**University of Arkansas---Department of Physics---Spring 1995**

# *ARKANSAS PHYSICS*

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**Note: Physics department scholarship deadline is April 1, not March 1!**

The new editor for this newsletter is Prof. Gay Stewart. Please contact her with your comments and suggestions, write: Department of Physics, University of Arkansas, Fayetteville, AR 72701; call: (501) 575-2408, or e-mail: gstewart@comp.uark.edu.

## NEW FACULTY

We are pleased to announce two additions to our department! Assistant Prof. Gay Stewart comes to us upon completion of her dissertation at the University of Illinois. Gay is an expert on Physics Education.

Assistant Prof. Mark Filipkowski comes to us from the Naval Research Laboratory. He is a condensed matter physics expert. His research is on novel magnetic materials, such as layered and superconducting materials. Mark is the author of the article on this year's Nobel Prize.

## HONORS AND AWARDS

Robert Quinn of Cabot, Arkansas was awarded the Bryson Scholarship for students who demonstrate an interest in astronomy, and the Wood Scholarship from Fulbright College, which is for outstanding students majoring in Physics, History, or English. He also holds a physics departmental scholarship, and is a participant in the Fulbright College 4-year Honors Program. Robert's younger brother Michael is a freshman physics major this year, and has a departmental scholarship.

Prof. Greg Salamo was given the Alumni Distinguished Achievement Award for his success in research. He is a specialist in lasers. The American Physical Society has elected Professors Bill Harter and Art Hobson to APS Fellowship. Harter was cited for his innovative theoretical methods in the study of the spectra of molecules. Hobson was cited in recognition of his contributions in the field of Physics and Society. He edits the newsletter *Physics and Society* published by the APS.

Prof. Min Xiao was given a highly prestigious National Science Foundation Young Investigator Award. Xiao is one of only 10 physicists in the country to receive this designation. Xiao studies fundamental properties of light using lasers.

## FACILITY UPGRADE

Those of you who visited us during the last two years have noticed that the Physics Building was under major renovation. We are happy to inform you that the renovation is now complete and on

your next visit you will find a major improvement in our facilities. In addition to the renovation of the old building, which is now devoted mostly to faculty and administrative offices, research laboratories and the library, an 11,000 sq. ft. extension has been built which houses new teaching facilities. The new wing contains a 70-seat lecture room, a 25-seat classroom, and six instructional laboratories, all state-of-the art. The $3.5 million renovation and addition was funded in part by the National Science Foundation. We will be happy to give you a tour of our new facilities!

**NEW IDEAS IN TEACHING**

U.S. educators agree that science education is slipping, but hotly debate the reasons why. Commonly, school systems are blamed for sending underprepared students into higher education. However school systems depend on universities to provide well-trained instructors. As long as students avoid sciences as much as possible during college and leave the courses with an unfavorable impression of science, they will be unable to communicate the beauty and necessity of science to their own students.

Science education research has identified several problems. The course format discourages student participation. The classes are often perceived as being intensely competitive, discouraging the participation of women and minorities. Students make extremely small gains in mastery of course materials, simply memorizing the formulas long enough to pass the tests, never bothering to understand what they mean. Students leave thinking science is unrelated to their everyday lives. Common complaints in introductory courses: (1) the emphasis of "how" questions: "why" questions aren't asked or answered; (2) no sense of community within the class; (3) laboratories rarely in sync with the lecture.

In the UA Department of Physics an experiment is underway to address these problems. Students often learn better by doing, so the course structure requires them to come to class prepared to ask questions. Concepts are presented within the framework of answering the questions, giving students an opportunity to synthesize information and taking them out of the role of passive learner. Laboratories and demonstrations that emphasize or develop the concepts take place in the classroom at jthe right time. Conceptual understanding is stressed.

The ultimate goal is to provide students with personal experience with the science that surrounds them; whenever possible familiar materials are used. Pre-prepared scientific kits are rarely used: real science rarely involves taking a box off the shelf and knowing what all the answers will be.

The students are encouraged to work in groups; helping someone else will not hurt anyone's grade. Students make excellent teachers for other students struggling with a concept they are all trying to master. Students discover teaching aides their own understanding.

Albert Einstein wrote "The most beautiful thing we can experience is the mysterious. It is the source of all true art and science." It is the *why* of things that engages the imagination, that makes science one of the great creative endeavors of humanity. It is the why to which we must turn in our efforts to improve science education.

**'94 NOBEL PRIZE IN PHYSICS**

The 1994 Nobel Prize in Physics was awarded to two individuals, Clifford G. Shull and Bertram N. Brockhouse, who were instrumental in the development of neutron scattering as a primary tool for the investigation of the properties of solids and liquids. Their method has become an irreplaceable method for studying both structure and dynamics.

Neutrons serve as an important probe of condensed matter systems for several reasons. Electrically neutral, they are therefore unaffected by the negatively charged electrons in order to directly hit the nuclei. Because of their quantum mechanical wavelike nature, neutrons are diffracted by the crystalline lattice of nuclei in a solid. This diffraction pattern reveals important information about the solid. While x-rays also diffract, neutrons have important advantages: they can distinguish different isotopes of nuclei, they are more sensitive to light elements, and their magnetic properties interact with the magnetic properties of the target nuclei and can be used to study the magnetic structure of matter. Electrons also affect x-rays and are grealy effected by them.

Shull and Brockhouse did their pioneering work about forty years ago. Both have retired from active service, Shull from M.I.T. and Brockhouse from McMaster University in Hamilton, Ontario.

**You are invited to participate in the field-testing of *Active Physics*. This is your chance to be involved with an exciting innovation in physics teaching.**

*Active Physics* is a NSF-supported curriculum project developed by the American Association of Physics Teachers (AAPT) and the American Institute of Physics (AIP) with assistance from the American Physical Society (APS). *Active Physics* is an alternative physics course for high school students who do not currently enroll in physics. Because of its limited prerequisite math and reading skills, this activity-based course can be successfully used with students from the 9th-12th grades.

As part of the *Active Physics* team, you will receive training at a national training site, tentatively scheduled for 29 July - 5 August 1995 at Gonzaga University, Spokane, WA (prior to the AAPT meeting), receive field support during the academic year, and have opportunities to network with *Active Physics* colleagues.

If you are interested, please contact Gay Stewart for a copy of the application!

**The Annual Physics Bowl sponsored by the AAPT/ Metrologic is coming up! Winning schools will receive a free laser!**

1. Each school must complete and mail the entry form. A check or school P.O. for a total calculated at $1.50 per student entry must be enclosed. Entry forms and payment must be received by **March 27,1995.**
2. Teachers should reserve a room and arrange for supervision of the contest on April 27,1995.
3. The American Association of Physics Teachers will ship contest forms and instructions about two weeks prior to the contest date. Please notify the AAPT if you have not received them by April 21st. Contact Gay Stewart at U of A if you haven't gotten an entry form from the AAPT.

**HIGH SCHOOL PHYSICS DAY**

The University of Arkansas Physics Department will host its annual High School Physics Day on **SATURDAY APRIL 22, 1995.** The day's events are open to all high school classes in Arkansas. The faculty and members of SPS invite students and teachers from your high school to participate. Note that a small registration fee is required, and that lunch will be provided by SPS, making the fee well worthwhile. Checks may be made payable to the Society of Physics Students.

We hope that this event will encourage the pursuit of physics as a career by providing an opportunity for detailed projects to be carried out in a light-hearted (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 undergraduate physics at the U.of A., Fayetteville, and show that physics is fun

## SCHEDULE OF EVENTS AND RULES

8:30 - 9:00 Registration
9:00 - 9:15 Introduction and welcome
9:15 - 10:00 Ping Pong Ball Launch
10:00 - 11:30 Demonstrations, tours of research labs
11:30 - 12:30 Lunch provided by SPS
12:30 - 1:30 Bridge Building
1:30 - 2:30 Physics Quiz Bowl
2:30 - 3:30 Egg Drop
3:30 - 4:00 Physics Study at U of A, Fayetteville
4:00 - 4:30 Awards ceremony

**EGG DROP RULES**: 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 both drops. In the event of a tie, the container with the least volume wins. Each container must hold **two** uncooked, unfrozen, untreated chicken eggs. Containers may be of any material but must fit into a cube 50 cm on each side. Containers which may chip the concrete or asphalt target will be disqualified. There will be two drops, and containers must be openable and reclosable to check the eggs between drops.

**PHYSICS QUIZ BOWL**: Students will estimate the proper orders of magnitude for very large or very small numbers, and match vocabulary terms with their definitions. Three points for a correct order of magnitude, 1 point if you are one order off, 1 point for vocabulary. Highest score wins.

**POSTER:** Entries should be made at home. They should deal with any thing related to physics, astronomy or mathematics. The posters should be turned in at registration time. The poster will be judged according to content and artwork. Entries are limited to one poster per person.

**BRIDGE BUILDING**: Students build a bridge from the supplied materials that will support the most mass. The bridge must span a 30 cm gap. The bridge is considered broken when the can falls off or the bridge buckles. No preparation is required. 30 minutes will be allotted for construction.

APPARATUS:

1. Each team will be supplied with 10 straws, 30 cm of masking tape and one piece of 8.5" X 11" white bond paper.
2. Scissors, one razor blade and a ruler will be provided but **may not** be used in the actual structure.
3. Materials other than those provided may not be used in the construction of the bridge

4. The bridge must be built in such a way that it will support a I lb. coffee can that will be used to hold the masses.

**PING PONG BALL SHOOT**: Students build an apparatus that will launch a ping pong ball the longest straight line distance from the point of launch to the point of first landing. The launcher must be built before the competition. 10 minutes will be allotted for set up. The best of three shots will be used. The launcher may be made from any material, but no combustible material may be used to launch the ping pong ball. A standard tournament ping pong ball will be provided for each team.

**HOW TO PARTICIPATE**: The previous schedule is tentative because of uncertainties in the amount of participation. Therefore it is very important that each school fills out the registration form below and sends it back by April 14 (sooner if possible). Awards will be given for first, second, and third place in the five competitions. Entries by individual high school students and by teams of two members are welcome, except for the Physics Quiz in which the team size may be up three members. Provisions will be made so that each team member receives an award. Everyone is encouraged to participate but anyone can come to observe. The decision of the judge is final-in the event of a tie, the points will be split between the teams.

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High School Physics Day Registration Form:

**Teacher's Name**_____

**School** _____

**School Address** _____

**City/State/Zip/Phone**_____

**Preregistering ____ students** at **$1.00 each for** a **total of $_____ payable to the SPS.**

Contests (check each your school will be competing in and give the number of teams competing in each):

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__Ping Pong Ball Launch   Number of Teams:___
__Egg Drop                Number of Teams:___
__Bridge Building         Number of Teams:___
__Physics Quiz Bowl       Number of Teams:___
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