenary: Large Hadron Collider	Grand Ballroom VI
3:30–5:15 p.m.	CW9	MIT OpenCourseWare–Highlights for H.S.	Heron
3:30–5:15 p.m.	CW13	Vernier–What's New in Physics Data Collection	Iron
3:30–5:30 p.m.	BC	Award Winning Undergrad. Research Programs	Laurel AB
3:30–5:30 p.m.	BD	CASTLE Teaching	Laurel CD
3:30–5:30 p.m.	BE	Using Remote Telescopes	Essex BC
3:30–5:30 p.m.	BF	Physics Education Research	Kent
3:30–5:30 p.m.	BG	Physicists in the Medical Profession	Dover AB
3:30–5:30 p.m.	BH	Interactive Lecture Demonstrations	Dover C
3:30–5:30 p.m.	BHH	Topics in Physics	Heron
4–6 p.m.		AAPT Job Fair, Exhbit Hall	Grand Ballroom IV
4–6 p.m.		Exhibit Show	Grand Ballroom IV
5–6 p.m.		Exhibit Show with snacks and cash bar	Grand Ballroom IV
5:30–7 p.m.		High School Physics Teachers Recognition Day Reception	Grand Ballroom VI
5:30–7:30 p.m.	CW11	Teachspin–the Essential Quantum Paradox	Heron
7–9 p.m.	T06	Providing Feedback: A Taste of RTOP	Heron
7–8:30 p.m.	BJ	The Use of Labs in a Physics First Class	Laurel CD
7–8:30 p.m.	BK	Future Technologies	Essex BC
7–8:30 p.m.	BL	Physical Science Courses for Pre-Service K-8 Teachers	Kent
7–8:30 p.m.	BN	The Best of comPADRE	Dover AB
7–9:20 p.m.	BO	Labs and Wikis	Dover C

7–8:30 p.m.	BP	Minority Science and Engineering Improvement Program	Essex A
8–10 p.m.		AAPT Council Meeting	Dover
8:30–10 p.m.	BI	Crackerbarrel: Textual Material for First Course in Physics	Laurel CD
8:30–10 p.m.	PST1	Poster Session	Grand Ballroom IV
9–10 p.m.		RQEHSPT	Essex B
9–10 p.m.		Awards Committee	Essex C
9–10 p.m.		Bauder Fund	Kent A
9–10 p.m.		RIPE (Research In Physics Education)	Essex A

Tuesday, Jan. 22

7–8 a.m.		Breakfast for Two-Year College Faculty and Friends (ticket)	Harborside D
7:30–9 a.m.		Membership and Benefits Committee	Essex BC
7:30 a.m.–5 p.m.		Registration	Marriott, 3rd floor
8–9 a.m.		Poster Session II – Teacher Training, Physics Ed. Research	Grand Ballroom IV
8–9 a.m.		Venture Fund meeting	Essex A
8–9 a.m.		Lotze Scholarship Committee	Harborside E
8–9 a.m.		Exhibit Show with snacks	Grand Ballroom IV
8 a.m.–2 p.m.		Exhibit Show	Grand Ballroom IV
8–9:30 a.m.	CW12	TI–Introducing the TI-Nspire CAS Learning Technology	Heron
8–9:30 a.m.	CW5	CPO Science–Teaching Intro. E&M	Iron
9–10:30 a.m.	CG	Closing the Gap Between Understanding and Action II	Essex A
9–11 a.m.	CA	Physics and Art	Laurel CD
9–11 a.m.	CAA	Educational Technologies	Laurel AB
9–11 a.m.	CB	Physics Teacher Preparation Program Accreditation	Essex BC
9–11 a.m.	CC	Relating Undergraduate Math and Physics Educ.	Kent AC
9–11 a.m.	CD	Medical Physics – Education and Careers	Grand Ballroom VI
9–11 a.m.	CE	Directions of the New NSF Division	Dover AB
9–11 a.m.	CF	Classroom Strategies	Dover C
9–11 a.m.		Chesapeake Section Papers and Business Meeting (CSAAPT)	Harborside D
9 a.m.–2 p.m.		AAPT Job Fair, Exhibit Hall	Grand Ballroom IV
9:30–10:30 a.m.		Investment Advisory Committee	Harborside E
9:45–11:15 a.m.	CW6	Educational Innovations–My Best Physics Lessons	Heron
9:45–11:45 a.m.	CW14	W.W. Norton–Online Homework with Smartwork	Iron
11:15 a.m.–12:15 p.m.	CDD	Oersted Medal Presentation and Speech	Grand Ballroom VI
12:15–1:45 p.m.		PTRA Advisory Committee	Harborside D
12:15–1:45 p.m.		Multi-Cultural/International Luncheon	Laurel
12:15–1:45 p.m.	DA	Crackerbarrel: International Student Exchanges	Dover C
12:15–1:45 p.m.	DB	Crackerbarrel: Preparing Future K-12 Teachers	Essex A
12:15–1:45 p.m.	CW1	The ADS for Physics Teachers	Iron
12:15–1:45 p.m.	CW16	American 3B Scientific Workshop	Heron
12:15–1:45 p.m.	DC	Crackerbarrel: Professional Concerns of PER Faculty	Essex BC
12:15–1:45 p.m.	DD	Crackerbarrel: Professional Concerns of PER Solo Faculty	Kent
12:15–1:45 p.m.	DE	Crackerbarrel: Efficacy of Outreach Programs for NSF	Dover AB
1:45–3:45 p.m.	DBB	Symposium on Physics Education: The Many Body Challenge	Grand Ballroom VI
4–5 p.m.	DF	Lobbying for Physics	Laurel AB
4–5:30 p.m.	CW10	Physics2000.com Free Workshop	Heron
4–5:30 p.m.	DI	High-Quality Scientific Reasoning	Kent
4–6 p.m.	DG	How to Get a Math-Science Grant	Laurel CD
4–6 p.m.	DH	Data Mining	Essex BC
4–6 p.m.	DHH	Exploring the Energy Frontier at CERN Large Hadron Collider	Grand Ballroom VI
4–6 p.m.	DJ	Medical/Health Physics Research and Education	Dover AB
4–6 p.m.	DK	Statistical and Thermal Physics in the Undergrad Curriculum	Dover C
4–6 p.m.	DL	Celebrating Women in Physics in the Baltimore Area	Essex A
4–6 p.m.		Exhibit Show	Grand Ballroom IV
5–6 p.m.		Exhibit Show with snacks and cash bar	Grand Ballroom IV
5:15–6 p.m.		Great Book Give Away, Exhibit Hall	Grand Ballroom IV
7:30–9 p.m.	DM	Awards Session – Richtmyer and Melba Newell Phillips	Grand Ballroom VI
8:30–10 p.m.	PST2	Poster Session II	Grand Ballroom IV
9–10 p.m.		Two-Year College Committee	Essex B
9–10 p.m.		High School Committee	Kent
9–10 p.m.		Laboratories Committee	Laurel AB
9–10 p.m.		Pre-High School Committee	Laurel CD
9–10 p.m.		SI Units & Metric Education Committee	Essex A
9–10 p.m.		Professional Concerns Committee	Dover C

Wednesday, Jan. 23

7–9 a.m.		Programs Committee II	Kent
7:30–9 a.m.		The Physics Bowl Advisory Group Meeting	Heron
7:30 a.m–3:30 p.m.		Registration	Marriott, 3rd Floor
8–9:30 a.m.	EA	Women in Science Policy	Laurel CD
8–9:30 a.m.	EB	Upper Level Labs for the Biosciences	Essex A
8–9 a.m.	EC	RTOP Implementation	Essex BC
8–11 a.m.	ED	Information Fluency and Physics Curriculum	Dover AB
9:15–10:45 a.m.	EE	Frontiers in Space Science and Astronomy	Dover C
9:15–11 a.m.	EH	Ethics in Research	Laurel AB
9:30–11 a.m.	EF	Innovations in Teacher Preparation: Recruitment	Essex BC
9:30–11 a.m.	EJ	Gender in Science	Laurel CD
11:15–12:15 p.m.	EGG	Plenary – Mario Livio	Grand Ballroom VI
12:15–1:45 p.m.		Screening of NOVA sponsored film, *Absolute Zero*	Laurel
12:15–1:45 p.m.	FA	Crackerbarrel: Work Load Equity	Essex BC
12:15–1:45 p.m.	FB	Crackerbarrel: Using History and Philosophy	Essex A
12:15–1:45 p.m.	FC	Crackerbarrel: Role of Student Evaluations	Dover AB
12:15–1:45 p.m.	FD	Crackerbarrel: Physics and Society Education	Dover C
2–3 p.m.	FE	Ceremonial Session: Awards & Presidential Transfer	Grand Ballroom VI
5:30–8:30 p.m.		Executive Board III	Faulkland

Workshop Abstracts

Saturday, Jan. 19

Note: Most of the Saturday and Sunday workshops will be held in the Bloomberg Center for Physics & Astronomy at Johns Hopkins University (JHU–BC), unless otherwise noted.

T01: Online, Inquiry-Based Physics Courses and Virtual Laboratories–Really?

Sponsor: Committee on Educational Technologies
Date: Saturday, Jan. 19
Time: 8 a.m.–12 p.m.
Location: JHU-BC 168

Gerald W. Meisner, Office of Research & Partnerships, 3607 HHRA Bld., UNC Greensboro, Greensboro, NC; gerald.meisner@gmail.com

Online learning will play an increasingly important role in educating tomorrow's scientists and engineers. To be both pedagogically and cost-effective, the challenge of offering inquiry-based, highly interactive, asynchronous or synchronous laboratory-based courses must be met. These courses must be based on proven pedagogy and include decision-making, selection of instrumentation, data collection and analysis, the ability to make realistic mistakes and transferable lab skills. Central to the laboratory environment is the dialog between user and virtual tutor; branching based on student answers permit nearly one-to-one guidance. A back-end database permits extensive research on cognitive learning. This approach can be used for Just in Time Learning (JITL), Remediation, Tutorials, Interactive Assessment and Problem-Based Learning. You will be given an account to see how this novel approach works. Participants are encouraged to bring wireless-enabled laptops.

T02: Tutorial: Mining the Internet

Sponsor: Committee on Graduate Education in Physics
Time: 8 a.m.–12 p.m.
Date: Saturday, Jan. 19
Location: JHU-BC 278

Pat Viele, 286 Clark Hall, Cornell University, Ithaca, NY 4850-2501; ptv1@cornell.edu

The Internet and World Wide Web are growing at an amazing rate. This tutorial is designed to give participants skills for fast, efficient searching of the Internet. In this digital age, skill in evaluating the information one finds on the Internet is essential. This tutorial will also offer some guidelines for evaluating information.

W01: Teaching Assistant Training

Sponsor: Committee on Laboratories
Co-sponsor: Committee on Graduate Education in Physics
Date: Saturday, Jan. 19
Time: 8 a.m.–12 p.m.
Location: JHU-BC 274

Jennifer M. Blue, 133 Culler Hall, Miami University, Oxford, OH 45056; bluejm@muohio.edu

Kathleen Harper, David Abbott

Graduate students enter the role of lab teaching assistant with little or no training for the work they are about to do. This workshop is intended to help university and college personnel involved in TA training develop, evaluate, and improve training programs for lab TAs. Participants will explore a variety of issues including training objectives, training techniques, local challenges, community building, and program evaluation. Each participant will take away a CD of resources from successful TA training programs.

FOR THOSE AT THE WORKSHOPS!

A buffet lunch may be purchased by all off-site workshop attendees at the Space Telescope Science Institute Cafeteria. The Space Telescope Science Institute is located across the street from the Bloomberg Center at Johns Hopkins University. *The cost is $12 per person.*

W02: Franklin and Electrostatics

Sponsor: Committee on History & Philosophy of Physics
Co-sponsor: Committee on Apparatus
Date: Saturday, Jan. 19
Time: 8 a.m.–12 p.m.
Location: JHU-BC 361

Robert A. Morse, St. Albans School, Washington, DC 20016; robert_morse@cathedral.org

Benjamin Franklin's experiments and observations on electricity established not only his reputation as a scientist, but also our electrical conventions and vocabulary, and the principle of charge conservation. In his letters, Franklin builds, tests, and defends his model with skill and eloquence, arguing from experiment and sharing both his wisdom and doubts, while clearly conveying his fascination with electricity. As Franklin was not formally schooled in mathematics, his theory was qualitative, and is an approachable example of hands-on and minds-on construction of a conceptual model with significant explanatory power. In this workshop, developed by the author at the Wright Center for Science Teaching at Tufts University, working with Franklin's descriptions, we will recreate many of his experiments using modern, inexpensive equipment. Participants will receive equipment and a CD-ROM containing the workshop manual, a collection of Franklin's letters relating to electricity, and movie clips illustrating the experiments.

W03: Video-Based Motion Analysis for Homework and Classroom Use

Sponsor: Committee on Educational Technologies
Date: Saturday, Jan. 19
Time: 8 a.m.–12 p.m.
Location: JHU-BC165D

Robert B. Teese, Rochester Institute of Technology, 54 Lomb Memorial Dr., Rochester, NY 14623; rbtsps@rit.edu

Patrick J. Cooney, Priscilla W. Laws, Maxine Willis

This workshop is for physics teachers who wish to explore the use of video-based motion analysis in a wide range of applications including the teaching laboratory, projects and homework. Participants will learn how to make digital video clips for analysis, as well as how to use video analysis for homework problems and in the classroom. We will discuss educationally effective uses of video analysis being developed in the LivePhoto Physics project, the Workshop Physics project and in other settings. Evaluation copies of analysis software, selected digital video clips and homework assignments will be provided to the participants for their use after the workshop. The software used in this workshop is available for both Mac and Windows computers. Participants in this workshop may find that some prior, hands-on experience with basic video analysis using software such as VideoPoint or VideoGraph will be helpful but is not required. (Format: Mac/PC)

W04: Seeing the Invisible Universe

Sponsor: Committee on Space Science and Astronomy
Date: Saturday, Jan. 19
Time: 8 a.m.–12 p.m.
Location: JHU-BC 478 (Front)

Mandy P. Frantti, 810 West M28, Munising, MI 49862; mpfrantti@hotmail.com

What's out there in our universe? Participants will engage in a captivating hands-on activity, observing different wavelengths of "light" or electromagnetic energy and what can be used to "block" it. Most wavelengths can't be seen with the eyes, so how scientists detect it and how that information is being used will be the focus of the session. Examine ultraviolet, infrared, radio, and find out about the most exciting of all—gamma rays and the distant universe! The activities can be done in a middle or high school classroom. (Brought to you by NASA using a GEMS guide for teachers.)

W05: Project CLEA: Observational Astronomy Simulations in the Instructional Laboratory

Sponsor: Committee on Space Science and Astronomy
Date: Saturday, Jan. 19
Time: 8 a.m.–12 p.m.
Location: JHU-BC 165B

Laurence A. Marschall, 300 N. Washington St., Physics Department, Gettysburg, PA 17325; dcooper@gettysburg.edu

Dick Cooper

Unlike most other sciences, astronomy is largely observational, not experimental, and making useful observations involves expensive equipment over time scales inconvenient for pedagogy. In recent years, however, the advent of large online databases and fast personal computers has made it possible to realistically simulate the experience of research astrophysics in the laboratory. Since 1992, Project CLEA (Contemporary Laboratory Experiences in Astronomy) has been developing such computer-based exercises aimed primarily at the introductory astronomy laboratory. We will review the 14 CLEA exercises that simulate important techniques of astronomical research and provide participants with CD-ROMS of the CLEA material, consisting of software, technical guides for teachers, and student manuals. Project CLEA is supported by grants from Gettysburg College and the National Science Foundation and is distributed free of charge to the educational community.

W06: High Performance Computing Education and Physics

Sponsor: Committee on Educational Technologies
Date: Saturday, Jan. 19
Time: 8 a.m.–5 p.m.
Location: JHU-BC 462

David A. Joiner, T-117 (NJCSTME) Kean University, 1000 Morris Ave., Union, NJ 07083; djoiner@kean.edu

Scott Lathrop

As modern applied physics becomes increasingly multi-disciplinary and computationally intensive, instruction in physics can benefit from the inclusion of high performance computational physics. Implementing High Performance Computing examples into physics curriculum faces challenges due to the lack of readily available hardware, software, and learning materials. Low-cost solutions for providing HPC environments to students will be presented, including a Live-CD environment (the bootable cluster cd, http://bccd.net) that can be used in standard PC labs without impacting local systems and a cluster kit project (LittleFe, http://littlefe.net). Lessons from the Computational Science Education Reference Desk (http://cserd.nsdl.org) will be presented that show the spectrum of computation from the desktop to small clusters to large-scale grid-enabled resources. Hands-on applications will allow participants to go through the process of turning a PC lab into a computer cluster, running parallel programs in a cluster environment, and using physics lessons based around research quality multi-physics simulations.

W07: New Teacher Handbook

Sponsor: Committee on Physics in High Schools
Date: Saturday, Jan. 19
Time: 8 a.m.–5 p.m.
Location: JHU-BC 478H

Jan L. Mader, 1900 2nd Ave. S, Great Falls, MT 59405; jan_mader@gfps.k12.mt.us

Mary Winn

With the decline in the number of physics graduates who enter the teaching profession, many teachers are assigned to teach physics and physical science with little or no formal preparation. *The New Teacher Handbook* is designed to provide the novice and experienced instructor who has been assigned physics or physical science with a standards and benchmark correlated learning cycle curriculum. Examples of lesson plans, lab activities, demonstrations and sample assessments for core topics kinematics to magnetism will be presented.

W08: Physics by Design: Strategies and Technologies to Support Diverse Learners

Sponsor: Committee on Physics in Pre-High School Education
Date: Saturday, Jan. 19
Time: 8 a.m.–5 p.m.
Location: JHU-BC 475

Julia Olsen, Steward Observatory / CAPER Team, 933 N Cherry Ave., Tucson, AZ 85719; jolsen@as.arizona.edu

Teaching science in diverse classrooms is a deeply complex and multifaceted process that can place extraordinary burdens on teachers. The current national emphasis on explicitly specified educational standards and high-stakes testing places a tremendous amount of responsibility on both teachers and administrators to ensure that all students achieve the same high levels. Unfortunately, simply adopting educational standards for all students does not automatically ensure acceptable academic achievement for diverse students and the very core of the issue centers on how to best provide an equal and excellent education to all students. The existence of a tension between equality and excellence often drives the unease that so many educators feel regarding inclusion of students with disabilities, English language learners, and students at-risk for failure. In short, teachers need to know which curriculum and instructional modifications, based on educational research, are most likely to support the science education of all students.

T03: Building a Physics Exchange with International Teachers

Sponsor: Committee on International Physics Education
Date: Saturday, Jan. 19
Time: 1–3 p.m.
Location: JHU-BC 272

Donald G. Franklin, Kennesaw State University, Dept. of Biology and Physics, Kennesaw, GA; dgfrank1@aol.com

We are part of the Global Community. As we have more students taking advantage of college exchanges, we need to do the same for the teachers and professors. We will discuss programs that are currently active and how they have developed. This is a good chance to bring your ideas as everyone will get a chance to comment.

W09: Exploring Beyond the Solar System

Sponsor: Committee on Space Science and Astronomy
Date: Saturday, Jan. 19
Time: 1–5 p.m.
Location: JHU-BC 278

Pamela K. Harman, SETI Institute, 515 N Whisman Rd., Mountain View, CA 94043; pharman@seti.org

Janelle M. Bailey, UNLV, NV; Pamela Greyer, NASA SEMAA, Chicago, IL ; Jack T. Howard, Rowan, Cabarrus, NC; Barbara Mattson, NASA GSFC, MD

Explore the biggest questions about our place in space and time. Many new astronomy learners, students, and adults alike, are unfamiliar with the universe beyond the solar system. This workshop provides an opportunity to deepen content knowledge and to practice strategies for teaching and learning about current scientific models and evidence for the origin and evolution of our universe of galaxies. The "Beyond the Solar System" project investigated student misconceptions and exemplary classroom strategies. Each participant will receive the project final product, a DVD produced for NASA Universe Education Forum at the Harvard-Smithsonian Center for Astrophysics. Key concepts, evidence, researchers, student ideas, and classrooms and resources will be presented from the DVD. Modeling the Universe, Exploring with Telescopes, Measuring Galaxies with Telescopes, and Cosmic Timeline inquiry-based lesson plans will be featured.

W10: Inquiry Based Learning for High School Teachers

Sponsor: Committee on Physics in High Schools
Date: Saturday, Jan. 19
Time: 1–5 p.m.
Location: JHU-BC 165A

Maxine C. Willis, Department of Physics and Astronomy, Dickinson College, Carlisle, PA 17013; willism@dickinson.edu

Priscilla Laws and Martin Baumberger

This is a hands-on workshop designed for teachers interested in using materials in their physics classes that will engage their students in active learning. Participants will gain experience working with curricular units in kinematics, dynamics, energy and optics from the updated Activity-Based Physics High School CD (ABP HSCD). These student-centered curricular modules are based on the outcomes of physics education research and are linked to the national standards. They make extensive use of computers for data collection and analysis. The outcome of this approach is that students learn physics by doing physics. The curricula on the ABP HSCD include: RealTime Physics, Tools for Scientific Thinking, Workshop Physics and Interactive Lecture Demonstrations. All of the equipment and software used in this workshop are compatible with both Mac and Windows computers and use interface equipment from both Vernier Software and Pasco.

W11: Haunted Physics Laboratory

Sponsor: Committee on Science Education for the Public
Date: Saturday, Jan. 19
Time: 1–5 p.m.
Location: JHU-BC 165C & 165D

Richard Flarend, 3000 Ivyside Park, Altoona, PA 16601; ref7@psu.edu

Nearly everyone enjoys Halloween. Combine this with physics, considered to be scary by most of the public, and you have a spooktacular Haunted Physics Lab to attract students to your department or community event. Children and adults will learn physics and be confronted by their misconceptions as they interact with displays and apparatus that illustrate phenomena from many areas of physics. Learn how to put on a Haunted Physics Lab at your school or elsewhere in the community while using mostly standard laboratory and demonstration equipment from your stockroom. Participants will receive a resource CD and some apparatus to create their own Haunted Physics Lab back home. See a description and pictures of some displays at http://www.aa.psu.edu/lionscience/hauntedlab.html.

W12: Building Physics Teachers' Pedagogical Content Knowledge

Sponsor: Committee on Teacher Preparation
Date: Saturday, Jan. 19
Time: 1–5 p.m.
Location: JHU-BC 274

Eugenia Etkina, 10 Seminary Place, New Brunswick, NJ 08901-1183; etkina@rci.rutgers.edu

Lee Shulman identified pedagogical content knowledge (PCK) as a necessary component of teacher knowledge—a blend of content and pedagogy that distinguishes the understanding of a content specialist from that of a pedagogue. PCK involves knowing students' original ideas and potential difficulties, alternative ways to represent those ideas, assessment strategies, and effective instructional methods within a particular discipline. What constitutes physics PCK and how can prospective and practicing physics teachers construct and improve theirs? What is the difference between PCK of a college instructor and a high school physics teacher? What elements of a teacher preparation program and what specific activities help physics teachers develop their PCK? In this interactive workshop participants will tackle the above questions and develop some strategies for the improving their own PCK, incorporating the building of teacher PCK into their physics courses, methods courses, and teacher preparation programs.

Sunday, Jan. 20 Workshops & Tutorials

T04: Civic Engagement and Service Learning: The SENCER Project

Sponsor: Committee on Professional Concerns
Co-sponsor: Committee on Physics in Two-Year Colleges, Committee on Physics in Undergraduate Education
Date: Sunday, Jan. 20
Time: 8–10 a.m.
Location: JHU-BC 272

Theo Koupelis, Univ. of Wisconsin-Marathon, Wausau, WI 54401; theo.koupelis@uwc.edu

This tutorial is aimed at those interested in improving physics education within the context of civic engagement (including service learning). During the tutorial we will describe the national dissemination program SENCER, which connects science and civic engagement by teaching "through" complex, capacious, and unresolved public issues and ways to participate in its activities. We will also discuss ways to include service learning in the physics curriculum using examples from across the country, and engage in group activities that will provide a springboard for making curricular changes that will make civic engagement an integral part of the physics curriculum.

W13: Make and Take Elihu-Thompson Coil (PIRA 5k20.30)

Sponsor: Committee on Apparatus
Date: Sunday, Jan. 20
Time: 1–5 p.m.
Location: JHU-BC 165D

Samuel M. Sampere, Syracuse University, Department of Physics, 201 Physics Building, Syracuse, NY 13244; smsamper@syr.edu

Stanley Micklavzina

Come and build this piece of apparatus that goes by many other names including the Thompson Coil, jumping ring, and ring flinger. In this workshop, all materials will be provided for you to assemble and test your new piece of apparatus complete with four different metal rings—aluminum, split aluminum, brass, and steel. After completing your unit, we will discuss some of the often overlooked details of its operation along with potential uses in your class or lecture room. These units easily fling the aluminum ring 6 m high. For pictures from a prior workshop, see: http://www.phy.syr.edu/courses/K-12/workshop_pictures_files/5_31_03/index.htm

W14: Modeling Mechanics from Free Fall to Chaos

Sponsor: Committee on Educational Technologies
Co-sponsor: Committee on Physics in Undergraduate Education
Date: Sunday, Jan. 20
Time: 8 a.m.–12 p.m.
Location: JHU-BC 475

Mario Belloni, Physics Department, Davidson College, PO BOX 6910, Davidson, NC 28036; mabelloni@davidson.edu

Wolfgang Christian, Anne J. Cox

Easy Java Simulations, Ejs, is a free and open source tool for creating Java simulations. Unlike other software programs designed to make programming easier for programmers, the structure of the Ejs environment allows users to focus on the process of building simulations, and therefore the underlying physics, as opposed to the technical aspects of building simulations. In this workshop participants will learn how to use Ejs to create simple and advanced simulations for mechanics. We will distribute on a CD the Ejs programming environment and several completed curricular units. The workshop will be based on templates that can be easily adapted to simulate other, more advanced, physical phenomena. Participants are encouraged to bring their own laptops with a CD drive and that the latest version of Java is installed.

The Open Source Physics Project is generously supported by the National Science Foundation (DUE-0442581).

W15: Preparing Pre-College Teachers to Teach Physics by Inquiry

Sponsor: Committee on Research in Physics Education
Co-sponsor: Committee on Teacher Preparation
Date: Sunday, Jan. 20
Time: 8 a.m.–12 p.m.
Location: Marriott Laurel D

Lillian C. McDermott, University of Washington, Department of Physics, Box 351560, Seattle, WA 98195-1560; peg@phys.washington.edu

This workshop focuses on how college and university physics faculty can contribute to the professional development of pre-college (K-12) teachers. Participants will have an opportunity to gain hands-on experience with Physics by Inquiry[1], instructional materials designed to provide teachers with the background needed to teach physics and physical science as a process of inquiry. Excerpts from a video produced by WGBH will be used to illustrate interactions between teachers and instructors during a course based on these instructional materials. Participants will also gain an understanding of how physics education research has guided the design of the curriculum. In addition, there will be a discussion of various intellectual and practical issues. Volumes I and II will be provided to participants.

1. L.C. McDermott and the Physics Education Group at the University of Washington, *Physics by Inquiry: An Introduction to Physics and Physical Science*, Volumes I and II (Wiley, New York, 1996). Development was supported, in part, by the National Science Foundation.
2. Physics by Inquiry: A Video Resource (WGBH, Boston, 2000). Development was supported, in part, by the National Science Foundation.

W16: Environmental Physics

Sponsor: Committee on Physics in High Schools
Date: Sunday, Jan. 20
Time: 8 a.m.–12 p.m.
Location: JHU-BC 462

David Gewanter, John Jay High School, 60 North Salem Rd., Rt. 121, Cross River, NY 10518; dgewanter@klschools.org

Jim Stewart, Western WA Univ

This workshop is a hands-on activity-based program adaptable to teaching grades 7–12. We will explore several units with an emphasis on the conservation laws, including Thermodynamics of Clothing, Solar House Design Project, which involves an understanding of solar geometry and energy use including software to evaluate the performance of the house throughout the year. The Sustainability Unit will have your students wondering how they can best protect their future on Earth. You will receive a CD with all workshop materials suitable for PC and Mac. Computers will be provided. However, you may use your own laptop.

W17: Using Research-Based Curricula and Computer-Supported Tools to Revitalize Your Introductory Course

Sponsor: Committee on Research in Physics Education
Co-sponsor: Committee on Educational Technologies
Date: Sunday, Jan. 20
Time: 8 a.m.–5 p.m.
Location: JHU-BC 165A

David R. Sokoloff, Department of Physics, 1274 University of Oregon, Eugene, OR 97403-1274; sokoloff@uoregon.edu

Ronald Thornton and Priscilla Laws

This hands-on workshop is designed for those who want to introduce active learning and computer tools into their introductory courses. We will introduce new approaches to teaching based on physics education research (PER) in lectures, labs, and recitations as well as studio and workshop environments. Among the approaches presented will be Interactive Lecture Demonstration (ILDs), Web-Based ILDs, RealTime Physics Labs, Activity Based Tutorials, Collaborative Problem-Solving Tutorials, Live Photo Assignments and Workshop Physics, as well as analytic modeling and video analysis tools. The computer tools used are available for both Macintosh and Windows computers. Results of studies on the effectiveness of these teaching strategies will also be presented. Current versions of the curricula, along with the book Teaching Physics with the Physics Suite by E.F. Redish will be distributed.

Partially supported by the National Science Foundation.

W18: Research-Based Alternatives to Traditional Problems in Introductory Physics

Sponsor: Committee on Research in Physics Education
Date: Sunday, Jan. 20
Time: 8 a.m.–5 p.m.
Location: JHU-BC 176

Kathleen A. Harper, Ohio State University, Dept. of Physics, 191 W Woodruff Ave., Columbus, OH 43210; harper.217@osu.edu

Thomas M. Foster, David P. Maloney

Accumulating research on problem solving in physics clearly indicates that traditional end-of-chapter exercises in physics texts are not useful and may actually hinder students' learning of important physics concepts. The research also raises questions about the efficacy of such tasks for helping students develop "problem-solving skills." In light of these results the question is, "What alternative tasks can we use to help students develop problem-solving skills and a conceptual understanding?" This workshop will review the research and then provide examples of several alternative tasks and their use.

T05: comPADRE (Tutorial)

Sponsor: Committee on Educational Technologies
Date: Sunday, Jan. 20
Time: 1–3 p.m.
Location: JHU-BC 274

Bruce Mason, Homer L. Dodge Dept. of Physics and Astronomy, 440 W. Brooks St., Norman, OK 73019; bmason@ou.edu

The comPADRE project is helping teachers and students of physics and astronomy, at all levels, find and share resources that will help them teach and learn. This tutorial will explore the comPADRE collections and tools. Topics covered will depend on the interests of the audience but will likely include example materials, item submission, personal filing cabinets, collaboration tools, and construction of topical modules. Wireless Internet connection has been requested so that participants who can bring their own computers will be able to have hands-on experience during the tutorial.

W19: Laboratories with Biomedical Applications

Sponsor: Committee on Laboratories
Co-sponsor: Committee on Apparatus
Date: Sunday, Jan. 20
Time: 1–5 p.m.
Location: JHU-BC 165B

Nancy Beverly, Mercy College, 555 Broadway, Dobbs Ferry, NY 10522; nbeverly@mercy.edu

A variety of laboratory activities that allow students to explore and deepen their understanding of physics in the context of medicine and biological processes will be presented. Participants will break into rotating groups to have the opportunity for hands-on experience with the different laboratory setups and more detailed discussion about the pedagogy and the apparatus with each presenter. Handouts for each laboratory activity will be available. Contextual topics of physics exploration will include diagnostic and therapeutic devices and their interactions with the body, bodily processes at different scales, and biological research techniques

W20: Recruiting Females into High School Physics Teaching: Issues, Actions, and Results

Sponsor: Committee on Physics in High Schools
Co-sponsor: Committee on Teacher Preparation
Date: Sunday, Jan. 20
Time: 1–5 p.m.
Location: JHU-BC 361

Patsy Ann Johnson, Department of Secondary Education/Foundations of Education, Slippery Rock University of Pennsylvania, Slippery Rock, PA 16057-1326; patsy.johnson@sru.edu

About one-half of all high school students in the United States taking physics courses are female. However, only about one-quarter of all their teachers are female. Why do people want to take or teach high school physics courses? What has caused this discrepancy in the proportions of female students and female teachers? How have these proportions changed over time? Is anyone hurt by this discrepancy? In what ways are people harmed? If the status quo is maintained, how long will it take for this discrepancy to be eliminated? If people wish to increase the rate of change, what can they do to encourage females to become high school physics teachers? Discussion in this workshop will be focused on these questions. Demographic statistics will be provided to help answer these questions. Recommendations based on education research will be summarized. Resources for further learning will be shared.

W21: TIPERS (Newtonian Tasks Inspired by Physics Education)

Sponsor: Committee on Physics in Two-Year Colleges
Date: Sunday, Jan. 20
Time: 1–5 p.m.
Location: JHU-BC 276

Curtis Hieggelke, Joliet Junior College, 1215 Houbolt Rd., Joliet, IL 60431; curth@comcast.net

David Maloney, Steve Kanim

This workshop will deal with various alternative task formats that can be used to make instructional materials that impact and improve student learning and understanding of physics concepts in mechanics. These exercises are based, in part, on efforts in Physics Education Research and thus are called TIPERs (Tasks Inspired by Physics Education Research). Such tasks support active learning approaches and can be easily incorporated into instruction in small pieces. This workshop will feature new TIPERs in area of mechanics but the techniques can be deployed in all areas of physics. The first part of the workshop will explore various formats, their characteristics, and how they can be used. Participants will work in groups to develop a set of TIPERs that address a concept, principle, or relationship in mechanics. These TIPERs sets will be shared with and critiqued by the group. More information about TIPERs can be found at http://tycphysics.org/tipers.htm.

Supported in part by a CCLI grant from the Division of Undergraduate Education of the National Science Foundation.

W22: Art of Approximation in Science and Engineering

Sponsor: Committee on Physics in Undergraduate Education
Date: Sunday, Jan. 20
Time: 1–5 p.m.
Location: JHU-BC 272

Sanjoy Mahajan, Teaching and Learning Lab & EECS, MIT, Room 5-122, Cambridge, MA 02139; sanjoy@mit.edu

Why, on a cold night, do you freeze under a thin sheet but not under a thick blanket? Exactly solving the heat-diffusion equations educates the computer that solves them but teaches us little. An approximate solution, however, emphasizes the essential physics: heat flux is proportional to temperature gradient and therefore heat loss is inversely proportional to blanket thickness. Approximation is an art, we will study the tools in the artist's toolbox, including divide and conquer, dimensional analysis, extreme-cases reasoning, and skillful lying. Using no mathematics beyond algebra, the approximation tools will help us investigate complex phenomena, such as the acoustics of xylophones (with a demonstration), the size of raindrops, or the fuel efficiency of a 747 compared to a car or a bicycle. When the going gets tough, the tough lower their standards...the better to enjoy the science and engineering embedded in the world around.

W23: PER-Based Tutorials with Instructor Resources to Facilitate Modification and Implementation

Sponsor: Committee on Research in Physics Education
Date: Sunday, Jan. 20
Time: 1–5 p.m.
Location: JHU-BC 475

Andrew Elby, Dept. of Physics, University of Maryland, College Park, MD 20742-4111; elby@physics.umd.edu

Rachel Scherr

Instructors who use PER-based "active-learning" materials find themselves facing common challenges. Many who use materials developed at another institution want to tailor the materials to fit the local curriculum, scheduling constraints, and student population. In addition, implementing new materials is always difficult, especially for instructors with limited experience using PER-based materials. To help address these challenges, we offer a package of open-source tutorials that come with resources designed to help instructors (i) modify the tutorials to suit local needs and (ii) implement the tutorials effectively. The instructor resources include video snippets of students using the tutorials. After introducing participants to the tutorials and accompanying instructor materials, which participants can take home on DVD, we provide an opportunity to work with us and with each other to modify one or more of the tutorials for use in class. If possible, please bring a laptop (Mac or PC) with Microsoft Word.

W24: Designing a Diagnostic Environment in the Pre-College Classroom

Sponsor: Committee on Research in Physics Education
Co-sponsor: Committee on Physics in High Schools
Date: Sunday, Jan. 20
Time: 1–5 p.m.
Location: JHU-BC 462

Stamatis Vokos, Seattle Pacific University, 3307 Third Ave West, STE 307, Seattle, WA 98119-1957; vokos@spu.edu

Pamela A. Kraus

A diagnostic learning environment is one in which assessments are used to identify students' evolving understanding and developing reasoning so that a teacher can identify productive and unproductive thinking and address specific difficulties with targeted instruction. While many teachers assess all the time, typically this means they identify whether the student has the "right" idea, and if not, the instruction presents more of the right idea. What we mean by a diagnostic learning environment closely parallels the diagnosis and prescription that a medical doctor does. The doctor doesn't just find out that you are not healthy. She/he assesses to find out, as specifically as possible, what the trouble is and then prescribes treatment to address that specific concern. Participants of this workshop will learn about and experience a diagnostic learning environment. In addition, participants will learn about the Diagnoser Project's free instructional tools to help diagnose pre-college student thinking.

W25: Tutorials in Introductory Physics

Sponsor: Committee on Research in Physics Education
Date: Sunday, Jan. 20
Time: 1–5 p.m.
Location: Marriott Essex A

Lillian C. McDermott, University of Washington, Department of Physics, Box 351560, Seattle, WA 98195-1560; peg@phys.washington.edu

Tutorials in Introductory Physics[1] is a set of instructional materials intended to supplement the lecture, textbook, and laboratory of a standard calculus-based or algebra-based introductory course. The tutorials are designed to address specific conceptual and reasoning difficulties that have been identified through research. In addition to providing hands-on experience with the curriculum, the workshop will include discussions of instructional strategies and results from assessments of student learning. Important aspects related to implementation of the tutorials will be covered, including preparation of graduate teaching assistants, undergraduate peer instructors, and post-docs. Copies of Tutorials in Introductory Physics will be provided to participants.

1. L.C. McDermott, P.S. Shaffer, and the Physics Education Group at the University of Washington, *Tutorials in Introductory Physics*, First Ed. (Prentice Hall, 2002).

Development was supported, in part, by the National Science Foundation.

W26: Fluid Instabilities in the Kitchen and Ocean

Sponsor: Committee on Science Education for the Public
Date: Sunday, Jan. 20
Time: 1–5 p.m.
Location: JHU-BC 478H

Matthew Briggs, PO Box 1663, MS P940, Los Alamos, NM 87545; briggs@lanl.gov

Robert Benjamin

We have developed a unique set of "kitchen physics" experiments that teach several important concepts of fluids and engineering. Based on the "Rayleigh-Taylor instability," these experiments elucidate the concepts of fluid density and pressure in a dramatic and unforgettable manner afforded by the student's attempts to control fluid instability. The experiments draw students' attention to the importance of fluid-fluid interfaces in controlling unstable flows that influence ecological and geophysical systems. Also, they introduce the students to "failure-mode analysis," an essential concept for engineering and applied physics. Because these phenomena make useful pranks, they teach students how physics knowledge nurtures personal power and self-esteem. These experiments are documented in the one-of-a-kind book about fluid instability, SPILLS AND RIPPLES, and we describe our 10-year experience presenting these activities to teachers and students.

W27: The Physics of Toys: Force, Motion, Light and Sound

Sponsor: Committee on Science Education for the Public
Co-sponsor: Committee on Physics in Pre-High School Education
Date: Sunday, Jan. 20
Time: 1–5 p.m.
Location: JHU-BC 478 (Front)

Ray Turner, Clemson University, Dept. of Physics and Astronomy, Clemson, SC 29634-0978; traymon@clemson.edu

Beverly A.P. Taylor

This hands-on workshop is designed for teachers at all levels in search of fun physics demonstrations, lab experiments, and interactive materials, through the use of ordinary children's toys. More than 50 toys will be demonstrated, and the physical principles related to these toys will be discussed. This workshop will concentrate on toys that illustrate the concepts of force, equilibrium, linear and rotational motion, optics and light, sound, and waves. You will have the opportunity to participate in both qualitative and quantitative investigations using some of these toys. The workshop leaders have found that toys can be utilized at all grades from kindergarten through college by varying the sophistication of the analysis. These same toys can also be used for informal presentations to public groups of all ages. Participants will be given a small assortment of toys to help start their own collection.

W28: Physics and Everyday Thinking (PET) and Physical Science and Everyday Thinking (PSET): Two New Curricula

Sponsor: Committee on Teacher Preparation
Co-sponsor: Committee on Physics in Pre-High School Education
Date: Sunday, Jan. 20
Time: 1–5 p.m.
Location: JHU-BC 278

Fred Goldberg, CRMSE, 6475 Alvarado Rd., Suite 206, San Diego, CA 92120; fgoldberg@sciences.sdsu.edu

Valerie Otero and Steve Robinson

Physics and Everyday Thinking (PET) and Physical Science and Everyday Thinking (PSET) are each one-semester courses that can serve the needs of both prospective and practicing elementary teachers and as a general education science course. Both PET and PSET engage students in four types of activities: (1) standards-based physics or physical science content, (2) nature of science, (3) learning about one's own learning, and (4) learning about the learning of elementary students. PET and PSET use a similar course pedagogy and activity sequence that is guided by research on student learning of physical science. The PET course content focuses on the themes of interactions, energy, forces and fields. PSET focuses on interactions, energy, forces and atomic-molecular theory. During much of the workshop participants will view and discuss video from college PET and PSET classrooms, and from elementary classrooms.

Supported in part by NSF Grant ESI-0096856.

PET and PSET are published by It's About Time, Herff Jones Education Division.

Monday, Jan. 21

T06: Providing Feedback to Improve Science Instruction: A Taste of RTOP

Sponsor: Committee on Teacher Preparation
Date: Monday, Jan. 21
Time: 7–9 p.m.
Location: Heron

Paul Hickman, 23 Rattlesnake Hill Rd., Andover, MA 01810; hickmanp@comcast.net

How do we break the cycle of "teaching as we were taught"? Can we really quantify science teachers' practice? Will formative feedback accelerate teachers' professional growth? Recent education scholarship asks that teachers include active-learning, inquiry-based, and problem-solving strategies in their science instruction (Beichner, 2004). These reform strategies have been proven to spark student interest in science, help students—especially women and under-represented minorities—learn more and get better grades, and lead students to enroll in advanced science courses (Handelsman, 2004). This tutorial will provide the rationale for studying teaching using classroom video and the Reformed Teaching Observation Protocol. We will engage participants in the exploratory use of the tool through selected video clips.

Commercial Workshop Abstracts

CW1: The ADS for Physics Teachers: A FREE Research Tool

Sponsor: ADS
Date: Tues., Jan. 22
Time: 12:15–1:45 p.m.
Room: Iron

Leader: Alberto Accomazzi and Donna Thompson

The NASA Astrophysics Data System (ADS) is a Digital Library portal for researchers and educators in Astronomy and Physics developed and operated by the Smithsonian Astrophysical Observatory. The ADS maintains a bibliographic database containing more than 6 million records and offers different search interfaces into the past and present literature, some of which are specifically catered to Physics and Astronomy Educators. Search results provide links to the full text of papers available from the publisher's websites or from the ADS full-text archive, which consists of over 500,000 astronomy articles freely available to the public. In addition to its search interfaces, the ADS provides the myADS Update Service, a free custom notification service for the recent literature in astronomy and physics. The service scans the literature added to the database weekly, and creates custom lists of recent papers according to each subscriber's profile, formatted to allow quick reading and access Subscribers are notified by email in HTML format or through an RSS feed. This workshop will highlight various uses of the ADS that would be helpful for classroom or research projects including:

- Using ADS's search forms
- myADS notification service
- Access to ADS's full-text

CW2: A New Twist on Rotational Inertia

Sponsor: Arbor Scientific
Date: Mon., Jan. 21
Time: 9:45–11:15 a.m.
Room: Heron

Leader: Steve Rea

Rotational inertia can be a difficult subject to teach. Come see this demonstration of a unique method to teaching a difficult subject using Arbor Scientific's new Rotational Inertia Demonstrator. This engaging apparatus provides an elegant method to do an investigation into angular motion. Discover an intriguing method to teach, in a "hands on" and quantitative format, angular acceleration, moment of inertia, torque and how they all relate to each other. The best way to captivate your student's attentention is for them to actually want to experiment on their own. This workshop will demonstrate how to accomplish this!

CW3: Cenco Physics Presents: Strangeness and Charm in Your Classroom

Sponsor: Cenco Physics from Sargent-Welch
Date: Mon., Jan. 21
Time: 8–9:30 a.m.
Room: Iron

Leader: Bob Reiland and Ted Zaleskiewicz

Quarks, leptons, and mesons have become standard topics in many high school and introductory college physics texts in the past decade. Many veteran physics teachers however are challenged to teach this material. Join two experienced teachers (both members of the Contemporary Physics Education project—CPEP) in exploring the basics and most recent discoveries in the field of particle physics. Using the CPEP developed teaching chart, The Standard Model of Fundamental Particles and Interactions, participants will explore the fundamental structure of baryons nad mesons, the current understanding of the "neutrino mass" problem, and the status the search for the elusive Higgs boson. In addition to interative discussion with the workshop leaders, participants will explore Rutherford scattering and fundamental particle detection by performing classroom tested, inquiry based activities. All participants will receive a copy of the CPEP chart, and several sets of apparatus for the activities will be given away.

CW4: Cenco Physics Presents: Bringing the Universe into Your Classroom

Sponsor: Cenco Physics from Sargent-Welch
Date: Mon., Jan. 21
Time: 9:45–11:15 a.m.
Room: Iron

Leader: Bob Reiland and Ted Zaleskiewicz

Since the early 1990's, major new technology developments have initiated a revolution in our understanding of the universe and its origins. In recent years new imaging techniques have made it possible to map concentrations of the material known as dark matter, and a new substance, known as dark energy has been discovered. For the most part these new developments are more and more present in state standards. Many of them are relatively easy to understand and also of high interest to students. Join two experienced CENCO teachers (both also members of the Contemporary Physics Education Project – CPEP) in exploring the teaching chart, The History and Fate of the Universe, as a vehicle to bring the understanding of dark energy and matter into your classroom. In addition, participants will have the opportunity to engage in several classroom tested inquiry based activities involving the expansion of the universe. All participants will receive a copy of the CPEP chart and a selection of activity materials.

CW5: Teaching Introductory E&M: What Comes First, Charge or Current?

Sponsor: CPO Science, School Science Specialty
Date: Tues., Jan. 22
Time: 8–9:30 a.m.
Room: Iron

Leader: Tom Hsu

The traditional approach to teaching Electricity and Magnetism begins with the modern understanding of charges and fields. Is this the most effective approach for high school physics, at any grade? Does this approach mirror how students came to understand electricity or magnetism? In this fun but intensive hands-on session, Dr. Tom Hsu will demonstrate an approach that builds to a true understand of fields by starting with the practical observables: voltage and current. This session explores how students engage with the content by investigating real systems such as; house wiring, ground fault interrupters, and lightning. The development of a modern understanding of Electricity and Magnetism proceeds intuitively and naturally from what students do with their own hands and see in their immediate environment.

Dr. Tom Hsu is the founder of CPO Science (formerly Cambridge Physics Outlet) the author of several unique published high school programs that include: textbooks, lab manuals and matching science equipment.

CW6: My Best Physics Lessons

Sponsor: Educational Innovations, Inc.
Date: Tues., Jan. 22
Time: 9:45–11:15 a.m.
Room: Heron

Leader: Ron Perkins, President & CEO

Having presented over 800 workshops and been awarded top national awards for science teaching, Ron will share a few of his best lessons in a hands-on environment. Teach excited states using lightsticks and phosphorescent vinyl, equilibrium using UV detecting beads and much much more!

CW7: Active Physics: Bridging Research and Practice

Sponsor: It's About Time
Date: Mon., Jan. 21
Time: 8–9:30 a.m.
Room: Heron

Leader: Dr. Arthur Eisenkraft

Research from cognitive sciences, motivational research and instructional models can inform the way in which we present physics content to students. Alongside the need for good instructional models that take into account results from research, physics instructors face the persistent issue of the need for differentiated instruction—challenging all students while not "dummying down the course" nor "driving the students from the course."

Teaching ALL students in our classes and avoiding attrition yet maintaining rigor, while be the focus of this workshop. The 7E instructional model will be presented with its link to research to how people learn. In addition, strategies for differentiating instruction will be presented. Finally, a "proof of concept" will be presented to demonstrate that this approach to designing lessons and courses can satisfy our needs for students to learn physics content, physics problem solving and the larger organizing principles of our discipline.

CW8: JHU CTY: Think Big, Exceed Expectations, Teach Physics

Sponsor: JHU Center for Talented Youth
Date: Mon., Jan. 21
Time: 12:15–1:45 p.m.
Room: Heron

Leader: TBA

For more than 25 years, the Center for Talented Youth at Johns Hopkins University (CTY) has helped spark future generations of physicists and astronomers. At 29 locations in the US and abroad, CTY matches bright, engaged students with passionate, talented educators. In this workshop, CTY staff members discuss the challenges and opportunities of spending the summer teaching exceptional middle and high school students. In addition, the presenters share syllabi, lessons plans, and teaching strategies from several of our most popular courses in the areas of physics, astronomy, and engineering: Astronomy, Principles of Engineering Design, Science and Engineering, Flight Science, and Fast-Paced High School Physics.

Through examining the curricular materials, CTY staff members illustrate the depth of learning that can take place by providing physics faculty with a teaching assistant, a generous lab budget, and a class of 12-18 talented students. The presentation includes information on how to become more involved in CTY, either through teaching or by recommending students as participants or staff. Participants will leave with an understanding of CTY and the benefits of teaching for it, as well as ideas they can apply to their own classrooms.

CW9: MIT OpenCourseWare—Highlights for High School

Sponsor: MIT OpenCourseWare
Date: Mon., Jan. 21
Time: 3:30–5:15 p.m.
Room: Heron

Leader: Daniel Carchidi, Ph.D., and Arnab Banerjee

Would you like to use the world famous lectures and demonstrations from Professor Walter Lewin's intro physics course at MIT for your AP students? Now you easily can!

MIT OpenCourseWare (OCW) is a free and open collection of MIT curricular resources used by high school students and teachers all over the world to supplement their coursework, reinforce lessons, and prepare for AP exams. In November 2007, OCW launched "Highlights for High School" —a guide for teachers and students to make finding resources on OCW even easier. In order to make the site as useful as possible for teachers, OCW is soliciting your feedback. High school physics teachers are welcome.

This session is organized in two parts. Part one is a presentation intended for teachers interested in adding real-world applications to their classes, viewing physics demonstrations by MIT faculty, adding to their professional knowledge, or guiding students to exams, homework problems or resources to help them study for their AP Physics exam. Part two is intended to gather feedback on improving the site for use by teachers.

CW10: Physics2000.com Free Workshop

Sponsor: Physics2000.com
Date: Tues., Jan. 22
Time: 4–5:30 p.m.
Room: Heron

Leader: Elisha Huggins

Come to the popular Physics2000 workshop where you learn how to include 20th century physics in the basic Introductory physics course. This is done by starting with special relativity in Week 1, using thought experiments rather than mathematical formalism. For example, you can easily show that, by combining the already familiar Lorentz contraction with Coulomb's law, you end up with the Magnetic Force law, Maxwell's formula for the speed of light, and the formula for the magnetic field of a current in a straight wire.

As calculus is the backbone of classical physics, Fourier analysis plays a similar role in understanding quantum mechanics. In the workshop we use the free MacScope II program and its Pulse Fourier Transform capability to teach the time-energy form of the uncertainty principle.

The workshop is more than free—attendees receive complimentary copies of the Physics2000 CD and printed volumes I and II of Physics2000.

CW11: Experience for Yourself the Essential Quantum Paradox

Sponsor: Teachspin
Date: Mon., Jan. 21
Time: 5:30–7:30 p.m.
Room: Heron

Leader: Jonathan Reichert and Barbara Wolff-Reichert

This is your chance to turn the dials, change the settings, make the measurements and plot the graphs of the classic quantum paradox experiment: Two-Slit interference, One Photon at a Time. TeachSpin will have three complete units available for workshop participants. This will allow you to become familiar with a single photon light source, photon counting, signal to noise optimization, and other experimental parameters.

You will investigate Two-Slit Interference three different ways. The first two methods use a red laser. First, with the system open, you will visually observe the diffraction pattern. While calibrating the slit blocker, you will examine the distinct differences between the interference patterns from a single and double slit. Next, using a photodiode detector, you will reproduce Young's classic two-slit experiment, plotting the light intensity as a function of position across several bands on either side of the central maximum. Finally, you will use a single photon source with a photomultiplier detector and photon counting output to experience the essential quantum paradox.

In Feynman's terms, you will have come to the "heart of quantum mechanics" and confronted its fundamental mystery.

CW12: Introducing the TI-Nspire CAS Learning Technology

Sponsor: Texas Instruments
Date: Tues., Jan. 22
Time: 8–9:30 a.m.
Room: Heron

Leader: Michael Osborne

Engage your students! In this hands-on workshop, we will demonstrate how TI's newest graphing technology can be integrated into the physics classroom. Come experience both the **TI-Nspire™ CAS Handheld** and the **TI-Nspire™ CAS Computer Software**. The new TI-Nspire learning technology has been developed to allow students to explore physics and to better understand concepts through the *manipulation of complex formulas, graphing, spreadsheets, data analysis, and simulations*. During the workshop you will receive an overview of the technology, sample activities, along with the opportunity to experience how TI-Nspire CAS can be effectively integrated into the physics classroom.

CW13: Vernier—What's New in the World of Physics Data Collection?

Sponsor: Vernier Software & Technology
Date: Mon., Jan. 21
Time: 3:30–5:15 p.m.
Room: Iron

Leader: David Vernier, John Gastineau, and Rick Sorensen

Attend this hands-on, drop-in workshop to learn more about data collection tools from Vernier.

- Work with the new Vernier LabQuest, our color touch-screen handheld data collection and analysis device. Use LabQuest as a standalone tool, or connect it to a computer and control it from Logger Pro software.
- Collect force, altitude and acceleration data with the Wireless Dynamics Sensor System (WDSS), either for live data collection or as a remote data logger. WDSS is perfect for amusement park physics.
- Use the Vernier Spectrometer to collect emission spectra of LEDs and other lamps.
- Incorporate GPS data into Logger Pro files, and even export to a Google map.
- Capture video from digital video (DV) cameras directly into Logger Pro, and even sync video with sensor data.

CW14: Online Homework Management with Smartwork

Sponsor: W.W. Norton & Company
Date: Tues., Jan. 22
Time: 9:45–11:45 a.m.
Room: Iron

Leader: Leo Wiegman and Rob Bellinger

SmartWork is W.W. Norton's innovative online homework-management system developed in collaboration with Sapling Systems of Austin, Texas. SmartWork makes it easy for instructors to edit, assign, and administer physics homework. Answer-specific hinting and feedback address common misperceptions and help students get the macimum benefit from problem-solving assignments. Smartwork's Guided Tutorial Problems addrss more challenging topics in which a series of discrete tutorial steps lead to a general algebraic solution. The many types of questions available make use of a sophisticated equation editor, vector diagramming tool, and a graphing function. SmartWork offers a bank of ready-made questions from the third edition of Ohanian/Markert's Physics for Engineers and Scientists, Third Edition, as well as suggested assignments of groups of problems. Adopters also have full access to all authoring tools, and may duplicate and modify system content or create their own. SmartWork is available as a standalone version or with an integrated ebook of Ohanian/Markert's *Physics for Engineers and Scientists,* 2rd Edition. www.wwnorton.com/smartwork

CW15: And You Thought It Was About Homework; The Way You Imagined Teaching Could Be

Sponsor: WebAssign
Date: Mon., Jan. 21
Time: 12:15–1:45 p.m.
Room: Iron

Leader: John S. Risley and Peg Gjertsen

Help your students learn with WebAssign. Find out what's new. WebAssign, the premier online homework, quizzing, and testing system, continues to have all of the features you want and includes content from all major publishers.

Access questions from all major physics and astronomy textbooks, or write your own. Check out our latest offerings with assignable simulations, assignable examples with content specific hints and feedback, more online components and tutorials—all specific to your textbook. Give partial credit with conditional weighting. Assign practice questions. Give group assignments. Select questions for your assignments knowing how difficult each questions is and how many students have tried it before. Prepare your students for labs and collect their lab data, analysis, and reports—all using WebAssign.

Streamlline your work flow with WebAssign. It's easy to use, reliable, and helps you stay connected, you way. Quickly accessstudent responses, view item analysis for each questions, communicate using class forums, Ask Your Teacher, and announcements, give students access to all of their course grades with complete class statistics, propagate common assignments to multiple sections, give secure queszzes and tests. Find out how to integrate WebAssign with Blackboard, Shibboleth, D2L, and other registration systems.

Over 240,000 students are using WeAssign. Find out why. Visit us at http://webassign.net.

CW16: American 3B Scientific

Date: Tues., Jan. 22
Time: 12:15 p.m.–1:45 p.m.
Room: Heron

Leader: TBA

Title: TBA

Abstract: TBA

Sunday, Jan. 20

Registration 7 a.m.–4:30 p.m. and 7–9 p.m.
Marriott, 3rd floor

H.S. Share-a-Thon 5–7 p.m
Grand Ballroom VI

Welcome Reception 8–10 p.m
Grand Ballroom VI

Session SUN: Crackerbarrel: Creation of a Physics on the Road Web Resource

Sponsor: Committee on Science Education for the Public
Location: Essex A
Date: Sunday, Jan. 20
Time: 5–7 p.m.
Presider: Patricia Sievert

Session SUN: Undergraduate Student Research – SPS Poster Session and Reception

Sponsor: Committee on Physics in Undergraduate Education
Location: Laurel AB
Date: Sunday, Jan. 20
Time: 5–7 p.m.
Presider: Gary White

SUN-01 5 p.m. An Undergraduate Experiment to Investigate Cantilever Beam Resonant Frequencies

Michael G. Hvasta, The College of New Jersey, Department of Physics, Ewing, NJ 08628; mhvasta@gmail.com

Romulo Ochoa, The College of New Jersey

Carlos Pizarro, Universidad Catolica del Peru

Physical applications of cantilever beams are observed in diving boards, airplane wings, tennis rackets and atomic force microscopes. In a new experiment designed to be suitable for a wide range of undergraduate students, we analyze the motion of cantilever beams at resonant frequencies for a variety of beam lengths. The experiment includes investigations of the "free-end" cantilever beam in addition to the case in which a mass is added to the free-end. This experiment uniquely demonstrates harmonic vibrational motion with a nonsinusoidal spatial profile. Excellent agreement between theoretical predictions and measured values is found and resonance curves (amplitude versus frequency) for both systems are presented.

Sponsored by the Society of Physics Students and Sigma Pi Sigma, the Physics Honor Society, with the generous support of the American Association of Physics Teachers.

SUN-02 5 p.m. High Temperature Resistivity Changes in the Thin Films of Manganese Oxide

Khim B. Karki, Towson University, 6663 Wycombe Way Apt. C, Parkville, MD 21234; kkarki1@towson.edu

Grace Yong, Towson University

Rajeswari M Kolagani, Towson University

Robert Kennedy, Towson University Almuni

Vera N Smolyaninova, Towson University

Doped rare-earth perovskite-type manganese oxides $R_{1-x} A_x MnO_3$ (R being a trivalent rare earth and A being a divalent alkaline-earth ion) exhibit wide variety of physical phenomena. External stimuli can induce magnetic, structural, and electronic transitions in these materials, which makes them attractive in the device applications. Behavior of these materials in thin film form often differs from bulk. Oxygen content is very robust in the bulk materials, but this is not always the case in the thin films. We report on electrical resistivity at high temperatures (from 290 K to 900 K) of $Bi_{1-x} Ca,Sr_x MnO_3$ thin films grown by Pulse Laser Deposition on different substrates. We have found a considerable increase of resistance at higher temperatures, presumably associated with the loss of oxygen. Influence of different substrates, annealing gases, and material of the electrical contacts on the temperature dependence of resistivity will be discussed. This research may lead to potential device applications of these materials.

SUN-03 5 p.m. Low Temperature Study of Mechanically Alloyed EuFeO3.

Suman Khatiwada, Morgan State University / Physics, 1700 E. Cold Spring Ln., Baltimore, MD 21251; suman980@hotmail.com

Dereje Seifu, Morgan State University

Rare-earth (R) and transition metal (T) perovskite Oxides RTO3 are of interest since they have shown promise for application in a variety of probes, devices, and exhibit interesting physics. In this work EuFeO3 synthesized by mechanical alloying is investigated using Mössbauer measurements. EuFeO3 is one of the rare cases where both the R and the T sites can be probed in the same compound using Mössbauer spectroscopy. Mössbauer measurements indicate that the hyperfine magnetic field increased with decreasing temperature. The 57Fe Mössbauer spectra depicts that there is only a magnetic sextet at 20K implying pure ferromagnetic state. The 151Eu Mössbauer measurements show that the line width at half maxima has a peak between 50K and 100K. The increase in line width at low temperature is not enough to suggest magnetic splitting in the spectrum at low

Supported by ARL, WMRD, Aberdeen Proving Ground W1813LT-5006-7056.

SUN-04 5 p.m. Applications of the Fourier Transform to Modern Physics

Brian Knorr, Ramapo College of New Jersey, 505 Ramapo Valley Rd., Mahwah, NJ 07430; bknorr@ramapo.edu

Eric Holzapfel, Ramapo College of New Jersey

Justin Hedin, Cornell University

Nick Kuzmik, Ramapo College of New Jersey

The purpose of this work was to investigate the use and properties of the Fourier Transform (FT) for several modern physics applications such as wave packets in Quantum Mechanics (QM), signal processing in nuclear magnetic resonance (NMR), and image reconstruction in magnetic resonance imaging (MRI). We created an undergraduate research/laboratory manual that includes an explanation of the fundamental principles, programming applications in IDL logic software, and visual examples of simulated image artifacts in MRI. This manual should serve as a starting point for the undergraduate student who decides to undertake research projects in the field of MRI. We focused in particular on the "mysterious" k-space in MRI and its applications. All programs are available online at http://physics.ramapo.edu/~nmrprograms. A sample set of data which represents an MRI of a brain slice is also given on this directory and is called ksp340_390.

Sponsor: Dr. Daniela Buna

SUN-05 5 p.m. Learning Science Through Modeling and Simulation: A TELS Case Study

Katherine M. Linton, Christopher Newport University, 1 University Place/PCSE, Newport News, VA 23606; k.m.linton@gmail.com

Christy Buzan, Christopher Newport University

S. Raj Chaudhury, Christopher Newport University

The Technology Enhanced Learning of Science (TELS) Center has designed a number of inquiry based online curriculum modules for secondary science classrooms. These modules emphasize making students' thinking visible, promote autonomous learning, foster peer interactions around content, and have built-in supports for teacher assessment of student work. In this poster we present the pathway designed at CNU for future teachers to become involved in this kind of research—working closely with middle and high school teachers and students to investigate how their learning expands within the TELS environment. One of us (Buzan) is also completing an undergraduate capstone research project based around TELS. Data on project runs in a middle school physical science class and a high school physics class will be presented.

Linton and Buzan sponsored by S. Raj Chaudhury

SUN-06 5 p.m. Synthesis of Porous Silicon by a Noncontact Method

Kristin E. Peterson, Angelo State University, 2601 West Ave. N, San Angelo, TX 76909; kpeterson3@angelo.edu

Toni D. Sauncy, Angelo State University

Tim Dallas, Texas Tech University

Mark Grimson, Texas Tech University

The goal of this work was to produce porous silicon (p-Si) thin films on n-type and p-type crystalline Si substrates with various dopant types by using a light-induced hydrofluoric acid (HF) synthesis technique. The expanded beam of a He-Ne laser was used to produce a localized electric field on bulk crystalline silicon while the sample was immersed in hydro-fluoric acid for varying amounts of time. Samples were analyzed by photoluminescence spectroscopy to check for visible emission which is characteristic of p-Si. In addition, pore size was estimated by examining SEM micrographs, which indicate pore wall thicknesses on the order of one micron, with a typical pore size of two microns or less. The physical structure and size of the porous regions were found to vary with the concentration and dopant type of the crystalline Si wafer. In contrast to previous published reports, only the side of the sample illuminated with the He-Ne beam during HF synthesis was found to produce the porous thin film.

AAPT Member/Sponsor- Toni D. Sauncy

SUN-07 5 p.m. Undergraduate Research and Outreach Activities in Physics at Hampton University

Claudia M. Rankins, Hampton University, Department of Physics, Hampton, VA 23668; claudia.rankins@hamptonu.edu

Janice Lassiter-Mangana, Hampton University

The Department of Physics at Hampton University offers a number of exciting and unique research opportunities for undergraduate students, as well as outreach programs for students ranging from K-12 age. This poster will showcase the research of our undergraduates, all of whom are required to participate in research, culminating in a senior thesis. Additionally it will feature research conducted by undergraduate students participating in the Undergraduate Institute for Physics—Research Experiences for Undergraduates (UnIPhy - REU) and the CUSP—COSM (Center for the Study of the Origin and Structure of Matter) Undergraduate Summer Program. We will discuss our numerous K-12 outreach programs, which have established a pipeline for the next generation of physics undergraduate students.

SUN-08 5 p.m. The Angelo State University Peer Pressure Team: West Texas Road Trip 2007

Toni D. Sauncy, Angelo State University, 2601 West Ave. N Box #10904, San Angelo, TX 76909; toni.sauncy@angelo.edu

The Angelo State University Society of Physics Students (SPS) local chapter has a strong history of science outreach activities, driven by the ideal that service is an important part of life for responsible scientists. Since the first road show in 2003, SPS students have continued visiting middle and high school students in local schools and throughout the region. A 2005 World Year of Physics grant and subsequent local funding allows for longer trips to school districts where geographic isolation has a major impact on resources for science classrooms. This year's annual week-long trip took the team of eight undergraduate students and one faculty member to five school districts, where they performed 12 shows and interacted with more than 1500 middle school students. SPS outreach programs are a critical part of our undergraduate program, but are equally important in bringing the excitement of discovery-based science to budding young scientists.

SUN-09 5 p.m. The Investigation of Blast Mitigating Materials for Aircraft Hardening

Jennifer E. Thompson, Rhodes College, Rhodes Box 2548, 2000 N. Parkway, Memphis, TN 38112; thoje@rhodes.edu

Mark J. Panaggio, Hope College

Zach Hoernschemeyer, Hope College

The purpose of this study is to investigate blast mitigating materials to protect an aircraft during an onboard explosion. Several protective materials were tested. The protective layers were mounted to the vertical frames of a test panel replicating the internal structure of an aircraft. The completed panels were then clamped to a vacuum tank and a charge of C-4 was detonated at a pre-determined standoff distance. Two combinations were successful: a sheet of aluminum 2024-T3 coated on one side with a thermoplastic elastomer, and a fiber-metal laminate backed with a Kevlar reinforced elastomer. The aluminum and the fiber-metal laminate were by themselves ineffective in preventing panel rupture, indicating that a stiff layer coupled with an elastic backing allows the protective panel to fracture while preventing rupture of the fuselage skin.

SUN-10 5 p.m. A Systematic Approach in Correlating the Sound Characteristics of Cello Strings with Materials and Price

Courtney L. Kaita, 27 La Valley Dr., Manalapan, NJ 07726; courtney-cello@optonline.net

Every year, string instrumentalists buy thousands of dollars worth of strings. There are numerous different brands, with a wide range of prices from $10 strings to $100 strings. Is the extra money really worth the better sound, or will the $10 strings adequately suffice? This experiment closely examines this problem by examining the wave forms of 14 different strings. Their resulting overtones and amplitudes were correlated with their respective weights and prices. Results will show whether there is a distinctive relationship between these variables, proving that there may just be a way to quantitatively determine which strings.

Sponsored by AAPT members Andrew Post-Zwicker (Princeton Unversity Plasma Physics Laboratory) and Nicholas Guilbert (The Peddie School).

SUN-11 5 p.m. Dipole Lattice Shells as Optical Metamaterials

Jared Maxson, Lehigh University, Physics Department, 16 Memorial Dr E, Bethlehem, PA 18015; rotkin@lehigh.edu

Slava V. Rotkin, Lehigh University, Physics Department and Center for Advanced Materials and Nanotechnology

We consider the response of low-dimensional lattice shells of coupled dipoles to an applied electric field. We assume that the lattice constant is much smaller than the wavelength of the field, to provide a coherent excitation. We consider four lattice types: a linear chain, a ring, a plane, and a cylindrical shell of dipoles. We apply a Fourier transform to the interaction matrix (Hamiltonian) to diagonalize it in reciprocal space. From the eigenvectors of polarization and the dispersion data, we thencalculate the response of each lattice type to an electric field. The response function was analyzed in terms of the partial response functions as they come from individual polarization modes. We determine resonance conditions for the eigenmode coupling by varying the shell geometry.We propose that dipole lattice shells may be considered as optical metamaterials given proper tuning of the optical properties by changing the geometrical system parameters.

Prof. Russell A. Shaffer (AAPT Member)

Monday, Jan. 21

Registration *Marriott, 3rd Floor*	7:30 a.m.–5 p.m.
Poster Session I *Grand Ballroom IV*	8–9 a.m. and 8:30–10 p.m.
First Timers Gathering *Harborside D*	7–8 a.m.
Exhibit Show *Grand Ballroom IV*	8 a.m.–2 p.m. and 4–6 p.m.
Young Physicist's Meet and Greet *Harborside D*	12:15–1:45 p.m.

Session PST1: Poster Session I – Lectures/ Classroom & Astronomy

Location: Grand Ballroom IV
Date: Monday, Jan. 21
Time: 8–9 a.m.

PST1-01 8 a.m. Impact of Student Major on their Achievement in Introductory Physics

Tetyana Antimirova, Department of Physics, Ryerson University, 350 Victoria St., Toronto, ON M5B 2K3; antimiro@ryerson.ca

Marina Milner-Bolotin, Department of Physics, Ryerson University

Most of the Canadian universities teach introductory physics to three different program streams: physical science, life science and engineers. However, at Ryerson University, in order to allow students to switch between programs after the first year, all of the science students are required to take common introductory science courses. Therefore students in all science programs have a common first-year physics course. Moreover, as a sizeable part of the class are students who did not declare their intentions upon entering the university, the impact of an introductory physics course on them can be even more significant. The current study investigates whether student achievement and attitudes toward physics correlate with their major and with their decision to switch programs or to stick with their original choice. We will also discuss how the results of the study can be used to improve future introductory physics curriculum design and implementation.

PST1-02 8 a.m. Using Clicker Systems to Conduct Perfectly Anonymous Class Polls

Harry E. Bates, Towson University, 8000 York Rd., Towson, MD 21242-0001; hbates@towson.edu

Basic information about students and how they study for exams and rank their experience in a class can be a valuable form of feedback for instructors. Students might be reluctant to reveal information that could be useful to the instructor if they think it would bias the instructor in determining their grade. For example, how much time did you spend studying for the last test? I will discuss the basic technique I have used for anonymous polling using the PRS clicker system and show the results of a sample poll I have been conducting this semester at Towson University.

PST1-03 8 a.m. Does Configurational Energy Have Potential?

Daniel Crowe, Loudoun Academy of Science, 21326 Augusta Dr., Sterling, VA 20164; dan.crowe@loudoun.k12.va.us

The phrase "configurational energy" is proposed as a preferred synonym for "potential energy." The proposed phrase has the advantages (1) that it implies that the energy is due to the interaction between two or more objects, and (2) it does not imply thatthe quantity is not really energy. The history of the two phrases will be reviewed, and the further advantages and disadvantages of the proposed phrase will be discussed.

PST1-04 8 a.m. Simulations as Lecture Tools in High School and University

Rachele G. Dominguez, Boston University, 590 Commonwealth Ave., Boston, MA 02215; erdomi@bu.edu

Andrew Duffy, Boston University

Denis A. Allen, Boston Latin Academy

Much work has been presented on the use of computer simulations as inquiry-based tools. But what is their value if the students do not directly interact with the simulation? In particular, how effective is the use of simulations in a lecture environment? I will present my observations and student feedback on using simulations to supplement lecture material in 10th grade introductory physics classes in Boston Public Schools and large introductory physics classes at Boston University. Work done at Boston Latin Academy in the Boston Public School system is sponsored by the NSF funded Boston Urban Fellows Project.

PST1-05 8 a.m. Teaching the Physics of Flight

Stuart Gluck, Johns Hopkins University Center for Talented Youth (CTY), McAuley Hall, 5801 Smith Ave., Ste. 400, Baltimore, MD 21209; stu@jhu.edu

Vincent Bonina, Johns Hopkins University Center for Talented Youth (CTY)

Takeyah Young, Johns Hopkins University Center for Talented Youth (CTY)

The physics of flight is a rich and interesting physical science topic, even for students who haven't yet had high school physics or algebra. However, it can be difficult to balance rigor with accessibility in order to create a fun but rewarding class. It can even be difficult to avoid the common content mistakes in materials developed to present the subject conceptually (e.g. the Bernoulli Principle myth). For more than a decade, Johns Hopkins University's Center for Talented Youth (CTY) has been offering a very successful and popular Flight Science course to highly gifted fourth, fifth, and sixth grade students. In this presentation, we describe the activities-based approach that CTY instructors use, review the CTY curriculum guide, sample syllabi, and texts and other materials used. Afterwards, participants should possess the resources to develop a course on the topic for a wide range of settings, age groups, and ability levels.

PST1-06 8 a.m. The Design and Effect of Laboratory Instruction Emphasized Uncertainty Analysis

Young Chang Kang, Seoul Natioanal University, #919D-719, Seoul National University Kwanaksa, Bongchum-dong, Kwanak-ku, Seoul,

151-818; riverowindow@hanmail.net

In this study, laboratory instruction emphasized uncertainty analysis for teaching uncertainty is designed, the effect of this instruction is analyzed by responses of students after laboratory instruction. Uncertainty concepts and calculation methods were previously executed, and experiments that need to consider uncertainty during quantitative analysing was selected. After instruction, analysis of reports, online discussion, and a questionnaire were executed to analyze the effect of this instruction. And an effective instruction program for uncertainty was presented.

PST1-07 8 a.m. Hanging Airplanes in a Museum: A Case Study in Statics

Debora M. Katz, US Naval Academy, Physics Dept., Annapolis, MD 21402; dkatz@usna.edu

As physicists we see the importance and relevance of physics, but our students often have trouble seeing that physics is anything more than a prerequisite to the next class. One way to help student connect their everyday experiences to the physics we teach in our classroom is through case studies. It is often difficult to make static problems interesting and relevant, and yet these problems are so important to our engineering majors. To make the topic exciting and fun, I have developed a case study based on an airplane hanging in a museum. This is a hands-on activity. Students measure the tensile strength of thread. Then they determine the number and location of threads required to hang a model airplane. This hands-on case study requires only modest equipment.You only need a few spools of inexpensive thread, and you can make the model airplane out of old meter

PST1-08 8 a.m. Tasks that Inspire Learners in Physics

Eunsun Kim, Seoul National University, 104-304 apt. Jugong-Greenvill,suksu1-Dong Manan-Gu, Anyang , 430-041; escherr1@snu.ac.kr

Gyoungho Lee, Seoul National University

We cannot be inspired by this solving, '3×5=3+3+3+3+3'. But when we were young, we might feel satisfaction and inspiration because we can solve this problem without memorizing. When I was a middle school student, I was confused because sometimes Electric power(P) is proportional to Resistance(r) but sometimes inversely proportional to Resistance(r). I moved deeply when I solve this problem by myself—fixed value in the proportional expression. I think tasks for inspiration, whether it is easy or not, are important to students to be interested in physics. All we might have had these experiences but it is not easy to recall them. In this poster, I want to share learners experiences. Teachers can offer tasks in these experiences to

PST1-09 8 a.m. VIBES: Gender Equitable Physics Curriculum

Stacy S. Klein, Vanderbilt University, Box 351631, Station B, Nashville, TN 37235-1631; stacy.s.klein@vanderbilt.edu

April Boldt, Vanderbilt University

David S. Cordray, Vanderbilt University

The National Science Foundation-funded Vanderbilt-Northwestern-Texas-Harvard/MIT (VaNTH) Engineering Research Center in Bioengineering Educational Technologies at Vanderbilt University has worked over the last eight years to develop a high school level, biomedical-engineering based, interdisciplinary curriculum. The Vanderbilt Instruction in Biomedical Engineering for Secondary Science (VIBES) curriculum (http://www.vanth.org/vibes) is now ready to be disseminated throughout the country. It uses a challenge-based approach anchored in biomedical engineering to motivate student interest and achievement in science, especially physics. These curriculum units meet numerous national science standards. In 2005, the National Science Teachers Association Press published a book, edited by Robert Yager, entitled *Exemplary Science in Grades 9-12: Standards Based Success Stories*. The VIBES program is featured as a chapter in this book, having been recognized as one of the 15 best science curricula in the country. New statistical analyses are proving this program to be appropriate for both male and female students.

PST1-10 8 a.m. Results of Computer-Based Modifications to Astronomy Curriculum for Special-Needs Students

Julia K. Olsen, University of Arizona, Steward Observatory, Conceptual Astronomy and Physics Education Research (CAPER) Team, 933 N Cherr, Tucson, AZ 85721; jolsen@as.arizona.edu

In early 2006, the Lawrence Hall of Science (LHS) conducted a national field-test of a new GEMS space science curriculum package developed for use with middle school students. During this field-test we modified a sub-set of the curriculum materials for use by special needs students, to be delivered via computer-mediated instruction. These materials were implemented in a subset of the field-test classrooms and LHS collected pre- and post-test data for each unit. These data were analyzed to determine if students in the classrooms using the modified materials scored differently than students in the larger assessment database. Data was disaggregated to measure the impact on students with special needs, as evidenced by individualized education plans (IEPs). Results suggest that many students, not just those with special needs, demonstrate greater achievement gains using materials modified using the principles of best practice for special needs students.

PST1-11 8 a.m. The Use of Humor in Enhancing Physics Education and Assessment

Stanley J. Sobolewski, Department of Physics - Indiana University of Pennsylvania, 56 Weyandt Hall - 975 Oakland Ave., Indiana, PA 15705-1087; sobolews@iup.edu

Bryant A .Meyers, Central Michigan University

In an attempt to reduce anxiety during testing, a comparison of means two sided t-test was used to determine if humorous test items made a statistically significant difference in improving test scores when compared to identical tests with no humorous entries. In addition, a questionnaire was given to determine the students' perceptions of humor benefiting them in a testing situation. Four experiments were performed, three in the physics class and one in an introductory algebra class. Humor was used in the title of the test, the directions, and the questions. The author analyzed both the actual performance of students in the assessment process along with the student's perceptions of humor relieving anxiety and helping them to perform their best. The results of using humor showed no statistically significant increase in the testing scores. The students' perception of using humor was significantly positive and encouraging.

PST1-12 8 a.m. The Development and Use of Physics Monothematics Micro Videos in Brazilian High Schools

Marcelo O. Souza, Laboratório de Ciências Físicas - Universidade Estadual do Norte Fluminense, Av. Alberto Lamego, 2000, Campos dos Goytacazes , RJ 28.013-600 ; mm@uenf.br

Sabrina G. Cozendey, Laboratório de Ciências Físicas - Universidade Estadual do Norte Fluminense

Samara S. Morett, Laboratório de Ciências Físicas - Universidade Estadual do Norte Fluminense

Marlon C.R. Pessanha, Laboratório de Ciências Físicas - Universidade Estadual do Norte Fluminense

Keitty R. Benevides, Laboratório de Ciências Físicas - Universidade Estadual do Norte Fluminense

This work will present the results obtained of an analysis of the efficiency of the use of physics educational micro videos for high schools students of two Brazilian public schools. The micro videos of physics were developed with the students active participation. The micro videos include topics of Mechanics, Thermodynamics and Electromagnetism.

Supported by CNPq, FAPERJ, TECNORTE/FENORTE and UENF.

PST1-13 8 a.m. Online Homework Self Reporting

Matthew L. Trawick, University of Richmond, Physics Department, Gottwald Science Center, University of Richmond, VA 23173; mtrawick@richmond.edu

In an effort to encourage regular studying throughout the week, students in several undergraduate physics classes at the University of Richmond were assigned homework due at every class meeting rather than every week.The students were also required to complete online reports before every class meeting, reporting for each individual problem whether they had successfully completed it, needed additional help, or did not have time to complete the assignment. This strategy, which was implemented using existing Blackboard Learning System software, allows the instructor to see both aggregate and individual responses and respond accordingly in class or by email. Data collected from the reports indicate that students in these classes overwhelmingly worked on homework regularly throughout the week. Responses from later anonymous surveys demonstrate that the students do complete the reports honestly, and that the students strongly support the strategy of online homework self

PST1-14 8 a.m. Extensions of a Standard Physics Problem for a Curious Student

Jeff Weitz, Horace Mann School, 231 West 246th St., Riverdale, NY 10471; weitz@pipeline.com

Joshua Parker, Horace Mann School

The projectile launch angle for maximum range is independent of initial velocity only for level ground. When the projectile is launched above or below the landing point the launch angle for maximum range approaches 45 degrees as the initial velocity increases. We investigated this phenomenon using spreadsheets and by studying the properties of the parabolas that describe the motion. Our work illustrates how a standard problem in introductory physics can open several lines of questioning for a creative and interested student.

PST1-15 8 a.m. Using Real Particle Physics Data in High School Physics Classes

Shane Wood, Irondale High School, 2425 Long Lake Rd., New Brighton, MN 55112; shane.wood@moundsviewschools.org

Mike Sinclair, Kalamazoo Area Mathematics & Science Center

This poster will demonstrate how real data from high energy particle physics experiments can be used by high school students. The European Particle Physics Outreach Group (EPPOG) has organized particle physics Masterclasses in which students use data from CERN's Large Electron-Positron Collider (LEP) experiments to better understand the world of quarks and leptons. Through the Internet, all teachers and students can access and utilize the LEP event display data housed on the Masterclass website.

PST1-16 8 a.m. Student Attitudes Towards Andes, an Intelligent Tutor Homework System

Brett D. van de Sande, University of Pittsburgh, 3939 O'Hara St., Pittsburgh, PA 15260; bvds@pitt.edu

Robert Shelby, U.S. Naval Academy (retired)

Donald Treacy, U.S. Naval Academy (retired)

Mary Wintersgill, U.S. Naval Academy

We know that students benefit from solving problems in the presence of an expert tutor. A tutor can encourage good problem solving techniques, provide timely feedback and provide hints when the student gets stuck. Andes, an intelligent tutor homework system designed for two semesters of introductory physics, can fill this need by encouraging students to use sound problem solving techniques and providing immediate feedback on each step of a solution. On request, Andes provides principles-based hints based on previous student actions. (See http://www.andes.pitt.edu for more information.) A multi-year study at the U.S. Naval Academy demonstrates that students using Andes perform better than students working the same problems as graded pencil and paper homework. In addition, student attitude surveys show that students prefer Andes over other homework systems. In this poster, we investigate the connection between student attitudes towards Andes and their actual use of Andes during the class.

PST1-17 8 a.m. Using Personal Response Systems in Conceptual and Algebra-Based Classes

Paul G. Ashcraft, Penn State Erie, The Behrend College, 4205 Station Rd., Erie, PA 16563; pga106@psu.edu

Student interaction within lectures in both conceptual and algebra-based introductory classes increased by the use of a personal response systems [PRS]. Students were queried by survey on benefits or disadvantages of using a PRS in the classroom. These results are compared to the instructor's understanding of benefits and disadvantages of using a PRS. Additionally, three populations of students were surveyed: conceptual (n = 100), first semester algebra-based (n = 70) and second semester algebra-based (n = 50). The differences between the classes' attitudes about learning are discussed.

PST1-18 8 a.m. Using Mobile Technology to Transform Physics Laboratory Learning for Women

Joseph Di Rienzi, College of Notre Dame of Maryland, 4701 North Charles St., Baltimore, MD 21210; jdirienzi@ndm.edu

Using mobile technology the General Physics labs at the College of Notre Dame of Maryland have been redesigned to provide a more integrated and cohesive learning environment that better meets the aspirations and needs of the unique student population served (100% female, 33% from underrepresented groups, 91% supported by financial aid, 50% first-generation college attendees). The General Physics course sequence attracts highly able science and engineering majors. With wireless technology and HP tablets, the two physics laboratories have been re-designed to support PASCO Science Workshop@ Physics equipment. With a more interactive laboratory environment more teaching time is now spent on directing Notre Dame's women students to work collaboratively on using computer-aided technology to run the experiment, analyze the data, and write up the results during the lab period instead of working individually outside of lab. As a result, there is a measurable increase of enthusiasm and interest in learning physics.

PST1-19 8 a.m. YouToo'b Can Extend Class Time with Technology

Brendan P. Noon, Argo Community High School, 7329 West 63rd St., Summit, IL 60501; bpnoon@sbcglobal.net

Every educator knows that classes are too short to cover the amount of material we're expected to teach. Brendan Noon has been successfully using the world wide web to motivate his students to learn physics outside the classroom environment. This poster presentation discusses a variety of innovative methods that are being used in conjunction with an online science curriculum (www.sciencewithmrnoon.com). Some of the lessons that will be highlighted include implementing online learning modules, Flash animated lectures, video podcasting, interactive quizzes, live web conferencing, virtual simulations, online discussions, webquests, and tapping into next generation mobile technology.

PST1-20 8 a.m. IBEAM: Integrative Biology Experimental Activity Modules

Tatiana A. Krivosheev, Clayton State University, 4115 Riverglen Circle, Suwanee, GA 30024; tatianakrivosheev@clayton.edu

Stephen C. Burnett, Clayton State University

Scott A. Reese, Kennesaw State University

John M. Pratte, Arkansas State University

The objective of the IBEAM project is to develop modular interdisciplinary educational materials for use in both introductory physics and upper-division biology courses. These activities increase student understanding of both disciplines' content and the interplay between them. The modular nature of these materials allows them to be easily integrated into existing courses with little to no modification necessary. In the introductory physics courses, the biology content is introduced via the laboratory component. Biology-oriented capstone activities apply the physical principles students learn in hands-on experiments to show the interdisciplinary nature of the subject. The physical concepts learned in these physics courses are reinforced in later biology courses with activities that refer back to the original modular activities, but expand and broaden their application. Pre- and post-course self-assessment survey is developed and administered to estimate the learning gains.

PST1-21 8 a.m. Multiple Evaluation Behind Quality Improvements in the Cadet Course

Antti Rissanen, National Defence University, PO BOX 7, Helsinki, 00861; antti.rissanen@mil.fi

This study was made at the National Defence College to the first year cadets. The quantitative survey on a Likert-scale questionnaire studied students' attitude toward teaching methods and tactics, content and amount of exercises, group work, learning material and motivational aspects. Open questions gave qualitative data. Main shortages in education were lack of a specific course material, feeling of unclear course structure, too theoretical teaching, and shortage of exercise. The content of the common course book in physics was too extensive for the most compact refresher course in physics. The results were joined to the evaluation data produced by the department's evaluation and analyzed with the SWOT-method. The study inspired to a course material project. The developed course book set was specified and synchronized with the lectures. Student feedback can give valuable information.

PST1-22 8 a.m. Using Students' Understandings of Light to Teach Astronomical Concepts

Sharon R. Blauvelt, Missouri State University, 901 S. National, Springfield, MO 65897; sblauvelt@spsmail.org

Many astronomical concepts are based on student's knowledge of light and the electromagnetic spectrum. Once the basic groundwork is laid, a scaffolding effect can take place in the classroom where one concept can be laid on another to help spiral students to greater understandings on a much higher level. This would include the Hertzsprung-Russell diagram, stellar evolution and stellar spectroscopy. These sometimes abstract astronomical concepts can be difficult for high school students to process and understand. Through my research I hope to show hands-on activities that enhance the classroom environment and show how scaffolding can work in the classroom.

PST1-23 8 a.m. Astroinformatics: The New eScience Paradigm for Astronomy Research and Education

Kirk D. Borne, George Mason University, 4400 University Dr., MS 6A2, Fairfax, VA 22030; kborne@gmu.edu

The growth of data volumes in science is reaching epidemic proportions. Consequently, data-driven science is becoming comparable to theory and experimentation. Many scientific disciplines are developing sub-disciplines that are information-rich and data-based, to such an extent that these are recognized stand-alone research and academic programs on their own merits. These disciplines include bioinformatics and geoinformatics, but will soon include astroinformatics and data science. Informatics is the discipline of organizing, accessing, mining, and analyzing data for scientific discovery. We will describe Astroinformatics, the new paradigm for astronomy research and education, focusing on new eScience education initiatives. The latter includes "Forensic Astronomy" (or "CSI Astronomy") and the new undergraduate program in Data Sciences at George Mason University, through which students are trained in Discovery Informatics tools to access large distributed data repositories, to conduct meaningful scientific inquiries into the data, to mine and analyze the data, and to make data-driven scientific discoveries.

*Sponsored by AAPT member Julia Olsen.

PST1-24 8 a.m. Remote Telescopes for Engaging Students in Real Research Experiences

Kirk D. Borne, George Mason University, 4400 University Drive, MS 6A2, Fairfax, VA 22030; kborne@gmu.edu

Julia K. Olsen, University of Arizona, Steward Observatory

We will describe plans for the LSST (Large Synoptic Sky Survey), an enormous project that will image the entire visible sky every three nights repeatedly for 10 years. This "cosmic cinematography" will enable the discovery and recovery of tens of thousands of astronomical events every night. These events include moving objects (e.g., asteroids) and optical transients (e.g., supernovae, quasars, variable stars of all kinds). The challenge will be for the world community to follow-up on these hundreds of millions of events (over the 10-year lifetime of LSST). A worldwide distributed network of robotic telescopes will enable classroom and citizen scientist participation in the research and characterization of the LSST bonanza of astronomical events. We will describe some of the plans by the LSST education and outreach team for bridging the gap from the LSST database to the Robotic telescopes, to engage students in real research experiences.

PST1-25 8 a.m. HI STAR: Hawaii Student Teacher Astronomy Research

Mary Ann Kadooka, University of Hawaii, 2680 Woodlawn Dr., Honolulu, HI 96822; kadooka@ifa.hawaii.edu

Catherine Garland, Castleton State College

Michael Nassir, University of Hawaii

Can middle and high school students learn astronomy research skills and a few basics about solar system bodies, stars and galaxies in a week? Yes, they can, as evidenced by the results of our 2007 HI STAR one-week summer program designed to encourage students to work on research projects after this experience. Armed with some background reading and a passion for astronomy, the 19 motivated students wanted more hours, lectures, and time to devote to learning. Students did image processing using astrometry and photometry software in preparation for working in groups on variable stars, asteroid, or galaxy projects. They found it exciting to do remote observing in real time with the 2-meter Faulkes and the 0.4-meter DeKalb Observatory telescopes. Highlights of the program and student selection process will be discussed, as well as pre-test and post-test results.

PST1-26 8 a.m. CSI Astronomy: Evidence-Based Learning for the 21st Century

Julia K. Olsen, University of Arizona, Steward Observatory, Conceptual Astronomy and Physics Education Research (CAPER) Team, 933 N Cherry, Tucson, AZ 85721; jolsen@as.arizona.edu

Kirk D. Borne, George Mason University

Current projects such as Sloan Digital Sky Survey, Google Earth with Sky, Galaxy Zoo and many others are moving large datasets from research science to the educational arena. Current institutional pressures to improve student achievement make it critical to develop, test, and evaluate data-based educational strategies. The impending avalanche of astronomical data will provide a wealth of material for students to experience real science in the classroom. Data Mining makes it possible to immerse students in physics, astronomy, and mathematics (as well as other content areas) while teaching and reinforcing 21st century skills. The Large Synoptic Survey Telescope (LSST) is a developing program for integrating research and education with large astronomy datasets. http://www.lsst.org/ For this poster, Julia is also representing:The Large Synoptic Survey Telescope LSST Corporation 4703 East Camp Lowell Dr., Suite 253/Tucson, Arizona 85712 jolsen@lsst.org/

PST1-27 8 a.m. Case Studies in Developing Activities with a Data-Rich Online Resource

Jordan Raddick, Johns Hopkins University, 3701 San Martin Dr., Baltimore, MD 21218; raddick@jhu.edu

Over the past several years, the SkyServer website of the Sloan Digital Sky Survey has offered access to a complete scientific dataset of more than 200 million stars and galaxies. Students can browse through the data to view individual objects, and can search through the data for objects that meet their criteria. There are a number of projects available on the site that use the data to teach concepts from astronomy and physics, but there are also many activities that were designed by teachers for their own courses. I will talk about, and provide copies of, both types of activities from the site. I will also show tools and guidelines for instructors to develop their own activities from the materials on the site.

PST1-28 8 a.m. Galaxy Zoo: a Citizen Science Site and its Classroom Potential

Jordan Raddick, Johns Hopkins University, 3701 San Martin Dr., Baltimore, MD 21218; raddick@jhu.edu

The Galaxy Zoo website (www.galaxyzoo.org) is a new experiment in public science participation. Following the model of SETI@home and Stardust@home, it asks people to classify a million galaxies by shape (spiral or elliptical). This task is simple for humans but nearly impossible for computers; a database of human-classified galaxies would be a major step forward in astronomy research. A simple web interface presents volunteers with a single galaxy and a button for each classification. The response has been amazing— more than 100,000 volunteers in only two months. All galaxies have now been classified multiple times, and astronomers are now analyzing the results. Although the site was designed as a public outreach and research activity, many teachers have used Galaxy Zoo in their classrooms. I will talk about ways that teachers have used the site, and I will share some features of the site to help supervise and assess student classifications.

PST1-29 8 a.m. LCOGTN: Keeping Education in the Dark

Rachel J. Ross, Las Cumbres Observatory Global Telescope Network, 6740 Cortona Dr., Suite 102, Goleta, CA 93117; rross@lcogt.net

Las Cumbres Observatory Global Telescope Network is a nonprofit organization that is building a completely robotic network of telescopes for education (primarily ~28 x 0.4m, clusters of 4) and science (primarily ~28 x 1.0m, clusters of 4 and 2 x 2.0 meters) which will be longitudinally spaced so there will always be at least one cluster in the dark. Everything will be available online from an interface used for remote observing both in real-time and queue-based modes to a huge archive of data, from a library of resources and activities for all age groups and levels of science to data processing software. Using the LCOGT network as a tool to enjoy real astronomical research will not only encourage studies in science, technology, engineering, and math but will provide skills needed in any field. All you need is a broadband Internet connection, computer, and lots of enthusiasm and

*Mary Kadooka, IFA, sponsor

Session AA: High School Physics Teachers Recognition Day

Sponsor: Committee on Physics in High Schools
Location: Grand Ballroom VI
Date: Monday, Jan. 21
Time: 8–9 a.m.

Presider: John Layman

AA01 8:10 a.m. The Central Atlantic Region: Leading Edge in High School Physics

Invited – Michael Neuschatz, American Institute of Physics, One Physics Ellipse, College Park, MD 20740; mneuscha@aip.org

High school physics enrollments have been slowly but steadily rising across the country for better than two decades, reaching new records and new groups of students as they climb. During this period, the Central Atlantic region—seven states with the Baltimore-Washington metro area roughly at its center—has witnessed outstanding growth, with an aggregate physics enrollment percentage that now far outstrips the national average. This talk will use data from the American Institute of Physics' recent Nationwide Survey of High School Physics Teachers to compare the backgrounds, current situations and views of high school physics teachers in this region with their colleagues across of the country, and to try and understand what underlies the enrollment growth and what changes may be in store in the future.

AA02 8:40 a.m. Experimenting Along with Volta: From Electrostatics to Electric Current

Invited – Robert A. Morse, St. Albans School, Garfield St., Washington, DC 20016; robert_morse@cathedral.org

Beginning as a high school teacher, Volta's invention of the electrophorus helped to clarify and advance the study of electrostatics. His later discovery of the electrochemical cell changed the study of electricity completely. Versions of Volta's experiments can help students to understand different processes of electrostatic charging, and how electrical cells combine in series and parallel. In this short workshop, we will use inexpensive equipment to carry out entertaining Voltaic experiments suitable for use from middle school through high school.

Session AB: Physics First Book Review: Criteria for a 9th Grade Physics Textbook

Sponsor: Committee on Physics in High Schools
Location: Grand Ballroom VI
Date: Monday, Jan. 21
Time: 9–11 a.m.

Presider: Barry Feierman

AB01 9 a.m. The New Edition of Conceptual Physics

Panel – Paul G. Hewitt, City College of San Francisco, Phelan Ave., San Francisco, CA 94112; Pghewitt@aol.com

A new edition of *Conceptual Physics*, years in the making, is now available. Its difference from the previous edition has to do with not only more problem sets, but the nature of the problems. Elementary algebra with symbols rather than numerical quantities is the focus. Ranking is also a new feature. Other new features will be discussed.

AB02 9:20 a.m. Engaging All Students in Real Physics

Invited – Thomas C. Hsu, 283 Salem St,. Andover, MA 01810; tom@ergopedia.com

For students to learn physics, they need to experience it, first hand. That means getting real physics into classrooms on a large scale, training teachers to create engaging lessons, and competing in a market dominated by science textbooks. CPO Science was founded by a small team of teachers to create quantitative, hands-on, physics education programs that would teach students to think and problem solve, not just memorize. By incorporating textbooks and lab equipment into a seamless learning system we have been able to achieve this goal for more than 500,000 middle and high school students in nearly all 50 states. The success is due to the melding of good teaching, deep knowledge of physics, and also comprehensive attention to the business of how schools select and purchase curriculum. I suspect my strongest personal contribution to science education will have been a workable, sustainable strategy for making this happen and extending that strategy to chemistry (this year) in a way that builds on physics.

AB03 9:40 a.m. Active Physics

Invited – Arthur Eisenkraft, University of Massachusetts Boston, 100 Morrissey Blvd., Boston, MA 02125; arthur.eisenkraft@umb.edu

Active Physics guides students and helps them learn and apply physics. The program is built on research results from studies in cognitive sciences, student assessment, student engagement, and problem-based learning. It supports inquiry in the classroom and meets the expectations of the National Science Education Standards, the AAAS Benchmarks and State Frameworks. Active Physics was developed by hundreds of physicists and physics teachers with support from NSF. There is a sharp contrast between the traditional physics textbook and its approach to learning and the Active Physics text with its attempt to bridge research in learning with practice in the classroom. In both traditional texts and Active Physics, there is content, equations and homework. In Active Physics, students also have a challenge to frame the content, an opportunity for teachers to elicit prior understanding, and a need for students to transfer their knowledge at the activity level.

AB04 10 a.m. Survey Results of Texts Suitable for Physics First

Invited – John L. Hubisz, North Carolina State University, 1604 South Salem St., Apex, NC 27502-7251; hubisz@unity.ncsu.edu

Barry H Feierman, Westtown School

In the past few years a number of books suitable for a Physics First course at the 8th or 9th grade level have risen to the surface. We have recruited a cross-section of more than 30 reviewers to look at many of these books for accuracy, readability, age appropriateness, and adherence to an accurate portrayal of the scientific approach.

Session AC: Research Experiences for High School Teachers and Students

Sponsor: Committee on Physics in High School
Location: Laurel AB
Date: Monday, Jan. 21
Time: 9–11 a.m.

Presider: Deborah Roudebush

AC01 9 a.m. MARIACHI – Forefront Science Research by Teachers, Students and Scientists

Invited – Helio Takai, Brookhaven National Laboratory, Physics Department, Building 510A, Upton, NY 11973; takai@bnl.gov

MARIACHI is a unique experiment that is being carried out by a team of high school teachers, students and scientists. This highly motivated group's goal is the development of an innovative technique to detect cosmic ray showers either produced by ultra high energy cosmic rays or neutrinos using radar technology. This unique mix of professionals leads to a natural integration of research and education. Real science makes it into the classroom environment while scientists have a front row opportunity to contribute to the development of experiments and demonstrations for the classroom. During the presentation we will introduce you to the experiment and discuss the lessons learned from the few years of its existence.

Sponsored by Kenneth Cecire

AC02 9:20 a.m. Teacher and Student Research in Particle Physics at COSM

Invited – Kenneth McFarlane, Hampton University, Graduate Physics Research Center, Hampton, VA 23668; kenneth.mcfarlane@hamptonu.edu

The author has experience working with high school teachers and students in particle physics research at the Hampton University Center for the study of the Origin and Structure of Matter (COSM). The research projects will be described and the author will discuss the impact on research as well as the ramifications for the participants.

Work supported in part by the National Science Foundation

AC03 9:40 a.m. Graviton Simulation

Daron A. Moore, I.C. Norcom High School, 1801 London Blvd, Portsmouth, VA 23704; daron.moore@pps.k12.va.us*

This paper will discuss my work in the Teachers Institute for Research in Physics (TIRP) program at the Center for the study of the Origin and Structure of Matter (COSM) at Hampton University in the summer of 2007. The purpose of my work was to find the invariant mass of a graviton using events generated from Pythia, the high-energy physics event generator, using ATLAS fast simulation. Data analysis was completed using the ROOT analysis package. This study suggests that when the LHC comes online, there is a possibility for determining the existence of the graviton using the Randall Sundrum model.

*Ken Cecire, sponsor

AC04 9:50 a.m. Physics Lessons from A to Z; American and Zambian Collaboration

Joseph J. Fehr, 13860 Laura Ratcliff Ct., Centreville, VA 20121; jjfehr@fcps.edu*

This paper will discuss my work in the Research Experiences for Teachers (RET) program in Zambia. The program involved a series of workshops at Lusaka, Livingstone and Chivuna. The goal of the workshops was collaboration with Zambian teachers to develop student-oriented lesson plans using readily available local resources. The lessons were tested in the classroom with Zambian students. These efforts allowed Zambian students to begin to experience scientific research.

*Ken Cecire, sponsor

AC05 10 a.m. Cosmic Calibrations: Summer Research with the QuarkNet Muon Detector

Andrea J. Geyer, Norfolk Christian School, 255 Thole St, Norfolk, VA 23505; andreageyer@norfolkchristian.org*

Latanya Sutphin, Windsor High School

This paper will outline our work in the Teacher's Institute for Research in Physics (TIRP) program at Hampton University during the summer of 2007. The purpose of our work was to calibrate a cosmic ray detector to optimize its performance. Our research included the evaluation and comparison of several different calibration techniques. Our work focused on selecting an optimum threshold and operating voltage for the detector. Once the optimum settings were selected new performance studies were done with excellent results. The detector will be used in future cosmic ray studies by teachers in the quark net program.

*Ken Cecire, sponsor

AC06 10:10 a.m. Cosmic Rays and Aerogel Performance: Cherenkov Detector

Brian L. Meechan, Salem High School, 1993 Sundevil Dr., Virginia Beach, VA 23464; brian.meechan@vbschools.com*

This paper will discuss my work in the Teachers Institute for Research in Physics (TIRP) program at Jefferson Lab in the summer of 2007. The purpose of my work is to test the performance of a Cherenkov detector using cosmic rays. The detector was and will be again part of particle identification system. Basic work is to take various data and find the characteristics through the analysis over the collected data. The end result is to expose students to current practices of research physics.

*Ken Cecire, sponsor

AC07 10:20 a.m. The Use of Muon Detectors to Bring High School Physics into the 21st Century

Deborah Roudebush, Oakton High School, 2900 Sutton Rd., Vienna, VA 22181; Deborah.Roudebush@fcps.edu

This paper will outline my classroom use of a muon detector connected through the QuarkNet Cosmic Ray e-Lab to allow my students to be involved in original research. The students have been responsible for calibrating the detector, run performance studies, upload data to the e-Lab server. In the long run students will analyze the data to develop research and will mine the data to search for for possible connections.

Work supported in part by the National Science Foundation and the U.S. Department of Energy Office of Science

AC08 10:30 a.m. Students Project in MARIACHI

Joseph Sundermier, Deer Park High School, 1 Harwood Pl., Melville, NY 11747; jsunderm@suffolk.lib.ny.us

Helio Takai, Brookhaven National Lab

We describe on the experience of having students developing research work at Brookhaven National Laboratory. The projects they were involved in are related to the MARIACHI experiment and include mostly hands-on activities in the construction of devices to help the science of MARIACHI. In particular we will report on the development of a electric field monitor, infrasound microphone and the installation of a video capture apparatus. We will discuss the projects and the lessons learned in advising the students through the steps of performing tasks to accomplish the projects.

*Ken Cecire, sponsor

AC09 10:40 a.m. Enabling Constraints: Making Physics Competitions Meaningful Learning Experiences

Rachel F. Moll, University of British Columbia, Department of Curriculum Studies, 2125 Main Mall, Vancouver, BC V6T 1Z4; rfmoll@gmail.com

This presentation reports on a study that investigated students' experiences of participating in a Physics Olympics and an amusement park competition. The study was guided by the question: what structures or features of the events and its activities promote meaningful learning experiences for senior high school physics students? Drawing heavily on complexity thinking in education (Davis & Sumara, 2006) student experiences during competitions will be contemplated and in doing so characteristics of complex systems such as positive feedback loops and self organization will be identified in these contexts. Conclusions will be drawn about the possibilities for similar activities and events to create meaningful learning experiences for physics students by tinkering with the mechanics of complexity. This study will contribute to a body of work that seeks to understand the effects of science outreach efforts such as Physics Olympics competitions.

AC10 10:50 a.m. Research in Elementary Level Physics Education and Professional Development

Michael R .Fetsko, Mills E. Godwin High School, 2101 Pump Rd., Richmond, VA 23238; mrfetsko@henrico.k12.va.us

This paper will discuss my work in the Hampton University Teacher Institute for Research in Physics (TIRP) program in the summer of 2007. The purpose of my work with mentor Alison Baski of Virginia Commonwealth University (VCU) was to develop a unit on atomic physics for VCU elementary education majors. These materials will be tested with the pre-service teachers during their course work with high school students as an introduction to the particle physics unit, and then used as professional development units for elementary teachers participating in the Physics Is Elementary (PIE) program in 2008. The PIE is jointly funded by the Hampton University Center for the study of the Origin and Structure of Matter and Jefferson Lab.

Session AD: Gender Issues in High Schools

Sponsor: Committee on Women in Physics
Co-Sponsor: Committee on Teacher Preparation
Location: Laurel CD
Date: Monday, Jan. 21
Time: 9–11 a.m.

Presider: Jon Rockman

AD01 9 a.m. Are Single-Gender Physics Classes Still Useful For a High-Achieving Population of Secondary Students?

Invited – Olga Livanis, NEST+m, 111 Columbia St, New York, NY 10002; OLivani@schools.nyc.gov

E. Rafferty, Teacher's College

The purpose of this study was to investigate the efficacy of single-gender physics classes. Literature abounds with studies of single-sex science classrooms that show positive or null results when students are separated by gender when studying science. The investigations primarily cite differences in learning styles, gender sensitivity by the teacher, and gender equity in the science classroom. Our brief study, however, looked at general attitude patterns and their correlation to academic achievement as determined by students' scores on department-wide assessment by an already high-achieving population. Our question was whether single-gender physics classes still make sense at Stuyvesant High School.

AD02 9:30 a.m. When Do Girls Lose Interest in Math and Science?

Invited – Jennifer Blue, Miami University, 133 Culler Hall, Oxford, OH 45056; bluejm@muohio.edu

Girls enter elementary school interested in math and science, but lose confidence by middle school. [1] Women get a smaller percentage of bachelor's degrees in science than men do.[2] When do girls lose interest in math and science? I worked with an experienced elementary school teacher to survey 2000 girls in grades 4-8 in southwest Ohio, asking them at each grade to rate science, math, and other school subjects. Some of our results were quite surprising. This talk will ground our survey and its results in the literature.

1. American Association of University Women (AAUW). (1992). Shortchanging Girls, Shortchanging America: Executive Summary. Washington, DC: AAUW.

2. Ivie, R. & Ray, K.N. (2005). Women in Physics and Astronomy, 2005. American Institute of Physics (AIP) Publication Number R-430.02. College Park, MD.

AD03 10 a.m. A Qualitative Examination of Mixed and Single-Sex Cooperative Groups

Jacob Clark Blickenstaff, University of Southern Mississippi, 118 College Dr. #5087, Hattiesburg, MS 39401; jacob.blickenstaff@usm.edu

Though group work is widely used in high school physics courses, few studies have examined laboratory exercises for how male and female students interact in the setting. As part of a larger examination of students' experiences of introductory physics, observations, interviews and document analysis in a high school physics classroom revealed interesting patterns in the behavior of single-sex and mixed laboratory groups. Though most attempted to get just "enough" work done in the laboratory period, the strategies used varied with the mix of males and females in the group. Implications for design and implementation of cooperative work in physics will also be discussed.

National Research Council. (2006) America's Lab Report: Investigations in High School Science. Washington DC: The National Academies Press

AD04 10:10 a.m Gender Differences in College Physics Performance: The Influence of High School Physics Preparation and Affect

Zahra S. Hazari, Harvard-Smithsonian Center for Astrophysics, 60 Garden St., MS-71, Cambridge, MA 02138; zhazari@cfa.harvard.edu

Philip M. Sadler, Harvard-Smithsonian Center for Astrophysics

Robert H. Tai, University of Virginia

The attrition of females studying physics after high school has been a continuing concern for the physics education community. If females are well prepared, feel confident, and do well in introductory college physics, they may be inclined to study physics further. This talk presents a quantitative study that focuses on factors from high school physics preparation (content, pedagogy, and assessment) and the affective domain that predict success in introductory college physics. The study includes controls for student demographic and academic background characteristics and employs 1973 subjects from 54 randomly chosen introductory college physics classes across the country. The results highlight high school physics and affective experiences that differentially predict female and male performance. The results paint a dynamic picture of the role of coverage, assessment, homework, and encouragement from parents.

Session AE: Physics in America and Russia

Sponsor: Committee on History & Philosophy of Physics
Location: Essex BC
Date: Monday, Jan. 21
Time: 9–11 a.m.

Presider: Cheryl Schaefer

AE01 9 a.m. A Brief History of the Inclined Plane in America

Invited – Steven Turner, Smithsonian Institution, P.O. Box 37012, Washington, DC 20013-7012; turners@si.edu

The inclined plane has been called the "Alpha" experiment, dating all the way back to Galileo and studied by nearly every physics student since the 18th century. In America, the evolution of this simple demonstration mirrored the changes in science teaching and the growth of technology. This history can be traced in the historic instruments, catalogs, textbooks and student lab manuals found in the Smithsonian collections.

Thomas B. Greenslade invited me to participate in his session. He is chair of the History and Philosophy of Physics committee.

AE02 9:30 a.m. Politically Nonconforming Scientists Met Behind the Iron Curtain

Invited – Mikhail M Agrest, College of Charleston, Physics and Astronomy Department, Charleston, SC 29424; AgrestM@cofc.edu

Contemporary inventions in science and in physics particularly are often more exciting then science fiction fantasies of the most sophisticated writers. The life and work of scientists in the contemporary world is of great interest to the public and politicians partially because of mass destruction opportunities hidden in these inventions. The gravitation to free communication and the exchange of ideas with colleagues in the world independently of their political affiliation sometimes takes over the sense of personal security. This paper uncovers just one page in the relationships of former USSR and U.S. scientists during the Cold War. A meeting of renowned American particle physicist Thomas Stix with one of the invisible Russian scientists, a participant of the Russian Nuclear project, a generator of extraordinary ideas, and a dissident Mates Agrest was documented by the KGB agent. The photographs of that meeting became available.

AE03 10 a.m. The "Modern" American Physics Textbook

Invited –Thomas B. Greenslade, Jr., Kenyon College, Department of Physics, Gambier, OH 43022; greenslade@kenyon.edu

Reading the forwards to American physics textbooks, as the authors explain the necessity for still another physics book, can be a sport in itself. Despite noteworthy attempts to break the mold over the last century and more, our textbooks tend to revert to the plan of the first truly American physics textbook, written by Denison Olmsted in 1831 "for the use of the students in Yale College." The modern American calculus-level book probably stems from the series of textbooks written for the cadets at the U.S. Military Academy by W.H.C. Bartlett in the 1850s. The natural philosophy book originally written in French by Ganot at the same time was widely used in a series of English translations until the first decade of the 20th century. The talk will conclude with the many permutations of the basic text written by Robert A. Millikan in the beginning of the 20th century.

Session AF: Teacher Preparation

Location: Kent
Date: Monday, Jan. 21
Time: 9–11 a.m.

Presider: TBA

AF01 9 a.m. What Is Teacher "Effectiveness" and How May It Be Assessed?*

David E. Meltzer, University of Washington, Department of Physics, Seattle, WA 98195; dmeltzer@u.washington.edu

I will discuss various issues related to "teacher effectiveness" and its assessment, specifically in the context of using research-based, guided-inquiry curriculum and instruction in pre-college classrooms. Among the factors often identified as contributing to effectiveness are (1) knowledge of content, (2) knowledge of science "process" skills such as experiment design and analysis, (3) knowledge of "Nature of Science" (practices and philosophies of the scientific community), (4) pedagogical content knowledge (knowledge of issues related to learning of specific concepts), (5) ability to apply general pedagogical strategies that are relatively independent of specific content, and (6) ability to implement effective methods while subject to institutional and logistical constraints.

*Supported in part by NSF PHYS-0108787

AF02 9:10 a.m. Developing Heat and Temperature Diagnostic Tools for K-12 Teachers*

Hunter G. Close, Seattle Pacific University, 3307 Third Ave. West, STE 307, Seattle, WA 98119; hclose@spu.edu

Eleanor W. Close, Seattle Pacific University

Stamatis Vokos, Seattle Pacific University

Sherm Williamson, Seattle Pacific University

Pamela A. Kraus, Facet Innovations, LLC

The Department of Physics and the School of Education at Seattle Pacific University, together with FACET Innovations, LLC, are in the third year of a five-year NSF TPC project, Improving the Effectiveness of Teacher Diagnostic Skills and Tools. We are working with school districts to use formative assessment to help teachers and pre-college students deepen their understanding of foundational topics in physical science. Part of optimizing these diagnostic tools is ensuring that they are consistent with national and state science standards and research on student learning. A strong unifying theme for these standards is transformation of energy in all processes of nature in physical, earth/space, and living systems. This approach brings the concepts of heat, temperature, and energy into a broader context than is usually explored in traditional physics instruction. We discuss some challenges in developing formative assessment tools that synthesize and respect these different perspectives.

*Supported in part by NSF grant #ESI-0455796, The Boeing Corporation, and the SPU Science Initiative.

AF03 9:20 a.m. Improvising Inquiry: How Content and Pedagogical Structures Shape Inquiry-Based Instruction

Danielle B. Harlow, Gevirtz Graduate School of Education, University of California at Santa Barbara, Santa Barbara, CA 93106; dharlow@education.ucsb.edu

Providing elementary school students with the opportunity to engage in scientific model building challenges teachers to create situations in which children articulate, test, and revise their ideas. When teachers respond to students' initial and transitory models to provide opportunities for students to revise their models in light of new evidence, the teachers improvise within pedagogical and content structures derived from their understanding of content, pedagogy, and scientific inquiry. I discuss three teachers who adapted the same activity for their classrooms. Each teacher engaged her students in developing a model of magnetism but improvised within different structures when they encountered unexpected students' ideas. I report on how the structures they improvised within impacted their instruction and how explicitly discussing pedagogical and content structures in professional development and teacher education courses may help teachers implement inquiry-based activities in ways that are consistent with authentic scientific inquiry.

AF04 9:30 a.m. Bringing Inquiry to the Pre-college Classroom Through Research-based Professional Development*

Donna L. Messina, University of Washington, Department of Physics, Box 351560, Seattle, WA 98195-1560; messina@phys.washington.edu

MacKenzie R. Stetzer, University of Washington

Peter S. Shaffer, University of Washington

Lillian C. McDermott, University of Washington

The Physics Education Group at the University of Washington conducts an intensive six-week Summer Institute for K-12 teachers. Physics by Inquiry,[1] a research-based curriculum, is used in providing an opportunity for teachers to develop a deep understanding of topics relevant to the K-12 curriculum and to experience the impact of inquiry on their own learning. Additionally, the pedagogical approach used in the Summer Institute serves as a model teachers can use for their own teaching practice. During an Academic-year Continuation Course, these teachers continue to work collaboratively with other teachers and members of the Physics Education Group in trying to implement inquiry teaching and learning in K-12 classrooms. Pre- and post-test results and RTOP scores will be presented that illustrate the effects of the Summer Institute and Continuation Course on K-12 teachers' content understanding and classroom practice and on student achievement.

*This work has been supported in part by the National Science Foundation.

1. L.C. McDermott and the Physics Education Group at the University of Washington, *Physics by Inquiry* (Wiley 1996).

AF05 9:40 a.m. Challenges of Adopting Physics by Inquiry

Homeyra R. Sadaghiani, California State Polytechnic University, Pomona, 3801 West Temple Ave., Pomona, CA 91768; hrsadaghiani@csupomona.edu

Teaching by inquiry, a pedagogical method in which students are guided through investigations to "discover" concepts, is among the most preferred instructional methods in teacher-prep programs. Implementations of such a method require a certain degree of alterations and adaptations. This talk describes issues related to adopting Physics by Inquiry* in a course for pre-service teachers (at Cal Poly Pomona), the challenges that arose, and the difficulties that were encountered.

*L.C. McDermott and the Physics Education Group at the University of Washington (1996)

AF06 9:50 a.m. How Can We Determine What's Hard for Physics by Inquiry Students?

Gordon J. Aubrecht, II, Ohio State University, 1465 Mt. Vernon Ave., Marion, OH 43302-5695; aubrecht@mps,ohio-state.edu

Several techniques were developed to track what sections of physics by inquiry's electric circuits module were most difficult for students in their own view. These techniques and their analysis lead us to see that elements of the course related to voltage are the most difficult .

AF07 10 a.m. Inquiry Physics for Elementary Science Teachers: The RIPE Program

Stephen J. Van Hook, The Pennsylvania State University, Department of Physics, 104 Davey Laboratory, PMB 158, University Park, PA 16802; sjv11@psu.edu

Tracy L. Huziak-Clark, Bowling Green State University

This paper describes the refinement of K-3 teachers' physics concepts (specifically, air & sound, light, motion, energy, and magnetism) from a professional development program employing the Research-based Inquiry Physics Experiences (RIPE) model. This model has evolved from a seven-year collaboration between a university physics professor, science education professor and a collaborative field elementary school to develop and test lessons in physics concepts for early childhood students. We describe the instructional model used with elementary science teachers and changes in their ideas about physics concepts from the professional development experience.

AF08 10:10 a.m. ASU Math and Science Teaching Fellows: Models of Teacher-Researcher Interactions*

Robert J. Culbertson, Department of Physics, Arizona State University, Box 871504, Tempe, AZ 85287-1504; robert.culbertson@asu.edu

Janet Bond-Robinson, Dept. of Chemistry and Biochemistry, Arizona State University

Forty-two 8th to 12th grade science and mathematics teachers participated in a four-week summer program where they were placed in one of 14 research groups in the areas of biosciences, computer science and information technology, or sustainable systems. Several effective models of teachers working in scientific research laboratories emerged to accompany our original model of teachers as "embedded reporters." In one model the researchers hosted the teachers and discussed their research every third meeting day. A second model was the use of a graduate student to host a team of three to four teachers on a series of experiments; the teachers attended larger group meetings and heard about research projects throughout their research experience. A third model was the orchestration of teachers' activities by research faculty directly. The key to success in all three models was coordination of activities throughout the four weeks rather than relying on teachers to fit into the group on the fly.

*Supported by Science Foundation Arizona and The National Science Foundation (MSP-0412537)

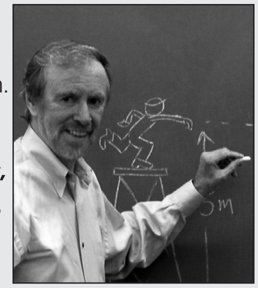
AK: Plenary I

Location: Grand Ballroom VI
Date: Monday, Jan. 21
Time: 11:15 a.m.–12:15 p.m.

Presider: Harvey Leff

Developing *Conceptual Physics,*

Paul Hewitt, author, TPT Column Editor



Paul Hewitt

My first teaching assignment at City College of San Francisco was a descriptive course for nonscience students. Knowing it was the only physics course that most would ever take, I wanted it to be an intimidation-free delightful experience. I soon found that this delight mostly occurred when students found they understood physics. To cover the widest range of physics that would fit in a semester I omitted numerical problem solving. With this roadblock removed, thousands elected the course each year. The essential mathematical foundation of physics was subtle. Direct and inverse proportions were treated in language familiar to students. Equations were introduced as guides to thinking rather than recipes for problem solving. By treating physics as a study of nature's rules, the course was relevant to all students. My handout notes soon became *Conceptual Physics*. Its development and its extensions will be discussed.

AF09 10:20 a.m. Project WISE: Working in Informal Science Education

Gregory A. DiLisi, John Carroll University, 20700 North Park Blvd., University Heights, OH 44118; gdilisi@jcu.edu

Keith McMillin, John Carroll University

Toni Mullee, Cleveland's International Women's Air & Space Museum

Gretch Santo, Beaumont High School

We piloted educational programs at Cleveland's International Women's Air and Space Museum (IWASM) while simultaneously conducting a research project to see if high school students could be hooked into STEM-based careers through an initial, positive exposure to teaching. Our goal was to develop materials for early-level children that focus on STEM and women's contributions to aeronautics and aviation via the creation of the "Working in Informal Science Education" (WISE) teaching academy for high school students. In this academy, diverse cohorts of secondary-level students performed preparation activities to give them specialized knowledge in content and pedagogy. Volunteers collaborated with university faculty, student teachers, and education specialists to develop, test, and evaluate permanent displays, classroom activities, and biographical portrayals of famous aviators. The project is remarkable in that our academy supports the social and scientific development of children, emphasizes cooperative learning, and directly benefits Cleveland-area youth who will utilize project deliverables.

AF10 10:30 a.m. Future Ready Science for Middle School: Create a Data-Rich Environment

Lisa L. Grable, NC State University, College of Education Box 7801, Raleigh, NC 27695-7801; grable@ncsu.edu

Meg Blanchard, NC State University

The Partnership for 21st Century Skills (http://www.21stcenturyskills.org/) has identified a set of competencies that can be used as a framework for science and math integration in the middle school curriculum. In the session, details will be given of hands-on activities based on science education and instructional technology research which are focused on data collection and visualization. Topics include the use of Vernier probeware, graphing calculators, TinkerPlots, and video tools.

AF11 10:40 a.m. Habits of Mind: Learning to Reason Like a Scientist

Maria R. Ruibal-Villasenor, Rutgers University, 10 Seminary Pl., New Brunswick, NJ 08901; mruibal@eden.rutgers.edu

Eugenia Etkina, Rutgers University

Anna Karelina, Rutgers University

Rebecca Jordan, Rutgers University

Cindy Hmelo-Silver, Rutgers University

Alan Van Heuvelen, Rutgers University

The Rutgers PAER group has designed and implemented a sequence of laboratory investigations for introductory physics. These laboratories are neither exercises nor illustrations or confirmations of lecture teachings, but their goal is to help students become acquainted with the processes of science by mirroring physicists' work: students make observations of phenomena, record data, find patterns, hypothesize mechanistic explanations to account for those patterns, test their hypotheses, and apply the newly acquired knowledge to solve experimental problems. The writes-ups provide scaffolding for completing the tasks but they do not outline experimental procedures; students need to design their own investigations. In this talk we will describe a qualitative video study that investigates the patterns in students' reasoning in these labs. We will also describe the different approaches adopted by these students and students in traditional laboratories when they face an experimental problem in an area of physics that they have not studied.

Session AG: Placing Computational Physics in Undergraduate Curricula

Sponsor: Committee on Educational Technologies
Co-Sponsor: Committee on Apparatus
Location: Dover AB
Date: Monday, Jan. 21
Time: 9–11:30 a.m.

Presider: David Winch

AG01 9 a.m. Lessons for Integrating Computation into Undergraduate Curricula: Changing Minds & Hearts

Invited – Norman Chonacky, Yale University, 36 Lincoln St., New Haven, CT 06511; norman.chonacky@yale.edu

There is evidence that the traditional undergraduate physics curriculum does not serve the computational needs of many of its graduates.[1] There is also evidence that, where computation has made inroads in the curriculum, it is the result of sustained effort of individual faculty without the support of a majority of their departmental colleagues.[2] A case can be made for integrating computation in the full undergraduate physics curriculum, but these data suggest this will never be possible without a greater degree of faculty and administrative support. I will describe some conceptual challenges presented by the objective of installing numerical modeling and simulation across the physics curriculum. The succeeding speakers will describe a variety of perspectives on making and managing significant curricular changes of any type, for consideration by those who would dare to contemplate the comprehensive integration of such computation in their own departmental curricula.

1. Rachel Ivie and Katie Stowe, The Early Careers of Physics Bachelors, (American Institute of Physics, College Park, MD, 2002), AIP Pub. R-433.
2. Robert G. Fuller, "Numerical Computations in US Undergraduate Physics Courses," Comput. Sci. Eng. 8 (5), 16-21.

AG02 9:15 a.m. Changing the Status Quo: Live to Tell the Tale

Invited – Andrew S. Hirsch, Purdue University, Department of Physics 525 Northwestern Ave., West Lafayette, IN 47907; hirsch@physics.purdue.edu

Instituting a significant curricular change requires buy-in from many different constituencies in addition to effort expended by supporters. I will share our experience at Purdue in adopting Matter & Interactions for our physics majors and, more recently, for approximately 2000 engineering students.

AG03 9:45 a.m. Integrating Computational Activities into the Upper-division Paradigms Curriculum

Invited – Corinne A. Manogue, Oregon State University, Department of Physics, Corvallis, OR 97331-6507; corinne@physics.oregonstate.edu

David McIntyre, Oregon State University

Janet Tate, Oregon State University

Paradigms in Physics is a novel upper-division physics curriculum developed at Oregon State University. The junior year comprises 10 modular courses, each focused on a specific paradigm or class of physics problems that serves as the centerpiece of the course and on which different tools and skills are built. As an integral part of the curriculum, we use multiple software packages including Maple, Mathematica, Java, and special purpose code to help students do calculations, visualize graphics, and perform simulations. We will discuss the criteria we use to decide what computational tools will be fruitful in different classroom situations and how we sequence a variety of activities to have added pedagogical impact.

Supported in part by NSF grants DUE 9653250, 0231194, 0618877

AG04 10:15 a.m. Computational Physics and Departmental Change

Invited – Robert C. Hilborn, University of Nebraska-Lincoln, Department of Physics and Astronomy, Lincoln, NE 68588-0111; rhilborn3@unl.edu

Instituting a computational component of an undergraduate physics program can be carried out in many ways, either through specialized courses or through a distributed model or through a combination of the two. In any case, such developments require a department to articulate goals and objectives for its undergraduate curriculum and to coordinate the content and pedagogy in a variety of courses. I will analyze several computational physics efforts in light of the recommendations contained in the report Strategic Programs for Innovations in Undergraduate Physics (SPIN-UP) of the National Task Force on Undergraduate Physics. Computational physics can serve as a catalyst for significant enhancement of all aspects of an undergraduate physics program.

AG05 10:45 a.m. Using Wavelet and Fourier Analsys on Surface Temperature Data

Joseph J. Trout, Drexel University, 2338 B Fairmount Ave, Philadelphia, PA 19130; joe.trout@sun.com

Fourier Analysis and Wavelet Analysis are used to analyze the surface temperature data. Fourier Analysis is used to analyze the time (or space) independent features of the temperature data. Wavelet Analysis is used to analyze the time (or space) localized features of the temperature data.

AG06 10:55 a.m. Enhancing the Study of Waves in Metals Using Computational Analysis

Michael B. Ottinger, Missouri Western State University, 4525 Downs Dr., Saint Joseph, MO 64506; ottinger@missouriwestern.edu

Mark A. Johnson, Missouri State University

When a compression transducer sends a sound pulse through a one-inch thick piece of aluminum with the reflected pulse observed on an oscilloscope, a faint secondary reflected pulse is also observed at the transducer. This second pulse travels through the material in a time consistent with that of a transverse wave generated at the metal's reflecting surface. To determine if the secondary pulse was a transverse wave, a simple computer simulation was created using a modified Euler technique with basic equations of motion found in introductory physics texts. The results confirmed that the secondary pulse was indeed a transverse wave generated when the compression wave reflected off the metal's free surface. In addition to showing the origin of the secondary pulse, the computer simulation also provides students with an alternate, enhanced view of the wave motion within the metal.

Session AGG: The National Aquarium as a Physics Resource

Sponsor: Committee on Physics in Pre-High School Education
Location: Dover C
Date: Monday, Jan. 21

Time: 9–10 a.m.

Presider: TBA

AGG01 9 a.m. Physics at the National Aquarium in Baltimore

Invited – Joe Harber, Conservation Education Department, National Aquarium in Baltimore, Pier 3 / 501 East Pratt St., Baltimore, MD 21202; jharber@aqua.org

Non-formal science institutions can provide opportunities for learning outside the traditional classroom. Learn about the exhibits, habitats, and unique animals found at the National Aquarium in Baltimore. In addition an overview of the Aquarium's programs will be provided.

Tom Foster, sponsor

AGG02 9:30 a.m. Physics at the National Aquarium: Brainstorming

Invited – Thomas Foster, Southern Illinois University Edwardsville, Box 2224, Edwardsville, IL 62026; tfoster@siue.edu

Joe Harber, Conservation Education Department / National Aquarium in Baltimore

The pre-high school teacher frequently needs to be an expert in all the sciences, but it does not mean that they do not favor biology over physics. The National Aquarium in Baltimore is an excellent example of this bias. Teachers and students visit to learn about marine biology, but why shouldn't they learn about physics? Come to this session and help the national aquarium create programs highlighting physics for its visitors.

Session AH: Teaching Physics Around the World

Sponsor: Committee on International Physics
Location: Dover C
Date: Monday, Jan. 21
Time: 10–11:20 a.m.

Presider: Donald G. Franklin

AH01 10 a.m. Physics for All: A Chinese Model

Invited – Ling L.. Liang, La Salle University, Dept. of Education, 1900 West Olney Ave., Philadelphia, PA 19141; liang@lasalle.edu

Each year, the science, technology, and engineering fields in higher education institutions in China successfully attract a large number of high school students who excel in the disciplines of mathematics and sciences. The *physics education for all* requirement in Chinese schools may partially account for such success. In this presentation, I will explain what and how physics education is provided to all secondary school students in a multi-year, spiral curriculum model.

AH02 10:30 a.m. Helping Students Think Critically During Problem Solving

Invited – Josip Slisko, Facultad de Ciencias Físico Matemáticas, Benemérita Universidad Autónoma de Puebla, Avenida San Claudio y Rio Verde, S/N, Puebla, 72575; jslisko@fcfm.buap.mx

Problem-solving is commonly used in physics teaching both as an appropriate context for learning physical concepts and laws and as an instrument for easy evaluation of the learning results. Improvement in problem solving skills is usually sought by making students practice explicitly expert-like steps: problem comprehension, conceptual and mathematical modelling of the problem situation, solution plan and its excecution and evaluation of solution. Although the last step should be an excellent opportunity for critical thinking, traditional problem design, codified in many physics textbooks, doesn't promote it adequately. In this talk I show by a few examples how some slight changes in problem design might help students think more deeply about what they should calculate and evaluate more critically the results of their calculations.

AH03 11 a.m. The Regularities of Physics Development

Genrikh Golin, Touro College, 2330 Voorhies Ave., Ste. 4R, Brooklyn, NY 11235; genrikhgolin@yahoo.com

One of the most important objectives of teaching physics is to demonstrate to the students that physics as science is not a rigid code of absolute laws, but a vivid organism liable to renewal, expansion, and corrections. This can be achieved through making the students familiar with the basic regularities of the development of physics. The regular character of the development of physics is determined by a number of factors, both external and internal with respect to physics. Among the external factors are social phenomena, the general level of culture, and the demands of technology. Among the most important internal laws in the history of physics is the alternation of "quiet" periods and revolutionary jumps. Albert Einstein named this law "a drama of ideas." Another important law inthe developent of physics is the existence of applicability of scientific concepts and laws at each stage of the development. There is still another feature to be mentioned—the continuty in the development of scientific knowledge (the correspondence principle). The presentation will be illustrated with examples from the courses of physics.

AH04 11:10 a.m. Average Learning Gains: The Effect of Instructor Implementation

Genaro Zavala, Tecnologico de Monterrey, E. Garza Sada 2501, Monterrey, NL 64849; genaro.zavala@itesm.mx

Our department has more than 2000 students in four introductory physics courses each semester. Since our sections have a maximum of 36 students, there are a large number of sections each semester and a large number of instructors are needed. Instructors are either faculty members or part-time instructors. We started implementing Tutorials in Introductory Physics from the University of Washington in a large scale in the Fall of 2004. It has been three years after our initial implementation and still the variability of average learning gains of sections is very large. A characterization of the way instructors implement tutorials in their own classrooms was done in one of the courses, Physics 3. Results show that a great deal of the variability is due to instructor implementation.

Session AI: Cutting Edge Research in Simple English

Sponsor: Committee on Graduate Education in Physics
Co-Sponsors: Committee on Science Education for the Public, Committee on Phyiscs in Undergraduate Education
Location: Harborside D
Date: Monday, Jan. 21
Time: 9–11 a.m.

Presider: Michael Thoennessen

AI01 9 a.m. Cutting-Edge Research in Simple English

Panel – Michael Thoennessen, Michigan State University, 1 Cyclotron, East Lansing, MI 48864; thoennessen@nscl.msu.edu

Communicating fundamental research results to the general public is a difficult task. In the following presentations students will present their research in simple English. Their task is to imagine that they are riding in a taxi from the airport to a scientific conference and the taxi driver asks them about the purpose of the trip. They have less than 10 minutes to convince him that they are doing something meaningful.

Session AJ: Undergraduate Student Research – SPS Oral Session

Sponsor: Committee on Physics in Undergraduate Education
Location: Essex A
Date: Monday, Jan. 21
Time: 9–11 a.m.

Presider: Gary White

AJ01 9 a.m. The Society of Physics Students Summer Internship Program

Meagan A. Saldua, Angelo State University, 2601 West Ave. N, San Angelo, TX 76909; meagansaldua@yahoo.com

Kendra Rand, Society of Physics Students National Office

Jessica Clark, American Physical Society

The Society of Physics Students (SPS) National Office provides internships to undergraduate physics students from around the nation. The focus of these internships ranges from advanced research to outreach programs, including positions with the SPS National Office, the APS, the AAPT, NASA or NIST. I will present my "D.C." experience as a first-time intern and my work at the American Center for Physics in College Park, MD. My position with the APS was in the PhysicsQuest program, where I focused on developing educational kits for middle school classrooms. These kits are made available to teachers at no charge to provide resources and positive experiences in physics for students. The impact of the internship program as well as the theme and experiments of this year's PhysicsQuest kits will be detailed.

AAPT MEMBER/SPONSOR: Toni D. Sauncy

AJ02 9:10 a.m. Using Microwaves to Determine Properties of Skin

Elizabeth Dowdell, Rowan University, 201 Mullica Hill Rd., glassboro, NJ 08028; dowdel21@students.rowan.edu

S. D. Tyagi, Drexel University

S. E. Lofland, Rowan University

We have investigated the use of microwaves to study properties of skin tissue. Samples of tissue were probed using a coaxial microwave resonator cavity with an exposed center conductor that operated at frequencies between 0.9 and 4 GHz. Measurements on several different materials indicate that the instrument is sensitive to a thickness of approximately 0.5 mm. This concentration of the microwaves ensures that the resonance frequencies indicate properties of the skin itself and are not significantly affected by underlying tissues. Subsequently, we have studied the change in resonant frequency with applied forceon the tissue samples. In general there is a large change in the resonant frequency which shows hysteretic behavior once the force reaches above a particular threshold. We discuss these results in terms of water content and elastic membranes.

AJ03 9:20 a.m. Ultrasonic Technique for Measuring the viscoelastic Properties of Magnetorheological Fluids

Jenna Smith, Department of Physics, Rhodes College, 2000 North Parkway, Memphis, TN 38112; smijk@rhodes.edu

Brent K. Hoffmeister, Department of Physics, Rhodes College

Magnetorheological fluids are composed of a suspension of very fine magnetic domains suspended in a carrier fluid. The domains in a magnetorheological fluid align themselves along the magnetic field, which affects the viscoelastic properties of the fluid. The goal of this project was to develop an ultrasonic measurement system that could measure the viscosity and shear stiffness of magnetorheological fluid in varying magnetic fields. To do this, we placed a 5 MHz AT-cut quartz crystal transducer in contact with the fluid and measured the change in the ultrasonic reflection coefficient at the transducer-fluid interface. Preliminary results show that the viscosity and shear stiffness change significantly when the magnetic field is parallel to the irection of propagation of a shear wave.

AJ04 9:30 a.m. Toward the Investigation of Magnetic Vortex Dynamics in Layered Superconductors

Juan C. Roche, Rowan University, 201 Mullica Hill Rd., Glassboro, NJ 08028; roche.cintron.j@gmail.com

Jeffrey D Hettinger, Rowan University

The dynamics of two-dimensional (2D) vortices in superconductors has been investigated over the past two decades. These investigations have focused on the extreme cases of weak pinning resulting from dilute native defects and very strong pinning resulting from extended columnar defects. The potentially large-scale applicable situation of strongly pinned superconducting layers with defects uncorrelated between layers has not been investigated. The work currently presented has the long-term goal of investigating this physical situation. Niobium nitride (NbN) is a superconducting material with strong native pinning. Adjacent layers of superconducting NbN will be coupled through varying thicknesses of aluminum nitride (AlN). We will adjust the AlN thickness from strongly coupled (~10Å), through Josephson coupled (10-40 Å) and decoupled (>40 Å). We have synthesized NbN and AlN films that are highly textured. Using this process, we will synthesize multilayers of NbN/AlN with varying AlN thicknesses. Initial electrical transport results will be presented.

AJ05 9:40 a.m. CDMS Veto Stability Study and Calibration

Gabriel A. Caceres, Augustana College, 639 38th St., Rock Island, IL 61201; gabriel-caceres@augustana.edu*

Most experiments searching for dark matter particles have been led deep underground to minimize the background produced by cosmic rays. The Cryogenic Dark Matter Search (CDMS) lies ½ mile underground in the Soudan Mine in Minnesota. Even though the muon rate is lowered by a factor of ~10^5, the rate is still high enough to produce background signals. To solve this problem, scintillator panels have been placed around the detector to veto cosmic induced events. This work studies the behavior over time of the scintillator veto panels. By analyzing and tracking the response to a LED pulser system, the stability was determined to be within 3%. The absolute energy scale of the spectrum was then calibrated using radioactive sources, as well as the muon distribution. Knowing the absolute energy scale and where the veto trigger threshold lies provides useful information for calculating the amount of background that can be rejected.

*Cecilia Vogel, sponsor

AJ06 9:50 a.m. An Investigation of Mn-Ni Double Perovskites

Robert J. Booth, Rowan University, 201 Mullica Hill Rd., Glassboro, NJ 08028; boothr89@students.rowan.edu

K. V. Ramanujachary, Rowan University

J. Gopalakrishan, IISC Bangalore

S. E. Lofland, Rowan University

The discovery of materials that exhibit both ferroelectric and ferromagnetic behavior at room temperature would have a tremendous impact on technology, particularly in the area of spintronics. To this end, we have investigated double perovskites of the form R2NiMnO6 [R=Y, Pr, Nd, Sm, Gd, Tb, Dy, Ho]. We studied the magnetization and electron paramagnetic resonance of these materials. The magnetic ordering temperature, effective magnetic moment, spin relaxation time, and the Lande g-factor were investigated. All materials were ferromagnetic. It appears that the Mn-Ni network is effectively independent of the rare earth moment: the magnetic ordering temperature appeared to be dependent only on the ionic radius of the rare earth and the effective moment remained essentially constant with ferromagnetic alignment of the Mn and Ni moments. However, both the spin relaxation time and the g value did depend upon the rare earth, indicating that one cannot neglect the effect of spin-orbit coupling on the Mn-Ni network.

This work was supported in part by NSF grant DMR0520471.

AJ07 10 a.m. Synthesis of V2AlC for Fundamental Electronic Transport Measurements*

Patrick E. Hann, Rowan University, 201 Mullica Hill Rd., glassboro, nj 08028; hannp63@students.rowan.edu

Jeffery D. Hettinger, Rowan University

Samuel E. Lofland, Rowan University

Ted Scabarozi, Drexel University

Juan C. Roche, Rowan University

We present a technique for synthesis of vanadium carbide (VC) and vanadium aluminum carbide (V2AlC) films using multi-target sputter co-deposition. V2AlC belongs to a class of materials that may be described as nanolaminates and are given the name MAX-phases because of their general chemical formula Mn+1AXn, where M is an early transition metal, A is an A-group element and X is either C or N. In spite of their anisotropic structure, the electrical properties of these materials have been found to be surprisingly isotropic. It is of interest to synthesize single crystals, epitaxial or highly textured films of several MAX-phasematerials to study the anisotropy to determine

if these properties are universal. We have found that V2AlC can be synthesized with VC seed layers or directly on Al203 substrates. We will also report comparisons between electrical transport measurements made on the oriented films and bulk polycrystalline samples.
*This work supported by NSF though grant DMR-0503711.

AJ08 10:10 a.m. Detection of One-Bead-One-Compound (OBOC) Combinatorial Library Using Oblique-Incidence Reflectivity Difference (OI-RD) Microscopy

Jamy B. Moreno, The Richard Stockton College of New Jersey, 6413 Ventnor Ave. Apt. 2, Ventnor, NJ 08406; stk30445@loki.stockton.edu*

The utilization of an Oblique-Incidence Reflectivity Difference (OI-RD) microscope to investigate a One-Bead-One-Compound (OBOC) combinatorial chemical library is described. A 6000 random sample molecule library was previously prepared for proof-of-principle experiments. This paper describes the initial results of these experiments.
*Dr. Fang Liu, sponsor

AJ09 10:20 a.m. Addressing Students' Difficulties in Explaining Current Conservation Experiment

Kwangmoon Shin, Seoul National University, Department of Physics Education, College of Education, Seoul National University, San56-1,

Sillim9-dong, Gwanak-gu, Seoul, 151-742; manga6@snu.ac.kr

Kyungho Lee, Seoul National University

Sungmuk Lee, Seoul National University

In this research, we address student difficulties in explaining current conservation experiment. Students carry out an experiment to find out whether current in both of two light bulbs is conserved with a simple electric circuit consisting of DC battery, galvanometer, leading wire, light bulb, and switch. Then they explain the result. However, they find that current is not equal at both sides of the light bulb and can't explain that result. In this process, we recognize many students have difficulties about error and uncertainty in measurement. We investigate students' difficulties by analyzing questionnaires and their experiment reports. Inevitability of error, finding source of error, analyzing results with considering uncertainty frequently appeared. We make a class supporter sheet and provide it to them.

AJ10 10:30 a.m. The Double Cone Project of SPS@UCF

Kevin H. Thomas, University of Central Florida, 3076 White Ash Trail, Orlando, FL 32826; kevin.h.thomas@gmail.com

Sohang Gandhi, University of Central Florida

The double cone ascending an inclined v-rail is a common exhibit used for demonstrating concepts related to center of mass in introductory physics courses. One student of SPS@UCF recently delved into the physics behind this demonstration, and made unexpected predictions for its motion. A group of SPS students have been constructing double-cone/v-rail systems at different scales as well as variations of the system to explore its physics (and have some fun). This talk will briefly review the physics of the system and summarize the efforts of the students at UCF. Hopefully, will inspire other SPS chapters to initiate similar projects.

1. PIRA demonstration 1J11.50. See http://www.physics.ncsu.edu/pira/.
2. S. Gandhi and C. Efthimiou, The Ascending Double Cone: A Closer Look at a Familiar Demonstration, *European Journal of Physics* **26** (2005) 681.

*Support by the National SPS is graciously acknowledged
*Costas Effthimiou, sponsor

AJ11 10:40 a.m. Properties of LINERs

Diana M. Marcu, George Mason University, 22 Rubin's Walk, Fredericksburg, VA 22405; dmarcu1@gmu.edu

Rachel Dudik, George Mason University

Shobita Satyapal, Goerge Mason University

With the recent discovery that virtually all local galaxies harbor massive nuclear black holes, there is now convincing evidence that active galactic nuclei (AGN)—galaxies containing accreting supermassive black holes&emdash;and normal galaxies in our local universe are fundamentally connected. However, the nature of this connection and the detailed evolutionary history connecting these objects is unknown. Low Ionization Nuclear Emission Line Regions (LINERs), defined by their narrow optical emission lines of low ionization uncharacteristic of photoionization by normal stars, may constitute a vital piece of this puzzle, possibly representing the "missing link" between the powerful quintessential AGN in the universe and galaxies such as our own. Despite several decades of intense research, there are still open questions, including: what fraction of LINERs are truly AGN, what are their accretion properties, and how do these quantities relate to the properties of the host galaxy? In this talk, I will summarize recent results from our ongoing infrared spectroscopic investigation of LINERs using data from the Spitzer Space

AJ12 10:50 a.m. Determining the Coefficient of Drag on Various 8 Man Rowing Shells by Means of Computerized Computational Fluid Dynamics

Joseph T. Manzo, Embry-Riddle Aeronautical University, 600 S Clyde morris Blvd, daytona beach, fl 32114-3900; manzoe50@erau.edu

Joseph M. Mosca, Embry-Riddle Aeronautical University

In the sport of rowing, where races may be determined by seconds, the drag of the racing shell is of great importance. An increase or reduction in drag over the span of the typical 2-km race will significantly impact the performance of the crew. This topic has been studied theoretically in the 1960s, but has yet to be extensively researched by means of computerized computational fluid dynamics (CFD). Since the size and shape of a rowing shell is constrained by functionality and racing regulations, the general contour of all shells is similar. The following analyzes actual racing shells used by the ERAU crew team, with the CFD program STAR CD, to obtain accurate coefficients of drag. By looking at the results, along with the subtle differences in shell design, recommendations were formed to minimize drag while preserving constraints. Afterwards, a brief look into using riblets to further reduce drag is considered. To demonstrate the results, a model incorporating the design recommendations as well as the riblets is prepared and analyzed using the same program.

Session BA: Crackerbarrel: Professional Development for Physics Teacher Educators — Setting an Agenda

Sponsor: Committee on Teacher Preparation
Location: Kent
Date: Monday, Jan. 21
Time: 12:15– 1:45 p.m.

Presider: Carl Wenning

Session BAA: Crackerbarrel: For TYC Faculty

Sponsor: Committee on Professional Concerns
Co-sponsor: Committee on Physics in Two-Year Colleges
Location: Essex A
Date: Monday, Jan. 21
Time: 12:15– 1:45 p.m.

Presider: Karim Diff

Session BB: Crackerbarrel: Professional Concerns of PER Graduate Students

Sponsor: Committee on Professional Concerns
Co-sponsors: Committee on Research in Physics Education, Committee on Graduate Education in Physics
Location: Dover AB
Date: Monday, Jan. 21
Time: 12:15– 1:45 p.m.

Presider: Thomas Bing

BBB: Plenary: American Physical Society

Location: Grand Ballroom VI
Sponsor: Committee on Graduate Education
Date: Monday, Jan. 21
Time: 1:45– 3:15 p.m.

Presider: Hitoshi Murayama

BBB01 1:45 p.m. The Large Hadron Collider and the Future of Particle Physics at High Energies

Invited – Lawrence Hall, Univ. of California Berkeley

The Large Hadron Collider will reorient particle physics toward a new realm—what will the coming era look like? New elementary particles without spin, unlike anything ever seen, would solve the mystery of how a new force can spoil symmetries and create mass. Could the 20th century discovery of anti-matter be followed by a 21st century discovery of super-matter, leading to a whole new regime of particles and hinting at an ultimate unification of the forces? Alternatively, replications of heavier versions of electrons, quarks and photons would imply that the four-dimensional space-time of Einstein is but a fragment of a higher dimensional world. Perhaps the LHC will discover new stable particles that comprise the dark matter of distant galaxies. We may find evidence for a microscopic world of strong gravity and black holes or for a large scale multiverse of universes, each with different laws of physics. The LHC will test these and other speculations of the last 30 years, defining the direction of particle physics for the coming decades.

BBB02 2:15 p.m. Exploring Nature's Fundamental Forces and Particles with the Large Hadron Collider

Invited – Beate Heinemann, Lawrence Berkely National Laboratory & University of California Berkeley; BHEHeinemann@lbl.gov

The "Large Hadron Collider" (LHC) is a new particle accelerator currently being constructed in Geneva in Switzerland. It is among the most powerful and largest scientific instruments ever built and will probe the fundamental forces and particles in nature with unprecedented precision. Starting in summer 2008 proton-proton collisions will take place inside two huge detectors (called ATLAS and CMS) which record the particles produced in those collisions. More than 2000 scientists from all over the world are working on the construction of each of these detectors and will analyze the large data volumes they produce. Nobody knows what new particles will be found at the LHC but it is very likely that some revolutionary discoveries will be made: among the most likely discoveries are the "Higgs boson" (that will explain the origin of mass), "super symmetric" particles or extra spatial dimensions as predicted by theoretical models. I will explain the LHC detectors and outline the experimental methods used to detect such new particles.

BBB03 2:45 p.m. The LHC Accelerator and Its Challenges

Invited – Rüdiger Schmidt, CERN, Geneva, Switzerland; Rudiger.Schmidt@cern.ch

The motivation to construct the LHC at CERN comes from fundamental questions in Particle Physics. A deeper knowledge in Particle Physics today is linked to the understanding of particle mass scales: Is there an elementary Higgs boson? The primary task of the LHC is to make an exploration in the TeV energy range. To reach the 1 TeV scale in the centre-of-mass of proton constituent collisions, a proton collider with two beams of 7 TeV/c moments has been constructed in the 27 km long LEP tunnel. The machine is also designed for collisions of heavy ions (for example lead) at very high centre-of-mass energies. A magnetic field of 8.33 tesla is necessary to achieve the required deflection of 7 TeV/c protons, which can only be generated with superconducting magnets. Beams will be accelerated in the complex chain of CERN accelerators, injected into LHC, accelerated and stored for many hours to collide at four interaction points. The collision rate is expected to be one to two orders of magnitude higher than for any other hadron collider. The nominal performance requires the operation with large stored energy in the beams in the presence of superconducting magnets with a very low quench margin. The presentation will present the layout of the accelerator and its planned performance and discuss the implications on the used technologies. Due to the unprecedented complexity of the technical systems, the thorough commissioning of LHC technical system ("Hardware Commissioning") started already in 2005. The commissioning will be discussed and an outlook to operation with beam will be given.

Lawrence Hall

Educated at Oxford and Harvard Universities, Lawrence Hall is the Director of the Berkeley Center for Theoretical Physics. He works on unified theories of elementary particles, searching for the symmetries that underlie nature. He explores theories of early universe cosmology, including dark matter, dark energy and the multiverse.

Beate Heinemann

Beate Heinemann received her Diploma (1996) and Ph.D. (1999) from the University of Hamburg in Germany. From 1999-2002 she had a postdoctoral fellowship from the Particle Physics and Astronomy Research Council (PPARC) at the University of Liverpool. From 2002-2004 she had a PPARC Advanced Fellowship and from 2004-2006 a fellowship from the Royal Society at the University of Liverpool. In 2006 she was appointed Associate Professor of Physics at the University of California Berkeley.

Rüdiger Schmidt

Rüdiger Schmidt received his Master's and Ph.D. in Physics from the Hamburg University. He began working at CERN in Geneva, Switzerland in 1984, and is currently Deputy for LHC Hardware Commissioning. He is a member of the Advisory Committee of HEACC from 1998–2003 and is a member of the Board of the EPA Accelerators Group.

Session BC: Award Winning Undergraduate Research Programs

Sponsor: Committee on Physics in Undergraduate Education
Location: Laurel AB
Date: Monday, Jan. 21
Time: 3:30–5:30 p.m.
Presider: Wolfgang Christian

BC01 3:30 p.m. Flow and Heating Dynamics of Merging Spheromaks in SSX

Invited – Michael R. Brown, Swarthmore College, 500 College Ave., Swarthmore, PA 19081; doc@swarthmore.edu

Several new experimental results are reported from plasma merging studies at the Swarthmore Spheromak Experiment (SSX) with relevance to collisionless three-dimensional magnetic reconnection in laboratory and space plasmas. First, recent high-resolution velocity measurements of impurity ions using ion Doppler spectroscopy (IDS) show bi-directional outflow jets at 40 km/s (nearly the Alfven speed). Second, ion heating to nearly 10^6 K is observed after reconnection events in a low-density kinetic regime. Transient electron heating is inferred from bursts on a 4-channel soft x-ray array. Third, the out-of-plane magnetic field in a reconnection volume shows a quadrupolar structure at the ion inertial scale. Time resolved vector magnetic field measurements on a 3D lattice (B(r,t)) enables this measurement. Each of these measurements will be related to and compared with similar observations in a solar or space context.
Wolfgang Christian, Davidson College, sponsor

BC02 4 p.m. Quantum Entanglement as a Quantifiable Resource

Invited – William K. Wootters, Williams College, Department of Physics, Williams College, Williamstown, MA 01267; william.wootters@williams.edu

Entanglement, a remarkable kind of correlation that can exist between quantum particles, was identified by Schrödinger as the crucial feature of quantum mechanics that forces a departure from the classical paradigm. Nowadays entanglement is viewed not only as a marvel of nature but also as a resource, specifically a resource for certain unusual forms of communication such as quantum teleportation. It has therefore become useful to quantify entanglement, just as one can quantify, for example, free energy or information. This talk reviews some of the applications of entanglement, and shows how the quantification of entanglement has been of value in quantum information theory and in other areas of physics.

BC03 4:30 p.m. Mentoring Undergraduates in Molecular Beam Spectroscopy

Invited – James Cederberg, St. Olaf College, 1520 St. Olaf Ave., Northfield, MN 55057; ceder@stolaf.edu

The gift of a molecular beam electric resonance spectrometer in 1981 launched a project that has given 74 undergraduate students at St. Olaf College an opportunity to experience research first-hand. They learn about vacuum technology, machine shop construction of components, computer interfacing, software programming, and statistical methods of data analysis, as well as the quantum mechanics and thermodynamics of the molecules, and present their results at conferences and in journal publications. I will describe some of the lessons I have learned from my own mentors and the challenges encountered in our own project.

BC04 5 p.m. Imaging Transport: Monitoring Motion of Charge Through Detection of Light

Invited – Nancy M. Haegel, Naval Postgraduate School (and formerly Fairfield University), 833 Dyer Rd., Monterey, CA 93943; nmhaegel@nps.edu

Transport imaging is a flexible technique to charge transport in luminescent materials. An optical microscope, inside a scanning electron microscope, collects and reimages the spatial information from the recombination luminescence. This allows direct imaging of drift and diffusion behavior from charge generated at a point. The technique is an optical Haynes-Shockley experiment, but with high spatial resolution and flexibility provided by e-beam generation. It also provides a contact-free approach to the direct determination of minority carrier diffusion length, a parameter of special interest for characterization of solar cell materials. Results will be presented for drift behavior in heavily doped heterostructures, anisotropic diffusion in ordered materials for solar cells and determination of local electric field profiles. For spatial imaging beyond the diffraction limit, a near field scanning optical microscope (NSOM) has also been introduced for transport imaging of nanostructures. This work was initiated with undergraduate students at Fairfield University.
This work has been suppported by the National Science Foundation under Grants DMR-0203397 and DMR-0526330.

Session BD: Challenges and Successes of CASTLE Teaching

Sponsor: Committee on Physics in High Schools
Location: Laurel CD
Date: Monday, Jan. 21
Time: 3:30–5:30 p.m.
Presider: Camille Wainwright

BD01 3:30 p.m. Something IS Moving

Invited – Karen J. Matsler, 3743 Hollow Creek, Arlington, TX 76001; kmatsler@mac.com

What has CASTLE done to get things moving in physics education? Curriculum is often perceived as a short-term fad that will soon be replaced with something bigger and better. Instead of being replaced, CASTLE has been a “charge” to the educational community. How the curriculum has impacted classroom teaching, pedagogy, student learning, and professional development will be highlighted. Session will include summary of data collected during the AAPT/PTRA summer institutes.

BD02 4:00 p.m. Modeling Modified CASTLE: A More Open Ended Approach

Invited – Richard J. McNamara, Dobson High School, 1501 W. Guadalupe Rd., Mesa, AZ 85202; richardmcnamara@cox.net

As a guided discovery curriculum, the CASTLE Curriculum provides a series of hands-on and minds-on activities that cover the major concepts related to simple DC circuits. Because the level of guidance in the original CASTLE materials was intended to make the curriculum successful independent of teachers' content knowledge, the developers were interested in providing a more open-ended approach to the curriculum. The Modeling Workshop in High School Physics has worked to create a set of curricular materials that maintains the spirit of the original CASTLE curriculum while requiring students to be more involved in the experimental design of the original CASTLE activities. This talk will address the development process, the current status of the materials and workshops that have provided training for teachers in the use of the revised materials.

BD03 4:30 p.m. Studies of Two CASTLE Teachers Fostering Modeling of Electric Circuits

Invited – Grant Williams, University of Massachusetts - Amherst, 231 Greenwood Dr., Fredericton, NB E3A 3V2; grant.williams@gnb.ca

This study examines the teaching strategies of two high school teachers using the CASTLE curriculum for circuit electricity. From classroom transcripts and interviews with the teachers, diagrammatic tools were developed for analyzing whole-class conversational interactions and suggesting hypotheses about co-construction of explanatory models. Student and teacher contributions to the model-building process were tracked in an attempt to identify differences in the ways teachers can foster students' model construction processes. Two levels of teaching strategy are identified: (1) supporting dialogical elements of classroom interaction, and (2) supporting students' cognitive model-construction processes. While the teachers used different strategies at both levels, both appeared guided by intentions of promoting dissonance, concept differentiation and integration, evidential and predictive reasoning, and the challenging of misconceptions. In both cases, the teacher moves appeared to contribute to what we call OGEM cycles: (O) utilizing observations, (G) generating model elements, (E) evaluating model elements and (M) modifying model elements.

Session BE: Using Remote Telescopes

Sponsor: Committee on Space Science and Astronomy
Co-Sponsor: Committee on Educational Technologies
Location: Essex BC
Date: Monday, Jan. 21
Time: 3:30–5:30 p.m.

Presider: Mary Kadooka

BE01 3:30 p.m. LCOGTN: Robotic Telescopes Keep Education in the Dark

Invited – Rachel J. Ross, Las Cumbres Observatory Global Telescope Network, 6740 Cortona Dr. Suite 102, Goleta, CA 93117; rross@lcogt.net*

Las Cumbres Observatory Global Telescope Network is building a completely robotic network of telescopes for education and science which will be longitudinally spaced so there will always be at least one in the dark with good weather. The telescopes will be accessible online allowing observations to be done either in a real-time or queue-based mode. Although the time on the current network is very limited, several research projects are currently being trialed with schools around the world. Some of this research includes supernova follow-up, searching for and classifying open star clusters, and NEO tracking. By using these telescopes and participating in real, cutting-edge astronomy research learners will be encouraged to pursue studies in science, technology, engineering, and math while developing skills that will be valuable to any subject studied.

*Mary Kadooka, IFA, sponsor

BE02 4 p.m. Utilizing Current Windows(tm) Programs for Remote Telescope Observing and Control

Invited – Donn R. Starkey, The DeKalb Observatory, 2507 CR 60, Auburn, IN 46706; starkey73@mchsi.com*

With the explosive growth in the number of amateur-based CCD-cameras attached to modest aperture telescopes, the potential exists for interfacing this equipment with elementary and HS students via the Internet. Because this equipment utilizes an Internet interface, the process is not hampered by geography. We detail the successful integration of CCD camera equipment in an amateur-owned observatory with the curriculum of high school students at a distance of 6 time zones. Students control the camera and view the results in real-time. The Internet interface between the equipment and the students is accomplished using off-the-shelf software that is typically bundled at no additional cost with current Microsoft Windows-based computers. The use of this technology allows receptive amateur astronomers to offer the use of their facilities to remote high school classrooms. This provides an additional tool to help instructors inspire students in the fields of math and physics.

*Mary Kadooka, sponsor

BE03 4:30 p.m. A Life Changing Experience: Astronomy Remote Observing

Mimi Hang, McKinley High School, 1039 S. King St., Honolulu, HI 96814; jadeprincess913@yahoo.com*

Sophia Hu, McKinley High School

Teachers have the ability to change students' lives and their future to a great extent. I know this for a fact when my 9th-grade biology teacher introduced me to the world of astronomy and telescopes. With the Faulkes Telescope, I was able to take images of the sky and learn so much about celestial bodies without ever having to visit them. After attending the 2005 Faulkes Telescope/Deep Impact Workshop in Maui, I completed and entered my Comet Tempel 1 project in the 2006 Hawaii State Science Fair. I will share what I did with you. Ever since then, astronomy has become my great passion. I want to convince teachers to give students opportunities to use robotic telescopes for astronomy projects because the experience my teacher gave me changed my life forever.

*Mary Ann Kadooka, sponsor

Session BF: Physics Education Research

Sponsor: TBA
Location: Kent
Date: Monday, Jan. 21
Time: 3:30–5:30 p.m.

Presider: TBA

BF01 3:30 p.m. The Dynamic Assessment of Student Acquisition of Scientific Abilities*

Eugenia Etkina, Rutgers University, 10 Seminary Place, New Brunsiwck, NJ 08901; etkina@rci.rutgers.edu

Anna Karelina, Rutgers University

Maria Ruibal-Villasenor, Rutgers University

Alan Van Heuvelen, Rugers University

In the past five years our group has been working on helping students develop such scientific abilities as the ability to design an experiment to investigate a phenomenon, to test a hypothesis or to solve a problem, the ability to collect and analyze data, to evaluate and validate assumptions, etc. while learning physics content. We found that with proper guidance and scaffolding, students develop such abilities during one semester of an introductory physics course without compromising the learning of traditional content. Our new study focused on the dynamics of the development of a particular ability. Using scientific abilities rubrics developed and validated earlier, we took weekly measurements of student progress and found the average time interval that students needed to understand the meaning of the ability and be able to demonstrate proficiency.

*The project was supported by NSF grant DRL 0241078.

BF02 3:40 p.m. The Relationship Among Mathematics Anxiety and Conceptual Knowledge of Electromagnetics

Johanna Leppävirta, Helsinki University of Technology, Otakaari 5, Otaniemi, 02015; johanna.leppavirta@tkk.fi*

Students in engineering schools and universities generally have the ability and skills to perform mathematical tasks. However, prior research has indicated that even students with aptitude for mathematics suffer anxiety that affects their academic performance. The Electromagnetics Math Anxiety Rating Scale (EMARS) was developed to assess engineering students' perceived mathematics anxiety when learning electromagnetics. The mathematics anxiety is defined as a feeling of tension and anxiety that interferes with the manipulation of numbers and solving of mathematical problems. The EMARS instrument consists of five qualitatively different factors: usefulness, mathematics confidence, interpretation anxiety, fear of asking help and persistency. Traditionally math anxiety tests have been used as diagnostic instruments. Only recently, math anxiety research has considered the underlying cognitive processes involved when performing mathematical tasks. This study examined the relation between mathematics anxiety and engineering students' online performance in Conceptual Survey in Electricity and Magnetism

*Ari Sihvola, sponsor

BF03 3:50 p.m. Research to Improve Student Understanding of Time-Dependence in Quantum Mechanics*

Andrew D. Crouse, University of Washington, Physics Department, Box 351560, Seattle, WA 98195-1560; acrouse@u.washington.edu

Peter S. Shaffer, University of Washington

Lillian C. McDermott, University of Washington

The Physics Education Group at the University of Washington is engaged in a long-term effort to investigate student understanding of quantum mechanics. One component of this investigation is to examine student ideas about time dependence. We have identified some specific difficulties, developed curriculum to address those difficulties, and implemented the curriculum in junior level physics courses at the University of Washington. An iterative process of assessing and refining that curriculum is under way. Elements drawn from this body of research will be discussed.

*This work has been supported in part by the National Science Foundation.

BF04 4 p.m. Student Use of Mechanics Knowledge in Electrostatics*

Maria Dolores Gonzalez, New Mexico State University, P.O. Box 30001, MSC 3D, Las Cruces, NM 88003; mdolores@nmsu.edu

Stephen Kanim, New Mexico State University

Instructors of introductory courses often try to use students' mechanics knowledge as a basis for the development of related concepts that are central to the subsequent electricity and magnetism course. This approach is most successful if students enter the second-semester course with an adequate mechanics background, and if they recognize the underlying features that are common to the two contexts. We are developing a pre- and post-test that is intended to measure the extent to which (1) students enter the electricity and magnetism course with a sufficient mechanics foundation; (2) there is a correlation between student responses to similar questions in mechanics and electrostatics contexts; and (3) mechanics understanding is strengthened through reintroduction of physics principles in a second context. We will give examples of "paired" questions and give data from administrations of the pre- and post-tests.

*Supported by NSF grant #DUE-0125831.

BF05 4:10 p.m. Case Studies in Learners' Ontologies in Physics*

Ayush Gupta, University of Maryland, College Park, Rm 1320, Physics Building, College Park, MD 20742; ayush@umd.edu

Edward F. Redish, University of Maryland, College Park

David Hammer, University of Maryland, College Park

Some difficulties in learning science ideas can be analyzed in terms of students trying to understand the "ontology" of a concept, or in other words "what kind of thing" it is. In our previous work [1,2] we presented the perspective that experts as well as novices are not committed to a single ontology of a concept and showed instances of ontological category hopping in everyday, professional and classroom settings. Detailed case studies of students interacting with science concepts in vivo can provide valuable insights for modeling learners' ontologies in physics. We will present case study data from our physics classroom. Preliminary analysis suggests variability in students' ontological view of a concept and that students at times struggle with questions about the ontological nature of a concept. We then discuss theoretical and instructional implications and directions for research.

1. Edward F. Redish, Ayush Gupta, and David Hammer, AAPT Greensoro, 2007.

2. Ayush Gupta, Edward F. Redish, and David Hammer, AAPT Greensboro, 2007.

*This work supported in part by NSF grants REC 0440113 and DUE 0524595.

BF06 4:20 p.m. Investigating and Addressing Student Difficulties with Periodic Waves*

Mila Kryjevskaia, University of Washington, Department of Physics, Box 351560, University of Washington, Seattle, WA 98195-1560; mila1@u.washington.edu

MacKenzie R. Stetzer, University of Washington

Paula R.L. Heron, University of Washington

Lillian C. McDermott, University of Washington

The Physics Education Group at the University of Washington has been developing and modifying research-based instructional materials on waves and physical optics for Tutorials in Introductory Physics.[1] In a typical introductory course, students develop a basic understanding of the quantities describing periodic waves (such as wavelength, frequency, and propagation speed). They then establish a relationship between these quantities that they later apply in a variety of more advanced contexts, including refraction of periodic waves, interference, diffraction, and thin-film interference. Our findings suggest that difficulties with these basic concepts persist even after extensive practice in more advanced contexts. Illustrative examples of such difficulties will be discussed.

* This work has been supported in part by the National Science Foundation.

1. L.C. McDermott, P.S. Shaffer and the Physics Education Group at the University of Washington, *Tutorials in Introductory Physics,* Prentice Hall (2002).

BF07 4:30 p.m. Learning Goals and Epistemological Beliefs: Case Studies from Physics Graduate Core Courses

Yuhfen Lin, The Ohio State University, 203 Buena Vista Dr., Champaign, OH 61820; yflin@mps.ohio-state.edu

What are we trying to teach students in graduate level physics courses? Physics graduate core courses often teach the base-line physics knowledge through traditional problem solving and lengthy derivations. However, to learn to do research, graduate students need to learn more than derivations, or a sophisticated form of plug and chug problem solving. In order to help students become physics researchers, I will propose that students need to be exposed to the culture of physics research inside the core courses. I will consider the cases of a traditionally taught core course, and a course taught by a physics professor who tried to implement a graduate physics course that focused on preparing the students for future research. Using case studies from two graduate students, I will examine how their different epistemological beliefs and learning goals led these two students to perceive the same courses in very different ways.

BF08 4:40 p.m. Student Understanding of Energy: Difficulties Related to Systems*

Beth A. Lindsey, University of Washington, Department of Physics Box 351560, Seattle, WA 98195-1560; bethl@u.washington.edu

Paula R.L. Heron, University of Washington

Peter S Shaffer, University of Washington

Lillian C McDermott, University of Washington

An understanding of the relationship between work and changes in energy is important in many areas of physics from introductory mechanics onward. In order to apply this relationship, students must identify a system of interest and then be consistent in identifying which external objects do work on the system. We will describe a sequence of questions that have been administered to students on pretests and post-tests and during individual demonstration interviews in order to identify student difficulties with analyzing systems in the context of energy in introductory mechanics. A set of instructional materials[1]designed to address these difficulties is under development by the Physics Education Group at the University of Washington.

*This work has been funded in part by the National Science Foundation.

1. L.C. McDermott, P.S. Shaffer and the Physics Education Group at the University of Washington, *Tutorials in Introductory Physics,* Prentice Hall (2002).

BF09 4:50 p.m. Gestures as Evidence of Student Meaning*

Rachel E. Scherr, University of Maryland, Physics Education Research Group, College Park, MD 20742; rescherr@umd.edu

Brian Frank, University of Maryland

David Hammer, University of Maryland

Students' spoken language and written records provide primary evidence of their understanding. However, students (and experts) use language differently in different activities, and words that people say or write may not mean the same thing in another context. In particular, terms with specific technical meanings in science contexts often have other meanings in informal discussions. Student discussions in tutorials are often both informal and scientific, complicating the task of understanding what they mean by what they say. One source of evidence of students' meaning is the gestures they use as they speak. We analyze a number of gestures that one student makes in conjunction with verbalizations about "surface area" as part of her reasoning about a third law question. Our analysis suggests that for this student, the term "surface area" in this episode does not necessarily reference what she would call surface area, volume, mass, or any other specific quantity in another conversation, but instead is an ambiguous term that could refer to a variety of size-related properties of the object.

*Funded in part by NSF Grant # REC-0440113.

BF10 5 p.m. Should We Use Ill-Structured Physics Problems in Introductory Physics Courses?

Vazgen Shekoyan, Rutgers University, 136 Frelinghuysen Rd., Piscataway, NJ 08854; vazgen@physics.rutgers.edu

Eugenia Etkina, Rutgers University

Most of real-life and professional problems are ill structured. Ill-structured problems do not have one right answer and require the solver to examine different possibilities, assumptions, and evaluate the outcomes. However, in traditional educational settings we polish problems and make them well-structured problems (most of traditional end-of-chapter book problems are well-structured). Introductory physics courses are usually short and packed with new content. Should we engage introductory physics students in solving ill-structured problems at the expense of traditional problems? In our study we substituted some of the traditional problems with ill-structured physics problems in cooperative group problem solving activities in recitations in an algebra-based introductory physics course. We provided scaffolding with a particular emphasis on epistemic questioning. In this talk we will discuss the implications of this intervention on the enhancement of students' cognitive abilities and physics content knowledge.

BF11 5:10 p.m. Proportional Reasoning Test: An Instrument to Assess Instructional Strategies

Cheryl P. Schaefer, Missouri State University, Physics 901 S. National Ave, Springfield, MO 65897; CherylSchaefer@missouristate.edu

The Proportional Reasoning Test was developed to have a way to evaluate student reasoning prior to instruction and to evaluate the efficacy of instructional strategies in improving student ability to reason with rates and ratios. This session will share the test in final form and will promote distribution of the test for general use.

BF12 5:20 p.m. Analysis of Students' Difficulties in Solving Problems Related to Magnetism

Jungho Choi, Department of Physics Education, Seoul National University, San 56-1 Sillim 9-dong, Gwanakgu, Seoul, 151-748; hosu8188@snu.ac.kr

Inho Lee, Seoul National University

Dongryul Jeon, Seoul National University

The achievement in electromagnetism in college physics course is not good. Especially students seem to think that magnetism is the most difficult topic. Thus in this study we tried to find the students' difficulties about the magnetism in college physics and the reason for the difficulties. We used paper-pencil tests and the semi-constructed interview. The students' difficulties and reasons were classified using the framework of knowledge and belief. These difficulties and reasons were substituted by the steps of the Wessels problem-solving model, which is a basic model in psychology. Our study showed that the main source of students' difficulties were concept understanding and thinking power.

Session BG: Physicists in the Medical Profession

Sponsor: Committee on Graduate Education in Physics
Location: Dover AB
Date: Monday, Jan. 21
Time: 3:30–5:30 p.m.

Presider: Michael Thoennessen

BG01 3:30 p.m. From Cascade Hyperons to Cartilage: A Physicist's Career in Medicine

Invited – Jeffrey Duryea, Radiology Dept., Brigham and Women's Hospital, 75 Francis St, Boston, MA 02115; jduryea@bwh.harvard.edu

Research medicine is a field that increasingly relies on innovative technology to make advances and new discoveries. Much of the new biomedical science is based on physics and methodologies used for physics and engineering research. Individuals with degrees in physics are a valuable resource for the medical community, and are in a position to have a major impact on the field. In this presentation, the speaker will discuss his transition from the field of high-energy physics to a faculty position in the radiology department of a major teaching hospital, and to a specialization in arthritis imaging research. The speaker found that his physics background provided a strong foundation for success, but unanticipated obstacles and the need to acquire new skills were among the challenges faced along the way. Medical imaging is an exciting field and an excellent career for individuals interested in an applied field with real-world impact.

BG02 4 p.m. Physics Thinking in Biomedical Research

Invited – Alison J. Lin, Harvard Medical School, 250 Longwood Ave., Dept. of BCMP, SGMB, Rm 321, Boston, MA 02115; alison_lin@hms.harvard.edu*

Discoveries in physics and subsequent development of cutting-edge technologies have been at the forefront of medical diagnosis and treatment since the discovery of x-rays in 1895. More than the techniques and technologies, a physicist can bring a new perspective to problem solving in biology and medicine. Education and training in physics provide an analytical and quantitative approach for studying complex biological systems. During the 1999 American Physical Society meeting, Dr. Harold Varmus, Nobel Prize laureate and then director of NIH, identified three areas of opportunities for physicists in contemporary biomedical research. These include single molecule manipulation, computational analysis of gene expression, and elucidation of cellular signaling pathways. All three areas are urgently active today, and have indeed become hot beds of multidisciplinary research. Here, based on my own experience working between the two disciplines in two of these areas, I will explore the power of physics thinking in biomedical research.

*Michael Thoennessen, sponsor

BG03 4:30 p.m. A "Beam's-Eye-View" on Therapeutic Medical Physics

Invited – Erik J. Tryggestad, Johns Hopkins University School of Medicine, Dept. of Rad. Onc. and Molecular Rad. Sciences, 401 North Broadway, Suite 1440, Baltimore, MD 21231; etrygge1@jhmi.edu

Therapeutic medical physics, or the physics of radiotherapy, has a rich history that evolved from the discovery of natural radioactivity near the turn of the 20th century. Driven by both basic and industrial research, over time the field of radiotherapy physics has broadened in scope and now employs an increasingly multi-disciplinary group of scientists. Worldwide, the broader field of medical physics now employs perhaps 5,000 physicists. It is in spite of these facts, however, that radiotherapy physics remains a relatively unfamiliar niche in the vast world of applied physics. Against the backdrop of a pop culture that increasingly associates the word *radioactive* with *bad*, modern radiotherapy provides the basis for effective, life-sustaining treatments for otherwise terminally ill patients. In 30 minutes or less, I hope to convince the audience that not only is radiation in radiotherapy not "bad", but that it also provides for an interesting and highly rewarding career.

Session BH: Interactive Lecture Demonstrations—Physics Suite Materials that Enhance Learning in Lecture

Sponsor: Committee on Research in Physics Education
Location: Dover C
Date: Monday, Jan. 21
Time: 3:30–5:30 p.m.

Presider: David Sokolof, Univ. of Oregon, 541-346-4755, sokoloff@uoregon.edu

The results of physics education research and the availability of microcomputer-based tools have led to the development of the activity-based Physics Suite. Most of the Suite materials are designed for hands-on learning, for example student-oriented laboratory curricula like RealTime Physics. One reason for the success of these materials is that they encourage students to take an active part in their learning. This interactive session will demonstrate—through active audience participation-Suite materials designed to promote active learning in lecture-Interactive Lecture Demonstrations (ILDs). The demonstrations will be drawn from energy, heat and thermodynamics, oscillations and waves, electricity and magnetism, light and optics. Results of studies on the effectiveness of this approach will be presented. This session should be of special interest to teachers of large lecture classes as well as those who teach small classes where only one computer is available.

Session BHH: Topics in Physics

Location: Heron
Date: Monday, Jan. 21
Time: 3:30–5:30 p.m.

Presider: TBA

BHH01 3:30 p.m. Plumbing the Depths to Design a Floating Device

Saami J. Shaibani, Instruction Methods, Academics & Advanced Scholarship (IMAAS), P.O. Box 12255, Lynchburg, VA 24506; shaibani@imaas.org

The expression "going over like a lead balloon" conjures up an image of abject failure, with or without some measure of ridicule. However, from the perspective of physics, the concept of such a floating device is not completely absurd even if it might be highly impracticable. The research reported here includes an examination of the underlying principles in mechanics, fluid dynamics and thermodynamics to derive the design equation for this type of object. Balloon variables such as size, contents, density and wall thickness are considered in order to determine the nature of the design features involved. The results are not quite as improbable as one might imagine, although they do support the expected lack of feasibility. At all stages, the motivation of the study is to foster an instructive environment that challenges students to expand their awareness of the power of physics as they explore a seemingly daunting exercise.

BHH02 3:40 p.m 2001 A Space Odyssey: Whose Gravity Is It Anyway?

Robert Schwartz, Harriton High School, 600 North Ithan Ave., Rosemont, PA 19010; schwarr@lmsd.org

By observing and making measurement estimates from the space station scene in the movie *2001 A Space Odyssey*, a value for the simulated g value in the station can be determined. What value might be desired in such a space station? Also the simulated g value in the spaceship Discovery will be discussed.

BHH03 3:50 p.m. Optical Phase Change Upon Reflection

Carl E. Mungan, U.S. Naval Academy, Physics Department, Mailstop 9c, Annapolis, MD 21402-5002; mungan@usna.edu

The phase changes for reflection at normal incidence from an interface between nonmagnetic, nonconducting media are needed in introductory physics for thin-film interference. Many textbooks attempt to justify these phase changes using a flimsy analogy to the reflection of a string wave off an end. But in fact it only takes a simple diagram and a few lines of algebra to formally derive the phase changes. As a bonus, index matching naturally arises as a possibility when comparing the refractive indices of the two media. The reflectance and transmittance can also be easily introduced in this context.

BHH04 4 pm. Useful Techniques for Spin You Didn't Learn in Graduate School

Gregory D. Mahlon, Penn State Mont Alto, 1 Campus Dr., Mont Alto, PA 17237; gdm10@psu.edu

Most quantum field theory textbooks focus on the calculation of spin-averaged or spin-summed stattering amplitudes, leaving the question of how to obtain spin-polarized amplitudes as "an exercise for the reader." We describe a method for calculating polarized scattering amplitudes for an arbitrary choice of spin quantization axis. This is particularly interesting in situations where the traditional helicity spin-basis does not provide the most transparent description of the underlying physics (such as for processes involving massive fermions). In fact, our method explicitly illustrates the role of the non-zero fermion mass in the decomposition of the spin eigenstates into a superposition of the two chirality eigenstates.

BHH05 4:10 p.m. Pictures in Quantum Mechanics

Dereje Seifu, Morgan State University, 1700 E. Cold Spring, Baltimore, MD 21251; dseifu@jewel.morgan.edu

In undergraduate and first-year graduate quantum mechanics courses a major conceptual difficulty students face is neither the orthodox viewpoint of measurement in quantum mechanics nor the exclusively quantum effects that have no classical analog, rather the major difficulty is the conceptual difficulty in Schrodinger's picture where dynamical variables such as momentum and energy become operators that were once functions that evolve in time. This conceptual difficulty can be surmounted by introducing early on Heisenberg's picture of quantum mechanics which unfortunately is omitted by most introductory quantum mechanics text books.

BHH06 4:20 p.m. Why Quantum Mechanics Is Usually Taught Incorrectly

Stuart Gluck, Johns Hopkins University Center for Talented Youth (CTY), McAuley Hall, 5801 Smith Ave., Ste. 400, Baltimore, MD 21209; stu@jhu.edu

Vincent Bonina, Johns Hopkins University Center for Talented Youth (CTY)

Takeyah Young, Johns Hopkins University Center for Talented Youth (CTY)

In most classes on quantum mechanics (QM), the conceptual foundations of the theory are misrepresented. Students are typically taught that we know that whenever a measurement occurs the wave-function collapses via a non-unitary evolution process; in essence, Schrödinger's equation "turns off" for that state transition. However, we don't know anything of the sort. There are consistent, empirically equivalent alternate accounts of QM in which Schrödinger's equation always holds valid and all temporal evolution is unitary. This is one amongst a morass of confusions about the conceptual foundations of the theory typically propagated from one generation of physics educators to the next. In this session, we sort out the myths from what the theory really tells us so you can teach students QM with accuracy and conceptual clarity.

BHH07 4:30 p.m. Recapturing Household Heat From Waste Water

Thomas F. Haff, Issaquah High School; Energy Conservation Group, 700 2nd Ave. SE, Issaquah, WA 98027; hafft@issaquah.wednet.edu

Energy Conservation Group, Issaquah High School

Five to 15 seconds. That's the approximate length of time it takes water to travel from a showerhead to the drain. The water then travels out of the house. In the greater Seattle area, water is recycled, but the heat stored in the water is not. In order to recapture that heat, Issaquah High School's Student Energy Conservation Group constructed a prototype apparatus that holds used hot waste water inside a wall until the heat energy has dissipated throughout the house. The heat is recycled. This lowers energy consumption, which in turn lowers greenhouse gas emissions and heating bills. We invite you to learn more about our project.

BHH08 4:40 p.m. Formula Recollection Through a Never Before Seen Mnemonic Technique

Shannon Schunicht, M & W Inc., 408 Eisenhower St., College Station, TX 77840–1715; mnemoni3mind@alpha1.net

While in the Army, Mr. Schunicht was involved in a mid-air collision rendering him unconscious for three weeks. Everything had to be re-learned as nursing actions were reported as having been displayed upon awakening from the extended unconsciousness (19 days). Studies in recovery brought about some pragmatic discoveries to compensate for the residual memory deficits. The most valuable was having each vowel represent a mathematical sign, i.e. "a" for multupliication implying "@", "o" for division implying "over", "i" for subtractionimplying "minus", "u" for addition implying "plus", and "e" implying "equals." Most constants and variables are indeed consonants, e.g. "c" = "speed of light", and "R" = "Rate/time variable." With this technique, any formula may be algebraicallly manipulated into aword/series. Additional letters may be added to enhance intelligibility, but these additional letters may only be consonants. Examples of this technique's applicability will be shown using common physics formulas, as well as representative formulas submitted upon arrival.

BHH09 4:50 p.m Radiative Equilibrium and Climate Change as an Application of Radiation

Mark Seefeldt, University of Colorado at Boulder / CIRES, 216 UCB, Boulder, CO 80309; mark.seefeldt@colorado.edu

Climate change and radiative equilibrium can be used as an application of the characteristics of EM radiation. Wien's displacement law indicates that the radiation from the Sun is emitted in the shortwave and that terrestrial radiation is emitted in the longwave. This difference leads to the greenhouse effect as the radiative absorption of atmospheric chemical species is dependent on the wavelength. Stefan-Bolzmann law provides the ability to understand the amount of incoming solar radiation to the Earth as well as the outgoing terrestrial radiation. An imbalance in the equilibrium between the incoming solar radiation and the outgoing terrestrial radiation results in a climate change with the Earth's atmosphere and ecosystem. By combining the principles of EM radiation with climate change the physics material can be connected to real-world events as well as providing a more educated understanding of one of the primary current environmental concerns.

BHH10 5 p.m. Students' Conceptual Understanding of Quantum Physics in College Level Classroom Environments

Bayram Akarsu, Horizon Science Academy, 425 Jefferson Ave., Toledo, OH 43615; bakarsu@indiana.edu

Beyhan Akarsu, HSAS

The purpose of this project was to study the potential solutions of the common learning difficulties, insufficient teaching techniques and other significant instructional or conceptual problems encountered while teaching and learning an important branch of physical science, quantum physics (QP), at the senior or junior college year. Both quantitative and qualitative methodologies were utilized in this study. The participants included five physics faculty members with different levels of teaching experience who were teaching one of the quantum physics courses (e.g. Modern Physics, Quantum Physics, and Quantum Mechanics) and 43 senior or junior undergraduate students enrolled in their courses during fall and spring terms of 2006. The findings of this study revealed that students struggle in QP classes mainly because of (1) complex mathematical tools in QP, (2) abstract concepts and nonparallel construction of QP, (3) QP has a bad reputation that negatively affects students prior to taking it, and (4) the pace in curriculum of quantum physics courses is too fast for the students. In order to increase students' conceptualization of QP concepts, the faculty members who participated in this study suggested that: (1) more time should be spend on solving more abstract conceptual questions, (2) recitation hours for solving more numerical problems need to be dedicated, and (3) revision of curriculum is necessary.

BHH11 5:10 p.m. Simple Experiments to Help Students Understand Magnetic Phenomena

David P. Jackson, Dickinson College, P.O. Box 1773, Carlisle, PA 17013; jacksond@dickinson.edu

Kerry P. Browne, Dickinson College

As part of the Explorations in Physics curriculum, we discuss a number of simple experiments that help students develop a reasonably sophisticated model of basic magnetic phenomena, including the interactions between magnets, magnetic materials, and current-carrying wires. These experiments are designed for nonscience majors in an introductory laboratory setting, but they have been successfully used with physics majors as well. To help students understand these experiments, we present a "microscopic magnet model," which is similar in spirit to understanding conductors and insulators using a microscopic charge model. We will also discuss the activity-based nature of the course and how the interplay between experiments and discussions helps promote student understanding.

BHH12 5:20 p.m. Ring Modulation: The Other Side of Beating

David Keeports, Mills College, 5000 MacArthur Blvd, Oakland, CA 94613; dave@mills.edu

A familiar trigonometric identity expresses the sum of two sinusoidal functions as the product of two other sinusoidal functions. Beating, the production of a time-dependent loudness variation when two sources of similar frequencies are sounded together, is a well-known phenomenon. Less well know is the phenomenon of ring modulation, in which amplitude modulation of a single frequency gives rise to the sum of two distinct and generally dissonant audible frequencies. I will discuss beating and ring modulation as mathematically identical phenomena. Additionally, I will play some audio files demonstrating the transition from beating to ring modulation as the frequency difference between added sinusoidal waves increases.

BHH13 5:30 p.m. The Visual Glossary for Physics

Natalia A. Semushkin, Shippensburg University, 1871 Old Main Dr., Shippensburg, PA 17257; nasemu@ship.edu

Victor V. Alexandrov, SPIRAS, St. Petersburg, Russia

The dominant feature of globalization is the power and ubiquity of new global technologies. Internet resources provide diverse perspectives on ways in which education is being shaped by global processes. We are introducing an alternative to the standard Internet search engine Google that was developed in SPIRAS*, Russia. This search engine is referred as a Visual Glossary or "VisGloss." The VisGloss is designed to improve the search for different areas of professional and educational information. The most important advantage of this search engine is that it provides access to information in interactive visual mode showing every term linked to the given topic. The VisGloss allows users to find information quickly by following semantic connections that surround every term linked to the topic. It provides quicker searches and faster and more intuitive understanding of the topic. We put efforts in developing the version of VisGloss for physics as the first part in a group of semiotic information system resources for science education.

BHH14 5:40 p.m. Covariation Framework in Higher Dimensions: Proficiency In The Function Concept

Adam S. Thompson, Department of Physics, Arizona State University, Box 871504, Tempe, AZ 85287-1504; adam.thompson@asu.edu

Robert J. Culbertson, Arizona State University

Michael Oehrtman, Arizona State University

Studies show that students' struggles with the concept of a mathematical function (the ability to coordinate changes in two functionally related variables) often prevents them from gaining a deep conceptual foundation in calculus and related sciences. Although several mathematics researchers collaborated to design a research framework (covariation framework) to allow more robust analysis, this framework was not extended beyond scalar functions of scalar variables. This talk will introduce a possible extension to the covariation framework that generalizes it to vector functions and vector variables (e.g. position, velocity, acceleration; gravitational and electric potentials; electric and magnetic fields; etc.). Questions will be addressed, including "How can this framework be used to diagnose proficiency of physics students?", "What benefit will such a diagnostic bring to my classroom?", and "How can this framework be used to guide curriculum?" Results of a initial diagnosis will be given.

Supported by The National Science Foundation (MSP-0412537)

Robert J. Culbertson, sponsor

Session BI: Crackerbarrel: What Are the Criteria for Textual Material Suitable for a First Course in Physics?

Sponsor: Committee on Physics in High Schools
Location: Laurel CD
Date: Monday, Jan. 21
Time: 8:30–10 p.m.

Presider: John Hubisz

Session BJ: The Use of Labs in a Physics First Class

Sponsor: Committee on Laboratories
Co-Sponsor: Committee on Physics in High Schools
Location: Laurel CD
Date: Monday, Jan. 21
Time: 7–8:30 p.m.

Presider: Duane Merrell

BJ01 7 p.m. Labs in "Active Physics"

Invited – John L. Roeder, The Calhoun School, 433 West End Ave., New York, NY 10024; JLRoeder@aol.com

As a physics course for all high school students, but especially for ninth graders, "Active Physics" is heavily lab-based, leading students to discover fundamental relationships experimentally rather than derive them theoretically. I shall present several examples of how this process works in my classroom.

BJ02 7:30 p.m. Goals for Physics First Labs

Invited – Barry H. Feierman, Westtown School, Westtown Rd., Westtown, PA 19395; bhfeier@aol.com

What makes a good Physics First (9th grade) lab? Remember that 9th graders are more likely to be concrete thinkers and have less mathematical experience compared to juniors and seniors. I will show a few examples of simple, inexpensive, creative labs that challenge 9th graders to think conceptually without overwhelming them with complex math. Apparatus will include home-made instruments to measure mass made from springs, straws, and aluminum meter sticks. This leads to a wonderful discussion contrasting mass and weight.

Session BK: Future Technologies

Sponsor: Committee on Educational Technologies
Location: Essex BC
Date: Monday, Jan. 21
Time: 7–8:30 p.m.

Presider: Kevin Lee

BK01 7 p.m. Beyond Clickers: Web-based Wireless Interactivity for the Physics Classroom*

Invited – Dean Zollman, Kansas State University, 116 Caldwell Hall, Manhattan, KS 66506-1619; dzollman@phys.ksu.edu

N. Sanjay Rebello, Kanas State University

Zdeslav Hrepic, Fort Hays State University

Wireless technology, which is rapidly becoming available in classrooms, offers the capability of engaging students in a wide variety of interactive and even collaborative learning. A web-enabled personal data assistant (PDA) or notebook computer can collect data in a variety of formats from students in any size class, even from students who are not all in the same location simultaneously. These data can be submitted as text, graphics, or a simple click of the mouse. All types can be analyzed and help an instructor learn how well the students are understanding information that is being presented. Perhaps a more important development is the number of collaborative tools which offer new ways of having peers interact in any size class. These tools allow instructors to create collaborations among students who may have not met each other but can work together through software. Results of collaborations from different groups on the same project or related projects can then form the foundation for a lesson. At present many of the collaborative tools would be cumbersome to use in large physics classes. However, they are pointing the way to what we should find readily available in the not too distance future. Some examples of our present efforts and speculations about future interactive physics classrooms will be presented.

*This work is supported in part by a Hewlett-Packard Technology for Teaching Grant.

BK02 7:30 p.m. Offline, Online and Beyond Communities as We Know Them

Invited – Jennifer Preece, University of Maryland, Room 4105E Hornbake Bldg., South Wing, College Park, MD 20740-4345; preece@umd.edu

There has been much talk about the steady decline of physical communities since the end of the First World War. In contrast the buzz about online communities has reached a crescendo during the last five years. Supported by a variety of synchronous and asynchronous software, people have come together to chat, vote, protest, share tales of woe, exchange jokes, check out each others' movements, do homework, look for, edit or contribute new information, play games and much more. Cell phones, Blackberries and other handheld devices, special input devices, digital kiosks, digital cones, lap and desktops all provide ways of sending, searching and retrieving information, and communicating with others. With the help of artists and creative technologists have developed digital clothes, and tiny, tiny, processors monitor our health and our movements, or check our behavior. So much is happening in our digital worlds, but how do these devices and communication trends impact education and vice-versa. What do we mean by community? What is a learning community? Does it matter if it is face-to-face or online? What kinds of trends have there been and what might happen next? These are some of the questions that I will address in this brief talk.

BK03 8 p.m. Out of the Projects and into the Game?

David Weaver, Chandler-Gilbert Community College, 7360 E Tahoe Ave, Mesa, AZ 85212; dweaver@cox.net

I tossed the baby out with the bathwater (and the shampoo, and the rubber ducky) seven years ago when I discovered problem/project-based learning. That transformation took me from what was (I think) an active engagement environment to a more immersive one. Gone was the tyranny of the topics and I embraced the power of learning in context. I should've been relatively content, yes? Not yet! I am on sabbatical this year to explore the interface between video/computer gaming and physics. Contemporary video games have amazing physics engines that could be wonderful sources of learning in contexts that my students already understand and enjoy. Moreover, my initial research indicates that video game designers might have a lot to teach us about keeping students willingly engaged in complex problem-solving for hours on end. Come see where I'll be halfway through my sabbatical.

Session BL: The Case for Specialized Physical Science Courses for Pre-Service K-8 Teachers

Sponsor: Committee on Physics in Pre-High School Education
Location: Kent
Date: Monday, Jan. 21
Time: 7–8:30 p.m.

Presider: Robert Poel

BL01 7 p.m. Physics by Inquiry: A Research-Based Approach to Preparing K-12 Teachers to Teach Science as a Process of Inquiry

Invited – Paula Heron, University of Washington, Department of Physics Box 351560, Seattle, WA 98195-1560; pheron@phys.washington.edu

The Physics Education Group at the University of Washington (UW) has been helping prepare pre-service and in-service teachers to teach physics and physical science for more thqn 30 years. Based on this experience, and on systematic research, *Physics by Inquiry* (Wiley, 1996) has been developed to help college and university faculty conduct courses, workshops and Institutes for K-12 teachers. This talk will address the development and use of PbI at the UW and elsewhere. Evidence of its effectiveness at helping teachers master important concepts and scientific reasoning skills will be presented. for the session The Case for Specialized Physical Science Courses for Pre-service K-12 Teachers.

BL02 7:30 p.m. Physics and Everyday Thinking and Physical Science and Everyday Thinking*

Invited – Fred Goldberg, San Diego State University, CRMSE 6475 Alvarado Rd., Suite 206, San Diego, CA 92120; fgoldberg@sciences.sdsu.edu

Physics and Everyday Thinking (PET) and Physical Science and Everyday Thinking (PSET) are curricula for one-semester college courses designed for prospective and practicing elementary teachers and non-science majors.[1] PET focuses on the themes of interactions, conservation of energy and Newton's laws. PSET also focuses on conservation of mass and atomic molecular theory. Both curricula include a substantive Learning about Learning component, focusing on the learning of scientists (NOS), young children and the students themselves. Both curricula were designed around principles based on research on learning: learning builds on prior knowledge; knowledge construction is a gradual process; interaction with tools facilitates learning; social interactions aid in learning; and norms (evidence, responsibility, respect) can structure student interactions, discourse and learning. Pre/post conceptual tests and the Colorado Learning Attitudes about Science Survey [2] administered at many sites show growth in students' understanding of content and the nature of science and learning.

*Supported by NSF Grant

1. *Physics and Everyday Thinking* and *Physical Science and Everyday Thinking* are both published by It's About Time, Herff Jones Education Division.
2. W. Adams, K. Perkins, N. Podolefsky, M. Dubson, N. Finkelstein and C. Wieman, *Phys. Rev ST: Phys. Educ. Res.* 2(1) 010101, 2006.

BL03 8 p.m. Facilitating Inquiry by Using Powerful Ideas in Physical Science (PIPS)

Invited – Patsy Ann Johnson, Slippery Rock University of Pennsylvania, 114 McKay Education Building, Slippery Rock, PA 16057-1326; patsy.johnson@sru.edu

In the National Science Education Standards, scientific inquiry abilities and understandings are included in content standards for kindergarten through high school. Students preparing to teach grades K-8 need substantial experiences engaging in inquiry if they are to be ready to guide others in inquiry. An efficient and effective way to provide these experiences is to design a college or university course using Powerful Ideas in Physical Science (PIPS) published by the AAPT. PIPS was developed and field tested by faculty, usually in small sections of physics courses. The four original modules are Light and Color, Electricity, Nature of Matter, and Heat and the Conservation of Energy. Two additional modules are Force and Motion. Most of the PIPS activities use inexpensive and readily available materials. Students record their prior knowledge, consider what their classmates think, observe discrepant events, take measurements, record data, make inferences, and reconstruct their understandings about natural phenomena.

Session BN: The Best of comPADRE

Sponsor: Committee on Physics in Undergraduate Education
Co-Sponsor: Committee on Educational Technologies
Location: Dover AB
Date: Monday, Jan. 21
Time: 7–8:30 p.m.

Presider: Wolfgang Christian

BN01 7 p.m. Using comPADRE and BQ to Distribute and Improve Interactive Curricular Material

Invited – Mario Belloni, Davidson College, Physics Department, BOX 6910, Davidson, NC 28036; mabelloni@davidson.edu

Wolfgang Christian, Davidson College

With the explosion of material on the web, digital libraries have increasingly become an important resource for teachers and curriculum developers alike. The value of digital libraries, such as comPADRE, and other curricular-specific search engines, such as BQLearning, is their ability to cut through the digital "noise" to provide high-quality material to teachers by cataloging, organizing, and ranking their content. Similarly, comPADRE and BQLearning allow curriculum authors an avenue to disseminate and receive feedback on their materials. Recently we have begun to write Open Source Physics (OSP) materials specifically for dissemination by comPADRE and BQLearning by using HTML- and XML-based materials that can be easily integrated and better searched for easier dissemination Examples from classical mechanics, general relativity, and quantum mechanics will be presented with the focus on how comPADRE and BQLearning have helped us improve and distribute OSP material.

The Open Source Physics Project is generously supported by the National Science Foundation (DUE-0442581).

BN02 7:30 p.m. Ben Franklin on ComPADRE: Historical Materials and Experiments in Modern Media

Invited – Robert A. Morse, St. Albans School, Mount St. Albans, Washington, DC 20016; robert_morse@cathedral.org

Printer and philosopher, newspaperman and postmaster—Benjamin Franklin was a media giant of his time. During a sabbatical at the Wright Center for Science Education at Tufts University, I explored Franklin's work in electricity and prepared resource and teaching materials for distribution via the Internet. I am pleased that comPADRE—an aspiring media giant of our time—has chosen them for dissemination.This talk will describe the package of materials, their development, considerations of format and copyright in preparing them, their intended audience and the role of ComPADRE in disseminating them. Look for "Ben Franklin as my Lab Partner" on comPADRE.

BN03 8 p.m. The Best of comPADRE: Science Appreciation — Introduction to Science Literacy

Invited – John W. White, Lawrence Livermore National Laboratory (retired), 4307 Drake Ct., Livermore, CA 94550-4910; white10@llnl.gov

Science literacy is a serious and difficult pursuit. New ways to inform nontechnical citizens about political issues with technical components is crucial. The speaker will describe a new college-level textbook that tries to address the need of science literacy. It has turned out that comPADRE has been an excellent vehicle for disseminating the text. It has received many downloads. Although feedback has been modest (but positive), a potential publisher has come forward.

Session BO: Labs and Wikis

Location: Dover C
Date: Monday, Jan. 21
Time: 7–9:20 p.m.

Presider: Anne J. Cox

BO01 7 p.m. Physics Labs on a Shoestring Budget

Takeyah Young, Johns Hopkins University Center for Talented Youth (CTY), McAuley Hall, 5801 Smith Ave., Ste. 400, Baltimore, MD 21209; takeyah.young@jhu.edu

Vincent Bonina, Johns Hopkins University Center for Talented Youth (CTY)

Stuart Gluck, Johns Hopkins University Center for Talented Youth (CTY)

Many valuable physics labs can be conducted with minimal funding. Even when budgets are generous, often these are the most successful labs, because they creatively convey the excitement that physics is all around us. Over the last few decades, the many instructors of physics and physics-related courses for the Johns Hopkins University's Center for Talented Youth (CTY) have used a variety of engaging physics labs and activities that can be done on a shoestring budget. In this presentation, we review examples collected from CTY instructors and share some resources and techniques for designing labs to support your goals.

BO02 7:10 p.m. Experimenting with the Introductory Physics Lab Sequence

Toni D. Sauncy, Angelo State University, 2601 West Ave. N (BOX#10904), San Angelo, TX 76909; toni.sauncy@angelo.edu

The introductory calculus-based physics lab sequence at Angelo State has been reinvented in an effort to fully address the AAPT Goals of Introductory Physics Labs as outlined by AAPT some years ago.[1] Since its initial publication, there has been much research on the exact manner in which these goals are best attained. The changes to the two-semester lab sequence are derived from such published research,[2] and include an emphasis on conceptual understanding utilizing Internet-based simulations, digital recording technology, and increased interaction between instructor and student. Experiments focus on experimental technique, data acquisition skills and detailed error analysis. Students transition from prompted lab recording to independent experimentation over the year. Students have responded favorably as have subsequent advanced lab instructors.

1. *AJP* **66**(6), pp. 483-485 (1998)

2. *J. Profl. Issues in Engrg. Educ. and Pract.* **133**(3), pp. 192-198 (2007); *AJP* **74**(11), pp. 979-986 (2006); *AJP* **73**(8), pp. 771-777 (2005).

BO03 7:20 p.m. The RC Circuit with LEDs

Feng Zhou, Indiana University of Pennsylvania, 167 Northpointe Blvd, Freeport, PA 16201; fzhou@iup.edu

Joshua P. Garcia, Indiana University of Pennsylvania

By measuring the discharge voltage in an RC circuit with an LED, we can accurately determine the time constant and voltage to turn on the LED by fitting the exponential decay curve. This method is reliable, generating an interesting way to determine an important physical constant such as Planck's constant h, the speed of light c or the basic charge on an electron e. The low-cost computer-integrated lab experiment combined with simple math modeling exhibits desirable characteristics for an entry-level physics course or an interactive lecture demonstration.

BO04 7:30 p.m. TeachSpin, Inc. Instruments Designed for Teaching

Barbara Wolff-Reichert, TeachSpin, Inc., 2495 Main St. – Suite 409, Buffalo, NY 14214-2153; bwolff-reichert@teachspin.com

TeachSpin's hands-on instructional apparatus sets the standard for advanced and intermediate teaching labs worldwide. And now, many of our optical components, including mirror mounts, lasers and detectors, are available individually. Each year we try to introduce two new instruments. This year, the first one is called Quantum Analogs—acoustic experiments modeling quantum phenomena. It's ready for your inspection. But you may also try your hands on Modern Interferometry, Muon Physics, Two-Slit Interference, One Photon at a Time, and the other units we brought with us.

BO05 7:40 p.m. Biological Application Oriented Physics Labs for Life Sciences Students

Fang Liu, The Richard Stockton College of New Jersey, Jimmy Leeds Rd., Pomona, NJ 08240; fang.liu@stockton.edu

Sipra Pal, The Richard Stockton College of New Jersey

Nada Jevtic, The Richard Stockton College of New Jersey

Monir Sharobeam, The Richard Stockton College of New Jersey

No data is more interesting to a student than data about his or her own body. In our efforts to promote more engaged learning in physics for life sciences students, we have introduced several biological application-oriented physics labs into our Physics for Life Sciences Laboratory. These new labs take advantage of the advanced lab apparatus including EKG system, stress-strain apparatus, and human arm model. Physics for Life Sciences students use these advanced lab apparatus and DataStudio software to obtain and analyze data in each section, enabling them to see the electrical signals generated by their hearts, to see the stress and strain during the entire process of stretching and breaking material such as bone and tissue, and to evaluate the work done by the arm in many types of motion such as extending and lifting an object, curling, or throwing a ball overhand.

BO06 7:50 p.m. Student-Created Wikis in Introductory Physics.

Eric J .Page, University of San Diego, 5998 Alcala Park, San Diego, CA 92110; epage@sandiego.edu

Many students are aware of, and some even contribute to online wikis, the most well known of which is the Wikimedia Corporation's Wikipedia. In this report, we describe how the creation of online secure wikis by introductory physics students working in small groups can benefit both the student and the instructor: the students gain understanding through an online collaborative creation of a "study guide," and the instructors gain insight into how the students are processing the information by overseeing the creation of these pages. We also describe how this method could be used to help evaluate student gains in introductory physics.

BO07 8 p.m. Working With Wikipedia, Not Against It

David L. Morgan, Eugene Lang College, 65 West 11th St, New York, NY 10011; davemorgan@excite.com

This talk describes a project in which college physics students spend a semester editing incomplete "stub" entries in physics and astronomy on Wikipedia.org.

BO08 8:10 p.m. Organizing an Undergraduate Research Group: Graduate Mentoring, Scaffolding, and Wikis

Ramon E. Lopez, University of Texas at Arlington, Department of Phys-

ics, Arlington, TX 76019; relopez@uta.edu

Robert Bruntz, University of Texas at Arlington

In this talk I will describe how my group manages a large number of undergraduates engaged in meaningful research projects. The interaction is very structured and includes considerable scaffolding to ensure student success. The undergraduates are organized into groups with specified research foci, and a graduate student assigned to each group as a mentor. Groups meet regularly on several levels, leading to a weekly whole group meeting. The structure fosters positive interdependence as well as individual responsibility as students are assigned individual projects with the research focus of the group. The use of a wiki is critical to facilitating the interaction, maintaining a record of progress, centralizing shared resources, and it allows for significant asynchronous interaction. This structure leads to student success, professional growth for graduate students, and a manageable time budget for the group leader.

BO09 8:20 p.m. Long-Range Wiki Interactions*

Kenneth Cecire, Hampton University, Graduate Physics Research Center, Hampton, VA 23668; ken.cecire@hamptonu.edu

Since the spring of 2007 the author has been using wikis and wiki pages to support teacher and student involvement in the Particle Physics Masterclass, the QuarkNet Virtual LHC Center, and interactions of the European Particle Physics Outreach Group. In each case the wiki has proven to be a useful tool for long-distance interaction of widely distributed groups. It has also proven very useful for creating less formal web pages that can be updated instantly from anywhere. Examples of the use of wikis and what can be done with them will be discussed.

*Work supported by the National Science Foundation and the Department of Energy Office of Science

BO10 8:30 p.m. "Adopt a Physicist": Connecting High School Physics Classes with Physicists via Online Forums

Jennifer L. Fischer, High School Physics Teacher/Former APS Employee, 5700 Grelot Rd, Apt 317, Mobile, AL 36609; JenniferFischer_321@yahoo.com

Kendra Rand, APS

The Adopt-a-Physicist program (www.adoptaphysicist.org) is designed to connect high school physics students to people with bachelors degrees or higher in physics via online discussion forums. Through their interactions, students can find out about the careers, educational backgrounds, and lives of current physicists. Physicists and students interact through discussion forums for a three-week period. Before the three-week period begins, the physicists and classes each create a brief introduction page. After registration closes, teachers choose some physicists for their classes to interact with,usually from different career categories. The physicists each host a discussion forum where students dialogue with them about careers, educational level, current projects, and issues. The Adopt-A-Physicist project is a great opportunity for high school physics teachers to create excitement and inspiration amongst students. It is also a great way to incorporate new technology into the classroom. There are several different ways to implement the program into high school physics classes and throughout the briefing I will highlight specific implementation ideas. I will mainly talk about the logistics of the program including how it works, how it is set up, how to register, etc. I will also share from personal experience how the program played out with my physics classes and especially how students reacted to it. Adopt-a-Physicist is a service provided by the American Physical Society (APS) in collaboration with the physics honor society Sigma Pi Sigma (SPS), the American Association of Physics Teachers (AAPT) and comPADRE.

BO11 8:40 p.m. The Ultimate High School (2000+) Astronomy Teachers Resource List

Larry E. Krumenaker, University of Georgia, 212 Aderhold Hall, Program in Science Education, Athens, GA 30602; lkrumena@uga.edu

A pair of dissertation surveys to more than 2000 high school astronomy teachers has netted the ultimate resource list, what is really used by teachers. Books, textbooks, websites, and other curricular materials will be discussed for content, for pedagogy and for networking. Which are the most popular and which should be given more attention than they have had? Website TBD.

BO12 8:50 p.m. The Solar Car Project: A Synthesis of Scientific Inquiry, Research, Experimentation, and Content Application

Kristen M. Guyser, New Trier High School, 385 Winnetka Ave, Winnetka, IL 60093; guyserk@newtrier.k12.il.us

The purpose of the solar car project is to create an end of the year synthesis activity that incorportates mechanics, electricity/magnestism, as well as the scientific method. In this project, students must research the physics behind a working solar panel, apply their content knowledge of mechanics and circuits, use the scientific method to independentlay create three experiments that would be used to enhance the building of their solar car, then race their car, not against each other, but against a predicted time value they submit based upon experimentation. On the day of the race, students submit their final projects in binders which include pictures of the stages of design/redesign of the car, purpose/data/analysis/conclusion for three experiments they independently ran on their car, a journal with entries outlining the day/time/people present and what was accomplished, a synthesis of how their results from their experiments were used to design the car, and a time they predict it will take their car to cross the finish line.

BO13 9 p.m. Celestial Navigation: Using a Simple Quadrant to Find Latitude and Longitude

Philip M. Sadler, Harvard-Smithsonian Center for Astrophysics, 60 Garden St., MS-71, Cambridge, MA 02138; psadler@cfa.harvard.edu

With the simplest of instruments, a protractor and a watch, students can easily determine their latitude and longitude within 30 miles. Measuring and recording the altitude of the Sun is a straightforward daytime activity, possible on any sunny day. By graphing such data, the time of Local Apparent Noon can be determined, along with the Sun's peak altitude. The special case of midday reduces the spherical trigonometry to the drawing of plane triangles and calculation requiring only addition and subtraction. The lab can be repeated on different dates and locations (e.g. during student vacations) demonstrating a practical use for positional astronomy still in use today as a backup to electronic navigation.

Session BP: The Minority Science and Engineering Improvement Program

Sponsor: Committee on Minorities in Physics
Location: Essex A
Date: Monday, Jan. 21
Time: 7–8:30 p.m.

Presider: Floyd James

BP01 7 p.m. Study Groups, Whiteboarding, and Community at a Minority Serving Institution

Invited – Leanne M. Wells, Florida International University, 11200 SW 8 St, ZEB 357A, Miami, FL 33199; wells.leanne@gmail.com*

Cengiz Alacaci, Florida International University

Maria Fernandez, Florida International University

Laird Kramer, Florida Internaitonal University

Abdelhamid Meziani, Florida International University

Florida International University's Student Equity and Achievement in Mathematics and Science (FIU-SEAMS) project recruits and supports undergraduate students from groups underrepresented in mathematics and physics with the goal of increasing the number of these students graduating with mathematics and physics degrees. Housed in the College of Education at FIU, Miami's public research university of 38,000 students of which more than 70% are Hispanic or African-American, FIU-SEAMS has built a system of study groups and peer mentoring that makes the academic environment hospitable and supportive. Project successes include a strong social and academic support network for math and physics majors, improved persistence in pursuing physics and math degrees, and increased academic achievement. An overview of project design and activities as well as effective practices will be presented along with results from analysis of participants' academic successes. Efforts to effect long-range improvements in FIU's physics and mathematics programs will also be addressed.

*Invited as part of the MSEIP section.

BP02 7:30 p.m. Virtual Community for Physics and Mathematics Teaching in Engineering Education

Invited – Roman Ya. Kezerashvili, Physics Department, New York City College of Technology, CUNY, 300 Jay St., Brooklyn, NY, 11201, Brooklyn, NY 11201; rkezerashvili@citytech.cuny.edu*

Engineering is the application of mathematics and physics to develop useful products or technologies and then turning ideas into reality. Physics is the study of the physical world based on observations and mathematical description, and physics and mathematics are an indispensable component in engineering curricula because technology is based on our knowledge of physical laws. We have two primary and complementary objectives that facilitate students' ability to transfer knowledge from physics and mathematics to engineering and technology: i) to establish the laboratory as a primary learning tool in STEM; ii) to demonstrate the efficacy of using e-learning and e-teaching through Blackboard and web-based communication systems. All these provide more avenues of STEM learning and support the retention, persistence, and graduation of the underrepresented groups in STEM. To achieve the objectives, we are creating a virtual community of students and faculty as a vehicle for promoting the transfer of knowledge from physics and mathematics to computer science and engineering applications using e-learning and e-teaching mechanisms as well as laboratory exercises and demonstrations.

*Supported by U.S. Department of Education grant P120A060052

Session PST1: Poster Session I – Lectures/ Classroom & Astronomy

Sponsor: Committee on High School Physics
Location: Grand Ballroom IV
Date: Monday, Jan. 21
Time: 8:30–10 p.m.

(See Monday a.m. Poster abstracts)

Tuesday, Jan. 22

Registration *Marriott, 3rd Floor*	7:30 a.m.–5 p.m.
Poster Session II *Grand Ballroom IV*	8–9 a.m. and 8:30–10 p.m.
Symposium on Physics Education *Grand Ballroom VI*	1:45–3:45 p.m.
Exhibit Show *Grand Ballroom IV*	8 a.m.–2 p.m. and 4–6 p.m.
Great Book Giveaway *Grand Ballroom IV*	5:15–6 p.m.

Poster Session II – Teacher Training, Physics Education Research & Topics in Physics

Location: Grand Ballroom IV
Date: Tuesday, Jan. 22
Time: 8–9 a.m.

PST2-01 8 a.m. OpenCourseWare – Highlights for High School

Daniel M. Carchidi, MIT OpenCourseWare, One Broadway, 8th Floor, Cambridge, MA 02142; carchidi@mit.edu

Arnab Banerjee, MIT OpenCourseWare

Would you like to use the world famous lectures and demonstrations from Professor Walter Lewin's physics course at MIT for your AP students? Now you easily can! MIT OpenCourseWare (OCW) is a free and open collection of MIT curricular resources used by high school students and teachers all over the world to supplement their coursework, reinforce lessons, and prepare for AP exams. OCW launched "Highlights for High School"—a guide for teachers and students to make finding resources on OCW even easier. This poster session is intended to introduce physics teachers to the Highlights for High School site. Teachers interested in adding real-world applications to their classes, viewing science demonstrations by MIT faculty, adding to their professional knowledge, or guiding students to exams, homework problems or resources to help them study for their AP science exams will find this poster session valuable.

PST2-02 8 a.m. CLUSTER: A Museum-College Partnership for Teacher Preparation

Sébastien Cormier, City College New York, Marshak science building J-419, New York, NY 10031; scormier@gmail.com

Preeti Gupta, New York Hall of Science

Federica Raia, City College New York

Laura Saxman, Center for Advanced Study in Education

Richard N. Steinberg, City College New York

CLUSTER (The Collaboration for Leadership in Urban Science Teaching, Evaluation, and Research) is a partnership of The City College of New York, the New York Hall of Science, and the City University of New York's Center for Advanced Study in Education. The goal of the partnership is to design a model to recruit and prepare science majors to become high school science teachers. The project integrates formal education, informal education, and education research. In this poster, we describe the model and give samples of how we are exploring participant approaches to the teaching and learning of science. This project is supported by the National Science Foundation

PST2-03 8 a.m. Evaluation of Physics by Inquiry Professional Development Programs for Teachers*

Robert J. Endorf, University of Cincinnati, Physics Dept., PO Box 210011, Cincinnati, OH 45221-0011; robert.endorf@uc.edu

Don Axe, University of Cincinnati

Kathleen M. Koenig, Wright State University

We report on a study of the effectiveness of the Physics by Inquiry professional development programs that we have been conducting at the University of Cincinnati for K-12 teachers in Southwest Ohio. Each summer since 1996, a four-week 120-hour graduate course in Physics by Inquiry has been held for teachers in grades 5-12 and a separate two-week 60-hour course has been held for teachers in grades K-5. More than four hundred teachers have successfully completed one of these summer courses, which use the Physics by Inquiry modules developed by Lillian McDermott and the Physics Education Group at the University of Washington. Pretest and posttest data will be presented demonstrating that the programs have produced large gains in the teachers' science content knowledge, science process skills, and their preparation and ability to teach inquiry-based science lessons.

* Supported by The Improving Teacher Quality Program administered by the Ohio Board of Regents.

1. L.C. McDermott and the Physics Education Group at the University of Washington, *Physics by Inquiry* (Wiley 1996).

PST2-04 8 a.m. Facilitating Change in STEM Education: A Research-Based Perspective on Initiating and Sustaining Change

Noah D. Finkelstein, University of Colorado, UCB 390 - Dept. of Physics, Boulder, CO 80309; noah.finkelstein@colorado.edu

Charles Henderson, Western Michigan University

Andrea Beach, Western Michigan University

R. Sam Larson, University of Denver

Over the past several decades, researchers, curriculum developers and practitioners in physics education have made significant strides in producing better educational experiences for our students. How is it that we might institutionalize these new approaches, and how can we promote the spread of these effective strategies elsewhere? We present a project[1] that seeks to integrate findings on institutional change from three different research fields into a coherent framework that allows us to propose answers to the questions of sustaining and scaling educational reforms. We draw from: Disciplinary-based STEM Education Researchers (SER), who focus on change in curricula and pedagogical materials; the Faculty Development Researchers (FDR), who focus on changing faculty, and the Higher Education Researchers (HER) who evaluate the policies and structures at various organizational levels that support or impede change. The outcomes of this synthesis project will be used to identify: 1) change activities, strategies, concepts, and theories across communities 2) common themes among disparate literatures; 3) evidence to support each change activity and strategy; and 4) promising directions for future research, theory-building, and funding. We present our approach and theoretical framework, solicit input from attendees, and share information on an associated conference to be held June 2008. [2]

1. Supported in part by NSF awards #0623009 and #0723699

2. http://www.wmich.edu/science/facilitating-change.

PST2-05 8 a.m. Teaching Opportunities in Physics and Physical Science (TOPPS) at FSU*

Eric J. Moore, Frostburg State University, 101 Braddock Rd., Frostburg, MD 21532; ejmoore@frostburg.edu

Katya D. Denisova, Homeland Security Academy, Baltimore

Jane Nelson

Francis M. Tam, Frostburg State University

The Improving Teacher Quality (ITQ)/TOPPS Project at Frostburg State University (FSU) provides high-quality professional development opportunities for 21 high school, middle, and elementary school science teachers from across Maryland. During one week in July, these Teacher Scholars gained physics content knowledge and developed teaching strategies. They were also encouraged to integrate technology in their teaching and attain "Highly Qualified" status. The fundamental goals of this three-year effort are to enhance classroom teaching and learning effectiveness, and improve student achievement in Physics and Physical Science. Modeled after the nationally proven AAPT/PTRA curricula, the teachers engage in inquiry-based experiments and activities. Moreover, TOPPS enhances their professional development through PRAXIS tutoring, graduate credit mentoring, and evening activities. According to post-survey assessments, 95% of the participants are more confident in teaching physics/science content and 81% have an increase/gain in the level of conceptual understanding of physics.

*Supported by a grant from Maryland Higher Education Commission (MHEC)

PST2-06 8 a.m. ATE Program for Physics Faculty: Year Two*

Thomas L. O'Kuma, Lee College, P. O. Box 818, Baytown, TX 77522-0818; tokuma@lee.edu

Dwain M Desbien, Estrella Mountain Community College

This poster will report on all the various activities of the Project. A section of the poster will be devoted to the New Faculty Training Conference for Two-Year College Faculty to be held March 6-8, 2008 at Delta College, University Center, MI. Another section of the poster will be on the follow-up activities done by the participants as part of the Project. Results from year one of the multi-year project will be exhibited.

*Supported in part by NSF grant #ATE-0603272

PST2-07 8 a.m. Enhancing Inquiry Science Teaching in St. Joseph, MO, Middle Schools

Michael B. Ottinger, Missouri Western State University, 4525 Downs Dri, St Joseph, MO 64507; ottinger@missouriwestern.edu

John Rushin, Missouri Western State University

John Ellis, Missouri Western State University

Jay Meyers, Saint Joseph School District

During the summer of 2007 two workshops were held at Missouri Western State University to initiate a collaborative effort between the university and St. Joseph School District to enhance the inquiry method of teaching science in the middle schools. In the first workshop, lead teachers from each of the district's middle schools learned how to develop inquiry/ technology-based lesson plans. In the second workshop, the lead teachers guided the rest of the district's middle school science teachers, as well as preservice teachers from the university in designing inquiry lessons for their classrooms. During the school year these lesson plans will be implemented on the middle school classrooms and copies of the lesson plans will be posted for all teachers to access. A detailed description of the workshops will be presented in the poster.

PST2-08 8 a.m. Using Video Assessment of Physics Lessons

James L. Redmond, Un. of Hawaii-CRDG-Science Section, 1776 University Ave (UHS2-202), Honolulu, HI 96822; jredmond@hawaii.edu

This poster will include a pictorial, as well as a video presentation of teachers using our PP&T lessons in Light/Color and Electricity and Magnetism with students from grades 7, 8, and 9. These lessons follow a constructivist approach to the teaching of basic concepts in physics. Seventeen teachers from O'ahu, Maui, and Kauai worked on the lessons in an intensive week-long class using PP&T materials. They then taught these lessons to a Summer Science Enrichment Class at the University Lab School in the summer of 2007 and videotaped the sessions. The videotapes were graded and shared with all members of the team. This approach has proven very instructive to all members of the team and will be used again in the summer of 2008.

PST2-09 8 a.m. Challenges Faced by First-Time Users of an Inquiry Science Curriculum

Cody Sandifer, Towson University, 8000 York Rd., Towson, MD 21252; csandifer@towson.edu

The purpose of this study was to document the expected and actual challenges faced by three part-time instructors as they taught the Physical Science and Everyday Thinking curriculum for undergraduate elementary education majors for the first time. Data included interviews, email communications, classroom RTOP observations, and audiorecordings of instructor mentoring sessions. Pre-interviews indicated that the instructors expected challenges involving the use of technology and student participation. In addition, prior to the start of the course, instructor communications indicated that certain instructors had intended to apply traditional lecture-based teaching strategies to the PSET curriculum because they were unaware that such strategies were contrary to the curriculum's underlying purpose and philosophy. Classroom observations, mentoring sessions, and post-interviews revealed that the instructors faced teaching challenges in many different areas, including groupwork, discussions, and the role of the teacher in inquiry. Some of these challenges were expected, whereas others were not.

PST2-10 8 a.m. Gestures as Evidence of Student Meaning

Rachel E .Scherr, University of Maryland, Physics Education Research Group, College Park, MD 20742; rescherr@umd.edu

Brian Frank, University of Maryland

David Hammer, University of Maryland

Students' spoken language and written records provide primary evidence of their understanding. However, students (and experts) use language differently in different activities, and words that people say or write may not mean the same thing in another context. In particular, terms with specific technical meanings in science contexts often have other meanings in informal discussions. Student discussions in tutorials are often both informal and scientific, complicating the task of understanding what they mean by what they say. One source of evidence of students' meaning is the gestures they use as they speak. We analyze a number of gestures that one student makes in conjunction with verbalizations about "surface area" as part of her reasoning about a third law question. Our analysis suggests that for this student, the term *surface* area in this episode does not necessarily reference what she would call surface area, volume, mass, or any other specific quantity in another conversation, but instead is an ambiguous term that could refer to a variety of size-related properties of the object.

Funded in part by NSF Grant # REC-044011.

PST2-11 8 a.m. How Much Physics Is Too Much Physics

Stanley J. Sobolewski, Department of Physics - Indiana University of Pennsylvania, 56 Weyandt Hall - 975 Oakland Ave., Indiana, PA 15705-1087; sobolews@iup.edu

David T. Pudder, Department of Physics - Indiana University of Pennsylvania

It is hypothesized that high school physics teachers who have completed a traditional physics teaching degree may have been overburdened with upper-level physics coursework. Typical pre-service physics teachers are required to complete a two-semester sequence of introductory coursework. This sequence is normally completed during their first year. During upper-level coursework, a student is so concerned with success that they concentrate their focus on the upper-level material and tend to forget the freshmen level material. In a September 2003 *Journal of Research in Science Teaching* (JRST) article, Joseph Taylor and Thomas Dana set out to develop a case study observation on the very ideas that I have aforementioned. I hope to expand on Taylor and Dana's 2003 JRST study and show that pre-service secondary education physics teacher may indeed have forgotten some of the upper- level material they have previously completed.

PST2-12 8 a.m. Problem-Based Learning in the Science Preparation of Elementary Education Majors

Keith Sturgess, The College of Saint Rose, 432 Western Ave., Albany, NY 12203-1490; keith.sturgess@strose.edu

Preparation in the sciences has long been seen as a weakness for many elementary school teachers. Students majoring in elementary education tend to be a self-selected group that fears science and math. To address this, The College of Saint Rose School of Math and Science, together with the School of Education, have created a new two-course sequence required for Elementary Education majors. In Science 100, students are team-taught by a physicist and chemist, while in Science 200 they are team-taught by a biologist and earth scientist. The courses are designed to teach the science an elementary school teacher needs, be highly interactive, and show the interconnections of science through the interactions of the team of scientists teaching the course. We also use peer leaders to emphasize class content during problem-based workshops held each week. These two courses are tied directly to the Science Methods course in the School of Education.

PST2-13 8 a.m. Francis Marion University's Summer Science Camp for Middle School Students

R. Seth Smith, Francis Marion University, Department of Physics and Astronomy, Florence, SC 29506; rsmith@fmarion.edu

Derek W. Jokisch, Francis Marion University

Jane E. Brandis, Francis Marion University

As part of an Improving Teacher Quality Grant administered by the South Carolina Commission on Higher Education, Francis Marion University conducted a Summer Science Camp in physics and biology for 65 middle school students from 13 schools in the southeastern section of South Carolina. This presentation focuses on the physics portion of the camp. 34 of the middle school students participated in the physics camp. Under the guidance of a physics professor, an education professor, and five specially trained middle school teachers, these students spent two weeks performing inquiry-based physics experiments on topics related to energy, machines, and motion. The purposes of the camp were to teach students to think as scientists and to generate additional interest in physics. The physics experiments, student data, teacher feedback, and camp implementation will

Alexander Dickison, sponsor

PST2-14 8 a.m. Framing and Reasoning in Tutorials Over the Course of a Semester

Luke D. Conlin, University of Maryland, College Park, 5002 Lakeland Rd., College Park, MD 20740; luke.conlin@gmail.com

Ayush Gupta, University of Maryland, College Park

Rachel E. Scherr, University of Maryland, College Park

David Hammer, University of Maryland, College Park

In a previous study of student groups working during introductory physics tutorials, we found that the nature of explicit student reasoning changed according to how the group was framing the activity moment-to-moment within a tutorial. [1] That analysis showed a disproportionately high amount of evidence for mechanistic reasoning when the groups framed their immediate activity as a discussion, with their attention focused on each others' reasoning rather than on the worksheet. Comparison across groups, meanwhile, shows different patterns of moment-to-moment behavior, which may reflect differences in their epistemological framing of tutorials as a whole. In this study, we compare student work in tutorial sessions across groups that showed different patterns of behavior, following their work over the semester for evidence of framing, mechanistic reasoning, and correlations with course performance.

1. Conlin, L., Gupta, A., Scherr, R.E., & Hammer, D. Accepted for publication in PERC Proceedings 2007.

This work supported in part by NSF grant REC 0440113.

PST2-15 8 a.m. Analyzing Student Difficulties with Longitudinal Standing Wave Concepts

Jack A. Dostal, University of Montana, University of Montana, Dept. of Physics and Astronomy, Clapp Bldg. Rm. 022, Missoula, MT 59812; jack.dostal@umontana.edu

In prior work, I reported on student difficulties with longitudinal standing wave concepts, specifically with respect to sound waves in air columns. Instructors commonly teach transverse standing waves first, and then treat longitudinal standing waves as an extension. Consequently, students often have little conceptual understanding of the underlying physical processes present in longitudinal standing waves, relying largely on pattern-matching and analogy (both appropriate and inappropriate) to answer questions. This investigation led to the creation of the Standing Wave Diagnostic Test (SWDT) to identify some of those difficulties, and a Longitudinal Standing Waves tutorial (LSW) to address these concepts in the classroom. In this poster I will describe the two instruments mentioned above, report student performance on the SWDT in algebra-based introductory physics courses, and discuss the differences between classes using the LSW tutorial and those that did not.

PST2-16 8 a.m. Student Problem Solving in Introductory Physics

Bernard Griggs, II, Purdue University, 1585 W 350 N, West Lafayette, IN 47906; griggsii@physics.purdue.edu

Mark P. Haugan, Purdue University

Lynn A. Bryan, Purdue University

Deborah E. Bennett, Purdue University

Problem solving is an integral part of students' experience in introductory physics courses. Often, students are instructed to solve problems as a way of learning physics. Their understanding of physics is certainly assessed by having them solve problems. This study seeks to understand how students approach physics problem solving in the context of Matter & Interactions, an innovative introductory curriculum emphasizing reasoning from fundamental physics principles and the microscopic structure of matter. We address two research questions: (1) What general problem solving procedures do students employ? and (2) How is physics content knowledge reflected in student solutions? To answer these questions, we conducted think-aloud interviews with students and analyzed our data using a rubric developed at our institution. We found that students generally struggled to approach problems systematically and had more difficulty solving algebraic problems than numerical ones.

PST2-17 8 a.m. Case Studies in Learners' Ontologies in Physics

Ayush Gupta, University of Maryland, College Park, Rm 1320, Physics Building, College Park, MD 20742; ayush@umd.edu

Edward F. Redish, University of Maryland, College Park

David Hammer, University of Maryland, College Park

Some difficulties in learning science ideas can be analyzed in terms of students trying to understand the "ontology" of a concept, or in other words "what kind of thing" it is. In our previous work [1,2] we presented the perspective that experts as well as novices are not committed to a single ontology of a concept and showed instances of ontological category hopping in everyday, professional and classroom settings. Detailed case studies of students interacting with science concepts in vivo can provide valuable insights for modeling learners' ontologies in physics. We will present case study data from our physics classroom. Preliminary analysis suggests variability in students' ontological view of a concept and that students at times struggle with questions about the ontological nature of a concept. We then discusstheoretical and instructional implications and directions for research.

1. Edward F. Redish, Ayush Gupta, and David Hammer, AAPT Greensoro, 2007,

2. Ayush Gupta, Edward F. Redish, and David Hammer, AAPT Greensboro, 2007.

This work supported in part by NSF grants RE 0440113 and DUE 0524595.

PST2-18 8 a.m. Student Resources for Learning Relativity

Mark P. Haugan, Purdue University, Department of Physics, West Lafayette, IN 47907; haugan@purdue.edu

Students bring initial ideas about physical systems and about physics knowledge to learning experiences. Such ideas are conceptual and epistemological resources because instructors may use them productively to enhance student learning. While students of introductory physics may draw resources from "everyday" thinking, more advanced students may also draw resources from ideas acquired during prior instruction. In this paper, we discuss and demonstrate ways of productively using resources of both kinds in relativity instruction. For example, we elicit students' initial, naive thinking about time and simultaneity and design subsequent instruction to help them refine their thinking and so develop a principled understanding of the corresponding relativistic concepts. We also demonstrate how to use knowledge of matter's atomic structure to convey a sense of mechanism underlying phenomena like time dilation to students. The requisite knowledge is a resource for our students because they have studied the Matter & Interactions introductory physics curriculum.

PST2-19 8 a.m. High School Astronomy Course – Sadler's 1983 Study Updated for NCLB

Larry E. Krumenaker, University of Georgia, Dept of Math and Science Education, 212 Aderhold Hall, Athens, GA 30602; lkrumena@uga.edu

The status and makeup of high school astronomy courses hasn't been examined for 25 years. This multimethod study is the result of two surveys of hundreds of high school astronomy teachers. The results detail who is doing the teaching, their training and needs, how many and what schools off it and where they are, which students, what resources are used, and the effects of the No Child Left Behind Act on astronomy classes. Teachers' attitudes on the course's purpose, toward starting and defending their classes and concerns for the future of astronomy courses in their schools and the nation are reported. We can report that there are more female teachers than nationwide science averages but are not coming from physics or astronomy. They work in isolation and rarely teach more than two sections, often only one.The students are more representative of the U.S. than physics. Schools are more AYP Pass than the national average.

PST2-20 8 a.m. Crossed Products: Student Use and Difficulty with Right Hand Rules

Mary Bridget Kustusch, North Carolina State University, 2401 Stinson Dr., Raleigh, NC 27695-8202; mbkustus@ncsu.edu

Robert Beichner, North Carolina State University

Ruth Chabay, North Carolina State University

While there have been several studies in recent years that have looked at student understanding of vector mathematics, none have focused on cross products and the tools we teach to deal with them, such as the different *right hand rules*. We will present preliminary results of a pilot study focused on how students deal with cross product problems in the context of both mathematics and introductory physics. The focus will be on the choice and implementation of methods, as well as the correlation between spatial ability and performance on these types of problems.

PST2-21 8 a.m. Are Introductory Physics Students Better Prepared for Kinematics and Dynamics?

Jeff Marx, McDaniel College, 2 College Hill, Westminster, MD 21157; jmarx@mcdaniel.edu

Shabbir Mian, McDaniel College

Every fall term since 2001, we have been administering Interactive Lecture Demonstrations (ILDs) to our first-semester, calculus-based General Physics class. As part of each ILD sequence, students are asked to make a "prediction" regarding the outcome of a demonstration. Students then share their predictions with their classmates who are sitting near them, and, possibly, update their predictions as a result of their discussion. We collect these Prediction Sheets (on which the students have signed their names) at the end of the class, or if they are part of a bound volume, at the end of the term. In this presentation, we will put forward our results and analysis of shifts in students' predictions related to the Kinematics and Dynamics ILDs over the last several years.

PST2-22 8 a.m. Cognitive Work Analysis: Whole-to-Part and Concrete-to-Abstract

Mark Rothmayer, Miami University, 133 Culler Hall, Oxford, OH 45056; rothmamd@muohio.edu*

Jennifer Blue, Miami University

We have developed a new conceptual research tool where we could potentially map the step-by-step flow of problem-solving strategies among experts and novices. This model is derived from the theory of cognitive work analysis, is grounded in ecological psychology, and as far as we know it has never been applied to a knowledge domain like physics. We have collected survey data from 140 undergraduates enrolled in an algebra-based introductory physics course at Miami University as part of a larger study aimed to test the validity of the model. The survey asks students to rank aspects of mechanics from whole to part and from most concrete to most abstract. These data will be presented and discussed.

*Jennifer Blue, sponsor

PST2-23 8 a.m. Solving the Problem of Physics Self-Efficacy: A Pilot Instrument

Kimberly A. Shaw, Columbus State University, 4225 University Ave, Columbus, GA 31907; shaw_kimberly@colstate.edu

Elizabeth Asbrock, Southern Illinois University Edwardsville

Tom Foster, Southern Illinois University Edwardsville

A type of belief that has been shown to affect student learning is self-efficacy, which can be described as a person's belief in her/his own ability to accomplish a specific task to a given performance level. Self-efficacy is both content and context dependent: a student may have a high self-efficacy in some domains, and low self-efficacy in others. We are examining the relationships between self-efficacy in physics problem solving, and student performance in that domain. An instrument has been pilot tested in order to examine physics problem solving self-efficacy. Students were asked to rate their confidence in their ability to correctly solve mechanics problems, and then separately asked to solve those problems. Preliminary results from this study will be presented.

PST2-24 8 a.m. Covariation Framework in Higher Dimensions: Proficiency In The Function Concept

Adam S. Thompson, Department of Physics, Arizona State University, Box 871504, Tempe, AZ 85287-1504; adam.thompson@asu.edu

Robert J. Culbertson, Arizona State University

Michael Oehrtman, Arizona State University

Studies show that students' struggles with the concept of a mathematical function (the ability to coordinate changes in two functionally related variables) often prevents them from gaining a deep conceptual foundation in calculus and related sciences. Although several mathematics researchers collaborated to design a research framework (covariation framework) to allow more robust analysis, this framework was not extended beyond scalar functions of scalar variables. This talk will introduce a possible extension to the covariation framework that generalizes it to vector functions and vector variables (e.g. position, velocity, acceleration; gravitational and electric potentials; electric and magnetic fields; etc.). Questions will be addressed, such as "How can this framework be used to diagnose proficiency of physics students?", "What benefit will such a diagnostic bring to my classroom?", and "How can this framework be used to guide curriculum?" Results of a initial diagnosis will be given.

Supported by The National Science Foundation (MSP-0412537)

*Robert J. Culbertson, sponsor

PST2-25 8 a.m. Inquiry-Based Versus Traditional

Patricia E. Palko, University of Denver Department of Biological Sciences, 2190 E. Iliff Ave.,Olin 102, Denver, CO 80208; ppalko@du.edu

How much does the mode of laboratory instruction matter for undergraduate non-major physics students? The results of a recent study comparing student performance on classroom materials, questions about the nature of science, and standardized tests after completing one or two quarters of inquiry-based or traditional "cookbook" laboratory exercises will be presented.

PST2-26 8 a.m. Symbolic Calculators Are Not Inert Tools

Thomas J. Bing, University of Maryland, Department of Physics, College Park, MD 20742; tbing@physics.umd.edu

Edward F. Redish, University of Maryland

Powerful symbolic calculators are not passive tools for physics students. They do not merely offer students a convenient way to perform the computations they would have done by hand anyway. These calculators can play an active role in sustaining students' thought around computational schemes. This poster presents a detailed example from the work of undergraduate physics majors where Mathematica helps keep their search for a dilemma's answer in the computational realm. The students employ powerful mathematical reasoning and do not treat Mathematica as a black box. Their difficulties arise, rather, from their focus on calculation instead of mapping their mathematics to the physical situation at hand. We model Mathematica's influence as an integral part of the constant feedback that occurs in how students frame, and hence focus, their work.

This work is supported by NSF grants DUE 05-24987 and REC 04-40113 and a Graduate Research Fellowship.

PST2-27 8 a.m. Solar Energy Can be Effective Even in Ohio

Gordon J. Aubrecht, II, Ohio State University, 1465 Mt. Vernon Ave., Marion, OH 43302-5695; aubrecht@mps.ohio-state.edu

David W. Carpenter, Hayes High School, Delaware, Ohio

Michelle A. Aubrecht, 193 N. Washington St., Delaware, Ohio

"Meet the Carpenters" is Michelle Aubrecht's submission to Al Gore's global warming awareness contest. The 60-second ad focuses on the Carpenter family's efforts to reduce their personal carbon footprint. One major way is a solar panel installation David Carpenter installed on his family's south-facing roof. This poster will present the contest ad and give highlights of David Carpenter's energy and monetary savings from the solar roof as well as details about how net metering works in Ohio.

PST2-28 8 a.m. An Experience Teaching and Assessing an Undergraduate Level Course in Biophysics

Mitra Feizabadi, Canisius College, 2001 Main St., Buffalo, NY 14208; feizabam@canisius.edu

The importance of including concepts, examples, and techniques from mathematics and the physical and information sciences in biology courses to fulfill the need of today's undergraduate biology students has been the principle motivation for developing interdisciplinary biology-focused courses. Although this movement started many years ago, developing and offering courses like biophysics is still new in many liberal arts colleges. Taking advantage of the experiences gained by introducing an interdisciplinary course, biophysics, this work was developed to present the adapted structure, course assessment, challenges met and factors which can be useful to further develop such a course in order to heighten students' retention of the material.

PST2-29 8 a.m. What Physics Is Needed on the Web?

Göran Grimvall, Theoretical physics, KTH, AlbaNova, Stockholm, SE-10691; grimvall@kth.se

The Internet plays an increasing role as a source of information on which we may act, depending on how it is interpreted. Consider reliable web pages, which the general public may consult, dealing for instance with medicine or consumer reports. Is today's school physics relevant for their interpretation? Knowledge of physics may lead to a deeper understanding of an issue, but does it also lead to a different decision. If one seeks a low-noise product, the numerical value of the noise level is in itself sufficient for most people as the basis for a decision, without further knowledge of acoustics. The physical definition of mmHg is of little importance in a discussion of blood pressure. Medical information is arguably the most important example of how web pages with technical content can be used as a source of information for the general public. What does this mean for physics

PST2-30 8 a.m. Student Blogs and the LHC

Michael J. Wadness, Medford High School/QuarkNet, 7 Morse Lane, Natick, MA 01760; mjwadness@verizon.net

Michael R. Fetsko, Mills Godwin High School/QuarkNet

This poster presents a pilot program involving students utilizing Internet technologies to learn about particle physics. Students from Massachusetts and Virginia collaborate to create an online blog and wiki page about the Large Hadron Collider under development at CERN outside Geneva, Switzerland. The goal of this program is to increase students' awareness of contemporary physics research and to develop a more comprehensive understanding of the nature of science. To aid the students in the creation of the blog and wiki, students are able to attend virtual office hours held by a particle physicist at CERN who has volunteered his time. This pilot program is in association with QuarkNet, an organization established by NSF and DOE to increase physics teachers' participation in particle physics research.

PST2-31 8 a.m. Teaching Electromagnetic Waves Using Visualizations of the Maxwell Equations

Roberto B. Salgado, Department of Physics - Syracuse University, 201 Physics Bldg, Syracuse, NY 13244; salgado@physics.syr.edu

Using visualizations of the Maxwell Equations [developed with VPython], key features of the plane electromagnetic wave are motivated and discussed. Emphasis is placed on the patterns of the electric and magnetic fields. Since no explicit equations are written down, this presentation may be useful for an introductory conceptual physics or algebra-based physics course. The VPython programs to visualize the Maxwell Equations and the Plane Electromagnetic Wave are available at http://physics.syr.edu/~salgado/software/vpython/ .

PST2-32 8 a.m. More Fun with Wavelet Analysis

Joseph J. Trout, Drexel University/Sun Microsystems, 2338 B Fairmount Ave, Philadelphia, PA 19130; joe.trout@sun.com

Fourier Analysis and Wavelet Analysis are used to analyze experimental data. Fourier Analysis is used to analyze the time (or space) independent features of the signal or data. Wavelet Analysis is used to analyze the time or space) localized features of the data.

PST2-33 8 a.m. Spreadsheet Analysis of X-ray Powder Diffraction Patterns for Advanced Lab

Eugene J. Hoffman, Morgan State University, Physics Department, Morgan State University, 1700 E. Cold Spring Lane, Baltimore, MD 21251; ehoffman@jewel.morgan.edu

Students in our Advanced Lab course analyze diffractometry results with the commercial software Jade, useful for professional training, but too automatic for a clear view of peak-matching logic. We therefore have them also work up the same data on a spreadsheet template that requires user decisions. The analysis is preceded by a complete process: pre-quizzes on Miller indices and on interference and diffraction, grinding and sieving the sample to 45 &mgr;m, filling a sample holder and running it in a Rigaku Miniflex powder diffractometer. We thus cover both the technique and the underlying theory of the method.

PST2-34 8 a.m. Does Sugar Cause Dental Decay?

Jayeong Lee, Seoul National University, 24-208, San 56-1 Sillim-9dong, Gwanakgu, Seoul, 151-748; hosu8188@snu.ac.kr

Jungho Choi, Seoul National University

D. Jeon, Seoul National University

We developed a guided inquiry program for secondary school students to conduct a quantitative and microscopic experiment to find the cause and progress of dental decay. High school and middle school students were invited to observe a chemical and morphological change on the surface of teeth treated in various media such as pure sugar, sugar+saliva, acid and soda solutions. The quantitative analysis of the amount of decay, i.e., the amount of the melted enamel was estimated using an absorption spectroscopy, i.e., calorimeter and the corresponding morphology was examined using an atomic force microscopy. Many people believe that dental decay is caused by sugar. Students found, however, that sugar solution alone did not cause damage to the teeth but the dental decay was caused when the tooth was treated in a sugar+saliva solution. Our guided inquiry program proved to be effective to help students get a correct idea that an acid produced by bacteria feeding on sugar is the real reason of dental decay.

PST2-35 8 a.m. Spherical Rare Earth Magnets in Intermediate Classical Mechanics

Al J. Adams, University of Arkansas at Little Rock, 2801 South University Ave, Little Rock, AR 72204; ajdams@ualr.edu

Spherical rare earth magnets (SREMs) present a variety of rich teaching and learning opportunities for both traditional classroom and laboratory settings. Opportunities abound also for activities-based pedagogy. Previous studies have been primarily directed toward the introductory courses and have shown the advantages SREMs offer in demonstrating uniform vs non-uniform motion, the inverse 4-th law dependency of force between dipoles, the influence of the earth's magnetic field on a rolling dipole, and the local potential energy minimization resulting from the dipole-dipole interaction. In this presentation three applications of SREMs in intermediate classical mechanics will be described. Each entails an analytical component that is consistent with the depth and scope of a representative intermediate classical mechanics course. The first is the one-dimensional dynamics of a moving dipole as it approaches a stationary dipole oriented for repulsion. The second is the intriguing case of a rolling ferrous ball colliding with a magnet with two ferrous balls linked magnetically on the side opposite to the collision (Gauss rifle) with a noticeable boost in the speed of the recoiling ferrous ball. The third is the case of a SREM rolling down an incline with noticeable changes in motion due to variations in torque as the dipole rotates in the earth's field. Analytical modeling results are correlated with video-based measurements.

Session CA: Physics and Art

Sponsor: Committee on Science Education for the Public
Location: Laurel CD
Date: Tuesday, Jan. 22
Time: 9–11 a.m.

Presider: Patricia Sievert

CA01 9 a.m. Teaching Physics with Art and Photography

Tetyana Antimirova, Ryerson University, 350 Victoria St., Toronto, ON M5B 2K3; antimiro@ryerson.ca

Although the community of physics educators has come a long way in developing and implementing effective strategies for teaching physics, physics still stands out among other sciences as the subject particularly difficult to learn and to teach effectively. Part of it is because the students still do not see physics as related to our everyday life and lack motivation. Visual arts such as photography, paintings, movies and cartoons seem to be totally unrelated to physics, and yet they all can become powerful tools for bringing excitement while teaching physics. I will present a series of professional and amateurs' visual arts samples containing manifestations (intentionally or not) of various physical phenomena we encounter in everyday life.

CA02 9:10 AM Symmetry and Aesthetics in Introductory Physics*

Jatila van der Veen, University of California, Santa Barbara, UCSB Department of Physics, Santa Barbara, CA 93106; jatila@physics.uscb.edu

Philip M. Lubin, UCSB Physics Department

Eric Mazur, Harvard Physics Department

Jenny Cook-Gumperz, UCSB/Gevirtz Graduate School of Education

In 2007, we piloted a new interdisciplinary physics and fine arts course entitled Symmetry and Aesthetics in Introductory Physics with a group of physics and arts majors at the College of Creative Studies at U.C. Santa Barbara. Our model curriculum begins with Symmetry and Relativity, uses interdisciplinary strategies and interactive methods, and is underlain by the ideology of aesthetic education. Instead of a textbook, students read articles by theoretical physicists, and Lawrence Krauss' book, *Fear of Physics*. We used art and music as visualization strategies along with more traditional assignments. The final project was to create a physics work of art. The course received outstanding ratings, and we plan to offer it again and develop the sequel. We will describe the curriculum, methodology, assessments, and potential applications for physics majors, liberal arts majors, teacher education, and implications of this model for addressing issues of diversity in physics through curriculum reform.

*This work was supported by NASA grant #20070268 and the Planck Explorer Mission.

CA03 9:20 a.m. Novel Ways of Bringing Science to Students of All Ages

Brian Schwartz, The Graduate Center of the City University of New York, 365 Fifth Ave., New York, NY 10016; bschwartz@gc.cuny.edu

Adreinne Klein, The Graduate Center of the City University of New York

Linda Merman, The Graduate Center of the City University of New York

A major challenge is to bring science to students of all ages and adults. For the past seven years the Science & the Arts program at The Graduate Center has made use of the performing arts to bring science to new audiences. See http://web.gc.cuny.edu/sciart. In this paper we focus on four examples of our innovative approaches: 1). A city-wide science festival in venues throughout the city including a legitimate theater. 2.) The display and performance of hands-on science experiences in association with a typical New York City week-end St. fair, offering science amidst the kielbasa and tube socks. 3.) A multidimensional performance of an event entitled "String Theory for Dummies." 4.) A comprehensive program being planned with the Metropolitan Opera for October 2008 associated with the opera Dr. Atomic, (Oppenheimer and the Manhattan project).

*Supported in part by the National Science Foundation NSF PHY-0431660

CA04 9:30 a.m. Homemade Animated Physics Cartoons

Jeffrey M. Wetherhold, Parkland HS, 2700 N. Cedar Crest Blvd., Allentown, PA 18104; wetherholdj@parklandsd.org

I make animated cartoons to entertain as well as teach certain physics topics. A video camera capable of doing stop motion animation is used to film the original art work. Editing and some of the special effects are done with Apple's iMovie. The cartoons are full of science and whimsy and each one lasts approximately 2 minutes long. Each cartoon takes many hours to create. A 3-D look is created using layers of glass. So far I have created 26 cartoons on the topics of 1-D kinematics, 2-D kinematics, dynamics, energy, gravitation, waves, and electricity.

Session CAA: Educational Technologies

Location: Laurel AB
Date: Tuesday, Jan. 22
Time: 9–11 a.m.

Presider: TBA

CAA01 9 a.m. Assessing the Role of Modeling and Simulation Within TELS Projects

Shiladitya R Chaudhury, Christopher Newport University, 1 University Place, Newport News, VA 23606; schaudhury@cnu.edu

Katherine Linton, Christopher Newport University

Modeling and simulation play an important role in the design of the curricular projects available through the Technology Enhanced Learning of Science (TELS) Center. Students working in pairs interact with computational models of scientific phenomena, reflect on their virtual experiments and write about them in online journal notes. This talk presents examples of the use of modeling and simulation in two particular TELS projects—probing your surroundings and airbags. In each case, students have opportunities to build their own knowledge while engaged in an inquiry cycle. Examples of student work and feedback on learning with models will be presented.

CAA02 9:10 a.m. Quantifying the Impact of CRS on Student Course Achievment

Kastro M. Hamed, University of Texas at El Paso, 734 S. Mesa Hills Dr. Apt 120, El Paso, TX 79912; kastro@utep.edu

John Olgin, University of Texas at El Paso

The objective of this study was to isolate and to quantify the impact of using Class Response System (CRS) on the course achievement of students enrolled in a large introductory astronomy class. To achieve our objective we implemented a quasi-experimental arrangement. Two sections of introductory Astronomy—about 300 students each—were taught by the same instructor (Olgin). Both sections used the same textbook, same syllabus, same assignments, and were taught in the same room. Peer instruction was implemented in both sections. However, in one section the students used the CRS along with Peer Instruction, but no CRS was used in the other section. In this presentation we aim to share the results of our investigation and potential implications for instruction.

CAA03 9:20 a.m. Learning Outcomes Assessment Study for Technology Rich Engineering Physics I

Russell A. Poch, Howard Community College, 10901 Little Patuxent Parkway, Columbia, MD 21044; rpoch@howardcc.edu

The results of a three-year study of Engineering Physics I at Howard Community College in Columbia, MD, will be presented. This technology-rich course uses microcomputer-based labs, a supplemental WebCT site, Physics Cinema Classics DVD, homework solutions format for multi-step problems, and interactive web simulations for the material presented. The survey instruments used to measure student success included a Math Diagnostic Test for prerequisite skills, pre/post WebCT survey, lab check-off sheet, pre/post physics demographic survey, pre/post student attitude/perceptions survey, bimonthly survey to determine student's concept difficulties, Mechanics Baseline Test (MBT), and course grades. As a result of these teaching techniques, there was a significant gain on the MBT, student attitudes, and course grades.

CAA04 9:30 a.m. Freezing Time: Using New Video Technologies to Track Teacher Attention

Rosemary S. Russ, Northwestern University, 2120 Campus Dr., 335 Annenberg Hall, Chicago, IL 60208; r-russ@northwestern.edu

Melissa Luna, Northwestern University

Bruce Sherin, Northwestern University

Miriam Sherin, Northwestern University

Science teachers today face the challenge coordinating multiple objectives—from preparing students for standardized tests to engaging students in meaningful inquiry to monitoring behavior. These multiple, and sometimes competing objectives force teachers to make choices in the moment about where they will focus their attention and instructional efforts. This work involves using wearable cameras to help teachers "freeze time:" teachers wear a tiny camera during class and with a simple button press instantly capture interesting or puzzling moments for later reflection. We discuss the technology itself and pilot work with one high school physics teacher. Interviews with him about his clip selection give insight into where and how teachers might focus their attention/insight that may differ from that gained only by after-class reflection. We describe future work that will involve using this technology with teacher "video clubs" designed to support on-the-fly reasoning about classroom events.

*David Hammer, sponsor

CAA05 9:40 a.m. Virtual Environment with a Remote Control System of Physics Experiments.

Marcelo O. Souza, Laboratório de Ciências Físicas - Universidade Estadual do Norte Fluminense, Av. Alberto Lamego, 2000, Campos dos Goytacazes, RJ 28.013-600; mm@uenf.br

Marcelo O. Souza, Universidade Estadual do Norte Fluminense

Marlon C. R. Pessanha, Universidade Estadual do Norte Fluminense

Verônica A. P. Boechat, Universidade Estadual do Norte Fluminense

Rudson D. Medeiros, Universidade Estadual do Norte Fluminense

A virtual system was developed for physics teaching that includes an Internet portal (http://www.uenf.br/avief) that centralizes the functions, which are available for students and the general public. The virtual system can simulate the operation of real physics experiments and also has a remote control sysetm of physics experiments with the use of a control software that uses the USB port of the computer. The interface used, based in the converter USB/Serial FT232BM, allows the reading of data through the USB port. This form of the data collection is innovative, with the possibility of high-speed data traffic.

Supported by CNPq, FAPERJ, TECNORTE/FENORTE and UENF.

CAA06 9:50 a.m. Assessment of the Effectiveness of Instructional Technology Use in High School: A Cross-Discipline Comparison

Robert H. Tai, University of Virginia, Curry School of Education, Ruffner Hall 248, Charlottesville, VA 22904-4261; rht6h@virginia.edu

Philip M. Sadler, Harvard-Smithsonian Center for Astrophysics

Instructional technology is at the forefront of innovation in physics teaching and learning. Recently, several large-scale studies have suggested that instructional technology use has no impact or even negative impact on student achievement. A vast body of research on instructional technology development suggests otherwise. We have conducted a study that includes three replicate analyses studying the relationship between technology use in high school and academic later college performance in introductory biology, chemistry, and physics.

CAA07 10 a.m. Video Analysis in the U.S. Military Academy Core Physics Program

Chad C. Schools, United States Military Academy, Dept. of Physics, Bartlett Hall, West Point, NY 10996; chad.schools@usma.edu

Keith W. Haufler, United States Military Academy

Bryndol Sones, United States Military Academy

The study of physics should not be limited to the physics building. Video analysis using Vernier Logger Pro® 3.4.6 was introduced in the 1,000-cadet, calculus-based, introductory mechanics course, with the goal of providing a link between the physical life of U.S. Military Academy cadets and physics. Video analysis was introduced in the laboratory, "in the barracks," and in the classroom. All cadets determined an objective quantity using video analysis in a capstone laboratory where they were provided an ill-defined scenario on video that related to "cadet life." Approximately 130 cadets in the advanced sections of the course were assigned out-of-class ("in the barracks"), small-group, video analysis projects with minimal guidance. Twenty instructors demonstrated video analysis through in-class demonstrations.We found our initial introduction of video analysis provided relevance, context-rich problems, cadet engagement, and a unique opportunity for synthesis and analysis.

CAA08 10:10 a.m. Physics Jeopardy and Other Engaging Ways to Teach with Technology

Brendan P. Noon, Argo Community High School, 7329 West 63rd St., Summit, IL 60501; bpnoon@sbcglobal.net

Whether you moodle, google, or doodle, technology is an essential part of developing engaging lessons. This presentation demonstrates a variety of innovative methods that are being developed in conjunction with an online science curriculum (www.sciencewithmrnoon.com). Some of the lessons that will be highlighted include implementing online learning modules, Flash animated lectures, video podcasting, interactive quizzes, live web conferencing, virtual simulations, online discussions, webquests, game show review, classroom response systems (clickers) and tapping into next generation mobile technology. Be sure to pick up your free cd-rom before they're gone.

CAA09 10:20 a.m. Teaching with Technologies: Lessons Learned from My Life Sciences Students

William McNairy, Duke Department of Physics, Box 90305, Durham, NC 27708; mcnairy@phy.duke.edu

Teaching with technologies in the classroom presents many challenges. In my introductory physics courses for Life Sciences majors I have employed several online homework, classroom polling, web-based resources, computer delivered content systems during the past eight years. I've even used whiteboards, live lecture demonstrations, and collaborative student groups. Each semester I am faced with choices from many attractive alternates that are affected by the evolution of the use of technology by students at Duke University, the support I receive from the Center for Instructional Technology and the Department, the infrastructure provided in the classroom, and, most importantly, feedback from students in recent courses. In my talk I will summarize my experiences and the challenges I've worked to overcome, and review the current version of teaching technology used for the fall semester.

CAA10 10:30 a.m. Interactive Flash Movies

Fredrick P. Gram, Cuyahoga Community College, Western Campus, 11,000 Pleasant Valley Rd, Parma, OH 44130; fredrick.gram@tri-c.edu

Adobe Flash (formerly Macromedia Flash) enables one to make interactive movies and put them on the Internet. It has drawing tools and ways to move them around without code, or with ActionScript, a language similar to Java Script, and allows the author to tell the drawings how to behave. The movies are user friendly: Over 95% of computers have the Flash Player, a free download, and they tend to load and begin playing in a flash. http://instruct.tri-c.edu/fgram/WEB/FlashStuff/MOVIES.htm

CAA11 10:40 a.m. Exploring the Science of Atoms and Molecules Using Molecular Workbench

Robert Tinker, The Concord Consortium, 25 Love Lane, Concord, MA 01742; bob@concord.org

The Molecular Workbench is an open source molecular dynamics application that permits students to explore the atomic scale. The software calculates the motion of atoms based on forces derived from Lennard-Jones potentials, electrostatic potentials, elastic bonds, and external fields. MW includes chemical bonding, light-matter interactions, and excited internal states, and can produce a very wide range of emergent phenomena such as phase changes, latent heat, diffusion, solubility, osmosis, black body radiation, and spectra. MW includes an authoring environment for the design and delivery of interactive learning activities that support a broad range of core science concepts. In addition to setting the parameters of the model, the authoring environment allows the activity designer to provide instructions, scaffolding, and performance assessment instruments related to the model. More than 200 learning activities that use MW are available at no cost from a searchable database. One collection of activities has been designed to support a "Physics First" high school curriculum. All MW activities are computer-based, delivered online, and run on Macintosh, Windows, and Linux systems and have been downloaded more than 250,000 times. Numerous studies of student learning have been conducted using curriculum materials based on MW. These studies, extending over a range of content, with diverse students ranging from middle grades through college, demonstrate that students who use well-designed learning activities based on MW can understand atomic-scale phenomena and transfer this knowledge to new contexts. Furthermore, typical misconceptions can be dispelled by using these materials.

Session CB: Physics Teacher Preparation Program Accreditation

Sponsor: Committee on Teacher Preparation
Location: Essex BC
Date: Tuesday, Jan. 22
Time: 9–11 a.m.

Presider: Dewey Dykstra

CB01 9 a.m. Physics Teacher Preparation Program Accreditation – National Perspective

Invited – Erica M. Brownstein, Capital University, 1 College and Main, Columbus, OH 43209-2394; ebrownst@capital.edu*

Accreditation for teacher preparation can seem to be a daunting task. This presentation will describe how to keep continuous improvement a priority in your physics teacher preparation program while using accreditation requirements as a constructive component. Historically, the physics community has been highly involved in education and made significant contributions not only to the learning of physics but also to the generalizable audience of teaching and learning in science. This session will invite members of the physics education community to become more involved in the science teacher preparation accreditation process.

*Dewey Dykstra, sponsor

CB02 9:30 a.m. Achieving Accreditation Through the Integration of Professional Association, State and National Teacher Education Standards for Preparing Physics Teachers

Invited – Ken Witmer, Frostburg State University, 101 Braddock Rd., Frostburg, MD 21502; KWitmer@frostburg.edu*

Maggie Madden, Maryland State Department of Education

Liz Neal, Maryland State Department of Education

Identifying common language to create performance assessments is an effective tool used by Maryland colleges and universities to address accreditation requirements. A model for aligning and integrating common elements of the National Physics Standards, Maryland Program Approval Standards and National Teacher Education Standards will be shared to achieve program accreditation. A matrix visually displaying the integration of all three standards will be a frame of reference for the presentation.

*Lisa L. Grable, sponsor

CB03 10 a.m. Role of the Physics Department in Program Accreditation

Invited – Carl J. Wenning, Illinois State University, Campus Box 4560, Normal, IL 61790-4560; wenning@phy.ilstu.edu

Program accreditation by states and national organizations represents "high-stakes testing" for universities and their science departments. As such, program accreditation is often seen as an adversarial process. High-quality accreditation processes, if viewed in the proper light, can help to make a significant improvement in the quality of both programs and graduates. NCATE-NSTA accreditation processes at Illinois State University have resulted in significant and worthwhile changes in our science teacher preparation programs and the quality of student teaching practice. The presenter will describe assessments implemented across the science curriculum, and will explain the impact of NCATE-NSTA accreditation on the physics teacher education program and its candidates.

Session CC: Relating Undergraduate Mathematics and Physics Education

Sponsor: Committee on Research in Physics Education
Location: Kent AC
Date: Tuesday, Jan. 22
Time: 9–11 a.m.

Presider: N. Sanjay Rebello

CC01 9 a.m. Transfer of Learning from Calculus to Physics

Invited – Lili Cui, University of Maryland, Baltimore County, 1000 Hilltop Circle, Baltimore, MD 21250; lili@umbc.edu

N. Sanjay Rebello, Kansas State University

Andrew G. Bennett, Kansas State University

Many introductory calculus-based physics students have difficulties when solving physics problems involving calculus. This study investigated students' retention and transfer of learning from calculus to physics. We proposed a theoretical framework to assess students' transfer of learning in the context of problem solving. A total of 28 students who enrolled in a second-semester introductory physics course were interviewed. The video-taped interviews were transcribed and analyzed. A major finding from this study is that a majority of students possess the requisite calculus skills, yet have several difficulties in applying them in the context of physics. A detailed understanding of students' difficulties in terms of the proposed theoretical framework will be discussed. Instructional strategies are also suggested at the end to facilitate the transfer from calculus to physics.

CC02 9:30 a.m. Teachers' Mathematical Modeling of Motion

Invited – Jill Marshall, University of Texas, Austin, 2911 Cherry Lane, Austin, TX 78703; marshall@mail.utexas.edu

I will report results of a study of pre-service and experienced teachers in a university physical science class. These teachers developed mathematical models of motion based on data acquired while observing actual motions. In general, even the teachers with the most experience in formal physics struggled to develop fully Newtonian models as characterized by Hestenes (1992). Clearly, the Newtonian mathematical framework that would be developed in a calculus class had not transferred to this modeling endeavor. However, some teachers with less formal experience developed their own approaches by invoking high school mathematics, the distance construct in particular. These teachers independently developed successful frameworks to describe and predict motion based on the concept of average velocity, i.e., the distance covered in a given time, and regular changes in the average velocity, analogous to the acceleration.

Hestenes, D., "Modeling games in the Newtonian World," *Am. J. Phys.* **60**, 732-748 (1992).

CC03 10 a.m. Integrating Mathematical and Physical Reasoning: The Role of Mechanistic Explanation

Invited – Brian W. Frank, University of Maryland, Department of Physics, College Park, MD 20742; bwfrank@physics.umd.edu

Rachel E. Scherr, University of Maryland

David Hammer, University of Maryland

Students often fail to relate mathematical representations to the physical situations that they represent. We observe this disconnect in a tutorial about one-dimensional motion, in which students' qualitative conclusions based on a ticker tape representation of motion contradict their quantitative results. Some students notice the contradiction and some don't. We have made preliminary observations that those students who explicitly reason about the mechanisms by which the ticker tape equipment works are more successful in integrating their intuitive resources for thinking about motion with their mathematical resources for thinking about scaling and proportionality. We support this hypothesis with video case studies of students at the University of Maryland.

CC04 10:30 a.m. Comparing Student Performance on Mathematical and Physical Isomorphic Vector Tasks

Joel Van Deventer, University of Maine, 395 Fourth St. Apt. 2, Old Town, ME 04468; joel.vandeventer@umit.maine.edu

Michael C. Wittmann, University of Maine

Using past research into student difficulties with vectors in introductory and high school physics courses,[1,2,3] we have developed isomorphic mathematics and physics vector tests to evaluate student understanding of vectors in both contexts. Questions are identical, with only the context of the question changing in each case. To validate our test, we carried out task-based interviews with introductory physics students completing a semester's instruction. We used results to develop multiple-choice versions of each vector test. These were administered to introductory physics students at the start of a semester, giving us insight into what knowledge students bring to understanding vectors in mathematics and physics contexts.

Supported in part by NSF grant REC-0633951.

1. N.-L. Nguyen and D. E. Meltzer, *Am. J. Phys.* **71** (6), 630-638 (2003).
2. R. D. Knight, *Phys. Teach*. **33** (2), 74-78 (1995).
3. P. S. Shaffer and L. C. McDermott, *Am. J. Phys.* **73** (10), 921-931 (2005).

Session CD: Medical Physics – Education and Careers

Sponsor: American Association of Physicsts in Medicine
Location: Grand Ballroom VI
Date: Tuesday, Jan. 22
Time: 9–11 a.m.

Presider: Mahadevappa Mahesh

CD01: 9 a.m. Medical Physics – Education and Carreers

Panel – Mahadevappa Mahesh, Editor – AAPM Newsletter, Assistant Professor of Radiology & Cardiology, Johns Hopkins University School of Medicine Chief Physicist-Johns Hopkins Hospital, Baltimore, MD; mmahesh@jhmi.edu

Herbert W. Mower, Chair – AAPM Education Council, Director of Radiation Therapy Physics, Lahey Clinic Medical Center, Burlington, MA

Kevin Corrigan, AAPM Liaison to AAPT, Assistant Professor of Radiology, Loyola Univ Medical Center, Maywood, IL

The goal of this session is to discuss about medical physics and its role in health care and also to discuss education and careers in medical physics. We will attempt to define the field of medical physics and to explore the challenges and opportunities available to practicing medical physicists with emphasis on the clinical and educational opportunities available. Medical physics provides an excellent opportunity for an individual to bridge the chasm between basic science and medicine in a stimulating clinical atmosphere. Although the field is small in overall numbers, it has a significant impact on the health and safety of patients undergoing diagnostic imaging studies and radiation therapy treatments. We will explore these and review the support provided for entrance into the field as well as continued growth during one's professional career.

Topics to be discussed include:

–Medical Physics as a Career
–Role and activity of a Radiation Therapy Physicist in the Hospital
–Role and activity of a Diagnostic Imaging Physicist in the Hospital
–Research and Teaching Activities in Medical Physics

Session CE: Directions of the New NSF Division of Research in Learning

Sponsor: Committee on Professional Concerns
Location: Dover AB
Date: Tuesday, Jan. 22
Time: 9–11 a.m.

Presider: Gerhard Salinger

CE01 9 a.m. Promoting Learning in Formal and Informal Settings Through NSF Programs

Invited – Joan Ferrini-Mundy, National Science Foundation, 4201 Wilson Boulevard Room 885, Arlington, VA 22230; jferrini@nsf.gov*

Gerhard L Salinger, National Science Foundation

The Division of Research on Learning in Formal and Informal Settings (DRL) invests in improving the effectiveness of STEM learning for people of all ages. DRL promotes innovative research, development, and evaluation of learning and teaching by advancing innovative knowledge and practices. The Research and Evaluation in Education in Science and Engineering program funds research at the frontiers and provides foundational knowledge for understanding and improving STEM teaching and learning at all educational levels. Discovery Research K-12 enables significant advances in K-12 student and teacher learning through research, development, and evaluation of innovative resources, models, and technologies. Informal Science Education increases engagement with STEM by individuals of all ages through self-directed learning experiences. Information Technology Experiences for Students and Teachers motivates student and teacher interest and engagement in STEM using information technology in school and after-school settings. We discuss the challenges and opportunities for improving STEM education through DRL-based programs.

*Gerhard L. Salinger, sponsor

CE02 9:30 a.m. Interactions in Physical Science: A Middle School Curriculum for Students and Teachers [1]

Invited – Fred Goldberg, San Diego State University, 6475 Alvarado Rd., Suite 206, San Diego, CA 92120; fgoldberg@sciences.sdsu.edu

The Interactions in Physical Science[2] curriculum was developed to provide middle school students the opportunity to develop a deep understanding of national and state science content standards. The yearlong curriculum is hierarchical, designed around the major themes of interactions, Newton's laws, Conservation of Matter and Energy, and Atomic Molecular Theory. An accompanying online teacher resource and specially developed workshop materials provide substantive professional development for teachers who implement the curriculum. Both the student and teacher materials were designed around principles based on research on learning: learning builds on prior knowledge; knowledge construction is a gradual process; interaction with tools facilitates learning; social interactions aid in learning; and norms (evidence, responsibility, respect) can structure student interactions, discourse and learning.

1. Supported by NSF grants # 9812299 and # 0138900
2. Published by It's About Time, Herff Jones Education Division

CE03 9:45 a.m. Learning What Students Are Thinking

Panel – Robert Tinker, The Concord Consortium, 25 Love Lane, Concord, MA 01742; bob@concord.org

With collaborators, we have developed software for authoring and delivering sophisticated computer-based learning activities that use models, tools, and probeware. The technology permits us to monitor performance in solving problems and undertaking investigations of participating students wherever they are. We can generate electronic reports on student performance and infer from these their thinking patterns. One study involving 12,000 high school students revealed patterns in the students' use of models that correlate with other aspects of their learning, such as their scores on traditional question-and-answer assessments. Students who were systematic in their use of models learned the content better and were able to apply their knowledge more broadly. We also saw a longitudinal effect: students exposed to our materials in one year performed significantly better than their peers when they encountered another set of model-based activities in a subsequent year, even though the scientific domains of the two units were different.

CE04 10 a.m. Physics in Informal Settings

Invited – Roy R. Gould, Harvard-Smithsonian Center for Astrophysics, 60 Garden St., Cambridge, MA 02138; rgould@cfa.harvard.edu

Recent research on how visitors learn in informal settings, combined-with marvelous new exhibit technologies, now make it possible to engage diverse audiences in the frontiers of physics. "The Black Hole Experiment Gallery" is a national traveling exhibition that brings together the skills of research scientists, education researchers, exhibit designers, and networking specialists to create a new kind of learning environment. Visitors construct their own understandings of black holes by gathering and interpreting evidence based on authentic data; by confronting prediction with evidence; and by constructing a big-picture view of the unfolding universe. Visitors carry their learning with them, thanks to exhibitry that takes into account their prior activities. The exhibitry also provides access to online telescopes, and automatically constructs a personalized website, based on the visitors' activities. This creates a seamless learning experience, limited only by the learners' curiosity and not by the four walls of the exhibit.

CE05 10:15 a.m. Education Activities in the NSF Physics Division

Invited – Kathleen V McCloud, National Science Foundation, 850 N. Randolph #1007, Arlington, Va 22203; kmccloud@nsf.gov

The Physics Division strongly supports workforce development, education, and broadening participation at all levels, from outreach efforts in large facilities and centers, to supporting efforts through groups such as the National Society of Black Physicists and National Society of Hispanic Physicists, to large-scale projects such as QuarkNet, CHEPREO, CROP, and ASPIRE, to individual PI awards. Students and teachers involved in these projects gain skills and knowledge to become members of the nationally critical high tech workforce, and the results of physics education and curriculum development projects are improving classroom activities throughout the physics curriculum. Many of these efforts within the Physics Division are funded through the Education and Interdisciplinary Research (EIR) program. The EIR program also supports Physics Related Research Experience for Undergraduate (REU) and Research Experience for Teachers (RET) sites across the nation and internationally.

CE06 10:30 a.m. Educational Activities in the NSF Division of Materials Research

Invited – Uma D. Venkateswaran, National Science Foundation, 4201 Wilson Blvd., Rm. 1065, Arlington, VA 22230; uvenkate@nsf.gov*

The interdisciplinary nature of materials research uniquely positions the Division of Materials Research (DMR) to invest in research and education activities that cut across disciplinary barriers. Current education and outreach activities within DMR, are embedded in Centers (Materials Research Science and Engineering Centers — MRSEC), Facilities (National High Field Magnet Laboratory, synchrotron facilities), Research Experience for Undergraduate (REU) Sites and Supplements, and individual investigator or group efforts. A number of these activities include K-12 students, pre- and in-service teachers as well as the general public. This presentation will highlight some of these activities. Furthermore, it will outline some areas where materials researchers and educators can join hands in evaluating and strengthening educational impacts and disseminating best practices in pursuit of a globally competitive materials workforce that is broadly inclusive of groups that are traditionally underrepresented

*Gerhard Salinger, sponsor

CE07 10:45 a.m. The CHEPREO Project: Building from a Learning Community*

Invited – Laird Kramer, Florida International University, FIU Dept of

Physics, CP 204, Miami, FL 33199; Laird.Kramer@fiu.edu

George O'Brien, Florida International University

CHEPREO brings together high school students and their teachers, undergraduate and graduate students, and university faculty to form a rich learning, teaching, and research community. CHEPREO, the Center for High-Energy Physics Research and Education Outreach, is located at Florida International University, a MSI serving more than 38,000 students in Miami. Our goal is to generate excitement about science, improve learning in the classroom, and increase enrollment in both high school and college physics courses by using high-energy physics as a foundation. Our team of particle physicists, educational researchers, teacher leaders, and lead students have combined inquiry-based instructional methods with particle physics outreach and community-building models to meet these goals. Our project also provides a unique research opportunity to study the evolution of a learning community in a diverse South Florida. Results from teacher and student assessments will be presented as evidence of the community's success and challenges.

*Work supported by NSF Award #0312038.

Session CF: Classroom Strategies

Location: Dover C
Date: Tuesday, Jan. 22
Time: 9–11 a.m.

Presider: TBA

CF01 9 a.m. Seventh-Grade Students' Ideas of Force and Work in Simple Machines

N. Sanjay Rebello, Kansas State University, Physics Department, 116 Cardwell Hall, Manhattan, KS 66506-2601; srebello@phys.ksu.edu

Mary J. Leonard, University of Wisconsin, Madison

Sadhana Puntambekar, University of Wisconsin, Madison

We examined changes in seventh-grade students' conceptions of force and work in the context of a design-based instructional unit on simple machines. The CoMPASS curriculum integrated digital hypertext and hands-on activities with design-based learning experiences. We present results from the analysis of a series of structured interviews with 10 students at three points in the eight-week curriculum. Our results indicated a general trend toward scientific conceptions as students progressed through the curriculum, but also highlighted several barriers to students' conceptual understanding of force and work in the context of simple machines. Most notably we found that the use of the hands-on activities, and scientific terminology vis-à-vis everyday language, as well as the curricular context of simple machines, together may have limited student understanding of force and work. This work is supported in part by U.S. National Science Foundation under grant DRL-0437660.

CF02 9:10 a.m. Tips for Creating a Successful Environment in a Modeling Classroom

Chris J. Smith, Barrington High School, 616 W. Main St., Barrington, IL 60010; cjsmith@cusd220.org

Through five years of teaching using the modeling instruction method in my high school physics class I have found that it is not always easy to get students to buy in to modeling method. Over these years I have learned some techniques that complement the modeling philosophy and have helped to build a community of learners in my classroom. You will see how I incorporate lab practicals, explorations, whiteboard presentations, internet HW, and an online community website into the modeling cycle. I will steer you away from some of the mistakes that I have made. If you are a new or experienced modeler or would just like to get a glimpse into one teacher's modeling classroom, then come to see some of the things that I have done to make modeling instruction work for me.

CF03 9:20 a.m. Starting Up a Teacher Share Group with a Bang

Scott C. Beutlich, Crystal Lake South High School, 1200 S. McHenry Ave., Crystal Lake, Il 60014; sbeutlich@d155.org

In January 2007 Physics Northwest, a teacher share group with more than 200 members in the Northwest Chicago suburbs, helped restart Physics West with a spectacular 2-hour demonstration meeting. A group of seven physics teachers from PNW each did five demonstrations. Under normal circumstance this would have been a great evening of sharing ideas. But the evening became exceptionally noteworthy when at the end of the meeting each of the 40 teachers from the western suburbs got information and equipment to do the 35 demos.My powerpoint will show the planning of the evening and the excitment of teacher share groups in the Chicagoland area.

CF04 9:30 a.m. Using Historical Papers to Motivate Physics Students in High School

Alan Gnospelius, Design and Technology Academy, 5110 Walzem Rd., San Antonio, TX 78218; agnosp@neisd.net

For the past few years, I have assembled a group of historical documents from original sources that I have shared with my students. These documents are in the public domain, and are from scientists such as Franklin, Kepler, Curie and Aristotle. The documents have provoked controversy and discussion in the class, and I have found this to be a strategy that needs to be be shared.

CF05 9:40 a.m. Conceptions and Misconceptions of High School Physics Students

Vincent Bonina, Johns Hopkins University Center for Talented Youth (CTY), McAuley Hall, 5801 Smith Ave., Ste. 400, Baltimore, MD 21209; vbonina@jhu.edu

Stuart Gluck, Johns Hopkins University Center for Talented Youth

Takeyah Young, Johns Hopkins University Center for Talented Youth

What knowledge and misconceptions do beginning high school physics students bring to the classroom? During the past 15 years, over 2000 students have taken the Fast-Paced High School Physics course through Johns Hopkins University's Center for Talented Youth (CTY). The course covers the complete content of an introductory series in physics, preparing them for an honors or AP physics course. These students were all given AAPT-developed pre- and post-tests to gauge their initial and final knowledge, providing a rich and unique source of data. In this session, we present an analysis of the results of the pre-tests in order to determine what beginning high school physics students already know and what they have misconceptions about. We also examine the results of the post-test to see which misconceptions were dispelled and which persisted. Parallels will be drawn between the Force Concept Inventory and the mechanics portion of the AAPT-developed examinations.

CF06 9:50 a.m. Recruiting and Retaining Physics Majors

Daryao S. Khatri, University of the District of Columbia, 4200 Connecticut Ave., NW, Washington, DC 20008; dkhatri@udc.edu

Anne O. Hughes, University of the District of Columbia

Brenda Brown, University of the District of Columbia

In general, recruiting and retaining majors in physics has become a major problem for the physics community. The situation, however, is worse when it comes to the recruitment and retaining of minority students as physics majors. At the University of the District of Columbia (UDC), we believe that we are close to a solution of this problem. In this regard, we have conducted a pilot study during the summer of 2006 and then an expanded research study during the summer of 2007. At UDC, the program was specifically designed to close the gap in basic math and introductory algebra for incoming freshmen coming from the District of Columbia Public School. The program using recent graduates not only achieved its goals, but produced a number of surprises. One of the surprises was the number of physics majors we were able to recruit and retain as a result of the program. During summer 2006, we were able to recruit and retain two physics majors out of a pool of 12. However, during the summer of 200, we were able to recruit three physics and two chemistry majors out of a pool of 16. All five of them are now working as freshmen teaching assistants in the department, and they all are involved in a number of courses and activities related to their majors. We will report in detail on the various aspects of this program.

CF07 10 a.m. Teaching Maxwell's Equations to Gen Ed Students

Sadri Hassani, Illinois State University, Campus Box 4560, Department of Physics, Normal, IL 61790-4560; hassani@phy.ilstu.edu

Using text, sound, images, and animations we will present Maxwell's equations in such a way that a general liberal-arts student can certainly appreciate, and even partially understand the discussion.

CF08 10:10 a.m. Assessing Conceptual Knowledge and Problem-Solving Skills in Basic Electromagnetics Course

Ari H. Sihvola, Helsinki University of Technology, Electromagnetics Laboratory, P.O. Box 3000, Otakaari 5 A, Espoo, FI-02015 TKK; ari.sihvola@tkk.fi

Johanna Leppävirta, Helsinki University of Technology, Electromagnetics Laboratory

Basic electromagnetic field theory forms a part of the core of engineering education in the Electrical Engineering department of the Helsinki University of Technology, Finland. Particularly abstract concepts, heavy mathematics as well as difficulties of visualizing electric and magnetic fields, compel the teacher to constantly revise his/her education methods and strategies. In our Fall term (2007) courses (see http://www.tkk.fi/Yksikot/Sahkomagnetiikka/kurssit/S-96.1111/) the Conceptual Survey in Electricity and Magnetism (CSEM) was applied in addition to classical problem-solving based exams to assess student performance. In this talk, we will share the experiences and results of how the two learning outcomes (the understanding of physical concepts and the ability to solve problems) possible correlate.

CF09 10:20 a.m. The Improvement of Student Learning Based on In-class Physics Demonstrations

Sergio Flores, University of Ciudad Juarez, 1424 Desierto Rico, El Paso, TX 79912; sergiflo@hotmail.com

In-class demonstrations are a very important physics concepts learning technique. In the department of physics at the University of Texas at El Paso, we have developed lecture demonstrations that must be used by most of instructors. These demonstrations will be conducted by a demonstration-coordinator or TA. In this way, we expect to improve the student understanding related to difficult topics students do not understand in most physics lectures. The demonstration is set up at the beginning of the lecture to be used at any time the instructor desires. Students are encouraged to participate by being asked about the corresponding prediction of the concept being observed and proved.

CF10 10:30 a.m. Models and Assessment of Undergraduate Research

Michael R. Braunstein, Central Washington University, Physics Dept, 400 E University Way, Ellensburg, WA 98926; braunst@cwu.edu

Over the last decade, undergraduate research projects were required of physics majors at the author's institution (CWU) and considered an important component of meeting the learning objectives of the undergraduate programs delivered by CWU's Physics Department. Learning objectives for the research requirement include: demonstrate ability to use content/skills associated with CWU Basic/Breadth outcomes; demonstrate ability to apply content/skills associated with physics major curriculum outcomes; demonstrate ability to communicate scientific ideas; demonstrate ability to apply appropriate technologies; demonstrate ability to apply the process of science; demonstrate ability to work and learn independently; and, demonstrate ability to apply appropriate resources. We will discuss how we incorporated these learning objectives into an assessment instrument and point out how this process has been instrumental in establishing the model that we use for undergraduate research as well as an extremely useful tool in identifying, developing and guiding research projects for the undergraduate research requirement.

CF11 10:40 a.m. Computation as a Learning Tool in an Undergraduate Nanoscience Course

Ronald M Cosby, Ball State University, Department of Physics & Astronomy, Muncie, IN 47306; rcosby@bsu.edu

Modeling and simulation exercises are used as learning tools in an undergraduate nanoscience course at Ball State University. Web-based computational resources are conveniently used by students to study the basics of quantum tunneling, compute electronic structure and density of states for long carbon nanotubes, and predict molecular conductance using a toy model. More sophisticated exercises on the electronic properties of nanostructures are completed using the commercial software packages Gaussian-03 and Atomistix's Virtual NanoLab. Local resources for the computations include a 128-processor Linux cluster and workstations. The historical context for computational activities in nanoscience is briefly established and a course description is given. The objectives, procedures, and outcomes are described for selected computational exercises completed by undergraduates in the nanoscience course.

CF12 10:50 a.m. Using Mathematical Properties to Identify Discriminating Physics Questions

Eugene Torigoe, University of Illinois at Urbana-Champaign, 1110 W Green St., Urbana, IL 61801; torigoe@uiuc.edu

Gary Gladding, University of Illinois at Urbana-Champaign

While previous studies have revealed that mathematical pre-tests correlate with success in physics, they were not able to specify the types of mathematical skills which were important for success in physics.[1] For the first time we have been able to identify highly discriminating physics questions by coding the questions based only on mathematical properties. The main property we used to code the questions was based on the importance of the formal representation of an equation in the solution of the problem. The properties used to identify questions originated from an earlier final exam study. [2] In that study we analyzed numeric and symbolic versions of 10 final exam questions and found common properties of questions that showed large differences in score between the numeric and symbolic versions. We will discuss and give details of our coding scheme, and suggest possible causal relations for the observed correlations.

1. D.E Meltzer, *Am. J. Phys,* **70**(12), 1259 (2002)

2. E. Torigoe & G.E. Gladding, "Symbols: Weapons of Math Destruction," in 2007 Physics Education Research Conference Proceedings (in press).

CF13 11 a.m. Does an intelligent Tutor Homework System Encourage Beneficial Collaboration?

Brett van de Sande, University of Pittsburgh, 3939 O'Hara St., Pittsburgh, PA 15260; bvds@pitt.edu

Robert Hausmann, University of Pittsburgh

All physics instructors agree that homework assignments are an integral part of physics instruction. When students complete their assignments, they choose to work individually or in small groups. Unfortunately, most computer-based homework systems are structured for individual learners. In particular, these systems only evaluate the final answer, putting pressure on any students working in groups to engage in copying. In contrast, Andes is an intelligent tutor homework helper that requires students to show intermediate steps when solving a problem and gives hints on demand. Andes has been used successfully by several college and high schools. In order to further investigate collaborative versus individual problem solving, we recorded verbal self-explanations and logged solution steps as individuals and student pairs use Andes to solve a set of problems. We found that students working in pairs rely less on the tutor's hints and engage in collaborative sense-making. Implications for instructional practices are discussed.

CDD: Oersted Medal

Mildred Dresselhaus

Sponsor: Programs Committee
Location: Grand Ballroom VI
Date: Tuesday, Jan. 22
Time: 11:15 a.m.–12:15 p.m.

Presider: Ken Heller

Expanding the Audience for Physics Education,

Mildred Dresselhaus, Institute Professor and Professor of Physics and Electrical Engineering, MIT

After graduation from high school, I looked forward to training for a career in teaching school children to love learning and science. But Sputnik and the expanding demand for physicists gave me the opportunity for a career in research and teaching in a research university. There I specialized in teaching physics to talented engineering students, expanding the horizons for women in physics and in mentoring students and young faculty first at MIT and then nationwide about careers in science. I describe briefly how Sputnik opened doors for me, what I learned from my mentors, how I used these opportunities to have an impact on many young people, and what the impact these young people had on me personally and on science policy more generally.

Session CG: Closing the Gap Between Understanding and Action II: Institutional Policies that Promote Change

Sponsor: Committee on Minorities in Physics
Location: Essex A
Date: Tuesday, Jan. 22
Time: 9–10:30 a.m.

Presider: Juan R. Burciaga

CG01 9 a.m. The Meyerhoff Scholars Program at UMBC

Panel – Anthony M. Johnson, University of Maryland Baltimore County (UMBC), Center for Advanced Studies in Photonics Research, 1000 Hilltop Circle, Baltimore, MD 21250; amj@umbc.edu

The Meyerhoff Scholars Program at UMBC was developed in 1988. At that time, UMBC was graduating fewer than 18 African-American STEM majors per year. In 1996 the program was opened to all students with an interest in the advancement of minorities in STEM fields. The program enjoys an overall 18-year retention rate of greater than 95% and has more than 500 graduates since 1993. The program challenges notions about minority achievement. Meyerhoff Scholars have changed the perceptions of those around them—the expectations of faculty who instruct them, the attitudes of students who learn beside them, and the perspectives of scientists who engage them in research. Having been a strong proponent of the recruitment and retention of women and underrepresented minorities into the scientific enterprise since my days at Bell Labs in the early 1980s, I will attempt to present an overview of this remarkable Meyerhoff Scholars Program.

CG02 9:30 a.m. A Faculty Perspective

Panel – Mariajose Castellanos, UMBC, 1000 Hilltop Circle, Baltimore, MD 21250; mariajose@umbc.edu

UMBC provides professors with the opportunity to teach in a diverse community. Preparing to make a difference involves more than just figuring out what you are going to do in class next week. As a teacher we should set goals for both students (as a population and individuals) and ourselves. The way we think about teaching and who we are teaching, influences the way we teach. Teaching should be more than telling; teaching is sharing meaning, engaging students so they can construct the implications and apply them. Multicultural education should take priority, where all students should have an equal opportunity to learn. However, in the real world, due to differences in some cultural characteristics, some students have a better chance to learn than others. Promoting dialogue with the students and recognizing our students as individuals who are independent and capable of original thoughts should lead to success.

CG03 10 a.m. Preparing Environments for Successful Underrepresented Graduate Student Recruitment and Retention

Panel – Renetta G. Tull, UMBC Graduate School, 1000 Hilltop Circle, Baltimore, MD 21259; rtull@umbc.edu

Attracting and retaining talented underrepresented students in STEM fields is crucial if America is going to add to its scientific workforce and compete with other nations in innovation. This talk will highlight methods that UMBC, an Honors University in Maryland, has used in the past five years to increase the university's underrepresented graduate student population, retain the students, and facilitate successful MS and Ph.D. graduation. Much of the success is attributed to progressive leadership in The Graduate School, connection with the vision of the university, building programs based on the successful undergraduate Meyerhoff Scholars program, involvement of faculty and staff, and leveraging awards such as the NIH-NIGMS funding of the Graduate Meyerhoff Biomedical Fellows program (which includes research in biophysics), NSF's Alliances for Graduate Education and the Professoriate or AGEP (PROMISE: Maryland's AGEP), NSF Bridge to the Doctorate program, and the Council of Graduate School's Ph.D. Completion Project.

Session DA: Crackerbarrel: International Student Exchanges

Sponsor: Committee on International Physics Education
Location: Dover C
Date: Tuesday, Jan. 22
Time: 12:15–1:45 p.m.

Presider: Don Franklin

Session DB: Crackerbarrel: Preparing Our Future K-12 Teachers to Conduct Effective Labs and Demonstrations

Sponsor: Committee on Teacher Preparation
Location: Essex A
Date: Tuesday, Jan. 22
Time: 12:15–1:45 p.m.

Presider: Greg Puskar

Session DBB: Symposium on Physics Education: The Many-Body Challenge: The Full-Community Solution for Strengthening Teacher Recruitment, Preparation and Retention in Physics

Location: Grand Ballroom VI
Date: Tuesday, Jan. 22
Time: 1:45–3:45 p.m.

Presider: Harvey Leff

A strong STEM education is essential for securing knowledgeable workers and informed citizens for today's and tomorrow's highly technical world. A strong STEM education starts in our schools and depends on a large supply of highly qualified teachers. Physics stands at the base of STEM education. Ensuring that we have a highly prepared and ready "workforce" of pre-college science and physics teachers requires the consistent and joint efforts of many sectors in our community: Universities, school districts, corporations and foundations, and the federal, state and local governments.

Session DC: Crackerbarrel: Professional Concerns of PER Faculty

Sponsor: Committee on Professional Concerns
Co-Sponsor: Committee on Research in Physics Education
Location: Essex BC
Date: Tuesday, Jan. 22
Time: 12:15–1:45 p.m.

Presider: Thomas Foster

Session DD: Crackerbarrel: Professional Concerns of PER Solo Faculty

Sponsor: Committee on Professional Concerns
Co-Sponsor: Committee on Research in Physics Education
Location: Kent
Date: Tuesday, Jan. 22
Time: 12:15–1:45 p.m.

Presider: Paula Engelhardt

Session DE: Crackerbarrel: Efficacy of Outreach Programs for NSF

Sponsor: Committee on Science Education for the Public
Location: Dover AB
Date: Tuesday, Jan. 22
Time: 12:15–1:45 p.m.

Presider: Julie Conlon

Session DF: Physics on Capitol Hill

Sponsor: Committee on Science Education for the Public
Co-Sponsor: Committee on Professional Concerns
Location: Laurel AB
Date: Tuesday, Jan. 22
Time: 4–5 p.m.

Presider: John L. Roeder

DF01 4 p.m. What to Say to Congress and Why?

Panel – Don Engel, American Physical Society, One Physics Ellipse, College Park, MD 20740; donengel@techhouse.org

Dahlia Sokolov, Subcommittee on Research and Science Education

Congress is built to respond to the desires of its constituents. Representatives and their staffs are awash in information. If scientists do not communicate regularly and effectively with Congress, the interests best represented by educators and scientists will not be met by the government. This talk will cover why we must communicate with Congress, and how to do so effectively. Effective collaboration with Congress requires an understanding of its structure and practices, as well as knowledge of recent and current happenings. Therefore, these will be addressed at the beginning of the talk.

Session DG: How to Get a Math-Science Grant: Some Real Experiences

Sponsor: Committee on Teacher Preparation
Location: Laurel CD
Date: Tuesday, Jan. 22
Time: 4–6 p.m.

Presider: Francis Tam

DG01 4 p.m. The AAPT/PTRA Project (Grant Ideas)

Invited – Jim Nelson, , 4345 NW 36th Dr., Gainesville, FL 32605; nelsonjh@ix.netcom.com

The AAPT/PTRA Project, http://www.aapt.org/PTRA/index.cfm, designed to provide Professional Development for Teachers of Physical Science and Physics has existed for more than 20 years. During that time the project has garnered over $10M in federal, state, and foundation grant support. The Project is presently seeking additional funding and has developed grant templates that highlight the infrastructure, curriculum, assessment, and leadership development components of the PTRA Project. The purpose of this session is to describe some of the recent successful grants and to explore ways you can work with the project to host a PTRA Professional Development project for teachers in your area.

DG02 4:10 p.m. PD ToPPS – Teaching Physics Teachers in North Carolina

Invited – Stephen Danford, Department of Physics & Astronomy, University of North Carolina at Greensboro, 236 McIver Building PO Box 26170 UNCG, Greensboro, , NC 27402; danford@uncg.edu

Nina M. Daye, Orange High School, Orange County, NC 27278

PD ToPPS (Professional Development for Teachers of Physics and Physical Science) is a new partnership between two public universities in North Carolina (UNC Greensboro and University of North Carolina at Pembroke), AAPT, and three North Carolina public school systems (Winston-Salem/Forsyth County School Schools, Guilford County Schools, and Robeson County Schools). PD ToPPS will provide a means for high school and middle school physics and physical science teachers to hone their physics teaching skills through hands-on workshops based on AAPT's PTRA model.

DG03 4:20 p.m. Texas Trails and Trials

Invited – Karen J Matsler, 3743 Hollow Creek, Arlington, TX 76001; kmatsler@mac.com

Tom Okuma, Lee College

Uncharted territory is often daunting and challenging, but the trials of others can be your triumphs. This talk will highlight the groundwork that was done to obtain the first Texas AAPT/PTRA MSP grant and what has been done to maintain those funds and visibility as a professional development provider. The grant is a cooperative effort between AAPT/PTRA, the University of Dallas, Lee College, and the Texas Regional Collaborative to prepare teachers for the upcoming Texas state mandated change in curriculum requiring all students to take physics to graduate by 2011. By using PTRA and C3P materials and the 5E learning cycles we have trained both teachers and professional development providers. Trails (evidence) of successes will be shared as well as areas that are still being modified and improved.

DG04 4:40 p.m. TOPPS: A Win-Win Situation in Maryland

Invited – Francis M. Tam, Frostburg State University, 101 Braddock Rd., Frostburg, MD 21532; ftam@frostburg.edu

Eric J. Moore, Frostburg State University

Katya D. Denisova, Homeland Security Academy, Baltimore

Jane B. Nelson

TOPPS is an Improving Teacher Quality (ITQ) Project, through Training Opportunities in Physics and Physical Science (TOPPS). Under the "No Child Left Behind" federal legislation, $300,000 has been awarded to Frostburg State University (FSU) from the Maryland Higher Education Commission (MHEC) for three years. The Project is providing high school and middle school teachers in the "high-need" LEAs across the state with training in Physics content, research-based teaching strategies, integration of technology, and assistance to reach the "Highly Qualified" status. The ultimate goal is to improve student approaches and achievements in Physics and Physical Science. The Project is modeled after the highly successful AAPT/PTRA program. This paper will discuss some of the challenges, lessons learned, as well as success stories that have made TOPPS a Win-Win situation in Maryland.

DG05 5 p.m. TIPPS: The Georgia MSP Grant

Invited – Bob Powell, University of West Georgia, 1600 Maple St., Carrollton, GA 30118; bpowell@westga.edu

Sharon Kirby, Cherokee County Schools

Ann Robinson, Paulding County Schools (Retired)

The University of West Georgia received a two-year grant from the Math Science Partnership Program (MSP) in the State of Georgia in March 2007. The proposal was funded because of a demonstrated need for improved physics instruction in area schools and the proven track record of the Physics Teaching Resource Agents (PTRA) workshops nationally. Other factors included the proposed assessments of the instruction incorporated into the project and letters of support from members of the partnership. The funded project is Training Institutes for Physics and Physical Science (TIPPS). Two PTRAs from Georgia taught 24 participants the AAPT/PTRA units on "Kinematics and Dynamics" (first year) in a summer workshop with two follow-up sessions and will teach "Momentum and Energy" (second year). Problems of putting the format for the PTRA workshops from the funded rural initiative program into the MSP requirements will be discussed.

DG06 5:20 p.m. Strike While the Iron is Hot – Grants from Private Foundations

Invited – Mark E. Mattson, James Madison University, Dept. of Physics & Astronomy, Harrisonburg, VA 22807; mattsome@jmu.edu

Deborah Roudebush, Oakton High School

In an effort to enhance the training and retention of physics teachers, the Department of Physics and Astronomy at James Madison University applied for and received a grant from the Toyota USA Foundation in the amount of $255,365. The success of this effort was contingent upon a well documented need for STEM teachers which was addressed using two proven programs, Teacher-in-Residence for pre-service teachers and a summer institute paralleling the Physics Teaching Resource Agent program for in-service teachers. This talk will focus on the details of the justification for the grant as well as the system for determining likely funding agents.

Session DH: Data Mining

Sponsor: Committee on Space Science and Astronomy
Co-Sponsor: Committee on Educational Technologies
Location: Essex BC
Date: Tuesday, Jan. 22
Time: 4–6 p.m.

Presider: Jordan Raddick

DH01 4 p.m. Data Mining in Astronomy

Invited – Alexander S. Szalay, Johns Hopkins University, 3701 San Martin Dr., Baltimore, MD 21218; szalay@pha.jhu.edu

Astronomy is now entering a golden age, with new telescopes generating enormous volumes of data. Astronomers need new ways to store, analyze, and understand all these data. At the same time, the Internet allows scientists to easily combine datasets—for example, to look at an image of the same galaxy in visible light, infrared light, and x-rays. Given these developments, "data mining" techniques from computer science will play an increasingly important role in helping astronomers understand the data they collect. Data mining refers to searching for patterns in large datasets. Such techniques can help in two ways: finding "needle in the haystack" objects like brown dwarfs, and "understanding the haystack" to solve problems such as finding the average spacing between galaxies in the universe. In this talk, I will share some major trends in modern astronomy research, and discuss how data mining can help increase our understanding of the universe.

DH02 4:30 p.m. Data Mining in Physics Research

Invited – Petar Maksimovic, The Johns Hopkins University, 3400 N. Charles St., Baltimore, MD 21218; petar@jhu.edu

In this talk I discuss the role of Data Mining in physics research. This role is examined through a contrast of two important but different examples—the use of large quantities of data in Astronomy and High Energy Physics. The latter is especially interesting since, with the advent of the Large Hadron Collider, it will soon face data samples sizes that dwarf those of the past.

DH03 5 p.m. Astroinformatics: The New eScience Paradigm for Astronomy Research and Education

Kirk D. Borne, George Mason University, 4400 University Dr., MS 6A2, Fairfax, VA 22030; kborne@gmu.edu*

The growth of data volumes in science is reaching epidemic proportions. Consequently, data-driven science is becoming comparable to theory and experimentation. Many scientific disciplines are developing subdisciplines that are information-rich and data-based, to such an extent that these are recognized as stand-alone research and academic programs on their own merits. These disciplines include bioinformatics and geoinformatics, but will soon include astroinformatics and data science. Informatics is the discipline of organizing, accessing, mining, and analyzing data for scientific discovery. We will describe Astroinformatics, the new paradigm for astronomy research and education, focusing on new eScience education initiatives. The latter includes "Forensic Astronomy" (or "CSI Astronomy") and the new undergraduate program in Data Sciences at George Mason University, through which students are trained in Discovery Informatics tools to access large distributed data repositories, to conduct meaningful scientific inquiries into the data, to mine and analyze the data, and to make data-driven scientific discoveries.

*Julia Olsen, sponsor

DH04 5:10 p.m. Integrating Algorithm Research with Measurement Data Analysis in Exploratory Science

Norman H. Fontaine, Gneiss Software, Inc., 4 Jacob Dr., Painted Post, NY 14870; nfontaine@GneissSoftware.com

In first-stage research, many scientists must switch frequently between four modes of working: measurement systems development, algorithm exploration, data analysis and reporting. And, it is a fact of life that all software platforms are specifically optimized for one of these four working modes. How can research scientists and students, with very limited budgets, personnel and time, find the right combination of software platforms and develop the most time-efficient methods for using them together? We present our solution for enabling interactive algorithm exploration and rapid analysis of data from evolving measurement systems.

DH05 5:20 p.m. CSI Astronomy: Evidence-Based Learning for the 21st Century

Julia K. Olsen, University of Arizona, Steward Observatory, Conceptual Astronomy and Physics Education Research (CAPER) Team, 933 N Cherry, Tucson, AZ 85721; jolsen@as.arizona.edu

Kirk D. Borne, George Mason University

Current projects such as Sloan Digital Sky Survey, Google Earth with Sky, Galaxy Zoo and many others are moving large datasets from research science to the educational arena. Current institutional pressures to improve student achievement make it critical to develop, test, and evaluate data-based educational strategies. The impending avalanche of astronomical data will provide a wealth of material for students to experience real science in the classroom. Data Mining makes it possible to immerse students in physics, astronomy, and mathematics (as well as other content areas) while teaching and reinforcing 21st century skills. The Large Synoptic Survey Telescope (LSST) is a developing program for integrating research and education with large astronomy datasets. http://www.lsst.org/ For this talk, Julia is also representing: The Large Synoptic Survey Telescope/LSST Corporation/4703 East Camp Lowell Dr., Suite 253/ Tucson, Arizona 85712; jolsen@lsst.org

Session DHH: Exploring the Energy Frontier at the CERN Large Hadron Collider

Sponsor: Committee on Graduate Education in Physics
Location: Grand Ballroom VI
Date: Tuesday, Jan. 22
Time: 4–6 p.m.

Presider: Kenneth Heller

DHH01 4 p.m. An Introduction to the Large Hadron Collider

Invited – Peter J. Limon, Fermilab, P.O. Box 500, Batavia, IL 60510; pjlimon@fnal.gov*

The Large Hadron Collider is on the verge of turning on to do physics, pushing the energy frontier higher by a factor of seven. The combination of its cutting-edge technology, its complexity and its vast size make the LHC the most challenging scientific instrument ever built. I will present an introduction to the LHC as an accelerator and storage ring, including discussions of some of the specific technological and management challenges that had to be overcome to bring it to fruition.

*Ken Heller, sponsor

DHH02 4:30 p.m. The ATLAS Experiment at the LHC

Invited – Ayana T. Holloway Arce, Lawrence Berkeley Laboratory, 1 Cyclotron Rd, Berkeley, CA 94720; atholloway@lbl.gov*

Experiments at the Large Hadron Collider (LHC) will make detailed measurements of the most energetic particle collisions ever engineered, because we expect that some of these collisions will involve new interactions that can only be explained by correcting our theoretical picture of fundamental particles and forces. ATLAS is one of two general-purpose instruments designed to record proton-proton collisions at the LHC. I will describe the ATLAS detector and how we are preparing it to accurately measure the particles created in collision events, and preparing ourselves to interpret these measurements and to interpret these measurements and to recognize the unexpected.

*Ken Heller, sponsor

Session DI: Beyond Correctness — Conceptualizing and Coding High-Quality Scientific Reasoning

Sponsor: Committee on Research in Physics Education
Location: Kent
Date: Tuesday, Jan. 22
Time: 4–5:30 p.m.

Presider: David Hammer

DI01 4 p.m. Recognizing Mechanistic Reasoning in Student Scientific Inquiry

Invited Poster– Rosemary S. Russ, Northwestern University, 2120 Campus Dr., 335 Annenberg Hall, Evanston, IL 60208; r-russ@northwestern.edu

Education research is rightly focused on developing tools for assessing scientific inquiry, and there has been progress in that regard with respect to student performances in experimentation and argumentation. However, assessments of the substance of student thinking during inquiry are often reduced to assessments of correctness—does student thinking after inquiry agree with the knowledge presented in the textbook? Yet the history and philosophy of science suggest other aspects of inquiry that may be more appropriate measures of the quality of student thinking. In particular, this work describes the activity of reasoning about the causal mechanisms that underlie natural phenomena. Using philosophy literature, I develop a framework for reliably recognizing mechanistic reasoning in student discourse. I apply the framework to a student science discussion to show that while sophisticated mechanistic reasoning is abundantly present in students, it may be overlooked and thus discouraged by more traditional assessments of correctness.

DI02 4 p.m. Student Behavior and Epistemological Framing: Examples fromTutorials

Invited Poster– Rachel E. Scherr, University of Maryland, Physics Education Research Group, College Park, MD 20742; rescherr@umd.edu

David Hammer

In a tutorial setting, we want students to engage in a particular kind of activity (collaborative investigation of physics ideas) more than we want them to produce a particular outcome (correct answers recorded on the tutorial worksheet). How might we assess the kind of activity students see themselves as engaged in in tutorial? In particular, how might we observe the extent to which students frame a tutorial as an opportunity for making sense of the physics, rather than an assignment to fill in the blanks? Previous analyses have found evidence of framing primarily in linguistic markers associated with speech acts. We show that there is useful evidence of framing in easily observed features of students' behavior. More broadly, we describe a dynamic among behavior, framing, and the conceptual substance of student reasoning in the context of tutorials in introductory physics.

Funded in part by NSF Grant # REC-0440113.

DI03 4 p.m. Redefining the Word

Invited Poster– Anna Karelina, Rutgers University, Graduate School of Education, 10 Seminary Place, New Brunswick, NJ 08901; anna.karelina@gmail.com

Eugenia Etkina, Rutgers University, Graduate School of Education

The Rutgers PAER group has been developing tasks and rubrics* to help students develop scientific reasoning abilities. In this talk I will focus on the abilities to test a hypothesis, to develop and justify a mathematical model, and to identify, evaluate and validate assumptions. The tasks that we use to help students develop such abilities usually do not have one correct solution and require choosing between the alternatives and justifying the choice. Our study involves 180 students in an introductory physics course for science majors, which is taught via the Investigative Science Learning Environment approach. Students have a set of tasks to acquire scientific reasoning abilities. Developed rubrics used in labs help them self-assess their performance and help TAs evaluate their work. Free response exam questions also assess how students acquire these abilities during the semester and how they apply them for solving problems.

The project was supported by NSF grant DRL 0241078.

*E. Etkina, A. Van Heuvelen, S. White-Brahmia, D. T. Brookes, M. Gentile, S. Murthy, D. Rosengrant, and A. Warren. (2006) *Phys Rev. ST Phys, Ed. Res.* 2, 020103.

Session DJ: Medical/Health Physics Research and Education

Sponsor: Committee on Apparatus
Location: Dover AB
Date: Tuesday, Jan. 22
Time: 4–6 p.m.

Presider: S. Ramesh

DJ01 4 p.m. MRI as a Physics-based Technology Driven by Applications in Medicine

Invited – Richard G. Spencer, National Institues of Health, National Institute on Aging, Gerontology Research Center, 5600 Nathan Shock Dr., Baltimore, MD 21224; spencer@helix.nih.gov

Magnetic resonance imaging (MRI) is a prime example of an applications-driven physics-based technology. Because the basic goal of acquiring high-quality diagnostic images of most internal organs has largely been achieved, much of MRI physics research centers on further improving available information content. Exploratory studies using tissues and animals play a central role in these developments. Examples include study of dynamic processes such as blood flow and cardiac motion, assessment of tissue properties such as hydration, vascularization, and macromolecular orientation, and, using MR spectroscopy, defining the metabolic state of tissue. In parallel with important extensions such as these, there remains the ongoing engineering challenge of working at higher magnetic fields in order to improve spatial and temporal resolution for all types of studies. An overview of the technology and applications will be presented from the perspective of the physicist.

DJ02 4:30 p.m. Medical Physics and Physics Education

Invited – Rod Milbrandt, Rochester Community and Technical College, 851 30th Ave. SE, Rochester, MN 55904; rod.milbrandt@roch.edu

The fields of medical physics and health physics have grown tremendously in recent years. Physicists have played key roles in the development of many imaging modalities, including ultrasound, MRI, and CT, as well as radiotherapy and radiation protection. These topics are interesting to students, and bringing some medical physics into the physics classroom can build interest and real-world relevance in our classes as well as making students aware of other career possibilities—yes, some physicists work in medical centers! Medical physics can be brought into the classroom in many ways. Instructors can choose examples and problems drawn from medical topics, show and discuss medical images and their production, create labs and activities related to medical physics, and set up visits to medical centers and corporations. This talk will include ideas and resources to bring medical physics into your classroom.

Session DK: Statistical and Thermal Physics in the Undergraduate Curriculum

Sponsor: Committee on Physics in Undergraduate Education
Location: Dover C
Date: Tuesday, Jan. 22
Time: 4–6 p.m.
Presider: Juan R. Burciaga

DK01 4 p.m. Research on Learning and Teaching of Thermal and Statistical Physics*

Invited – John R. Thompson, Department of Physics and Astronomy, The University of Maine, 5709 Bennett Hall, Orono, ME 04469-5709; thompsonj@maine.edu

Over the past several years, physics education researchers have begun to investigate student learning at the upper division, including the topics of statistical and thermal physics. A small but growing body of research presents clear evidence that university students, at both the introductory and advanced levels, display a number of difficulties in learning many thermal physics concepts. Work to date has largely focused on the First and Second Laws and the associated concepts (work, heat, entropy, etc.). Some investigations further probe connections between physics and relevant mathematics concepts in these areas (integrals of state functions and process variables, partial derivatives, probability). Results point to difficulties among advanced students incorporating mathematics and physics into a coherent framework.

*Supported in part by NSF Grants PHY-0406764 and REC-0633951.

DK02 4:30 p.m. Teaching Statistical Physics by Thinking about Algorithms

Invited – Jan Tobochnik, Kalamazoo College, 1200 Academy St., Kalamazoo, MI 49006; jant@kzoo.edu

Harvey Gould, Clark University

A discussion of algorithms and models can provide concrete examples of abstract ideas in physics. We illustrate some ways of illustrating important concepts in statistical and thermal physics by considering various algorithms and models. In many cases it is sufficient to discuss only the results of an algorithm or the behavior of a model rather than actually coding or even running a program.

DK03 5 p.m. Energy and Entropy: A Paradigms in Physics Approach to Thermodynamics

Invited – Michael Rogers, Ithaca College, 953 Danby Rd., Ithaca, NY 14850; mrogers@ithaca.edu

Allen Wasserman, Oregon State University

Oregon State University's Paradigms in Physics is a revisioning of the junior-level curriculum where nine, 3-week-long courses offered in series focus on unifying themes. The Energy and Entropy paradigm approaches thermodynamics using a quantum mechanical perspective. With its internally consistent unification of statistics with microscopic mechanics, quantum mechanics offers thermodynamics based on quantum averages and quantum probabilities. But thermodynamic systems are not the isolated quantum systems found in QM courses. Interactions of thermodynamic systems with the "outside" has enormous consequences with thermal variables now understood as macroscopic quantum averages and thermal probabilities as macroscopic quantum probabilities with an entropy postulate playing the crucial role of matchmaker in this marriage. This approach gives rise to an overarching philosophy and a clear pedagogical path that allows thermodynamic methods to resemble the epigrammatic laws of "real physics." Adapting this approach to a traditional, semester-long thermodynamics course at Ithaca College will be discussed.

Session DL: Celebrating Women in Physics in the Baltimore Area

Sponsor: Committee on Women in Physics
Co-Sponsor: Committee on Physics in Pre-High School Education
Location: Essex A
Date: Tuesday, Jan. 22
Time: 4–6 p.m.
Presider: Chitra Solomonson

DL01 4 p.m. Galaxies, Telescopes, and Women: A Life in Astronomy

Invited – Vera C. Rubin, Department of Terrestrial Magnetism, Carnegie Institute of Washington, 5241 Broad Branch Rd., NW, Washington, DC 20015-1305; rubin@dtm.ciw.edu

I became an astronomer because the majesty and mystery of the night sky captivated me as a child, and I could not imagine living on Earth and not trying to understand what I saw. A series of almost unrelated incidents permitted me to have one husband, two children, and a Ph.D. degree in astronomy at the age of 25. My nontraditional background led to unconventional questions, such as "what happens at the outer edge of a galaxy?" I will describe the observations that led to the interpretation that most of the matter in the universe is not radiating at any wavelength, that is, it is dark. In addition to my research work, I will describe my continuing efforts to eliminate the roadblocks that face young women who wish to become astronomers. I still protest a system that makes it harder for a woman than a man to succeed in science.

DL02 4:30 p.m. Seeing Atoms: The Beginnings of Nano-Technology*

Invited – Ellen D. Williams, Institute for Physical Science and Technology, Materials Research Science and Engineering Center. University of Maryland, College Park, MD 20742-4111; edw@umd.edu

Exciting opportunities in science often arise from a new discovery or capability. I was fortunate that the invention of the scanning tunneling microscope occurred just at the beginning of my academic career. As a result, I was an active participant in the transformation of how we think about doing low energy science, from indirect observation of average quantities, to direct observation and manipulation of the properties of individual atoms. I was also fortunate to enter science at a time of change of attitudes towards women's participation. When I began graduate school at Caltech, formal admission of women had only been allowed there for a few years. My generation, in some sense, became the guinea pigs for an experiment in allowing womenaccess to science. In addition to discussing my research in seeing atoms, I will discuss the challenges and opportunities that I have experienced in making things happen in science.

* Major support for this work has been provided by the NSF-MRSEC and the Laboratory for Physical Science, with additional support over the years from the DCI post-doctoral fellows program, NSF, ONR, NIST, the ACS-Petroleum Research Fund and Research Corporation.

DL03 5 p.m. A Woman's Perspective on Inspiration and Science in Today's NASA

Invited – Kimberly A .Weaver, NASA Goddard Space Flight Center, Code 660, Greenbelt, MD 20771; Kimberly.A.Weaver@nasa.gov*

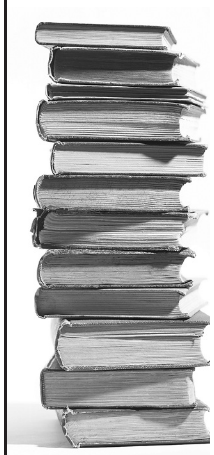
I was a child of the space age, with my eyes drawn toward the stars and my heart drawn toward America's Space Program. I always imagined a career at NASA. Having now served as a NASA scientist for nine years, I have had amazing opportunities to study exotic objects like black holes and exploding stars with observatories such as the Hubble, Chandra and Spitzer Space Telescopes. These telescopes provide new eyes on our universe covering the entire electromagnetic spectrum and our views of the universe have changed dramatically in the past 40 years. NASA has also changed. More women are pursuing careers in physics and astronomy, while at the same time, they bring new personal styles to the process of science, which can have tremendous benefit. I will talk about my journey as a scientist within NASA and the joys and challenges I have faced along the way.

*Chitra Solomonson, sponsor

Session PST2: Poster Session

Sponsor: Committee on Physics in Undergraduate Education
Location: Grand Ballroom IV
Date: Tuesday, Jan. 22
Time: 8:30–10 p.m.

Please see morning poster abstracts



Join Us for the Great Book Giveaway

Tuesday, Jan. 22

5:15–6 p.m.

Exhibit Hall

Raffle tickets are available for 50 cents each at the AAPT Booth, Registration Desk, or AAPT Membership Lounge before Tuesday at 5 p.m. Proceeds will benefit the AAPT Excellence in Education Fund.

DM: Awards Session

Sponsor: Programs Committee
Location: Grand Ballroom VI
Date: Tuesday, Jan. 22
Time: 7:30–9 p.m.

Presider: Ken Heller

Richtmyer Memorial Award – Rotating Galaxies and Dark Matter

Vera Rubin, Senior Fellow, Carnegie Institute of Washington, Department of Terrestrial Magnetism, 7:30–8:15 p.m

Vera Rubin

From the time of the earliest humans to the present, each civilization has told stories about the universe. How we understand the universe is dictated in large measure by the available technology. In the last century, we learned that we inhabit a galaxy of 200 billion stars, that the universe is populated by billions of galaxies, and that galaxies are moving away from each other. Equally important, we now understand that everything evolves: stars are born, evolve, and die; galaxies grow at the expense of their neighbors. I will describe the evidence that the stars, galaxies and clusters of galaxies that populate the universe make up less than 5% of its matter. The remaining matter is dark, and is only detected by its gravitational effect on the bright matter we study. While virtually everything we know about the universe we have learned in the 20th Century, still more remains unknown.

Melba Newell Phillips Medal

Judy Franz, Executive Officer, American Institute of Physics, College Park, MD, 8:15–9 p.m.

Judy Franz

Judy Franz is a condensed matter physicist and has served as the Executive Officer of APS since 1994. In her current position, she is actively involved in the education, outreach, diversity, public affairs, and international programs of the APS. Before joining APS, she was a professor of physics at Indiana University, Bloomington; West Virginia University; and the University of Alabama, Huntsville. Throughout her professional career, she has been active in trying to improve physics education. She chaired the APS Committee on education in 1983-85 and served as President of AAPT in 1990.

Wednesday, Jan. 23

Screening of *Absolute Zero* 12:15–1:45 p.m.
Laurel

Plenary – Mario Livio 11:15 a.m.–12:15 p.m.
Grand Ballroom

AAPT Awards Ceremony
& Presidential Transfer 2–3 p.m.
Grand Ballroom

Session EA: Women in Science Policy

Sponsor: Committee Women in Physics
Co-Sponsor: Committee on Physics in High Schools
Location: Laurel CD
Date: Wednesday, Jan. 23
Time: 8–9:30 a.m.

Presider: Bryan A. Pyper

EA01 8 a.m. What the Heck Is Science Policy and Who Really Does It?

Invited – Amy K. Flatten, Director of International Affairs, American Physical Society, One Physics Ellipse, College Park, MD 20740-3844; flatten@aps.org

The objective of this discussion is to provide insights regarding careers in science policy—how a scientific graduate degree can lead to a opportunities beyond the laboratory, combining scientific expertise with diverse interests such as business, international affairs and national security. The topics covered will include: 1) an overview of the U.S. government bodies and other stakeholders involved in science policy development; 2) case studies to exemplify the "process" of science policy formulation; and 3) where/how one might explore a career in science policy. The speaker served from 1999-2004 with White House Office of Science and Technology Policy and now serves as the Director of International Affairs with the American

EA02 8:30 a.m. Perspectives on Science and Federal Policy

Invited – Jane A. Alexander, P.O. Box 1712, Falls Church, VA 22041; jxanalex@aol.com*

This talk will focus on the changing role of science in federal public policy making. I will also discuss trends in federal policies concerning research and development funding. I will present examples for my over 19-year career serving in the federal government, from Congressional aide to senior manager in federal R&D funding agencies including DARPA, ONR, and the Department of Homeland Security.

*Jill Marshall, Brian Pyper, sponsor

EA03 9 a.m. Scary Things That Don't Exist: The Costs of Bad Science Policy to the Pentagon

Invited – Sharon Weinberger, Wired News, 1325 13th St. NW #49, Washington, DC 20005; sharonweinberger@gmail.com

Everything is possible, but not all things are equally possible. In recent years, U.S. national security institutions have been forced to change how they think about future threats to U.S. security—and how to counter those threats. Faced with the possibility that terrorist groups or rogue states could "surprise" the United States with new weapons or tactics, the U.S. government must ensure that it possesses the most advanced technology to counter future threats and stay ahead of its adversaries. Yet are judgments about possible threats being made on the basis of sound scientific and technical advice? And is the Pentagon making reasoned decisions about its investments in science and technology? After years of decline, there is again a resurgent interest in the need for sound scientific advice to the government. A recent proposal to revive the Office of Technology Assessment mayhave foundered, but Congress is again awakening to the need for scientific expertise. A host of scientific and technical dilemmas —from radiation detection to protect U.S. ports to the threat of new weapons of mass destruction—challenge our national security institutions. This talk will examine the costs and threats of bad science to the Pentagon and other national security agencies, spanning mainstream issues like technology for homeland security and WMD, to more bizarre concepts for weapons that violate the laws of physics.

*Brian Pyper, sponsor

Session EB: Upper Level Labs for the Biosciences

Sponsor: Committee on Apparatus
Location: Essex A
Date: Wednesday, Jan. 23
Time: 8–9:30 a.m.

Presider: Steve Wonnell

EB01 8 a.m. Medical Physics Laboratories and Demonstrations for the Physics Curriculum

Invited – Suzanne Amador Kane, Haverford College, Physics Department, Haverford, PA 19041; samador@haverford.edu

We describe a variety of laboratory exercises and classroom demonstrations that make use of topics in medical physics to illustrate physical phenomena and to connect to applications. Examples of laboratories include an ultrasound imaging laboratory implemented at the sophomore level, magnetic resonance imaging topics covered in labs on spin, and applications of total internal reflection and geometrical optics to medicine.

EB02 8:30 a.m. Photodynamic Therapy: Capping off a Year of Integrated Laboratories

Invited – William Ryu, Princeton University, Carl Icahn Lab, Princeton, 08544; wsryu@princeton.edu

A new series of laboratories and introductory courses for science majors have been recently developed at Princeton University. The freshman course presents a broadly integrated, mathematically and computationally sophisticated introduction to physics and chemistry, drawing on examples from biological systems. I will present, in detail, a three-week laboratory on the synthesis and use of Erythrosin B as a photodynamic therapy agent applied to yeast and bacteria. This final laboratory makes many connections to previous laboratories in the series and I will highlight these connections. I will describe how the use of a "core" set of laboratory equipment, protocols, and computational tools, has made many of these connections possible and have given the students who use these techniques with increasing sophistication throughout the year, the independence and confidence necessary to tackle the final Photodynamic therapy laboratory.

EB03 9 a.m. Optical Trapping for Biological Instrumentation Teaching Laboratories

Invited – David C. Appleyard, Massachusetts Institute of Technology, 500 Technology Sq NE47-221, Cambridge, MA 02139; dapple@mit.edu

Hyungsuk Lee, Massachusetts Institute of Technology

Kelsey Y. Vandermeulen, Massachusetts Institute of Technology

Matthew J. Lang, Massachusetts Institute of Technology

Optical trapping has become a powerful tool for probing the biomechanics of single molecules and cellular structures as well as examining basic tenets of physics and statistical mechanics. Bringing optical trapping technology to the classroom offers exceptional hands-on exposure to advanced instrumentation and biological assays. The simple, inexpensive, and open layout maintains functionality for a wide variety of experiments while offering position detection, computer-controlled stage movement, and fluorescence imaging. Laboratory modules have been developed designed to expose students to a range of measurements from basic optical trapping operation to single molecule force spectroscopy. A calibration experiment serves to introduce trapping theory and examine characterization of stiffness through equipartition, Stokes drag, and roll off measurements. A second assay examines the rotation speed and stall torque of E.coli. The third assay measures the force-extension relationship of dsDNA to extract persistence and contour lengths.

Session EC: RTOP Implementation to Improve Teaching & Learning

Sponsor: Committee on Teacher Preparation
Co-Sponsor: Committee on Physics in Undergraduate Education
Location: Essex BC
Date: Wednesday, Jan. 23
Time: 8–9 a.m.

Presider: Kathleen Falconer

EC01 8 a.m. Use of the RTOP to Reform a Science Education Program for Elementary Education Students

Invited – Gail R. Luera, University of Michigan-Dearborn, School of Education, 4901 Evergreen Rd., Dearborn, MI 48128; grl@umich.edu*

Paul W. Zitzewitz, University of Michigan-Dearborn

All elementary education students at the University of Michigan-Dearborn are required to complete 18 credits in science content and methods. This unique program was driven in part by the definition of “reformed pedagogy” described in the RTOP. As a group of physics, chemistry, biology, and science education faculty jointly constructed and taught three new science content courses using a guided inquiry approach, they were trained in the use of RTOP. RTOP training gave faculty a common language and tool to use when evaluating their curriculum and pedagogy. Methods faculty use RTOP with their students to analyze science teachers and to evaluate the impact of the reformed science education program on our students’ instructional practices once they are in their own classrooms. This work would not have been possible without the continuing close collaboration between natural sciences and science education faculty.

*Paul Zitzewitz, sponsor

EC02 8:30 a.m. Results of Mentoring New Science Teachers Using RTOP

Invited – Julia K. Olsen, University of Arizona, Steward Observatory, CAPER Team, 933 N Cherry Ave., Tucson, AZ 85711; jolsen@as.arizona.edu

Research suggests that new and early career teachers benefit greatly from systematic and frequent feedback on their classroom lessons. In the absence of useful feedback, even the best trained teachers will move away from reformed teaching approaches for more didactic, teacher-centered approaches. In an effort to mitigate this natural tendency to backslide, repeated observations of 10 first-year science teachers were conducted using RTOP as a discussion and feedback tool for the new teachers. Evaluations of new teachers’ RTOP scores throughout the year demonstrate their progress as educators, both in their classroom teaching practice and in their attitudes toward teaching. Significant progress was made by these new teachers when RTOP was used as a device for initiating discussion in a mentoring relationship.

EC03 9 a.m. Using RTOP to Assess Interactive Engagement in Two Widely Disparate Classroom Environments

Panel – Cathy M. Ezrailson, University of South Dakota, 414 Clark St., Vermillion, SD 57069; Cathy.Ezrailson@usd.edu

Cathleen C. Loving, Texas A&M University

Peter L. McIntyre, Texas A&M University

Teruki Kamon, Texas A&M University

In this study, the RTOP was used to assess instructor attitudes about interactive engagement pre and post their teaching. Participants were drawn from two disciplines with widely different classroom environments. These included: 1) pre-service elementary teachers in an elementary instructional setting and 2) physics graduate teaching assistants teaching freshman physics. The instructors were trained on the RTOP instrument before stepping into their teaching assignments and given subsequent weekly instruction in Socratic questioning, cognitive apprenticeship techniques, cooperative group dynamics and context-rich activity design. Differences between the two populations were examined as well as synthesis of common issues. Changing attitudes toward teaching and adherence to method were among factors examined. An ongoing study of a new population of graduate students teaching a common interdisciplinary course from across many disciplines will supply new data to be compared with the results of this study in order to test the validity of the conclusions further.

Session ED: Information Fluency and Physics Curriculum

Sponsor: Committee on Graduate Education in Physics
Co-Sponsors: Committee on Physics in Undergraduate Education, Committee on Professional Concerns
Location: Dover AB
Date: Wednesday, Jan. 23
Time: 8–11 a.m.

Presider: Pat Viele

ED01 9 a.m. Information Literacy and Informative Literature in Physics

Panel – Jean-Francois S. Van Huele, Brigham Young University, N151 ESC BYU, Provo, UT 84602-4681; vanhuele@byu.edu

Justin B. Peatross, Brigham Young University

Lawrence B. Rees, Brigham Young University

Steven R. Turley, Brigham Young University

To become productive physicists, students need to be fluent in two-way communication. They need to be able to retrieve (existing) information and they need to be able to produce and disseminate (new) information. Neither is easy. Both skills have to be learned. The undergraduate physics curriculum needs to make room for the teaching of communication skills to a receptive audience. In our department, we believe that doing original research as an undergraduate is the best way to guarantee physics learning and communication. An accompanying writing-in-physics course gives seniors hands-on skills to communicate their results and write their thesis. By learning how to connect their work to the existing physics literature, by writing up their research for an audience of peers and instructors, and by reflecting on the process of scientific communication and publication, our students become more effective contributors to the scientific literature.In this talk, I will give examples, share tools, discuss challenges, and review progress of our approach.

ED02 9:30 a.m. Seizing Opportunities for Library Instruction Beyond the Physics Classroom

Panel – Adriana Popescu, Princeton University, Friend Center for Engineering Education, Princeton, NJ 08540; popescua@princeton.edu

Librarians can be very creative when it comes to implementing information fluency activities to enhance the academic curriculum. In recent years, academic librarians have made significant progress in promoting the importance of developing solid information evaluation skills in addition to educating students to become successful in their physics related careers, and the success in part is due to the various means and ways that they have worked and collaborated with faculty members to incorporate these skills in the academic curriculum. At Princeton University there are several significant points in the academic path of undergraduate and graduate students when information fluency skills can be taught. The presentation will highlight several instructional opportunities, some of them taking place outside the physics classroom setting, which were used by science and engineering librarians to build information fluency skills and enhance the lifelong learning skills of physics and engineering students.

ED03 10 a.m. Integrating Active Learning and Information Literacy in the College Classroom

Invtited – Bonnie A. Osif, Penn State, 325 Hammond, University Park, PA 16802; bao2@psu.edu*

Time is always a scarce commodity in college science and engineering classes. Most professors find it is difficult to include all of the lectures and laboratories needed to accomplish the basic requirements of the class. “Losing” a class session to provide librarians a chance to promote information literacy is difficult. Yet, the benefits of early and appropriate library instruction can provide a high yield on the time invested. Research papers, laboratory exercises, and exams all can be improved with knowledge of appropriate databases, search techniques, and evaluation criteria. Several successful strategies to incorporate information literacy in engineering classes at Penn State will be reviewed.

*Patricia Viele/Cornell, sponsor

ED04 10:30a.m. Information Fluency for Graduate Students

Panel – Pat Viele, Cornell University, 286 Clark Hall, Ithaca, NY 14853-2501; ptv1@cornell.edu

During this session, I will discuss ways to integrate information fluency instruction into the physics graduate student experience.

Session EE: Frontiers in Space Science and Astronomy

Sponsor: Committee on Space Science and Astronomy
Location: Dover C
Date: Wednesday, Jan. 23
Time: 9:15–10:45 a.m.

Presider: Janelle M. Bailey

EE01 9:15 a.m. Hubble Now and Again: Recent Results and Future Efforts

Invited – Carol A. Christian, STScI, 3700 San Martin Dr., Baltimore, MD 21209; carolc@stsci.edu

The Hubble Space Telescope, now in its 17th year, continues to provide marvelous images and insights to the Universe. The faintest, smallest galaxies yet discovered; the detailed structure of planetary nebulae; Uranus’s thin ring—these are just some of the objects about which astronomers have expanded our knowledge using Hubble images. This fall, some of the best images were incorporated into Sky in Google Earth. In the same way users can explore the far reaches of the planet, they can now also explore the far reaches of the Universe. With so many great discoveries behind it, what’s next for Hubble?

EE02 9:45 a.m. The James Webb Space Telescope: Ahead to the Past

Invited – Kathryn A. Flanagan, Space Telescope Science Institute, 3700 San Martin Dr., Baltimore, MD 21218; flanagan@stsci.edu

The James Webb Space Telescope is one of NASA’s Great Observatories, a worthy successor of the Hubble Space Telescope. This space observatory will detect star clusters formed from of the universe’s first stars, giving it the nickname “the first light machine.” It will explore how galaxies and black holes grow, form, and evolve, and how stars and protoplanetary systems are born. It will determine the properties of planetary systems, investigating their potential for life. In order to look back to the earliest stars, JWST is optimized to detect infrared light, using a mirror more than 20 feet in diameter and operated cold (< 50K) at L2, an orbit 1.5 million kilometers from Earth, well beyond the moon. Launch is scheduled for 2013.

EE03 10:15 a.m. Taking Astronomy to the People

Invited – William Luzader, Blake Planetarium/Plymouth Public Schools, 117 Long Pond Rd., Plymouth, MA 02360; wluzader@plymouth.k12.ma.us

Many astronomy clubs sponsor “evenings in the park” for the public to view various celestial objects with telescopes. Depending on the location and weather of these events, attendance varies. Musea with planetarium offer programs to complement other museum programs. These days with the varying price of gasoline and environmental concerns and increased pressure on classroom “time-on-task,” fewer groups leave their primary building for field trips. Having been a member of astronomy clubs and directing school planetaria looking for audiences, this presenter has experienced taking a telescope to the public and taking a portable planetarium to schools and libraries. These experiences will be shared and contributions from the audience will be Gordon McIntosh

Session EF: Innovations in Teacher Preparation: Recruitment of Prospective Physics Teachers

Sponsor: Committee on Teacher Preparation
Location: Essex BC
Date: Wednesday, Jan. 23
Time: 9:30–11 a.m.

Presider: Ingrid Novodvorsky, Panel

EF01 9:30 a.m. Improving Learning and Recruiting Teachers: The SPU Learning Assistant Program

Invited – Stamatis Vokos, Seattle Pacific University, Physics Department, 3307 Third Ave W, STE 307, Seattle, WA 98119-1957; vokos@spu.edu

Seattle Pacific University is a Primary Program Institution of PhysTEC, a national program of AAPT, APS, and AIP that seeks to increase the number and improve the professional preparation of teachers of physics and physical science. One of the national challenges is the effective recruitment of undergraduate students who are willing to consider science teaching as a career. The Learning Assistant program is one strategy to address this challenge. In this talk, a description of the elements of the program and its implementation at Seattle Pacific University will be presented. Far-reaching benefits to our overall undergraduate physics program will be discussed, as will stubborn difficulties.

* Supported in part by PhysTEC, The Boeing Corporation, and the SPU Science Initiative

EF02 10 a.m. Recruiting the Next Generation of Physics Teachers: The Illinois Model

Invited – Carl J. Wenning, Illinois State University, Dept. of Physics, Normal, IL 61790-4560; wenning@phy.ilstu.edu

In 2004, the Illinois Section of the AAPT established the Ad Hoc Committee for the Recruitment, Preparation, and Retention of High School Physics Teachers using a $500 grant from the national office. Since that time the Committee has conducted research, held a workshop, conducted Crackerbarrel discussions, and presented findings and recommendations in a 9-page report published in the *Journal of Physics Teacher Education Online* (Vol. 2, No. 2, November 2004). The Committee has recently produced an 8-page recruitment booklet for teachers, a tri-fold brochure for students, and two follow-up web pages.* This has been done in cooperation with three other Illinois science teacher associations. The presenter will provide access to these materials, and explain their use in recruiting the next generation of high school physics teachers.

*http://www.isaapt.org/

EF03 10:30 a.m. A Modest Proposal: Addressing the Physics Teacher Shortage by Master's Level Cross and Alternative Certification into Physics Teaching

Invited – Dan MacIsaac, SUNY–Buffalo State College, 222 SciBldg BSC, 1300 Elmwood Ave, Buffalo, NY 14222; macisadl@buffalostate.edu

Dave Henry, SUNY–Buffalo State College

Kathleen Falconer, SUNY–Buffalo State College

Since 2002, SUNY-Buffalo State Physics has established and grown two M.S.Ed. (Physics) programs leading to NYSED 7-12 Physics Certification from two to more than 45 candidates, with another 25 graduates. An attendant Summer Physics Academy serves 60-90 physics teachers annually, awarding graduate credit to both program and non-program graduate students. These programs will be described in some detail, together with their impact on the candidates and our department. Funding opportunities for candidates of these programs leading to physics teacher certification will also be described.

http://PhysicsEd.BuffaloState.Edu/programs/

MacIsaac, D.L., Henry, D., Zawicki, J.L. Beery, D. & Falconer, K. (2004). A new model alternative certification program for high school physics teachers: New pathways to physics teacher certification at SUNY-Buffalo State College. *Journal of Physics Teacher Education Online*, 2(2), 10-16.

Session EH: Ethics in Research

Sponsor: Committee on Graduate Education in Physics
Location: Laurel AB
Date: Wednesday, Jan. 23
Time: 9:15–11 a.m.

Presider: Michael Thoennessen

EGG: Plenary

Sponsor: Programs Committee
Location: Grand Ballroom VI
Date: Wednesday, Jan. 23
Time: 11:15 a.m.–12:15 p.m.

Presider: Gordon McIntosh

Mario Livio

Symmetry: From Human Perception to the Laws of Nature

Mario Livio, Senior Astrophysicist, Head, Office of Public Outreach, Space Telescope Science Institute, Baltimore, MD

What do the fundamental laws of nature, human perception, the music of J.S. Bach, and the selection of mates have in common? They are all characterized by certain symmetries. Symmetry is the concept that bridges the gap between the physics and psychology, between science and art. Yet the "language" of symmetry—group theory—emerged from a most unlikely source: an algebraic equation that couldn't be solved. I will tell the story of symmetry, of group theory, and of their applications to phenomena ranging from the way we perceive the world around us to the way we select our mates.I will also follow the sad lives of two mathematical prodigies who opened the door for these concepts, but did not live to see the impact of their creativity.

EH01 9:15 a.m. Teaching Research Ethics at Graduate Level

Invited – Gary Comstock, Philosophy and Ethics Program, North Carolina State University, Raleigh, NC 27695-8103; gcomstock@ncsu.edu

In collaboration with the NC State Philosophy and Ethic Program, the Physics Department has instituted a graduate course in research ethics required of all physics graduate students. The course is part of a research collaboration sponsored by a major grant from the NSF and titled LANGURE (Land Grant University Research Ethics). I will describe the course and other aspects of the academic program in research ethics at NC State and in the nationwide LANGURE effort. The course emphasizes case studies and includes computer modules that are available on line at www.chass.ncsu.edu/langure/index.html.

EH02 9:45 a.m. Ethics Issues in the Practice of Physics

Invited – Kate Kirby, Harvard-Smithsonian Center for Astrophysics, kirby@cfa.harvard.edu

The American Physical Society (APS) Task Force on Ethics was charged with looking at Ethics practices and the state of Ethics education in Physics. Through surveys of and discussions with the physics community, a number of concerns regarding Ethics have come to light. I will focus on issues in the practice of Physics which were raised particularly by junior members of the APS.

EH03 10:15 a.m. Combating Bad Science–Ethical Considerations

Invited – John Hubisz, Physics Department, North Carolina State University, Raleigh, NC 27695-8202; Hubisz@ncsu.edu

We simply can not allow bad science to go unchallenged. As teachers we are obligated to respond to all media promoting pseudoscience as legitimate science. Some suggestions for accomplishing this will be presented including ideas for a resource library that can be accessed by teachers and journalists.

EH04 10:45 a.m. The APS/AAPT Joint Task Force on Graduate Education Study of Ethics

Michael Paesler, Physics Department, North Carolina State University, Raleigh, NC 27695-8202; Paesler@ncsu.edu

In 2005 the APS/AAAPT Joint Task Force on Graduate Education was charged with undertaking a study of graduate physics education in the United States. Among the specific items was a charge to determine the status of and make recommendations concerning ethics education. In this talk, I will discuss the backdrop to the Task Force's work, report on the results of their investigations, relate their deliberations, and present their recommendations.

Session EJ: Gender in Science: What Recent Data Tell Us

Sponsor: Committee on Physics in Pre-High School Education
Co-Sponsor: Committee on Women in Physics
Location: Laurel CD
Date: Wednesday, Jan. 23
Time: 9:30–11 a.m.

Presider: Betty Preece

EJ01 9:30 a.m. Key Transition Points in Scientific and Engineering Careers

Panel – Catherine Didion, National Academies, Keck 1047, 500 Fifth St., NW Washington, DC 20001; cdidion@nae.edu

The National Academies has issued several recent reports that address women's participation in the scientific and engineering workforce. These include Beyond Bias and Barriers: Fulfilling the Potential of Women in Academic Science and Engineering (2007) and the forthcoming Gender Differences in the Careers of Science, Engineering, and Mathematics Faculty. This session will share some of the findings and recommendations from these reports and explore the critical points of transition in the career pathways for women in the scientific and engineering disciplines as well as what institutions can do to encourage greater participation of women at all levels.

EJ02 10 a.m. Leaks in the Pipeline for Academic Scientists Are Discipline-Specific

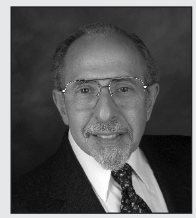
Panel – Phoebe S. Leboy, Association for Women in Science (AWIS), 1200 New York Ave. Suite 650, Washington, DC 20005; phoebe@biochem.dental.upenn.edu

Years ago it was appropriate to discuss generic problems of women in science and draft possible solutions. Most of these focused on making science careers more attractive to girls. However, the increasing numbers of women earning doctoral degrees in many scientific fields has led to a situation in which generic approaches must yield to discipline-specific approaches. Most of the areas in life sciences now have roughly equal numbers of women and men, the pipeline of

Session FE: Ceremonial: Awards and Presidential Transfer

Location: Grand Ballroom VI
Date: Wednesday, Jan. 23
Time: 2–3 p.m.

Presider: Harvey Leff



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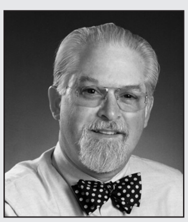

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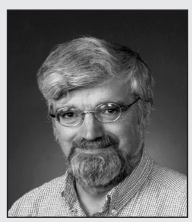

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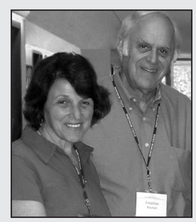

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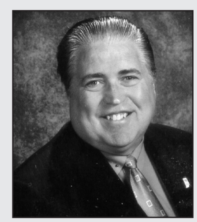

Mike Wolter
In memory, (September 2007)

SPS Outstanding Chapter Advisor Award

Presenter: Earl Blodgett, National SPS President, faculty member of University of Wisconsin-River Falls

American Institute of Physics presents this award annually to faculty members who have excelled in the role of SPS advisor. This year the winner of the award is Dr. Toni Sauncy, faculty member of Angelo State University.

Jacob Berkowitz

American Institute of Physics (AIP) 2007 Science Writing Award for a Children's Author

Presenter: James H. Stith, Vice President, AIP Physics Resources

The Science Writing Award for Children is presented to Jacob Berkowitz, for his book, *Jurassic Poop: What Dinosaurs (and Others) Left Behind,* Kids Can Press (2006).

Jacob Berkowitz is an author, playwright and journalist whose writing combines a passion for science and story. He began his career as a high school English and science teacher. His first job was teaching biology in a portable with no lab equipment and 30 students, two of whom were just released from juvenile prison for violent offences. He thought he was lucky to get the job and learned a lot about teaching and the human condition. Berkowitz has been a full-time writer for the past decade. His boutique science writing business, Quantum Writing, popularizes science for Canada's leading research organizations. *Jurassic Poop: What Dinosaurs (and Others) Left Behind* is his first book.

qualified women is full, and the focus is on ensuring that these qualified women are recruited and retained in faculty positions. Graduate enrollments in chemistry and mathematics suggest that these disciplines are rapidly approaching the situation in life sciences. However, bringing adequate numbers of women role models into physics, computer sciences and engineering education still requires concentrated efforts to fill the pipeline by recruiting and retain undergraduate and graduate women in these fields.

EJ03 10:30 a.m. Gender and Science: What the Data Tells Us

Invited – James H. Stith, American Institute of Physics, One Physics Ellipse, College Park, MD 20740; jstith@aip.org

There is much discussion about the low numbers of women and other underrepresented groups in the sciences. The Statistical Research Center, an arm of the American Institute of Physics (AIP), has a long history of collecting and reporting ethnic and gender diversity data. While the numbers reflecting the representation of women in physics has made steady progress and are now sizable at many levels, the numbers for other underrepresented minorities have not experienced similar growth. This talk will look at some of the stories behind the AIP numbers. Are we for example, asking the right questions? Why is it that efforts that seem to improve the gender diversity are apparently ineffective in addressing ethnic diversity?

Session FA: Crackerbarrel: Work Load Equity – Teaching a Physics Course & Lab vs. Teaching a Humanities Course

Sponsor: Committee on Professional Concerns
Location: Essex BC
Date: Wednesday, Jan. 23
Time: 12:15–1:45 p.m.

Presider: David Donnelly

Session FB: Crackerbarrel: Using History & Philosophy in Teaching Physics

Sponsor: Committee on History and Philosophy in Physics
Location: Essex A
Date: Wednesday, Jan. 23
Time: 12:15–1:45 p.m.

Presider: Ester Zirbel

Session FC: Crackerbarrel: The Role of Student Evaluations in Faculty Assessment

Sponsor: Committee on Professional Concerns
Co-Sponsor: Committee on Physics in Two-Year Colleges
Location: Dover AB
Date: Wednesday, Jan. 23
Time: 12:15–1:45 p.m.

Presider: Theo Koupelis

Session FD: Crackerbarrel: Physics and Society Education

Sponsor: Committee on Science Education for the Public
Location: Dover C
Date: Wednesday, Jan. 23
Time: 12:15–1:45 p.m.

Presider: Jane Flood

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Thanks to all our AAPT members who participated in the survey for the 2007 Summer Meeting in Greensboro, NC. The five winners of $100 AAPT Physics Store gift certificates are:

John Hubisz – North Carolina State Univ. in NC
D.J. Wagner – Grove City College in PA
Christy Heid – Chatham College in PA
Kathy Koenig – Wright State Univ. in OH
David Wright – Tidewater Comm. College in VA

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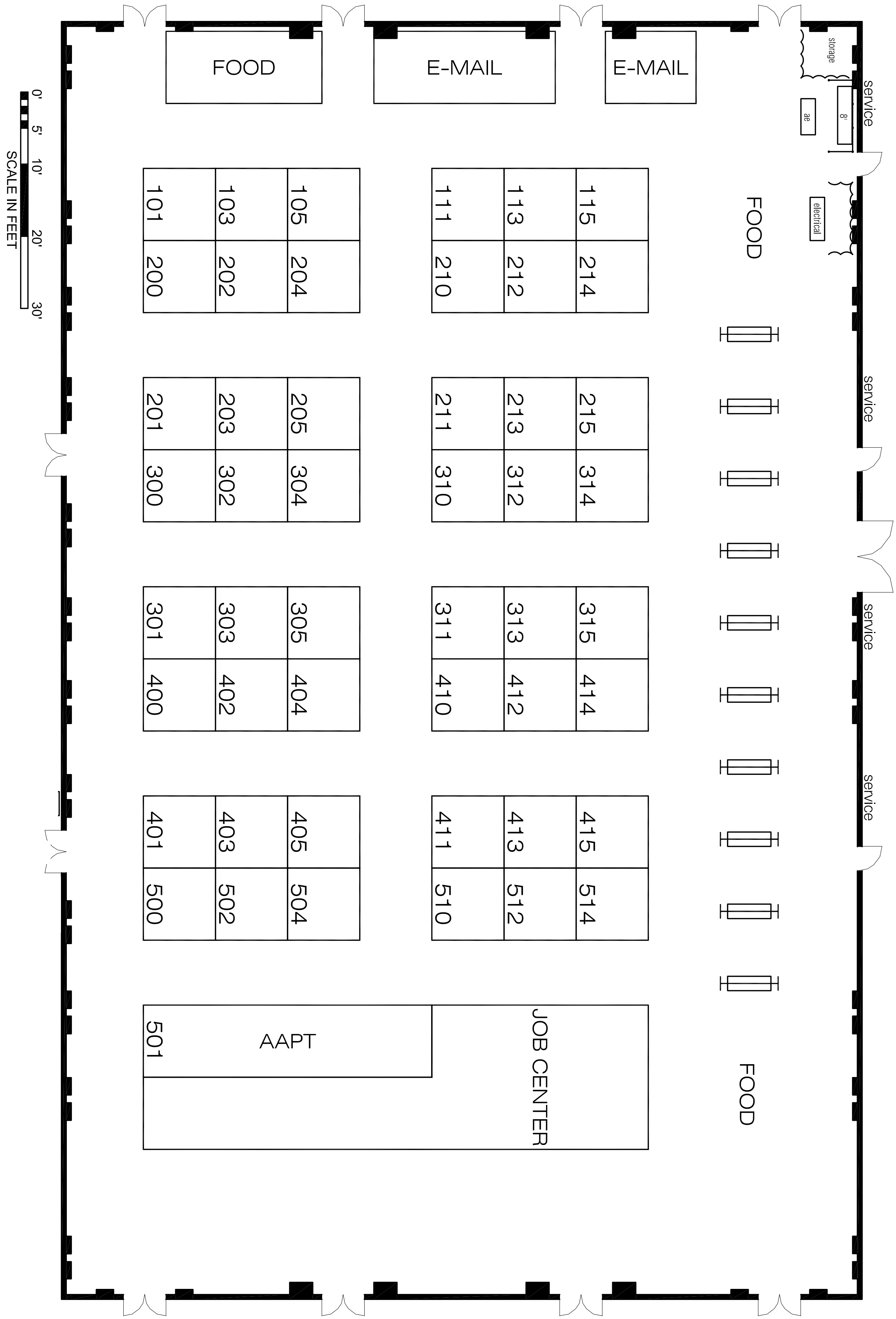
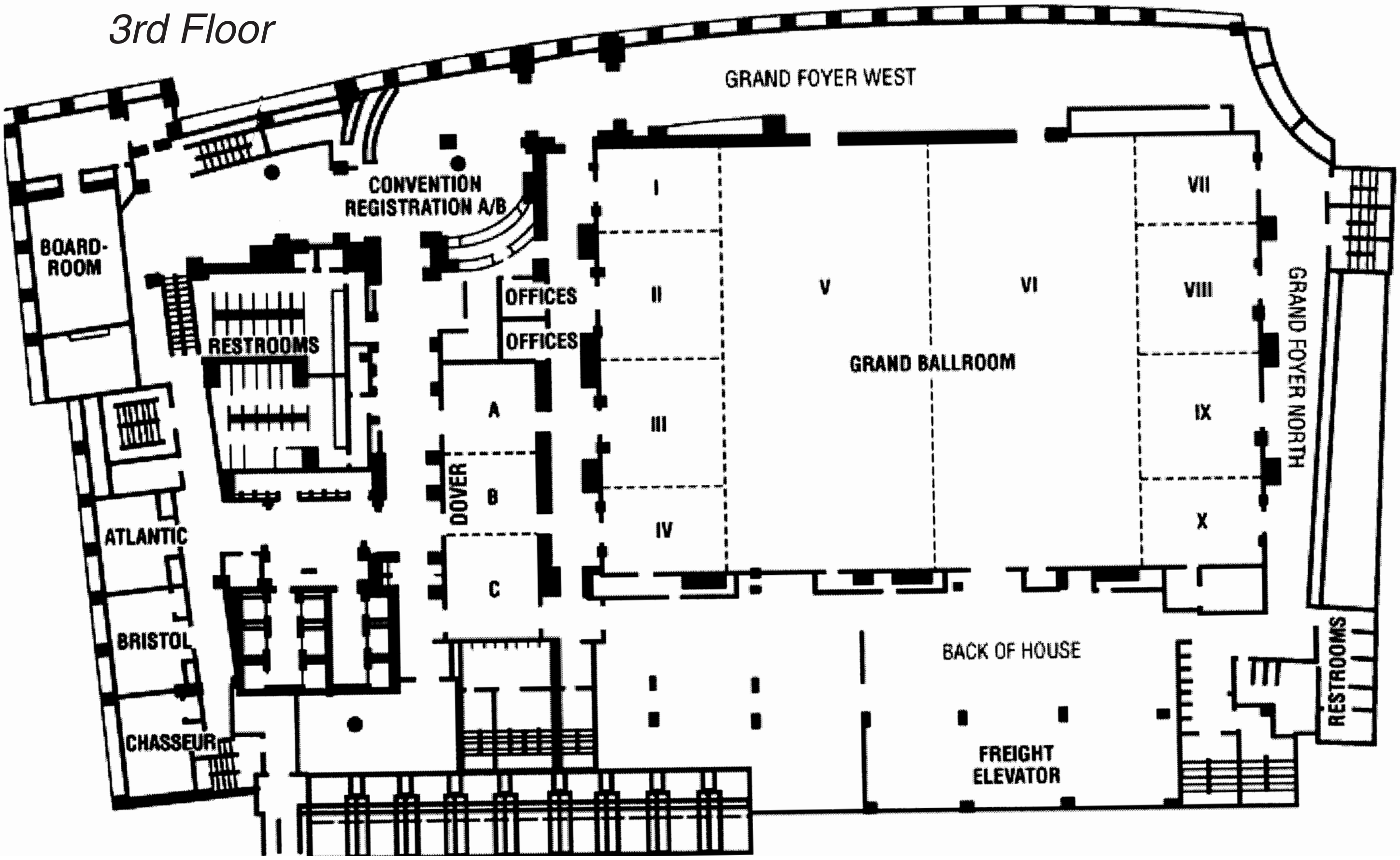
2007 contributions as of November 30, 2007

Exhibit Hall Floorplan

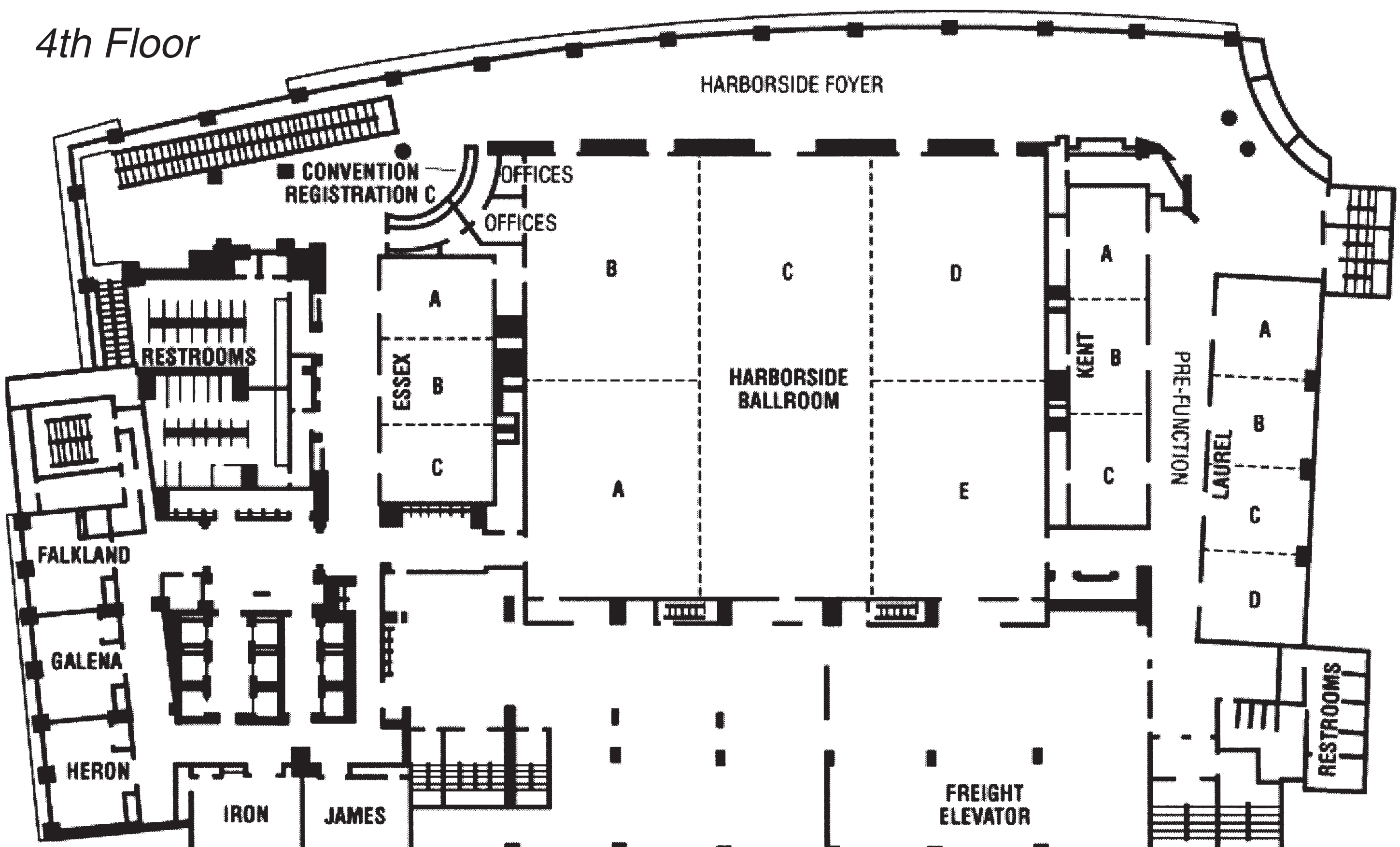


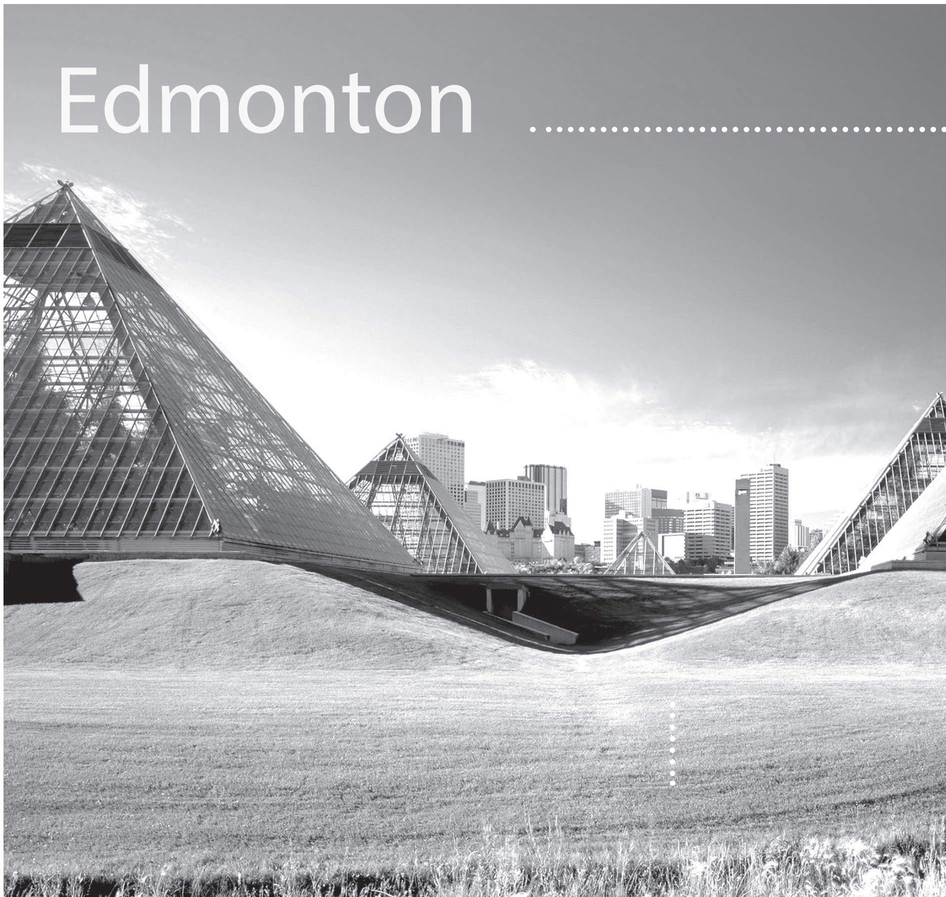
Map of Marriott Waterfront Hotel

3rd Floor



4th Floor





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