

Chicago Section

February, 2009—The Chicago Section AAPT met Saturday, November 8th at Crystal Lake South High School in Crystal Lake, IL. There were roughly 45 teachers in attendance. We were welcomed by Scott Beutlich and his musical Ruben's Tube made from gutter pipe. There were two sessions of contributed talks at 9:30 am followed by an invited speaker plenary session at 10:30 am. The speaker was Dr. George Lisensky from Beloit College and he spoke to us about nanoscale science and technology and provided us with some very valuable resources for teaching about nanotechnology. We then had several more talks before we adjourned for lunch and a business meeting. During the business meeting, new officers were elected, including Scott Beutlich as new Section President, Mel Sabella (Chicago State University) as new Vice-President, and Martha Lietz (Niles West HS) as new Section Rep. After lunch, there were two workshops presented: Nanotechnology, presented by Dr. Lisensky, and a Teaching Color Workshop, presented by Diane Riendeau and John Lewis.

Members of the Section were also quite excited about the upcoming National AAPT Meeting which was held here in Chicago in February. One of the highlights of the meeting was the official kick-off, presented by the Chicago Demo Team on Friday; Tom Senior did a superb job coordinating this effort. Members of the demo team included Keith Bellof, Scott Beutlich, Ann Brandon, Paul Dolan, Anthony Escuadro, Pete Insley, John Lewis, Matt Lowry, John Milton, Andrew Morrison, Josh Norten, Don Reid, GionMatthias Schelbert, Art Schmidt, Patti Sievert and Mark Welter, with musical accompaniment by Nick Drozdoff & Gordon Ramsey, Willetta Greene-Johnson, Kyle Duckert and Joe Schneider. Nick (New Trier HS), Gordon and Willetta (Loyola) are physics teachers while Kyle and Joe are undergraduate physics majors at Loyola. We are all of course amazed that there were no 'collisions' during the dancing, flashy-ball finale!

In the spring of 2009 we will meet at Glenbrook South High School, hosted by John Lewis. The date is tentatively scheduled for April 18th. John is talking to Tom Henderson, also on staff at Glenbrook South, about presenting an invited talk for us related to his Physics Classroom website. We are currently in negotiations with several locations for the fall 2009 meeting, to be held south of the city (to balance the several recent meetings held north of the city). Chicago State has offered to host the meeting in the spring of 2010.

—Martha Lietz, Section Representative

Colorado/Wyoming Section

The spring meeting of the Colorado/Wyoming Section was held jointly with SPS Zone 14 on Friday and Saturday, April 17-18, 2009 at Colorado School of Mines in Golden, CO. Over 80 people registered to attend, and close to 30 members of the local SPS chapter volunteered at the meeting.

Listed below are some of the program highlights:

Friday, April 17th

The afternoon started off with a field trip to the home of car No. 78 and the Furniture Row NASCAR Garage. The evening's invited talk, "NASCAR: The Science Behind the Speed," was presented by Dr. Diandra Leslie-Pelecky from the physics department at the University of Texas at Dallas. The Mines SPS chapter hosted a barbecue dinner, an ice cream social, and a bowling night for all attendees.

Saturday, April 18th, Morning Sessions

Sam Sampere, Physics Instructional Lab Manager at Syracuse University and a leader of the AAPT Summer Meeting's "Lecture Demonstrations Workshop", started the Saturday morning with an overview of the PIRA 200 (200 demonstrations organized by the Physics Instructional Resource Association that professionals believe to be essential in teaching about the most common physics phenomena). Sam performed some of his favorite demos from all areas of physics.



Following Sam's invited talk were the contributed paper sessions. There were 24 papers, sorted into 4 parallel sessions. The contributed papers ranged from high school projects to faculty research. The Four Corners Section of the American Physical Society sponsored a student paper competition in three categories. Bill Fairbank, the Chair of the Four Corners Section, recognized the following students:

Best Overall Student Paper: "Injury Risk upon Impact for Terrain Park Snowboard Jumping," Travis Michelle Nokes (Colorado School of Mines – Golden, CO)

Most Unique/Creative Student Paper: "Understanding Physics in Motorsports," Jaime Bubak (Ralston Valley High School – Arvada, CO)

Best Student Pedagogical Paper: "Design and Implementation of a Muon Lifetime Experiment," Matt Bowles and Jonathan Powers (Colorado School of Mines – Golden, CO)

Business Meeting

The section business meeting was held after the luncheon. The agenda included approval of previous minutes, constitution/by-laws issues, values that the CO/WY Section offer, and discussion of membership dues. Officers' reports were followed by the election of new officers. Election results are:

President: Chuck Stone
President Elect: Adam Pearlstein
Vice President: Barbra Maher
Secretary/Treasurer: Richard Krantz
Section Representative: Vince Kuo

The new VP, Barbra Maher, agreed to host our next CO/WY Section AAPT meeting, in the spring of 2010, on the campus of Red Rocks Community College in Lakewood, CO.

Saturday, April 18th, Afternoon Sessions
Two workshops were concurrently scheduled:

Brian Jones, the Director of "The Little Shop of Physics" at Colorado State University in Fort Collins, provided everyone with an overview of his science outreach program, and then led a workshop for both teachers and SPS members who wished to learn more about hands-on science education outreach. This workshop featured numerous make-and-take activities that provided attendees with ready-to-use demonstrations for their classes.



Diandra Leslie-Pelecky presented a workshop called "Building SPEED" that provided the audience with a number of make-and-take activities that illustrate how principles of auto racing can be used to address statewide science standards.



A special presentation, "The DynamicBook™ Solution" followed the workshops. Mark Santee, from the W. H. Freeman publishing company, introduced a new, multi-option solution that integrates an eBook, full-color bound paperback textbook, plus WebAssign Premium, the leading online homework system.

Acknowledgements

The Section would like to thank the Department of Physics at the Colorado School of Mines for hosting the meeting, the APS Four Corners Section for sponsoring the student paper competition, and the outgoing vice president for putting together the program. A special thanks goes to the SPS Chapter at CSM for doing all of the leg-work that made this a very successful meeting.

—Vince Kuo, Section Representative

Hawaii Section

AAPT Spring Meeting

April 25, 2009, BYUH Laie Campus

Meeting commenced at 9:20 am. Members in attendance: Hanno Adams (President), Mike Weber (VP), James Redmond (Section Rep), Liz King (Secretary), Forrest Luke, Mike Jones, Pui Lam, Jeanine Nakakura, Aaron Tamura-Sato (Treasurer), Selene Cadirao, Gerry White, Lila Lelepali, Marshall Bartlett Gene Guillian (guest), Mimi Dang

Notes

Demos revisited (Jeanine) - photos from the New Teacher Grant Workshop that was a huge success. The workshop was designed to promote relationships between new and veteran teachers, to provide resources (demo books and veteran knowledge), and to increase participation in AAPT meetings. The culmination was a presentation of projects by veteran/newbie pairs. Jeanine showed us photos from the event - see them at <http://www.flickr.com/photos/drnice44> and click on Physics Demos at Roosevelt. And, Aaron showed us a video of the Newton's Cradle his Damien students built using bowling balls!! It's a great idea and should be continued, but Jeanine is stepping down; please feel free to step into the coordinator position, anybody.

Farewells to current officers (see above)

Election of new officers: Summary of duties

Pres - coordinate meetings, give awards at Physics Olympics and such, can be more if desired VP - Snacks; traditionally assumes position of President at end of term

Secretary - take notes

Section Rep - gets a free trip to AAPT annual Winter Meeting

Nominations: Pres - Mike Weber**

VP: - Gerry**, Mimi, Liz, Jeanine

Secretary - Liz**, Selene, Laila

Treasurer: Aaron **

Section Rep - Jim Redmond **

Note: ** denotes the candidate who was elected to serve in the 2009-2010 term

Calendar of events - a complete listing will be posted on the AAPT Hawaii Website soon (see below in links section)

May 23 - HURC Underwater Robotics Challenge (see details below)

July 28 - DOE 1st day of school

Sept 12 - AAPT Fall Meeting at Punahou (to be confirmed)

Oct 3 - New Teacher workshop (Jim Redmond) (in conjunction w/HaSTA Fall Conf)

Oct 3 - HaSTA Fall Conference 7:30 to 1:00 at Punahou

Oct 5-9 DOE Fall Break

Oct 16-17: SOEST Open House

November: The Manoa Experience/Physics and Astro Open House/Engineering Day (tent.)

Physics Olympics (Pua Lam, plam@hawaii.edu) - AAPT and UH Manoa, BYUH, KCC Engineering Club, and the Society of Physics Students at UH host this 1/2 day, hands-on event for HS students. This year marked the 20th Physics Olympics here in HI!! It was held on the KCC campus in February. This year saw 30 teams (representing about 9 schools) competing in 5 events. This event isn't just for brainy physics types -- any student can compete. Please consider bringing a team to the next one.

HURC - Hawaii Underwater Robotics Challenge (Mark Rognstad mrognsta@Hawaii.edu - of the Institute of Geophysics and Geology at UH Manoa). This is a local and cheap alternative to the expensive FIRST competition that is currently being held in Honolulu. Highest scoring team does go to international competition (sponsored by MATE Marine Advanced Technical Education). Next year, this international competition will be held on the Big Island. HURC provides a parts kit to the first team to apply from each school (about \$250 worth of stuff in the kit). The robot has tasks (this year, the robot will "rescue" a stranded "submarine" by inspecting the sub, placing oxygen bottles, connecting a hose to the sub, and docking with the sub. There is a nontechnical component, as well: students must present their budget and technical report to judges during the event. This coming competition will be on May 23, 2009 at the Battleship Missouri (for presentations) and in Richardson Pool nearby (for the robot challenge).

AAPT Meeting Report (Jim Redmond) -- next meeting July 25-29 in Ann Arbor, MI. Winter meeting will be held Feb 13-16, 2009 in Washington D.C. New membership application now offers cheaper membership option. See link below. The meetings are definitely worth going to!! Jim went to Fermi Lab during the Spring Meeting held in Chicago and also attended a section on the concept of teaching Physics first (freshman year in HS), which lead to a long discussion of the pros, cons, and tribulations of moving toward this idea both here and on the mainland. Just a note: Winter meetings are held in a big city, and you have to stay in a hotel, so it's expensive. The spring meetings are held at a University, so you can stay in a dorm and it's cheap. And, regardless as to which you attend, it's a career-changing event that's absolutely worth attending.

Treasurer's Report (Aaron) -- Paul Hewett gave us another \$1000 J and we now have around \$1300, so we're good to go for another few years. We will use some of this money to continue to give the Paul Hewett Award at the Science Fair to the teacher of the best Physics project. Actually, HSSO has combined physics and astronomy into one category, so the Hewett award goes to the teacher of the winning student in that category. The future of the event is now seriously in question, as they lost funding in a big way. So, what the next science fair will look like, if there is one, is a big question.

New business

Continuing the New Teacher Workshop- Not just for new teachers!! Jim Redmond got a grant to hold a 1-day workshop that will equip teachers with resources and labs. The idea is to create labs that are performed twice -- once low-tech, and once hi-tech,

so see the difference between labs that are good for conceptual learning and those that are good for analysis. Jim will hold the workshop in conjunction with the HaSTA Fall Conference (he has a room booked for that). Preregister on the HaSTA Website (form will be posted soon). Jim could use some help on this -- please contact him if you are willing (jredmond@hawaii.edu).

Announcements:

FREE STUFF!!! UH Manoa still has physics textbooks available and old electronic equipment (syncho rotators, spark timers, cylindrical containers used for calorimetry, galvanometers, spark sources, AC/DC ammeters) -- please contact Mike Jones (mdj@phys.hawaii.edu) ASAP if you want anything
Next Meeting: Sept 12 -- AAPT Fall Meeting at Punahou links:
AAPT, national: www.aapt.org
AAPT, local: <http://www.phys.hawaii.edu/~aapt>
Physics Calendar of Events (old): www.phys.hawaii.edu/~aapt/calendar/events2008-2009.html
New Teacher Grant Workshop Photos: <http://www.flickr.com/photos/drnice44>
HaSTA: www.hasta.us/
ROV competition info: www.marinetech.org

Idaho/Utah Section

The annual meeting of the Idaho Utah Section was held March 6-7, 2009, at Brigham Young University, Provo, Utah. Duane Merrell from BYU hosted the meeting. There were 73 registered attendees.

We began the meeting Friday evening with a dinner hosted by BYU, followed by a demonstration show. Following the show, we gathered in the new planetarium for a star show presented by Matt Divilbliss, a BYU undergraduate student.

On Saturday, 16 oral presentations were given in three sessions. These included 4 students, 1 high school teacher, and 11 college and university faculty. Concurrently with two of the sessions, Duane Merrell and John Ellsworth (BYU) held a workshop for high school teachers and also for students preparing for a high school teaching career. The 20 participants each constructed an induction coil jumping ring apparatus.

We conducted our business meeting following lunch on Saturday. We elected as vice president, Farhang Amiri (Weber State University). We also re-elected Adam Beehler as section treasurer and Harold Stokes as section representative.

The meeting was concluded with a drawing for door prizes which included various physics "toys". The grand prize was an all expense paid trip to the national AAPT meeting in Ann Arbor, Michigan, July 25-29, 2009. The donor providing this prize specified that it be awarded to a high school teacher who has never attended a national AAPT meeting. The winner was Brad Talbert, a teacher at Pleasant Grove High School, Pleasant Grove, Utah.

You can find out more details about the meeting, including photos and videos, at <http://aapt.byu.edu>.

—Harold Stokes, Section Representative

Minnesota Section

The fall meeting of the Minnesota Section was held at Gustavus Adolphus College in Saint Peter, Minnesota on October 24 and 25, 2008.

The meeting began in the evening of October 24, with a public lecture by Nobel Laureate Leon Lederman, Pritzker Professor of Physics at Illinois Institute of Technology. Professor Lederman's opening lecture, "Why Did the U.S. Collaborate to Build an Eight Billion Dollar Particle Accelerator?" was delivered to a standing-room-only audience of physics teachers and interested adults and students. On the following day, he spoke about his current passion to physics teachers and students in a lecture entitled, "Physics First: A Revolution in Science Education." Steve Ethen, 2006 Recipient of the 2006 AAPT Excellence in Pre-College Teaching, also presented a talk on the PTRA Program, Past and Future. Video of all three of these talks is available on the Gustavus web site at <https://podcast.gac.edu/groups/physicsdepartment/>

Preceding Professor Lederman's talk on Saturday morning, the audience was treated to talks by students and faculty on topics ranging from ultrasonic excitation of micro-cantilevers to presentation of the physics of nuclear weapons to non-science majors. There was a good mix of reports on the results of physics research and physics education research at the meeting. During the break for coffee and rolls, the audience was able to visit with the student authors of five posters on topics from acoustics to astrophysics, optics to condensed matter physics.

At the business meeting which followed, a discussion of themes for upcoming meetings took place, as well as meeting locations and dates. Those present decided that another joint meeting with the Iowa and Wisconsin sections is desirable and the officers should begin planning to do this in 2010. Suggestions were solicited for the program of the spring meeting, tentatively scheduled for April 25, 2009 at St. Thomas University. For the latest information on this and future meetings, visit <http://www.maapt.org/> Charles Niederriter and Leon Hsu, Section Representatives

Papers:

- Non-Contact Modal Excitation of Micro-Cantilevers Using Ultrasonic Radiation Forces, Bradley Abell and Daniel Mellema, Gustavus Adolphus College (sponsored by Thomas Huber, Gustavus Adolphus College)
- Applied Physics in the Advanced Lab: Studies on Acoustic Vibrations, Keith R. Stein, Richard W. Peterson, Jack Houlton, Justin Knapp, Brandon Peplinski, Christopher Scheevel, and David Swenson, Bethel University
- Presenting the Physics of Nuclear Weapons to Non-science Majors, Ananda Shastri, Minnesota State University Moorhead
- Quantum Mechanics of Classical Isochronous Oscillators, Bruce R. Thomas, Carleton College
- Bread Oven Heat Flow, Nathan Moore, Winona State University
- Predicting Student Performance in University Introductory Physics: The Role of Physics Concepts and Math Skills, Ken Heller and Jennifer Docktor, University of Minnesota
- Developing a Useful Instrument to Assess Student Problem

Solving, Jennifer Docktor and Ken Heller, University of Minnesota

- The $v=0, J=1-0$ Silicon Monoxide Maser Emission from VY Canis Majoris, Gordon McIntosh, University of Minnesota, Morris, and Ben Rislow, College of William and Mary
- Posters:
- Construction of a Low-Coherence Optical Reflectometer, Chenyu Yang, (adviser Dr. Steve Mellema), Gustavus Adolphus College
- College Characterization of Speech Intelligibility in Christ Chapel, Benjamin Wolf, Daniel Mellema, and Jing Han Soh (adviser Dr. Steve Mellema), Gustavus Adolphus
- Searching for Transiting Extrasolar Planets, Heather Cegla, Minnesota State University Moorhead; Tim Young, Tricia Johnson, and Dean Smith (University of North Dakota) (sponsored by Ananda Shastri, Minnesota State University Moorhead)
- Nuclear Magnetic Resonance of Solid State Hydrides, Devin Kasper, Jordan Schmidt, Ananda Shastri, Minnesota State University Moorhead
- The Characteristic Lifetime of Mira's SiO Maser Features, Jason Bonde and Gordon McIntosh, University of Minnesota, Morris

The spring meeting of the Minnesota Section was held at St. Thomas University in St. Paul, Minnesota on Saturday April 25, 2009. The theme of this meeting was "Computation, computers, and physics instruction." The keynote presentation, "Bringing computation to the classroom" was given by Anne Cox from Eckerd College in St. Petersburg, Florida and gave an overview of the various ways that instructors have incorporated computers and computing into the physics classroom. Other talks on the theme included:

- "NDSolve your problems: Mathematica in the advanced undergraduate physics curriculum," by Andy Rundquist (Hamline University),
- "Blacksmithing, introductory physics, and computer programming, or what do pickles and coal have in common?" by Nathan Moore (Winona State University),
- "Computational science: what our students need now," by Robyn Wangberg (St. Mary's University of Minnesota), and
- "Using computers as problem-solving coaches for students" by Leon Hsu (University of Minnesota).

Other talks given at the meeting were:

- "Measuring Beginning Students Perception and Applicability of Force in Physics and Engineering," by R. C. Misra (Minnesota State University, Mankato)
- "Building musical whistles in an introductory physics of music class," by Ananda Shastri (Minnesota State University, Moorhead).

In the last talk, Professor Shastri described a lab at MSU Moorhead in which students use physics principles to design and build PVC whistles in a 2 hour lab. With a bit more time and effort, these whistles could be turned into full-blown recorders.

A major feature of the Minnesota section's Spring meeting is the competition for the best undergraduate student poster and best

undergraduate student presentation. This year, the award for best student presentation went to Eric Colegrove from Hamline University for his talk titled "Fabrication and Characterization of Nanoporous Platinum Thin Films." The award for best student poster went to Nathaniel Johnson for his poster "Gibbs Monolayer Equilibrium and Periodic Marangoni Instability." Other student presentations and posters were:

- "Computational Analysis of the Lipid Monolayer," presented by Andrew Nguyen (Augsburg College)
- "Controlling Monolayer Domain Morphology," presented by Sergio Romero-Garcia (Augsburg College)
- "Construction of a Magnetic Needle Viscometer for Measuring Surface Viscosity," presented by Thomas Lopez (Augsburg College)
- "The Influence of Sterol Structure on Transbilayer Diffusion Rates," presented by Christine Staloch (Augsburg College)
- "External cavity laser diodes for lithium spectroscopy," presented by Jami Johnson and Sarah Kaiser (Bethel University)
- "Sub-picometer resolution from a low-cost Michelson wavelength meter," presented by Adam Banfield (Bethel University),
- "High Altitude Balloon Experiment: Radiation vs. Altitude," presented by Amy Fleischhacker and Nicole LaHaye (University of Minnesota)

At the business meeting that followed, plans were discussed for the upcoming "Physics Day" to be held on October 30, 2009 in collaboration with the National Science Teachers' Association regional meeting in Minneapolis. The members decided to hold, in addition, a Minnesota Section meeting the immediately following day focusing on a theme of "Laboratories." We thank St. Thomas University for hosting this Spring's meeting and to the undergraduates for being willing to present their work.

—Leon Hsu and Charles Niederriter, Section Representatives

Missouri Section

The annual spring meeting of the Missouri Association of Physics Teachers (MAPT) was held at Northwest Missouri State University, Maryville, on April 24-25, 2009. As usual, this was a joint meeting with the Missouri Academy of Science (MAS). Section President, John Shaw, Northwest Missouri State University, presided, acting also as the Chair of the Senior Physics Division of the MAS. There were five oral presentations and one poster presentation. About 15 members were in attendance.

Oral Presentations:

- An Astronomy Course for K-8 Teachers, Gibbons, P.C., McMahon, A.P., and Wieggers, J.F., Dept. of Physics and Science Outreach, Washington University.
- Fourier Analysis of Subshell Photoionization: Pristine C60 and Atoms Endohedrally Confined in C60, McCune, M., Dept. of Physics, Northwest Missouri State University.
- Paraxial Geometric Optics: a Study of 1-Dimensional and 2-Dimensional Image Distortions, Manivannan, K., and Manivannan, A., Dept. of Physics, Astronomy, & Materials Science, Missouri State University and Dept. of Physics, Carnegie-Mellon University.
- Science, Pathological Science, and Pseudoscience, Mitra, S.,

Dept. of Physics, Astronomy, & Materials Science, Missouri State University.

- Absorber Material and Device Design for Increasing Photovoltaic Cell Efficiency, Mangan, T.C., and Mitra, S., Dept. of Physics, Astronomy, & Materials Science, Missouri State University.

Poster Presentation

Improving the Performance of Solar Cells by Single-Walled Carbon Nanotubes, Muchharla, B., and Dong, L.F., Dept. of Physics, Astronomy, & Materials Science, Missouri State University.

Business Meeting:

At the business meeting, the next fall meeting was set at Washington University, St. Louis, date to be announced later. Current plans are for this to be a joint meeting with the new St. Louis Section of the AAPT. Elections were held for a new section Vice President; the current Secretary-Treasurer and Section Representative were re-elected. Last year's Vice President and President-Elect move up in turn to President-Elect and President. New and current officers are:

President: Pat Gibbons, Washington University, St. Louis

President-Elect: Sunder Balasubramanian, Lincoln University, Jefferson City

Vice-President: Kandiah Manivannan, Missouri State University, Springfield

Secretary-Treasurer: Robert J. Whitaker, Missouri State University, Springfield

Section Representative: Jim Borgwald, Lincoln University, Jefferson City

New Jersey Section

NJAAPT Spring Meeting – 2009 at Princeton University Focuses on Applications of Physics Responding to the preferences of its membership, the New Jersey Section of the American Association of Physics Teachers (NJAPT), meeting at Princeton University on 20-21 March 2009, devoted its annual spring meeting to applications of physics to other fields. Speakers covered such diverse areas of application as law enforcement, embryology, music, and medicine.

Leading off as the Friday night after-dinner speaker was William H. Pauli of the Collision Analysis Reconstruction Team in the Somerset County (NJ) Prosecutor's Office – a team formed as the result of two acquittals of people charged with vehicular homicide, presumably because less had been done to support the prosecution than the defense. A former police officer with a background in traffic safety, Pauli has sought to do outreach to students to prevent them from causing collisions themselves. He sought to do the same kind of outreach to NJAPT – in a presentation called "Physics is Your Passenger."

Physical evidence, Pauli said, is the most important ingredient in reconstructing a collision. The intent is to determine the speeds of cars before they collided and how the collision occurred, matters that could be material to a subsequent court case. Evidence includes distribution of the severity of damage to vehicles and marks left on the road. The

analyses Pauli showed focused on forces exerted between colliding vehicles at their point of maximum contact, and Pauli noted that forces striking far from the center of mass will cause a car to rotate about its center of mass, possibly including rotation about a horizontal axis to produce gouges in the road. But, in contrast to crime scenes that can be kept isolated for inspection as long as needed, Pauli noted that he needed to do his analysis quickly, because roads must be kept open.

Many of the examples of serious collisions shown by Pauli, most of them resulting in death, were caused by people under the influence of alcohol or drugs. In general, Pauli said, human factors are the major cause of accidents. But there are important physical factors too, principal among them the coefficient of friction between vehicle tires and the roadway. This coefficient, the ratio of the friction force to the vehicle's weight, is 0.8 for dry new pavement, but this reduces to 0.6 or 0.7 in time, is only 0.5 for wet gravel and 0.4 for a snow-covered road. Only 0.2 is needed for normal driving, but 0.5 is needed for casual braking and 0.7 for maximum braking. Moreover, sudden braking requires disproportionate stopping force applied by the front wheels. In this case the tire surface is found to buckle up in the middle.

The physics for calculating the speed of a vehicle prior to collision is very straightforward if the coefficient of friction and the distance traveled by the vehicle after collision are known. The vehicle is slowed by negative work done by the friction force, and this negative work equals the decrease in the vehicle's kinetic energy. Since the negative work is determined by multiplying the friction force by the distance through which it acts, one obtains $mg\mu d = \frac{1}{2}mv^2$, where

m = mass of car

g = acceleration due to gravity (32 ft/s² in the units used by Pauli)

μ = coefficient of friction

d = distance traveled by car (in ft)

v = speed of car (in ft/s).

This leads to

$$v = \sqrt{64\mu d}$$

for the speed in ft/s or

$$v = \sqrt{30\mu d}$$

for the speed in mi/hr, since 1 mi/hr = 1.466 ft/s.

Pauli stated that he measures the coefficient of friction on-site three ways and determines the distance traveled after collision by skid marks on the road. But, although this formula for measuring speed derives from energy transformation analysis, Pauli added that momentum analysis is far more useful a tool to analyze collisions.

Pauli also noted that the typical response time of drivers in accident situations, including the time to move their feet over to the brake pedal, is 1.6 seconds, more than the 0.7 seconds used in driver education manuals to calculate the distance traveled before braking when approaching a traffic light. He called the 1.6 seconds a passive response time and added that it is longer than 0.7 seconds for approaching a traffic light, because in the latter case the driver expects to have to take action. And even this 0.7 seconds is longer, Pauli said, than the 0.1 seconds needed to react after being hit in the head or blasted with a horn.

As an indication of the increased safety of automobiles, Pauli noted that vehicles must be subjected to barrier tests before they

can be sold. Cars today, he said, are designed to bend, to lengthen the time of a collision impulse (and thereby reduce the force). Most of them also have black box recorders, to protect manufacturers in the case of product liability lawsuits. At the same time, Pauli expressed concern that drivers are lulled into the security of relaxing in their living rooms while driving. Crashing at 40 miles per hour (which is what some vehicles did in the accident scenes he showed us) is equivalent to falling from a five-story building, he observed.

Pauli also pointed out that driver education cannot provide young drivers the experience that is ultimately the basis for safe driving. "Experience," he said, "cannot be taught." Eighteen of New Jersey's 21 counties now have units similar to the one in which Pauli works. The New Jersey Division of Highway Traffic Safety trains the personnel, using staged collisions with donated cars in a poor state of repair.

Bialek Discusses Embryological Problems

Although Bill Bialek spoke to NJAAPT about "Physics Problems in Early Embryonic Development," he holds an appointment in Princeton's Physics Department as part of an interdisciplinary program. Bialek chose as his subject the fruit fly, which starts life as a single-celled egg half a millimeter long, which becomes a maggot, sectioned like human vertebrae.

Since this development happens within a shell, it happens at constant volume and mass and does so in the course of three hours. He observed that the type of a cell is determined by which protein is made from reading its DNA. This, in turn, is determined by "transcription factor" molecules which block certain genes in the DNA. The segmentation of maggots resulted from the alternating concentration of transcription factors in the egg.

Studies of all possible variations of segmentation of maggots shows that they are identified with only 100 of the fruit fly's 25,000 genes. Bialek said that the mother laying the eggs determines their segmentation by placing messenger-RNA for a particular protein at the head of the egg. This evolves into a decaying concentration from the head to the tail of the egg, which interacts with other proteins in the egg to produce the ultimate alternating concentration of transcription factors.

Bialek also observed that concentrations of proteins in cells are typically nanomolar and pointed out that a 1 nM solution would contain only 0.6 molecules per cubic micron (micrometer), typical size of a cell. For this reason, as little as 10% in the difference of a protein concentration would have a significant effect on the fate of a cell.

Aaronson Makes Us Aware of How We Hear

Using his background in psychoacoustics and a modification of his presentation on "Sounds, Hearing, and Music" to the American String Music Association, Neil Aaronson of Richard Stockton College of New Jersey, involved us in listening to a series of sounds to understand how they are perceived by the human ear. The vibrations of strings, with two fixed ends, are known for having harmonics with frequencies a whole number times the lowest, or fundamental, frequency, which corresponds to a wavelength twice the length of the string. Aaronson enabled us to

hear that the apparent pitch of the sound of a vibrating string was that of the fundamental frequency, regardless of the distribution of harmonics. Moreover, the apparent pitch remained the same even when the fundamental frequency was deleted, because the synthesis of the harmonics had the same frequency as that of the missing fundamental.

By presenting only selected frequencies to us, Aaronson also enabled us to learn how information is transmitted in speech. Vowels, he pointed out, are characterized by formants, which are harmonics far above the fundamental frequency. When he transmitted a message of human speech with the formant frequencies deleted, we could barely understand what was being said. But when he transmitted the message with the fundamental frequency deleted, we could understand the message, although with poorer quality sound. Because this requires less energy, Aaronson said, telephones use this procedure, and this is why the voices of mothers and their daughters can be confused on the telephone. Aaronson took us on a “tour” of the human ear, noting that we can hear sounds produced when the amplitude of the vibration of the eardrum is as low as a tenth of a nanometer. Our hearing system, he pointed out, uses analog signals until they reach the organ of Corti, which converts them to digital input to our brain. Aaronson demonstrated cross-linking between our visual and auditory systems by playing what was ostensibly an audiovisual of a person saying “da.” But when he replayed it and asked us to close our eyes, we heard “ba” – our lip reading of the visual signal overrode what our ears had been hearing (the separately-recorded soundtrack had been synchronized with the visual “da”).

Lastly, Aaronson showed, by playing a repetition of a phrase, that although different parts of our brain handle speech and music, there is a musical quality of speech. The more we heard the repeated phrase, the more it sounded as if it were being sung – and Aaronson even showed the notes he had written to represent the music.

Dougherty Speaks About Physics in Medicine

Larry Dougherty, from the University of Pennsylvania, speaking about “Physics Research and Clinical Medicine,” observed that 76% of all physicists in medicine were involved with therapeutic radiology and another 15% with diagnostic imaging. He focused his presentation on these two aspects of physics in medicine.

Dougherty cited six types of diagnostic imaging – X-rays, nuclear radiation, CT (computerized tomography), ultrasound, MRI (magnetic resonance imaging), and optical (diffuse optical tomography). MRI, he said, images local body chemistry and shows up the contrast between healthy and diseased tissue, primarily by imaging protons from their magnetic properties as a spinning charge. A strong magnetic field aligns them, but even with a field as strong as 1.5 tesla, the ratio of “spin up” to “spin down” is only a thousandth of a percent greater than 1. Applying a resonant oscillating magnetic field causes the aligned protons to flip, and MRI looks for an echo that indicates the presence of disease. The first commercial MRI scanner was developed by General Electric in 1982, Dougherty said, and in 1985 Medicare started paying for MRI scans.

MRI can produce images at various depths, he added, noting that it can detect breast cancers more reliably than mammo-

grams, which give 20% false negatives. On the other hand, MRI is much more expensive and has been accused of detecting too much. Dougherty noted an emerging school of thought that the body can heal many cancers, that lung and breast cancers below a certain size should be left alone except for further monitoring. “Overtreatment,” Dougherty observed, can escalate the already exploding cost of medicine even more.

Dougherty spoke about two other techniques of diagnostic imaging – PET (positron emission tomography) scans and optical tomography. PET uses positrons from radioactive beta decay, by the gamma rays emitted from positron-electron annihilation, to produce images, but it requires a nearby cyclotron to make the required short-lived radioactive isotopes. Optical tomography uses near-infrared radiation, which is scattered multiply as it passes through tissues. It does no damage and can detect cancer, Dougherty said.

Once cancer is detected, Dougherty went on, there are three radiation options: 1) X-rays, which penetrate too much to concentrate energy onto a target; 2) electrons, which don't penetrate much and are therefore useful for treating only surface cancers; and 3) protons, the most versatile option. Proton dosage is maximized at a “Bragg peak,” whose depth is determined by the proton energy. Treatment consists of determining the total dose needed and the number of installments needed to deliver it. Multiple beams will insure delivery of maximum dose to the target while afflicting neighboring areas with lower doses. Although proton treatment was pioneered by Bragg and Wilson, little was done on a widespread basis until Loma Linda made it available in 1990. In addition to Loma Linda, there are now four other proton treatment centers in the U.S. It is very expensive, and Dougherty felt it might be most efficacious in children, who are more radiosensitive than adults.

Bilash Presents Physics Demonstrations

The classic end to NJAAPPT meetings at Princeton University is the presentation of physics demonstrations, usually by the Princeton University staff, drawing from their huge emporium of lecture demonstrations. But this time the demonstrations were scheduled for presentation by the team of Borislav Bilash II of Pascack Valley High School and Dave Maiullo of Rutgers University – this team has recently published a book, *A Demo a Day – A Year of Physics Demonstrations*, available through Flinn Scientific. However, because Flinn had called Maiullo to present demonstrations to the National Science Teachers Association's Annual Conference in New Orleans, his participation at the NJAAPPT meeting was limited to a call to Bilash on his cell phone.

This couldn't have been timed better. Bilash had just made a splashy entrance with a fire extinguisher backpack that had ripped the slats out of the side of the stage left entrance, when the phone rang to have Maiullo ask him how things were going. After we shouted our greetings to Maiullo, Bilash picked up where things had left off before the phone call and posed a very legitimate question: is a teacher entering his classroom with a fire extinguisher backpack teaching or showing off? Would a balloon or fan cart be more effective to teach Newton's Laws of Motion? Demonstrations should be followed by questions to engage students in inquiry, he said. The fan cart allows more variations to lead to a lot more

discussion than a backpack fire extinguisher, and Bilash demonstrated several of these. Learning through demonstrations without subsequent engagement, Bilash went on, shows only a 30% retention rate. On the other hand, practice by doing gives 75% retention, and teaching others 90%. In teaching students how to learn, we should build upon what they already have learned, Bilash said. If you want only to entertain, you should join a circus.

Bilash demonstrated some interesting kinematics with dart guns, which he observed have become hard to find and have been totally banned in Australia. Two darts, one weighted, will hit the ground simultaneously when dropped at the same height from rest. But when fired downward, the lighter dart had a greater initial velocity and it the floor before the weighted one. Bilash also demonstrated a tug-of-war between two evenly-matched constant velocity buggies. He showed that adding mass to one increases its friction with the ground and allows it to win. So does allowing a cart to move onto sandpaper (another way to increase friction between it and the ground).

Among the other things Bilash demonstrated: eggs dropped from the same height onto a plain and cushioned bucket to show the effect of lengthening the time for the impulse to stop them; beats from the sounds generated by rubbing two aluminum rods differing in length by a centimeter when held at their center; electric field lines emanating from a charged object, represented by tinsel taped to the charged object.

Hein Presents AAPT Vision

Warren Hein, Executive Officer of the national American Association of Physics Teachers, was also on hand to tell members of the New Jersey Section what the national organization offers. An incentive to get more section members to join the national organization, which will be available the next three years on a trial basis, is a reduced-price Associate Membership. Costing only \$36, it offers first-time members hard copy of *Physics Today* and the AAPT Annual Report plus 42 articles on-line from the two AAPT journals, the *American Journal of Physics* and *The Physics Teacher*. There is also a financial incentive of \$9 to each section for each new AAPT member they produce. AAPT's goal for 2009 is to increase its membership by 2000 in this way, Hein said, and he is counting on the sections to help achieve it.

—*John Roeder, Section Representative*

North Carolina Section

The 14th Annual Spring Meeting of the NCS-AAPT was held at Catawba Valley Community College in Hickory NC March 27-28, 2009 with approximately 65 members in attendance. Thanks to Michael Ruiz you may view highlights (over 400 photos including those of the fire engines, Sheriff's car, etc.) at http://www.phys.unca.edu/sps_aapt.asp by clicking on Spring 2009 NCS-AAPT Meeting.

Friday evening began with a cordial welcome from Dr. Garrett Hinshaw, President of CVCC, and was followed by a catered banquet. Our after dinner speaker was Dan Caton from Appalachian State University who spoke on "STEMming the loss of Science Majors: Astronomy as a Gateway to Science, Technology, Engineering, and Math", in which he highlighted the popularity of

astronomy and the ASU's outreach program as ways to attract and hold on to students.

Bill Schmidt of Meredith College woke us up early with "Supplemental Reading and Real-World Connections in a General Physics Course" that utilized Jearl Walker's *The Flying Circus of Physics* as a supplementary text. Students Bradley Eidschun and Michael Everhart from UNC Pembroke followed with a description of their project interfacing five single core systems physically and through software to produce super fast processing speeds approaching that of a CRAY. (For this effort they shared the award for Best Undergraduate Student Paper.) Joe Heafner of CVCC wants to get rid of "gravity", at least, in the way that the word is used in our introductory courses for something more physically descriptive like "gravitational attraction". Jeff Register of Greensboro Country Day School filled out the first half of the morning with "Video Production for Physics Education" that won the award for Best Pedagogical Paper.

Our invited speaker for the morning was David Maiullo of Rutgers, demonstrator extraordinaire, who did not disappoint. He arrived at CVCC with a van full of equipment to present, "Physics Demonstrations as Theater". His philosophy is that to just do a demonstration is not enough – you must supplement it with up-front preparation of what is being demonstrated and follow-up with question and answer opportunities. He not only did that within his time constraints, but also as we exited the building after he set off the fire alarm and throughout the rest of his time at CVCC including lunch.

Dave was hard to follow, but Michael Ruiz did a great job with "You Tube Physics: Doing Kinematics with You Tube Videos". Aaron Titus of High Point University followed with "miSolutions – A modern(ized) solutions manual", that is, one that checks that the practice problem that a student has solved, in fact, has been solved correctly. Marion Belloni and Wolfgang Christian of Davidson College presented back-to-back papers, "Using Easy Java Simulations to Model a Rolling and Slipping Wheel" and "A Proposal for a Digital Library of Computer Models for NC High School Teachers" with the first being one of many examples already available for inclusion in the second and all becoming available to teachers for incorporating into their courses. Bill McNairy of Duke finished off the morning session with "Honors Physics in North Carolina: Interesting Questions" coming out of a distance education program at the North Carolina School of Science and Math.

Unfortunately weather conditions were such that planned observing opportunities by the CV Astronomy Club had to be cancelled. Our Lunch and Business Meeting followed.

The usual Minutes and reports from the representatives were presented with upcoming meetings set for UNC Pembroke and Elon University.

Joe Heafner was elected Vice-President and Bill Schmidt was elected Four-Year College/University Representative

There was also a poster, "Spectroscopy of Comet C/2007 N3 (Lulin)" presented by Jason York, Michael Everhart, and Jose D'Arruda, all of UNC Pembroke.

There were two workshops: “And You Thought It Was about Homework” presented by WebAssign and “Lab Practicums as a Means of Assessment and Review” by Liz Quinn-Stine of Cary Academy.

We thank our sponsors: PASCO, Cambridge University Press, Smithsonian Books, Prentice-Hall, AAPT, Herb Gottlieb, Catawba Valley Community College, North Carolina State University, SHODOR, Spectrum Technologies, and Vernier Software which organizations provided us with a very rich supply of door prizes and money for coffee breaks.

Submitted by John Hubisz, Secretary-Treasurer, NCS-AAPT

North Dakota Section

The North Dakota section of the American Association of Physics Teachers (AAPT) met 7 March 09 in conjunction with the North Dakota Science Teachers Association (NDSTA). The meeting was held in the classrooms of the science building on the campus of Bismarck State College in Bismarck, ND.

The meeting began with a business meeting for the ND section followed by members and guests sharing demonstrations, teaching methods, and ideas.

Photo below: one of the demonstrations, making dry ice using pressurized carbon dioxide source



Ohio Section

The 2009 Spring Meeting of the Ohio Section of the American Association of Physics Teachers (OSAAPT) was held in Wilker Hall on the campus of Baldwin Wallace College in Berea, Ohio on Saturday, March 28th. The meeting began with greetings from the host, Peter L Hoekje, Chair of the Department of Physics and Astronomy.

Dr. Hoekje introduced the first of the two plenary speakers, Ed Meyer, Edwin Meyer, Department of Physics and Astronomy, Baldwin Wallace College, Berea, OH.

Plenary Session 1: “You’re a Physicist – Be Proud!”

Dr. Meyer started out by saying, “Virtually all teachers think that the subject they teach is the most important,” whether it be math, English, history, computer science, etc. Yet, only those who teach physics are right! Even Ernest Rutherford realized that when he exclaimed that “all science is either physics or stamp collecting.” After all, if you ask anyone the question, “Why do things fall?” Everyone knows the answer – gravity. Physicists know that it is much more complicated than a single word. They aren’t satisfied with a “rule” because they have higher standards. They demand a deeper level of understanding. A fundamental, conceptual understanding can be applied to new situations; a rule cannot. Ed then went through the example of the expansion of a gas. Chemistry can explain it through the application of the gas laws and the motion of the molecules. The physicist asks the question as to how the molecules know how to move? The physicist understands.

Dr. Meyer said that biologists talk about osmosis and the movement of water through a membrane. The physicist would ask, “But how does water know which way to go?” The molecules in water can be moving at 800 miles per hour. There is a water flow rate even in a glass of water. What is to prevent the water from coming out? The physicist understands.

Physical chemistry can look at a temperature versus time graph to determine the temperature of an oven. The physicist asks, what is the size of my sample? Is heat being applied at a constant rate? Why is the thermal energy increasing? Knowing the equations, doesn’t mean understanding. The physicist understands. What about the soft sciences? Ed said that being a physicist, he had the opinion that these fields are not real science. “The researchers get grants, take data, and plot the results. But I could think of nothing that they have contributed. I could think of nothing that they had discovered.”

Take a look at psychology. What are the contributions? There is regular psychology and there is reverse psychology. What are some of the advances in psychology?

- Jean Piaget showed for the first time that human intelligence develops in stages.
- Masters and Johnson discovered that women can have more than one orgasm in a lovemaking session.
- Ellen Langer demonstrated that thinking – just thinking – may help you live a longer, healthier, more productive life. “We gave each nursing home resident a plant for which he/she was responsible. We found that significantly fewer of the mindful residents had died - in one study, 14% compared with 47%.”
- Harry Harlow, through his research with monkeys, showed that love and care from a mother in the early years is critical to normal emotional and intellectual development.
- “Speaking is the one trait in which woman is superior to man. Consider what happens when a couple argues. The man tries to talk to the woman. The stupid fool, he can never win.”
- Judith Rodin showed that the mere sight of sweets gets certain people hungry because it raises the insulin levels.

- Elizabeth Loftus, a pioneer in memory research, showed how unreliable eyewitness testimony is, and how easily false memories can be implanted in both children and adults.
- B. F. Skinner, probably the century's most influential psychologist, developed "operant conditioning" – the systematic use of positive reinforcement to modify behavior.
- Howard Gardner expanded the concept of intelligence by proposing a theory of multiple intelligences. He suggests that "intelligence" should encompass diverse abilities such as self-knowledge, musical intelligence and "body-kinesthetic" intelligence.
- Erik Erikson was the first to propose that intellectual and emotional development occurs throughout the life span; until his theory, it was generally accepted that development ceased at age 12.
- Martin Seligman, in his research with dogs, showed that unconditional punishment has serious and persistent debilitating, emotional effects.
- Hans Selye was the first researcher to identify psychological "stress." In the 1930s, he borrowed the concept of stress from modern physics and applied it for the first time to human beings. "Unfortunately, there is a great deal of confusion about what stress actually is and how we should deal with it." "Stress is the body's nonspecific response to any demand placed on it."
- Carl Rogers created the "humanistic" approach to therapy, emphasizing the therapist's genuineness and openness and unconditional positive regard for the client.

Dr. Meyer asked, "What is my source for this information?" All these examples are taken from the January 2000 issue of *Psychology Today*, which contained a list of the top Breakthroughs in Psychology of the 20th Century. By their own admission this is the best they have after a century of research. Rutherford summed it up well by saying, "The only conclusion that can be drawn from an experiment in the social sciences is; some do and some don't."

Another observation, this time by Thomas Meyer, Ph.D. physicist, "Psychology has only two buckets - an 'obvious' bucket and a 'wrong' bucket." What about the new age social science? Ed said that researchers in these fields typically make up big words to cover up the fact that they have little content. "If you were in a social science class and didn't understand what the professor was talking about, you may have thought that you weren't smart enough to understand. It is much more likely that the professor was trying to hide the fact that he had nothing to say behind jargon, AKA psycho-babble."

This was spectacularly exposed by physicist Alan Sokol in 1996. He submitted an article to a top journal of post-modern cultural studies, published by Duke University that was complete nonsense, but contained a lot of jargon used in the field and references to other publications in the field. It was published. The title of the article was; "Transgressing the Boundaries -- Towards a Transformative Hermeneutics of Quantum Gravity." One passage from the article states, "The pi of Euclid and the G of Newton, formerly thought to be constant and universal, are now perceived in their ineluctable historicity." The editors, Bruce Robbins then at Rutgers University and Andrew Ross, then at New York University responded, "The editors were distressed at the deceptive means Sokol used to make his point. In the future, lesser known authors who submit articles may come under needless suspicion."

So what are some of the contributions of physics? Electricity, Nuclear Power, Space Probes, Microwave, Hubble Telescope, Light Bulb, Lasers, Medicine, x-rays, Telegraph, Cell phones, Origin of Universe, Optic Fibers, GPS, Radio, Telephone, Computers, The Standard Model, Airplane, World Wide Web, QED, Rockets, Fermilab, Television, Transistor, Moon Landing, LHC – these are among the many, many contributions provided by physics.

"If the Earth were visited by an alien culture, what would be the best example of the progress we have made as a species? Of what are we most proud? Our Magnum Opus?" Yes, physics is obviously the best subject to study. Why point this out? To humiliate those in other fields? To build our already massive egos? According to Ed, here are the problems..."College and University administrators often treat physics and other subjects as equals; they want to be fair. Most administrators believe that it takes the same degree of transformation to get a typical incoming freshman a BA in physics as a BA in, say, education. Providers of research grants often want to be "fair and equitable" and provide funding to all "sciences." The public, in general, believes that licensed child psychologists have actually learned skills that will benefit their children. The public, in general, believes that someone with a degree in economics or finance will be able to give them good financial advice. The public, in general, believes that someone with a teaching certificate knows how to teach. Your tax dollars have paid for many studies that, even if successful, would reveal absolutely nothing. Students choosing a major might not realize how much better it is to choose physics over, for example, psychology, even if they want to be a psychologist."

"Students are wasting their time in psychology classes when they could be taking physics -- or a real science," said Dr. Meyer. "There is plenty of harm done here. E.g., college students with an inch and a half of index cards one of which has Selye's definition of stress."

Why is it better to study physics? "The Study of Physics has right and wrong answers. The Study of Physics is idea-rich and knowledge-poor. Physics is the best playing field upon which to develop pure problem-solving ability."

Why is physics better? "In other fields, one fact will provide one test question. In physics, one fact will provide myriad test questions. The average speed is the distance divided by the time. Acceleration is the rate of change of velocity. $F = ma$. The speed of light is a universal constant. In physics, knowledge is de-emphasized in favor of thinking and problem solving. When working on a physics problem, students aren't trying to remember, they are trying to work something out. As far as I can tell, psychology is a study of the history of psychology. Students studying physics are free to think rather than remember. There are no flash cards in physics.

How does this make physics better? "In today's society, success is based, now more than ever, on the ability to solve problems. Having knowledge is devalued for two reasons: 1. Knowledge can become obsolete quickly and 2. the internet."

In answering his own question as to how does this make physics better, Ed explained the difference between the computer and a

human. “The computer is so much better than the human mind at storing and recalling knowledge. The human mind is so much better than a computer at solving new problems. While it is true that a computer can do the work of one-hundred ordinary people, it is equally true that no number of computers can do the work of one extraordinary person. i.e., a physicist. Education should develop the skills that complement rather than compete with the skills of a computer. This is exactly what the study of physics does. No other subject develops problem-solving skills like physics. Researchers in other fields try to increase the amount of knowledge associated with their field of study. Physicists are trying to decrease it. Physicists are trying to simplify, unify.”

Dr. Meyer continued by saying that physics training is universal. “By studying French, you can speak French. By studying chemistry, you can do chemistry. By studying medicine, you can be a doctor. By studying law, you can be a lawyer. By studying psychology you can??? By studying physics, you can do anything!”

If you want to be a lawyer, study physics as an undergraduate. If you want to be an economist, study physics as an undergraduate. If you want to be a psychologist, study physics as an undergraduate. If you want to be a mathematician, study physics as an undergraduate. If you want to be a thinker, study physics as an undergraduate. If you want to be a problem-solver, study physics as an undergraduate. If you want to increase the number of neural connections in your brain, study physics as an undergraduate. If you want to be a corporate leader, study physics as an undergraduate (but take a bunch of business courses).”

Ed pointed out that physics majors have the highest scores in the verbal, quantitative, and analytical sections of the GRE in 28 fields of Ph.D. study. On the law school entry test (LSAT), physics majors are rank #1 year after year. Even Wall Street has taken notice. Physicists can interrogate data and draw proper conclusions. Physicists can separate truth from irrational beliefs. Physicists are NOT fooled by randomness. Physicists are on Wall Street.

Dr. Meyer reported that in the book, *Heard on the Street*, the introduction says that “this book bridges the considerable gap between the typical education and the knowledge required to successfully answer job interview questions. The considerable gap arises because interviewers must separate the “wolves” from the “sheep.” The sheep are confined by the boundaries of their education. The wolves are not. Of course, most interviewers are wolves. Unfortunately, most interviewees are sheep. The “butchering” that can take place in these interviews is horrific. Physicists, of course, are wolves.”

Regarding employment in general, Ed said that problem-solving is by far the #1 marketable skill in today’s economy. “Employers are pleading for universities and colleges to produce innovative problem solvers. There are very few job openings for being able to memorize rules and names for things. That is, employers are not looking “stimulus - response” skills they are looking for Original Thinkers.”

Problem-solving is recognized by many others as being a very important skill.

- Robert Reich, Former US Secretary of Labor— “Looking closely at the American economy today you find two growing categories of work. The first involves identifying and solving problems.”
- What Business Wants From Higher Education, Oblinger and Verville (1998)— “Successful firms primarily need problem solvers.”
- Bill Gates, *The Road Ahead*— “More than ever, an education that emphasizes general problem solving skills will be important.”
- William Poundstone, *Moving Mount Fuji*— “It doesn’t matter what school you attended, where you worked before, or how you dress. All that matters is your logic, imagination and problem-solving ability.”
- Greythorne, International IT recruiting firm— “No matter what job you get, no matter what you are hired for, the bottom line is that the company has a problem, or collection of problems, that it needs solved.”
- Center for the Study of Collaborative Problem Solving - University of Missouri— “Despite the importance of problem solving, it is one of the least engaged intellectual skills in K-12 and university education.”
- Tom Peters, *The Pursuit of Wow!*— “When I’m recruiting, I’m not looking for someone with straight A’s; I’m looking for someone with a few unexcused absences.”

Students need to develop good problem-solving skills, Ed said. “Today’s college student has been so indoctrinated with stimulus-response learning that they have a lot of trouble developing general problem solving ability. That is, they are stymied by a new problem. They look at it and say, “I don’t know.” They complain, “How can I get the answer if you don’t show me how to do it?” Problem-solving skill is NOT the ability to solve a problem once you are shown how to do it. Problem-solving skill is the ability to look at a new problem and effectively and efficiently figure out a way to attack and eventually solve it. This is the skill that employers are seeking. This is the skill developed by solving physics problems!”

Physics is problem-solving! “Physics is just the playing field upon which problem solving ability is developed. My primary goal as a physics teacher is not to produce students who can get the answer to physics problems. It is to develop problem-solving ability. My students ask me, “Professor Meyer, when in my life am I ever going to have to know how to calculate a magnetic field?” The worst thing a candidate could say at one of my job interviews, “I didn’t have that in school.” Most candidates wanted to impress me with their knowledge. I didn’t care what they knew; I wanted to know what they could figure out. Many times I felt like telling the candidate, “You should sue the university. I don’t know what you have been doing over the past four years, but it certainly was not developing your ability to think, reason and solve problems.”

Dr. Meyer emphasized that we as teachers must realize that times are changing so fast that we don’t know what specific skills will be needed in the future. Specific job training can be useless. Rather than train a student to solve a specific type of problem, it is better to develop their general problem-solving ability. The jobs that many of our students will have ten years from now don’t exist yet.

However, the ability to think and to solve problems will always be in demand.

Keep physics #1! “Don’t ask your students to memorize anything. Give them the equations. Give them problems that make them sit and THINK! Don’t ask, “Joe traveled 500 miles in 10 hours. What was his average speed?” Ask, “You are traveling at 70 mph and you are 100 feet behind a car that is traveling at 65 mph in the same direction. How far will you travel before you pass it?” Instead of, “What is the equivalent resistance of two 30 Ohm resistors in series?” Ask, “What is the equivalent resistance across any side of a tetrahedron of 30 Ohm resistors.” Or, “You have a box of three 4 μF capacitors and a box of three 12 μF capacitors. Construct a circuit for each integer value of capacitance from 1 – 20 μF .” When your students are taking a test, virtually all of their time should be spent trying to figure something out rather than trying to remember something. This is the skill that they need to develop.

Plenary Session 2

“The Flying Circus of Physics,” Jearl D. Walker, Physics Department, Cleveland State University, Cleveland, OH

Dr. Walker started his talk telling us a story about his dismal beginnings as a teacher. He was a teaching assistant (better known as a TA) in graduate school at the University of Maryland. Sharon was an undergraduate student taking an introductory physics course. She asked Jearl the most probing question he had been asked. “Why doesn’t this have anything to do with my life?” This question started him thinking that he needed to couple physics with the real world. After all, physics is everywhere! The result of his trying to answer Sharon’s question was the publication of his book, *The Flying Circus of Physics*, now in its second edition. Note: see the accompanying web-site to the book at www.flyingcircusofphysics.com.

Jearl started going through examples of real “life” physics by showing many slides in his power point presentation. His first example was that of cracks in the glaze of various old plates. He went on to show pictures of cracks in concrete, asphalt, and mud. He said that more than 5000 words have been written about cracks. So what causes them? High stress is the cause. The stress is pulling at right angles to another crack or seam. Magna sponge also produces cracks when it dries, but the cracks are at 60° thus forming hexagons.

A hydraulic jump has always fascinated Dr. Walker. He illustrated this effect with pictures of Cheerios® in a bowl of milk. Two Cheerios® in the bowl will be attracted to each other. The attraction is the result of the reduction of energy between the two Cheerios.® The same thing happens with inverted tacks in water. However, if a Cheerio and a tack are both placed in a liquid, they seem to experience a type of “repulsion.” Of course, surface tension is a key factor in these examples just like a water spider which indents the surface.

Another example from everyday experience is the “tea leaves effect.” When the water is stirred, the tea leaves or beads will collect in the center of the bottom of the container. Jearl said that

Einstein had explained that there is a secondary flow within the stirred liquid. The “tea leaves effect” is at work in the meandering of rivers.

Professor Walker showed several examples of the “teapot effect.” When the tea is poured out of the teapot and as the teapot is tilted back, the last bit of tea runs down the side of the spout. He said that he has been examining this effect for a good explanation. Is it surface tension? He thinks that it has to do with the fact that the flow lines are compressed, so that instead of the tea flowing straight down from the spout, it clings to the side of the spout. Someone in the audience suggested that you need to pour fast, thus utilizing the lip on the spout.

Next Jearl showed several pictures of the “shower curtain effect”. Is this like the “chimney effect”? Dr. Walker said that he experimented by observing the effect first with cold water and then with hot water. In both cases the curtain moved into the shower. However, the movement was much greater for the hot water than the cold water. The falling water drags the air on the other side of the curtain down and under the curtain. The use of hot water has the heated air rising, thus pulling more air down the outside of the curtain and underneath, thus pulling the curtain into the shower.

Dust explosions can be very dangerous. Certainly in silos where there is airborne flour or dust, a random spark can set off quite a large explosion. Engineers try their best to reduce the incidence of sparking. Explosions can occur with fuel vapors such as when refueling race cars. When the cars pull in, they are charged up. Before the fueling begins, a conducting pole is used to discharge the car. At this point Jearl showed a clip from YouTube which had been shown on the national news. The clip is video from a gasoline station surveillance camera showing a driver putting gas into the car and all of a sudden, the car is on fire.

This led to his showing several pictures of lightning while he began to talk about the dangers of a direct hit which produces anywhere from 5000 amperes to around 500,000 amps. On the screen was a picture of a lightning strike at a football game. Jearl said that high voltage will stop your heart. You will stop breathing and thus die of suffocation. But can you get killed by ground current in a lightning storm? Well, if you put your feet together, there is no potential difference. Cows can’t put their feet together, so there is a potential difference and the current travels through the body, stopping the heart. So you must either put your feet together and squat or run so that you only have one foot on the ground at a time!

In the recent news there was the incident in New York City where birds were sucked into a jet engine shortly after take-off, resulting in the disabling of the engines. The pilot miraculously landed the plane in the Hudson River. Dr. Walker studied the videos of the landing and measured that the nose of the plane was up at an angle of 12°. He said that pilots practice such landings in flight simulators where they hold the plane at the 12° angle. In interviews with the pilot, he said that he just did what he had practiced over and over. So in order to land a plane traveling at 170 mph, the nose must be tilted at a 12° angle.

Jearl said that we as physics teachers must explain things rather than just saying WOW! His last example was a video clip showing a motorcycle jump that took place in Las Vegas. The bike went up a ramp and then landed on the roof of a building. If that was not enough, then the driver rode off the roof and landed on the ramp, riding the bike to the ground. How did he do this? Jearl said that the driver re-oriented his bike so that he hit with the front wheel up the ramp to the roof top. At some point the driver had to turn down the angular momentum which he by braking the bike.

Business Meeting

Mary Kay Patten, President of the Ohio Section AAPT welcomed everyone present. She personally thanked the people of Baldwin Wallace College for hosting the meeting and for providing the continental breakfast and boxed lunches. Mary Kay also reminded the audience that there were a number of submissions from students for the High School Photography Contest. She asked that everyone review the student pictures and explanations some time during lunch and before the afternoon workshops.

Charlie Reno, Section Treasurer, reported that the Ohio Section was in the black. Myra West distributed the Section Representative's Report of the AAPT's Winter Meeting held in Chicago this past February. Mary Kay announced the slate of nominees for office for the election for the OSAAPT Officers for next year.

The following people were elected for office by those present:

Chas Deremer, President-Elect;
Charlie Reno, Treasurer;
Ken Kane, Recording Secretary;
Myra West, Section Representative;
Tim Battista, Vice-President: High Schools,
Alexandra Woods, Corresponding Secretary.

Continuing in their current terms or moving up the ladder of session were:

Greg Di Lisi, President,
Mary Kay Patten, Past-President,
Sue Ramlo, Vice- President: 4-yr Colleges,
Sherri Stefanovic, Vice- President: 2-yr Colleges,
Myra West, Newsletter Editor.

Mary Kay announced that the OSAAPT Executive Board has set the meeting locations for the next year. The fall meeting will be held on October 10, 2009 at Metro Health Campus. The spring meeting will be held at John Carroll University with the date to be determined.

—Myra West, Section Representative

Ontario Section

Ontario Association of Physics Teachers
2009 May News Report (OAPT www.oapt.ca)



1) Report of the May Meeting of the Ontario Association of Physics Teachers at the Royal Military College in Kingston, ON
Ontario Association of Physics Teachers had an Annual Conference at the Royal Military College in Kingston Ontario from May 28-30, 2009. The Conference was a success. More than 80 Ontario physics teachers attended the conference. A complete program as well as the photographs from the meeting can be found at: www.oapt.ca

Meeting overview: The event opened with traditional barbecue followed by the traditional Favorite Demo session presented by Rolly Meisel, James Ball and Glenn Wagner. The favorite demos this year included Rolly Meisel's "Ten Minute Orchestra". Under Rolly's guidance, the participants made tunable flute-like instruments using a soda straw. The highlight of James Ball's presentation, among others, was a "Who wants to hit a teacher with a hammer" demo.

Dr. Joe Buckley from the Royal Military College gave a fascinating talk on Remote Sensing of the Earth from space. This year's keynote address was given by Randy Knight, an author of a popular physics textbook. The talk was titled "Moving Physics Education Research from the Laboratory to the Classroom."

This year's program included a total of 12 workshop sessions (three time slots with four parallel workshops) on a broad variety of topics (info in the program).

Dr. Jim Hunt's talk on the subject of his interest and expertise (Anamorphic images) featured new information on rediscovered 17th century scientific toy which is called Refractive Anamorphic Viewer.

Friday concluded with a guided tour of a historic landmark of a National importance – Fort Henry - and a dinner. The banquet speaker, Terence Dickinson, an author of best-selling astronomy books, gave a fascinating presentation about the world's largest telescope facility at the Atacama Desert, Chile. The presentation included amazing images of the night sky, galaxies and constellations.

OAPT News and Election results:

1) Big election news: John Atherton will become the next Vice-Executive Board for the next academic year will be as follows:

Executive President: Dave Doucette

Vice-President: John Atherton

Past-President: Glenn Wagner

Treasurer: Shawn Brooks

Secretary: Roberta Tevlin

Member at Large: Tetyana Antimirova

Section Representative: Marina Milne-Bolotin

Detailed information about newly elected members is posted on: www.oapt.ca

2) Next OAPT conference (2010) will be hosted by the University of Toronto.

3) Glenn Wagner received a prestigious physics teaching award and was congratulated by the OAPT members.

4) Founder and first president of OAPT Ernie McFarland was honored by a standing ovation on the occasion of his coming retirement. Despite his retirement, he will continue to edit "Demonstrations Corner" of the OAPT Newsletter and to take care of the OAPT membership.

2) Additional News from the Section:

a) Our Section members continue working together as a team of physics educators from high schools, colleges and universities to promote physics teaching in the Province of Ontario. We are very fortunate to have a support of many of the retired physics teachers across the Province, whose contribution to the OAPT cannot be emphasized enough! We have a good representation of members (as well as the Executive Board members) from various institutions across the Province and various stages in their professional careers.

b) We continue updating our Section web site that has current and relevant information (Patrick Whippey is constantly working on it).

c) Ontario has adopted a new Science Curriculum and an OAPT section had an opportunity to make an input into it. This was the first time when OAPT, university faculty and high school science teachers had a real opportunity to provide feedback and this feedback was taken into account. We are very positive about this development.

d) We continue our strong collaboration with the Greater Toronto District School Board (GTDSB). John Atherton, Supervisor of the Science Department of the GTDSB has been leading our organization in this direction. We took an active part in the Science Teachers events in Toronto to recruit new members and strengthen our influence on the science education in the Province.

e) We continue publishing an OAPT Quarterly Newsletter (Marianne Franklin, Ernie McFarland, Glen Wagner and James Ball are in charge of it) that has exciting information for physics teachers across the Province. Our Newsletter is published on the www.oapt.ca web site and is accessible by all physics teachers across Ontario and in the world. This year the Newsletter had a number of new features, such as a Book Review Corner.

f) We had a few very successful Executive Board meetings during the year and we were able to provide continuity between the last year and next year's Executive Board members. The exchange of ideas during the meetings was very productive.

g) Marina Milne-Bolotin, Ontario Section Representative actively attended two National meetings in 2008-2009 representing our Section at the National Level. She also filed the Section reports.

—Marina Milner-Bolotin (mmilner@ryerson.ca)
OAPT Section Representative, Toronto, ON, Canada
May 31th, 2009

Southern Atlantic Coast Section

The 2009 Spring Meeting of Southern Atlantic Coast Section of the AAPT (SACS-AAPT) was held on March 27-28, 2009 at the University of South Carolina, Columbia, SC. The host was Jeffrey Wilson from the Department of Physics and Astronomy, University of South Carolina.

The opening session was a banquet held at the Marriot Downtown on Friday, March 27-28, 2009 at 7 pm. The Keynote speech was delivered by Dr. David Doty, Founder of Scientific, Inc. on the topic "A Solution for Storing Renewable Energy and Producing Transportation Fuels Using CO₂."

On Saturday, March 28, 2009 the morning session started at 8:30 am with a welcome from David Tedeschi, Acting Chair, Department of Physics and Astronomy. This was immediately followed presentation of individual contributed papers.

- Musical acoustics: a gateway for introducing science to non-science majors (Milind Kunchur).
- Building introductory honors Courses in a Small Physics Program (JB Sharma).
- Using Mastering Astronomy website to teach introductory astronomy in both courses with scheduled class meetings and in independent Learning (IL) courses (John Safko).
- Reflections on a Three Year Project, Restructuring Introductory Physics at Georgia Southern university (Delena Bell Gatch).
- A Lecture Notes Supplemental Workbook for Introductory and General Physics (Mikhail Agrest).
- The IQRECTM Educational Environment (Joseph E. Johnson).
- The Physics Source, a digital library for teachers of Introductory physics (Taha Mzoughi).
- New Physics Toys (Ronald Edge)
- Confronting Un-popular Science Reading in Secondary Education (Craig Wiegert).

The meeting recessed for lunch at noon and reassembled for the business meeting a 12:45 pm. The meeting concluded with two concurrent workshops from 1:30 to 2:45 pm:

- Workshop I: "Midway Physics" David Tedeschi, University of South Carolina.
- Workshop II: "Introduce Computer Modelling in Your Classes with VPython", Craig Wiegert, University of Georgia.

—Submitted by Ntungwa Maasha, Section Representative

Southern California Section

The Spring Meeting of the Southern California Section was held Saturday, May 2 at California State University Channel Islands, Camarillo, California. Attendees were welcomed to the meeting by the local host, Geoff Dougherty, California State University,

Channel Islands Physics Department. Special thanks are due to Geoff for arranging the meeting site. Approximately 65 people attended.

The meeting began with a choice of two workshops: *Get Updated with Vernier*, Clarence Bakken, Vernier Software & Technology, led the workshop and highlighted new Vernier products.

The Sound of Music—Teaching the Physics of Sound and Musical Instruments, Jerry Clifford, CSU Channel Islands, led the workshop, described the course offered by the Physics Department, and presented some of the activities used in it.

Dr. Rene Ong from the University of California, Los Angeles gave the morning invited talk: “Viewing the Universe at Very High Energies” Dr. Ong described how the field of very high energy astrophysics has developed rapidly during the last few years as a result of new instruments and exciting new discoveries. Ground-based telescopes, such as VERITAS (Very Energetic Radiation Imaging Telescope Array System) in southern Arizona, have made great progress in understanding processes in the cosmos that produce tera-electron Volt (TeV) particles. Currently more than seventy TeV sources have been found. These include supernova remnants, pulsar wind nebula, x-ray binaries, active galactic nuclei, and some sources not yet identified. It is hoped that their study will shed light on the origin of cosmic rays, produce tests of Lorentz invariance, and contribute to the search for cold dark matter. For more information, please visit <http://www.astro.ucla.edu/~rene/research.html> and <http://www.astro.ucla.edu/~rene/research.html>.

Dr. Brian Rasnow from California State University, Channel Islands gave the afternoon invited talk: “Do-it-Yourself Electronics Laboratory” Dr. Rasnow described a university level electronics course he has developed. The students design and build a very compact and simple “open” electronics workbench with adjustable DC power supplies, a versatile function generator, an audio amplifier, and a solderless breadboard. They are able to construct all of this on a small-perforated circuit board for about \$25. Along with a digital multimeter (about \$10), they are able to build, troubleshoot, and study a wide variety of circuits without an oscilloscope or other apparatus. The goals of the course were for students to be able to understand basic concepts, learn the art of measurement, identify simple circuits, and learn to parse schematics. Dr. Rasnow presented the results and lessons learned from this experimental curriculum.



The ever-popular Show ‘n’ Tell featured demonstrations by James Lincoln, Tim Heumier, Ralph F. Wuerker, David Chandler, Fred Carrington, and Jeff Phillips.

The following contributed talks were presented:

- *Example Harmonic and Anharmonic Oscillators Demonstrated*, Bernard Cleyet, Univ. of CA, Santa Cruz
- *Physics of Music Online at CSUN*, David R. Bach and Henning Ottsen, California State University, Northridge
- *Where are my lot lines? Precedent and Intention in land survey*, Donald Krotser, California State University, Northridge
- *Engineering Innovation: A summer program for high school students*, Jerry Clifford, California State University, Channel Islands
- *Living And Teaching With A GEMe2 Electric Car*, Ralph F. Wuerker, UCLA, retired
- *Video Frame Analysis of 9/11 Building Collapses*, David Chandler, Eleanor Roosevelt CLC

Two contributed talks *Measurement of Edge Plasma Rotation* and *Measurement of Plasma Parameters in the LAPTAG Plasma Device* were presented by high school students: Amy Lee, Gabriela Rosales, Robin Wong, Roland Hwang, Max Praglin, Ali Lodge, Rachel Biniaz, Jason Novak. They participated in a Saturday research program at UCLA directed by Dr. Walter Gekelman. Joe Wise, New Roads School and Bob Baker, University High School also work with the program and sponsored the talk.

The business meeting highlighted AAPT Programs and described Associate Membership, the new membership class available to section members. There was also a call for officer nominations and a request for sites for future meetings.

The meeting ended with our World Famous “Order of Magnitude Contest.” This meeting’s question was: “How long would it take a properly-applied net force equal to your hardest push to stop the continental drift of the North American plate?” The answers ranged from 106 s to 1015 years. Peanut McCoy submitted the median answer of 30,000 years and selected Teaching Introductory Physics by Aarons. Door prizes were won by Edward Steever (Cenco Inertial Balance), Larry Friedrich (Hydrocar), Peter Krumbein (Vernier Lab Quest), Jean-Luc Gauvreau (Light Sanitizer), Jim Broderick (Ranking Task Exercises in Physics), Don Krotser (AAPT tee shirt), Claudio Egalon (AAPT tee shirt), Richard Moore (AAPT tee shirt), James Lincoln (Cenco Sweatshirt), Gregory Wood (The Physical Universe), John Currie (Cenco Particle in a Box), Steve Cooperman (Teaching Physics with Physics Suite), Michelle Meyer (Physics by Giambattista), Katsuya Yamada (Teaching Physics for the First Time), and Ralph Wuerker (Physics Physlets). We thank our corporate sponsors – Vernier Software & Technology, John Wiley & Sons, McGraw-Hill Science, AAPT, and Cenco-Sargent/Welch – for their support and donation of door prizes.

The Southern California Section will hold its Fall Meeting in late October or early November. Please bookmark the SCAAPT URL <http://www.scaapt.org/> and check for the date in early Fall.

—Mary Mogge, Section Representative