

Arkansas Physics

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Newsletter Editors: Gay Stewart and Tracy Bond (2006 Teacher-in-Residence) Please contact us with comments or suggestions- Dept. of Physics, University of Arkansas at Fayetteville, Fayetteville, AR 72701 or thebonds_1213@yahoo.com.

Featured Physics Department: Springdale High School will be featured in the Spring 2007 newsletter. Two of their physics teacher, Claire Small and Matt Jones, are hard at work on a Toyota Tapestry grant proposal. They hope to have something great to report in the Spring!

Arkansas High School Physics Teachers Listserv: Did you know that there is a listserv just for physics teachers? You can participate in some thought-provoking discussions (think frog in a vacuum chamber), get lab ideas, or ask for advice. If you would like to join the listserv, email David Young at dyoung7@uark.edu or visit the AR HS Physics Teacher Alliance at <http://comp.uark.edu/~dyoung7/Alliance.htm> for more information.

Rural PTRA Workshops: Sponsored by the American Association of Physics Teachers (AAPT), the Rural PTRA (Physics Teaching Resource Agents) program is an opportunity for rural physics instructors to grow professionally in physics content, in the use of technology for instruction, and in established successful teaching strategies. Teachers participating in the program are then able to provide support for other area teachers. A one-week summer institute for physics and physical science teachers in high schools and middle schools will be held in summer 2007. There are follow up sessions, and there is a series of annual summer events. Participants will be able to attend 36 workshop hours per year (wouldn't that be nice!). If you teach in a rural or small-city school district there is no cost to attend (neither to the attendee nor to the school division). Lodging and meals will be provided on campus. Non-rural participants may attend for a small fee from their school, or apply for one of two physics department scholarships for the program. Included in the Spring newsletter will be an application, as well as more information about 2007 dates. Visit the PTRA website at <http://www.aapt.org/PTRA/> until then!

Did you know? This year marked the 75th anniversary of the AAPT! Amazing, isn't it, to think that physics teaching has been around for 75 years? What will happen in the next 75 years, in terms of teaching and learning physics? Send your ideas to Tracy Bond (thebonds_1213@yahoo.com) for publication in the Spring 2007 newsletter.

Professional Memberships: Are you a member of any professional organizations? If not, you should be! You can gain valuable advice, receive great journals, and take advantage of opportunities to attend conferences and workshops. Professional organizations are valuable tools, but not all teachers take advantage of them. If you are a new teacher (usually within the first 3 years), many organizations offer reduced membership rates. Added bonus- the look of bewilderment on the mail carrier's face when your "Physics Today" magazine is delivered!

American Association of Physics Teachers www.aapt.org

Arkansas Science Teachers Association <http://users.aristotle.net/~asta/>

National Science Teachers Association www.nsta.org

Project Idea: Looking for a project that isn't the same old idea? Try a Differentiated Learning Project (DLP)! It is an opportunity to address different learning styles, and students can design their own projects based on their interests. A DLP also gives students the opportunity to explore concepts in depth, which is not always possible within the constraints of high school. I have used this idea with my students, and they loved it. It engaged even the most indifferent students. Here's how it works: Students are given a list of projects worth various amounts of "credits." I used 2, 5, and 8 credit projects. Students then choose a combination from the list, totaling at least 10 credits. They may choose up to 15, and the extra credits over 10 will be bonus points. The difficulty of each project is reflected in its point value. 2 credit projects have included: make a crossword puzzle with terms and definitions, answer review questions, change song lyrics to reflect a physics concept, and make a poster illustrating a physics concept. 5 credit projects have included: write and perform an original physics song, read a book from my collection and report on it, report on the physics in three movies, and report on a top science story of the previous year. 8 credit projects have included: shadow and interview a person who uses physics, design a demonstration and perform it in an elementary classroom, write and film an original physics video, and write a tour guide for a nearby science museum. If you would like more information about this project or if you have a project you would like to share in the Spring 2007 newsletter email Tracy Bond at thebonds_1213@yahoo.com.

Teacher-in-Residence: Tracy Bond is the TIR for this year. What does that entail, you ask? She is working to mentor physics teachers, re-write labs for high school use, and outreach to local schools. She is here to help you! If you have a demonstration you would like to do but lack materials, Tracy may be able to bring them to you on loan from the U of A. If you have students who are thinking about science teaching as a career, Tracy would love to speak with them. In a nutshell, anything that you need/want, Tracy can probably help you! Email her at thebonds_1213@yahoo.com!

HIGH SCHOOL PHYSICS DAY

The annual High School Physics Day is scheduled for **Friday, March 16, 2007**. The faculty and members of SPS (Society of Physics Students) invite students and teachers from your high school to participate. Note that a small registration fee is required (\$2.50 per student), which includes a pizza lunch, making the fee well worthwhile. There will be prizes in every category, and a classroom prize for the best school overall. We hope that this day will encourage the pursuit of physics as a career itself or as a valuable asset to a large number of possible careers by providing an opportunity for detailed projects to be carried out in a lighthearted (and hopefully light-landing) manner. We also hope to give students and teachers from across the state an opportunity to get acquainted, better inform them about our undergraduate physics programs, and show that physics is fun!

High School Physics Day Registration Form (also available on the web)

Teacher's Name _____ School _____

School Address _____ Teacher e-mail(s): _____

City/State/Zip/Phone _____

We are PreRegistering _____ students @ \$2.50 each for a total amount of \$ _____

Make checks payable to the UofA@F Physics Department by March 9, 2007. Check each contest your school will compete in and indicate the number of teams you will have for each event. **Please print participants names on the back of this form.**

Water Rockets, # of Teams: _____;

Photography, # of Teams: _____;

Egg Drop, # of Teams: _____;

If you use this form, please include student names on the back for certificates! Thanks.

Paper Tower, # of Teams: _____;

Physics Demonstrations, # of Teams: _____

SCHEDULE OF EVENTS AND RULES

8:00 - 8:45 Registration Rockets, Egg Drop

12:30 - 1:30 Paper Tower Contest

Apparatus, Demonstrations and Photographs must be registered. 1:30 - 2:30 Physics Demo Contest

8:45 - 10:00 Water Rocket Launch

2:30 - 3:30 Egg Drop

10:00 - 11:30 Research Labs Tours

11:30 - 12:30 Pizza Lunch

3:30 - 4:00 Physics is fun!

4:00 - 4:30 Awards Ceremony

Registration and detailed rules may be found at <http://www.uark.edu/depts/physics/highsch.html>.

WATER ROCKET LAUNCH: Students will modify a 2-liter soda bottle to be launched with 0.5 to 1.0 liters of water at an air pressure of 60 psi. Rockets will be judged for greatest time aloft and originality of design. The angle of the launch will be the same for each team, and determined by the judges at the launch pad. Multiple bottles may be used in the construction of the rocket. However, the main bottle must not be altered in any way. The bottle opening must not be tampered with, as the launcher must be clamped to the bottle opening. **Limit 3 entries per school, maximum three students per team.**

PAPER TOWER: Construct a free-standing tower of maximum height using a single sheet of 8.5" by 11" photocopier paper and one 50 cm strip of cellophane tape. No other materials may be used. Materials and construction aids will be provided. The tower may not be attached to the floor or any other object. A tower shall be declared free-standing if it remains self-supporting for more than 10 seconds. Height is determined by measuring the perpendicular distance from the highest point on the tower to the supporting surface. **Limit 3 entries per school, maximum two students per team.**

PHYSICS DEMONSTRATIONS: Design a demonstration that illustrates physical concepts or phenomena and enter it into the contest. The design must not have been presented or judged previously. It will be judged for originality and fidelity to the physical principles that are being illustrated. **Maximum two students per team.**

EGG DROP: No restraining devices or aerodynamic devices may be attached to the container. The container itself may not be an aerodynamic device. The maximum height of drop will be 60 to 80 feet. The winner is the container with the most eggs surviving the drop. In the event of a tie, the container with the least volume wins. Each container must hold **two** raw, unfrozen, untreated/unsprayed chicken eggs. Please bring your own eggs. Containers may be of any material but must fit into a cube 50 cm on each side. Containers that may chip the asphalt target will be disqualified. The containers must be opened to check the eggs after the drop. Unbroken eggs will be broken to determine if qualified. **Limit 3 entries per school, maximum 3 students per team.**

PHYSICS PHOTOGRAPHY CONTEST: Entries are limited to one photograph per person, and must be the work of the entering student. Black and white or color, traditional or digital photographs are allowed. Photos should be submitted as 8" x 10" or 8.5" x 11" prints. An essay of 250 words or less describing the physics in the photo should accompany the submission. The essay should have a title and must be written by the student. **Maximum two students per team.**

HOW TO PARTICIPATE: Please fill out the Registration Form and return it before Friday, March 9, 2007. Awards will be given for first, second, and third place in the five competitions. Entries by **individual** high school students and by **teams as described above** are welcome for all contests. Provisions will be made so that each team member receives an award. Everyone is encouraged to participate but anyone can come to observe. Judges' decisions are final. In the event of a tie, the points will be split between the teams. We hope to see you there!

Student news from the physics department: The physics soccer team is officially named "Newton's 2nd Law of Funk", and "plans to crush the competition beneath the summation of our forces." (They did beat the Army ROTC team quite handily). For more student news, both funny and serious, visit our Society of Physics Students WIKI: <http://www.uark.edu/depts/physinfo/wiki/>

Student report on new research opportunity/tool in the department: Josiah Walton talked to Dr. Gregory Salamo about an exciting and new addition to the physics department's repertoire of advanced imaging machinery: the incorporation of a state of the art Transmission Electron Microscope (TEM). But what exactly, you may ask, is a TEM? In a short answer, it is a machine that harnesses the power of electron microscopy to produce astounding images of objects on the order of 0.1nm or 1 Å; that's roughly the size of an atom! "This opens up the door to see single atoms and to some degree to identify the atom," Dr. Salamo said. The image of the specimen is made by focusing a beam of electrons onto the specimen and allowing them to transmit through to a fluorescent screen behind where they are then displayed on a screen. Traditional light microscopes, however, can only resolve features that are comparable to the wavelength of light used; a major drawback if we want to image single atoms. With the new TEM, resolving the images of individual atoms will prove vital to the further study and design of semiconductor structures; it will put us in a greater position for research in semiconductors and photonics. While the new TEM will be used extensively by physics faculty, it will also be an important tool for the investigation of biological structures by faculty of the biological and chemical sciences. Dr. Salamo feels, as do others, that there are striking similarities between a cell and a semiconductor surface and that physics has much to offer: "The surface [of the semiconductor] is playing the role of DNA – it presents a way to self-assemble the atoms [along it]. These are exactly the same rules going on in the cell; the same basic physics. There is a new conceptual understanding required at this level. Physics has much more to contribute to biology than just instruments." In addition to providing valuable research opportunities for the physical and biological sciences, the physics department intends to help prepare students with greater technological skills in the work place: "[There is a large] need to create a more advanced workforce of people with the skills to succeed in this advanced technological age," Dr. Salamo said. Moreover, the TEM we are acquiring will be unlike any at any other school in the nation according to Dr. Salamo's current knowledge: "there is at most one other school in the country that has this [TEM], and maybe not even as advanced as ours." Unlike standard TEMs, the new microscope will have a valuable set of correcting lenses that fix certain aberrations which occur during the imaging process; this is known as High Resolution Transmission Electron Microscopy (HRTEM). The many reasons why the TEM is being brought in all refer to an overarching idea: "this is about entering a new era in science in which the growth and manipulation of structures at the nanoscale will be pivotal to future advancements in technology" as Dr. Salamo stated. Although the new TEM will give us an edge in nanoscience research and the ability to train a more technologically adept workforce, we must not take overlook the actions of the individuals who are making this all possible. Since the equipment is very expensive (a reasonable estimate is around \$3 million), it has taken the tireless efforts of Dr. Salamo and others along with important outside sources, such as the 2000 Clinton Nanoscience Initiative, to really help make this project a reality. Dr. Salamo explained that the original planning for the TEM began back in 1995.

NEWSLETTER
Department of Physics
University of Arkansas
Fayetteville, AR 72701

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