# APS NEWS

OCTOBER 1998 THE AMERICAN PHYSICAL SOCIETY VOLUME 7, NO. 9

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Centennial Meeting Alert

5 Months to Go

## APS Centennial

**March 20-26, 1999**

**www.aps.org/centennial**

# Once Every Hundred Years

It's a birthday party! In 1999, we will celebrate the 100th anniversary of the founding of the American Physical Society. Physicists worldwide and especially APS members are invited to Atlanta next 20-26 March to celebrate the accomplishments of physics in the 20th century and to look ahead to the challenges and accelerating change that will greet us in the next 100 years and beyond. Now is the time to begin preparing your abstract and make plans for Atlanta. You won't want to miss it, and we hope you will consider bringing your spouse, companion or children along to enjoy the broad range of activities that will make up the APS Centennial celebration. This special issue of *APS News* will give an overview of the Centennial events in Atlanta and cover related projects and activities that will take place throughout 1999. All the information you need right now is in this issue and in the enclosed *APS Meeting Announcements*. Keep an eye on http://www.aps.org/centennial/ in the coming months for further details and developments.


Photo courtesy of the Atlanta Convention and Visitors Bureau; Kevin C. Rose

## Inside...



## Special Centennial Events

In addition to the plethora of distinguished special invited guests, including President Bill Clinton and Vice President Al Gore (pending confirmation) and assorted Nobel Laureates in physics, the APS Centennial Meeting will feature numerous special events, many aimed at drawing the general public as well as APS members in attendance.

### Nobel Laureate Luncheon/ Exhibit

A special invited Nobel Laureate Luncheon (Saturday, March 20, 1999) will include over 50 Nobel laureates as well as outstanding high school teachers from across the country and students from throughout the state of Georgia. The students and teachers will have an opportunity to interact with the Nobel laureates in physics and chemistry. Of particular interest is an invitation to Vice President Gore to give an address at the luncheon. The luncheon is designed to be the preamble to the public opening of the "Nobel Discoveries Exhibit: Exploring Nature, Saving Lives, Driving Technology" immediately following the luncheon. Both of these events are expected to draw significant media attention.

The purpose of the exhibit is to engage and inspire young people, to excite them about physics and to surprise them with the ways it has impact on daily life. The Nobel exhibit is being designed to travel to science centers and science museums across the country after the Centennial Meeting. The exhibit will illustrate how Nobel discoveries have probed the fundamental mysteries of our world and, through the use of interactive components, allow visitors to see in a hands-on, contemporary way exactly how these discoveries have improved our lives.

### Alumni Reunions

More than 40 physics departments from educational institutions and laboratories throughout the U.S. will be organizing alumni receptions and reunions for Tuesday evening, March 23, 1999, in conjunction with the centennial meeting.

### Fernbank Museum Gala

International, U.S. and Atlanta dignitaries, including Nobel laureates and science teachers in attendance, will be special guests at a gala event and reception to be held on the evening of March 21, 1999 at

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- Nobel Discoveries Exhibit—Exploring Nature, Saving Lives, Driving Technology
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## CRITICAL CENTENNIAL MEETING DEADLINES

**ABSTRACTS**

***Usual March Program Topics*** (Including CCP '99) **11/13/98**

***Usual April Program Topics*** (Including Sherwood) **12/04/98**

**Early Registration Deadline 1/15/99**
*(To be eligible for the lowest registration fees)*

**Housing Deadline 2/20/99**

**See Enclosed *APS Meeting Announcements* for complete Centennial Meeting Abstract and Registration Information**

# APS Units Sponsor Centennial Exhibits

Almost all of the APS units, as well as three standing committees, are developing topical exhibits on subjects of concern to their respective charters for the upcoming APS Centennial Meeting in Atlanta, Georgia. A listing of the displays planned at this time, with a brief description, is below.

### Division of Astrophysics

One strongly visual display will link the contributions of astrophysics to other disciplines. A second exhibit will include interactive displays of astronomical images via computer terminals.

### Division of Biological Physics

Slide shows will feature the varied applications of nonlinear dynamics, with the main focus on biological applications. Computers will be available for interactive participation.

### Division of Chemical Physics

One display will feature magnetic resonance imaging (MRI) accompanied by a user-friendly Web site. A second display will explore combustion chemistry.

### Division of Condensed Matter Physics

The display will consist of a series of posters describing the history of the many different sub-areas of condensed matter physics.

### Division of Computational Physics

The display will feature a series of live demonstrations of computational physics, using a work station and/or the Immersadisk (3-D interactive). A poster on the impact of physics on computing will also be produced.

### Division of Fluid Dynamics

The display will present the 1998 winning entries for the division's annual Gallery of Fluid Motion: pictorial displays obtained from physical or numerical experiments which are intriguing, novel or revealing of intricate physical mechanisms.

### Division of High Polymer Physics

The exhibit will combine a poster-board backdrop highlighting the historical use of physics in the field of polymer science with interactive computers to educate users about a variety of polymer characteristics and uses.

### Division of Laser Science

The exhibit will include demonstrations highlighting laser history and applications at the forefront of science, medicine, fiber optic communications, and education.

### Division of Nuclear Physics

The theme of the exhibit is the role of the nucleus as the center of the atom and the heart of all matter around us. The exhibit will focus on the current major scientific thrusts, selected applications and education.

### Division of Physics of Beams

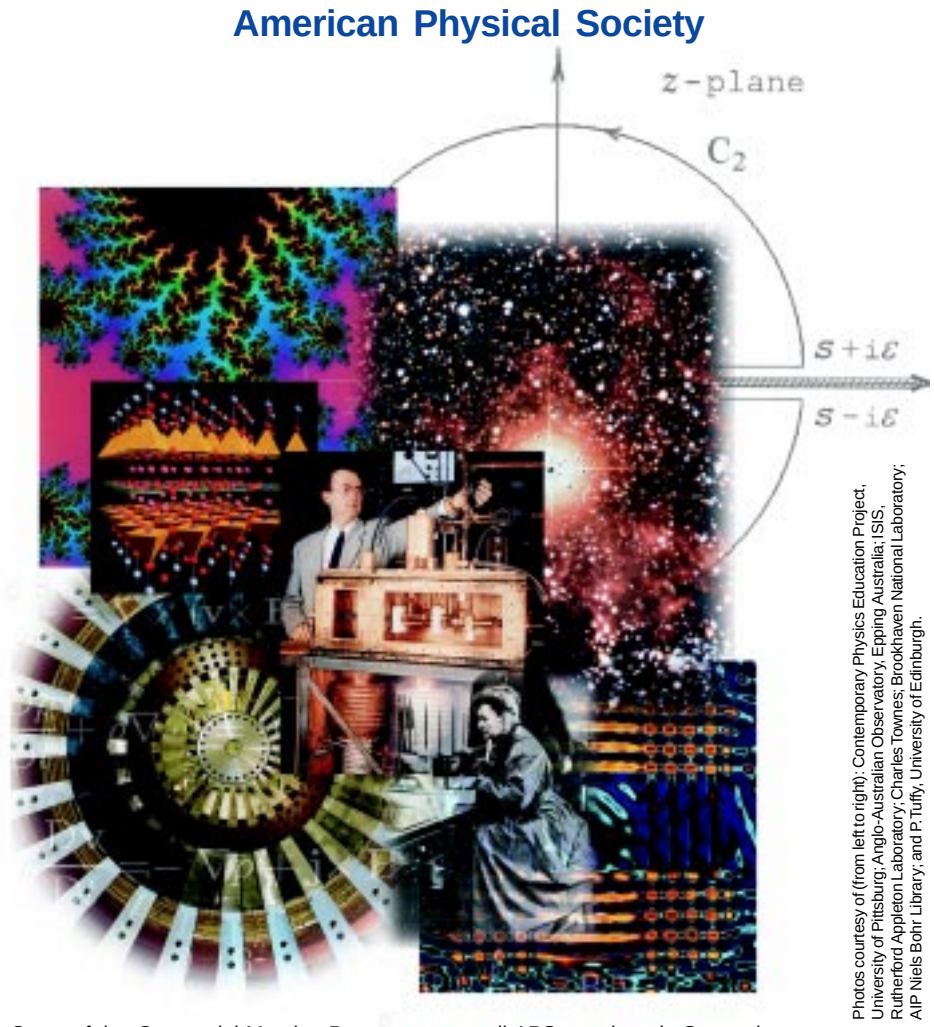
The exhibit will feature joint displays with laboratories active in the use and construction of accelerator systems for nuclear and high energy physics, and for synchrotron radiation.

### Division of Particles and Fields

The display will present an introduction to elementary particle physics using three computers running "A Particle Adventure," as well as a demonstration of the existence of particles using an optical spark chamber.

### Division of Plasma Physics

Three displays are planned: plasmas, kiosks and a backdrop. Two areas will be interactive with active plasmas and interactive computer kiosks, with a large graphic plasmas display providing a backdrop for the interactive components.




Photos courtesy of (from left to right): Contemporary Physics Education Project, University of Pittsburg; Anglo-Australian Observatory, Epping Australia; ISIS, Rutherford Appleton Laboratory; Charles Townes; Brookhaven National Laboratory; AIP Niels Bohr Library; and P Tuffy, University of Edinburgh.

Cover of the *Centennial Meeting Program* sent to all APS members in September.

### Topical Group on Precision Measurement and Fundamental Constants

The display will feature the new values of the fundamental constants with graphical display material, as well as a demonstration of the on-line WWW database on fundamental constants.

### Topical Group on Gravitation

The display will highlight gravitational waves in general, focusing on LIGO and LISA, as well as provide a strong historical component dating back to Einstein's formulation of General Relativity in 1915.

### Statistical and Nonlinear Physics Topical Group

The exhibit will feature a poster of photographs of the many great physicists in the field of statistical and nonlinear physicists, along with photographs illustrating nonlinear phenomena.

### Instrument and Measurement Science Topical Group

The presentation will reflect the universal importance of measurement in a wide range of topics, incorporating three fundamental themes: the history of instrumentation, its role in enabling discovery, and its beneficial impact on human welfare.

### Forum on Education

The exhibit will focus on three areas: how physics demonstrations and laboratory equipment have been used to teach introductory physics; a display of introductory textbooks over the last century; and a display of computer-assisted learning.

### Forum on Industrial and Applied Physics

This exhibit will focus on the use of physics in industry.

### Forum on Physics and Society

The display will feature a retrospective of the unit's activities over the last 25 years, highlighting its role in fostering debates, publishing, short courses, and awards on public policy topics with considerable physics content.

### Forum on History of Physics

The display will present a series of Einstein posters originally produced in 1979 for the 100th anniversary of Einstein's birth, in conjunction with the exhibit from the Forum on Education.

### Committee on the International Freedom of Science

The exhibit will present an illustrated history of CIFS activities in the past, as well as inform the public of current cases, including an Internet connection with links to relevant human rights sites.

### Committee on the Status of Women in Physics

The exhibit will feature a display of "Women Doing Physics", complemented by access to the UCLA Web site, "Contributions of Women to 20th Century Physics."

### Committee on Minorities

The display will focus on Bouchet Award winners as well as a pamphlet listing all minority fellows of the APS.

### Southeastern Section

The exhibit is entitled "Large Physics Facilities in the Southeast," and will present a 28-foot poster highlighting several major institutions of the region.

### Ohio Section

The exhibit will focus on early physics in the state of Ohio, emphasizing physics teaching apparatus and featuring a small-scale model of the Michelson interferometer.

### Four Corners Section

The exhibit will be a joint effort with institutions in the region, including New Mexico State University, Los Alamos National Laboratory, and the National Renewable Energy Laboratory.


# APS News

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**Letters** to the editor are welcomed from the membership. Letters must be signed and should include an address and daytime telephone number. The APS reserves the right to select and to edit for length or clarity. All correspondence regarding *APS News* should be directed to: Editor, *APS News*, One Physics Ellipse, College Park, MD 20749-3844, E-mail: letters@aps.org.

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# The Historical *BAPS*

*by Danita Boonchaisri, APS Meetings Department*

Housed on a low, two-shelf bookcase in the fourth floor conference room of the American Physical Society is a collection of inconspicuous green books. They occupy relatively little space and are mostly ignored by the people who use the conference room. They appear to be no more than decoration, adding color to the otherwise plain wooden shelves.

However within the pages of these archived volumes of the *Bulletin of The American Physical Society (BAPS)* is an enormous amount of scientific, political, cultural and historical information. Selecting several volumes at random can uncover such interesting and enlightening facts as these:

• The first meeting of the Society was held in Fayerweather Hall, Columbia University, New York City, on Saturday, May 20, 1899. At this meeting, the motion was approved to formally organize the Physical Society with the following bylaws: that the election of members be by the Council; that there be four regular meetings annually; that the annual fee be five dollars; and that a regular bulletin be published.

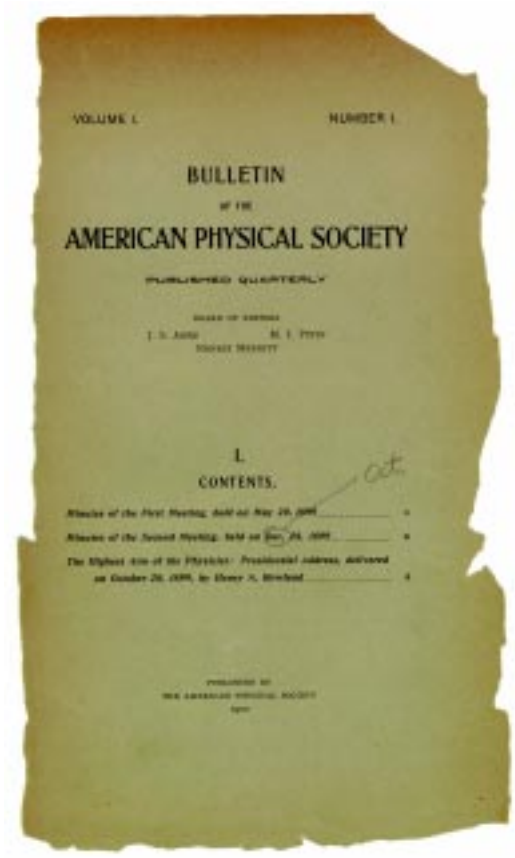
• The November 30-December 1, 1923 meeting in Chicago, Illinois contained 47 abstracts. The keynote address was given by Niels Bohr on "The Quantum Theory of Atoms with Several Electrons."

• The annual dues for APS fellows in 1924 were $12; member dues were $9.

• The registration fee for the 1936 annual meeting in Atlantic City, New Jersey, was $1.

• Among the six Honorary Members of the APS in February 1937 were Niels Bohr, Albert Einstein, and Max Planck.

• Published seven times per year, the subscription rate for BAPS in 1937 was $5 per year; $1 each for single copies. This rate remained unchanged for 31 years, until 1968, when the subscription fee was raised to $12 per year and $2 for back issues.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I.

CONTENTS.

*BAPS:* Volume 1, Number 1, 1890.

• In November 1943, the staff of the APS and AIP eagerly awaited the opening of their new offices on East 45th Street in New York City, in a "stately and commodious building, formerly a private house of a magnificence now rare." The purchase price was $70,000, and the grand opening was planned for January 1944, "if the exceptional obstacles of wartime [could] be overcome."

• "The Physics of the Solid State" was the theme of the 1947 meeting in Montreal, Canada. The largest percentage of contributed papers was dedicated to solid state physics, with another large percentage pertaining to nuclear physics research.

• A banquet ticket at the 1951 annual meeting cost $5. The after-dinner speaker was J. Robert Oppenheimer.

• Due to member pressure in 1968, the council voted on a recommendation to move the 1970 annual meeting from Chicago to protest events that occurred during the Democratic National Convention that year. While agreed to be well-motivated, the motion was defeated because it requested "a political protest in an area not related to physics."

• The rate for a single room at New York City's Hilton Hotel for the 1969 Joint Meeting was $16. But you could get a single room at the YMCA for only $3.50 a night.

• At the 1971 business meeting of the APS in New York, two important motions were passed. One called for a public plea to the U.S. President not to use nuclear weapons or devices in the Vietnam War, and recommended that APS members not engage in research activities that directly contributed to the commission of war crimes in Vietnam. The second charged APS members "with the duty of racial and sexual integration of their institutions" to help overcome the overwhelmingly white male dominance in the physics community.

• An abstract in the program for the 1984 Joint APS/AAPT meeting in San Antonio, Texas noted that microcomputers "were just beginning to be used to gather and store data" in undergraduate physics labs.

As we pause during the APS Centennial Celebration to consider the contributions that physics has made to society, we should also consider the effect that society has had on the evolution of physics.

Consider the closing of Henry Rowland's presidential address, delivered at the second APS meeting on October 28, 1899: "Let us hold our heads high with a pure conscience while we seek the truth, and may the APS do its share now and in generations yet to come in trying to unravel the great problem of the constitution and laws of the universe." Dr. Rowland's words are as pivotal today as they were 100 years ago.

Additional highlights of the history of the APS, *BAPS*, and its research journals will be displayed in an exhibit at the Centennial Meeting in March. Stop by and browse through 100 years of world history — with a scientific twist.

# A Century of Physics

## 1955-1965: Connections

*by Hans Christian von Baeyer*


Photo courtesy of Benjamin Yalow

Rosalyn Sussman Yalow

By mid-century the new physics was beginning to spread out into a wide range of applications. Its scope extended vertically, as it were, from the unimaginably small interior of the nucleus up to the incomprehensibly vast stretches of the universe. At the same time, physics also had a powerful horizontal impact on other branches of science, often by way of novel instrumentation, and on technology.

For biology, physical methods brought about spectacular results. The discovery of the double helix of the DNA molecule, revealed by X-ray images of crystallized DNA, triggered a revolution in genetics. Henceforth the mechanisms of heredity could be understood in tangible, material terms, and eventually even manipulated. Medicine acquired an important technique when Rosalyn Sussman Yalow, an American nuclear physicist, invented a way to use radioactivity for detecting minute amounts of a huge variety of materials, ranging from nicotine to viruses, in the human body. Though its name twists the tongue, her method, called radioimmunoassay, relies on a simple principle. If you count six red-eyed fruit flies in a jar, and you know that the incidence of red eyes is one in a thousand, you conclude that there are 6000 flies in the jar — without the tedium of counting them. Radioimmunoassay counts molecules rather than flies, and tags them by radioactivity rather than eye color.

Chemistry gained a valuable diagnostic tool with nuclear magnetic resonance. Radar research had led to instruments that can identify nuclei by the way they absorb microwaves. For chemists, whose usual province is the electron cloud of the atom, this descent to the nucleus opened new opportunities. Nuclear magnetic resonance itself would later develop into magnetic resonance imaging, with a name chosen purposely to avoid the word nuclear. Geology also adopted an instrument based on 20th century physics. The SQUID (Superconducting Quantum Interference Device) which relies on a peculiar quantum effect discovered in 1962, can detect otherwise imperceptible changes in magnetic fields induced by the presence of mineral deposits.

In these and countless other ways physics began to stimulate research in its sister sciences. The most influential achievements of the 1950's, however, were the invention of the laser and the development of computers based on integrated circuits. Both of these devices, which are direct applications of quantum mechanics, would transform science and spawn entire industries devoted to new technologies.

*Editor's Note: A CENTURY OF PHYSICS, a dramatic illustrated timeline wallchart of over a hundred entries on eleven large posters is intended for high schools and colleges. Each poster covers about a decade and is introduced by a thumbnail essay to provide a glimpse of the historical and scientific context of the time. A Century of Physics will be on display at the Atlanta Centennial Meeting in March.*

*In the November issue, APS News will feature the seventh introductory essay:* ***1965-1975: Closing the Circle****.*

## Centennial Publications

As part of the APS centennial's lasting legacy, the APS is developing three special publications in honor of the event:

***Physics in the 20th Century.*** Produced jointly with the American Institute of Physics, this will be a lavishly illustrated coffee table book intended for the general public. With text by well-known *Washington Post* science writer Curt Suplee and more than 200 illustrations, it will be available at the Centennial Meeting at a reduced, pre-publication price.

***Special Edition of Reviews of Modern Physics.*** A special issue of *Reviews of Modern Physics* will commemorate the APS Centennial, with approximately 50 articles by distinguished physicists covering a wide range of areas of contemporary physics, as well as a section on historical perspectives. It will be distributed without extra cost to all subscribers to RMP, and also will be published as a hardcover book by Springer-Verlag.

***A Century of Physics.*** The APS has commissioned the production of a timeline wallchart entitled "A Century of Physics," consisting of eleven 40" by 26" panels. Each is dedicated to approximately one decade of the 20th century, describing many of the main developments and contributions of physics with accompanying photographs. *APS News* has been featuring the introductory essay from each such panel in every issue until the Centennial Meeting itself (see above for this month's installment). The timeline wallchart will be distributed free of charge to all high school science and college physics departments, and will be available for purchase by individual APS members at the Centennial Meeting.

## Plenary Speakers

As reported in the August/September issue of *APS News*, The following world-renowned scientists will present plenary lectures at the upcoming APS Centennial Meeting, 20-26 March 1999, in Atlanta, Georgia:

**Joel Birnbaum • Mary Good • Martin Klein**
**Richard Smalley • Harold Varmus • Steven Weinberg**

# OPINION

## Some Suggestions for Combating "Science Anxiety" in the Classroom

*by Art Hobson*

Priscilla Auchincloss (The Back Page, *APS News*, May 1998) points out that much needs to be done and can be done to attract and retain more women in physics. I would like to add some comments regarding that great majority of women who are, and will remain, non-scientists. There is much that physicists can do to encourage these women toward greater understanding, confidence, and enthusiasm about physics.

In presenting physics to nonscientists, it is imperative to recognize that most of them have severe anxiety and fear of failure concerning science and math. This is an unfortunate fact of American culture, a self-perpetuating problem that begins in homes and grade schools when science-anxious parents and teachers communicate their own anxiety to children. Science anxiety then accompanies these children to adulthood, when the cycle repeats.

As the American Association for the Advancement of Science (AAAS) and others have noted, science anxiety is especially significant for women. The AAAS report *Science for All Americans* notes that "Far from dismissing this anxiety as groundless, teachers should assure students that they understand the problem and will work with them to overcome it. Teachers can....make sure that students have some sense of success..., and they should de-emphasize getting all the right answers. Many students are fearful of lab instruments. Girls in particular suffer from the mistaken notion that boys are naturally more adept at using tools. ...Because the scientific and engineering professions have been predominantly male and white, female and minority students could easily get the impression that these fields are beyond them or are otherwise unsuited to them. This debilitating perception—all too often reinforced by the environment outside the school—will persist unless teachers actively work to turn it around."(Oxford University Press, New York, 1989 and 1990)

This cycle needs to be broken all along the line: at home, in grade school, in middle school and high school, in college, and in adulthood. One such place is in high school and college science courses for non-scientists. Here are six classroom suggestions, not original with me, that have been successful in my large-enrollment liberal-arts physics course.

Make the course relevant to real human concerns. In my experience, women are especially interested in the human implications of science, implications for the environment, for children, for a peaceful world, for Earth's future. When physics is taught within the social and cultural context of topics such as global warming, energy resources, pseudoscience, and scientific methodology, students can appreciate its relevance to their own lives.

Cite role models, such as Marie Curie, Irene Curie, Lise Meitner, Ida Noddack, and Susan Solomon. Noddack's first National Ozone Expedition in 1986 confirmed the Antarctic ozone "hole" and led to Solomon's hypothesis, since confirmed, concerning the CFC-initiated chain of events by which ozone is destroyed. Another good candidate is Cecilia H. Payne, the astrophysicist who, in her 1925 PhD dissertation, announced the revolutionary discovery that the stars are made primarily of hydrogen.

Keep it conceptual. As Paul Hewitt (see the instructor's manual accompanying his textbook *Conceptual Physics*) and others have argued, non-scientists have little need for traditional problem-solving techniques, or the accompanying algebra. It is possible to make the course numerate (with graphs, powers of ten, probabilities, numerical estimates, etc.) but non-algebraic. Do not introduce technical terms unless and until they are really needed. Follow Arnold Arons's maxim: "idea first, name afterward." Dispense with formulas, or state them only as proportionalities, or state them first in words and then perhaps with symbols—explaining that the symbols are merely abbreviations for words.

Discuss science anxiety as well as fear of failure, fear of speaking up in class, and fear of laboratory apparatus. Explain that these fears are often due to overbearing siblings and parents, or parents and teachers who are themselves anxious about science or math. Your class should provide a supportive environment for all students to work through such fears. Laboratories, in particular, offer lots of opportunity for one-on-one help from an understanding instructor. Be sure your lab assistants understand this.

Here is one revealing technique for discussing science anxiety: Ask your class, verbally, a simple problem such as "It's 120 miles to Little Rock, and you drive there at 60 miles per hour. How long does it take?" Then immediately ask "What are you thinking at this moment? Are you thinking about solving the problem, or are you thinking: Oh no—it's one of those horrible word problems?" For those many students whose first reaction was anxiety, the trick will be to learn to relax while thinking about physics. A way to do this it to practice relaxation (breath deeply and relax) while studying physics, during practice examinations, during real examinations, etc.

Keep classes interactive and student-oriented. Call on students by name, even in large lectures, where you can at least learn the names of those who speak up in class. Toss out topics for brainstorming and discussion.

Use peer instruction techniques. I give peer-assisted pop quizzes in which students work in groups to answer a question posed to the class, but are then responsible for their own written response. Pop quizzes should be for extra credit, so that students never lose points when they miss class or answer incorrectly. Questions should be sufficiently easy that most groups will, perhaps with coaching, come up with the right answer. I also use peer-assisted "workshop questions," similar to pop quizzes but not handed in. It's inspiring to see a large classroom buzzing about physics. Eric Mazur (*Peer Instruction*, Prentice Hall: Upper Saddle River, NJ, 1997) and others show that all students respond positively to these group-learning techniques. My observations persuade me that women respond even more enthusiastically than men.

It's important to work on both sides of the "physics gender gap." We need more women in physics, but we also need more women outside of physics.

*Art Hobson (ahobson@comp.uark.edu) has been teaching physics at the University of Arkansas since 1964 and is the author of a liberal-arts physics textbook Physics: Concepts and Connections (Prentice Hall). Art has also been very active in the Forum on Physics and Society.*

# LETTERS

### Zero Tolerence for "Zero Gravity"

The answer given to the second limerick listed in the Zero Gravity section of *APS News* in the Aug/Sept 1998 issue is arguably incorrect and libelous [Answer: Gwen has forty-two boyfriends. 42-1=41. 41+3=44. 44/4=11. 11-1=10.]. A better answer, in my opinion, is that Gwen has only nine boyfriends, rather than 42. The key lies in the interpretation of the words "Together give", which I take to mean the operation of addition of the two preceding phrases separated by the word "and". Thus "one less" (9-1=8) "and three more divided by four" ((9+3)/4=3), "Together give" (8+3=11) "one more than ten" (11). I fear, though, that it is too late to save Gwen's sullied reputation.

**Kevin Gahagan**
*Los Alamos National Laboratory*

I note that in Item 5 of "Zero Gravity" in the July 1998 issue of *APS News*, the force that prevents an insect from going through normal matter is said to be the electrostatic repulsion between the charged particles making up the atoms in the two bodies. I have always thought that the electrostatic forces between the electrons and nuclei of two atoms pretty much cancel one another out, and what is left is a very weak attractive force usually associated with the name of van der Waals. The fact that two atoms do not penetrate each other, I thought, was a consequence of the Pauli principle: the electrons of one atom cannot get into the filled shells of the other atom. But perhaps the laws of physics are different in "Zero Gravity" if so, this should please NASA no end.

**B.S.Chandrasekhar**
*Groebenzell, Germany*

### Renormalization of Bloopers

I read the July Zero Gravity "Top Ten Star Trek Bloopers," by Lawrence Krauss, with some anxiety: Were the bloopers all supposed to have been in the show? To avoid ambiguity, I have included a second-order correction below in which each blooper has been categorized either as "correct fiction" or "incorrect fiction". Readers also may choose the category into which their other theories best might fall.

1. *In Space, No One Can Hear You Scream*. Correct Fiction. Also, nothing really "blows up" in space either: There isn't any air to transmit pressure differences.

2. *Faster Than A Speeding Phaser.* Incorrect Fiction. Any such weapon must be aimed; the aiming action might be observed and the beam thus avoided. Also, some of the initial beam might be observed at the target before the deadly part arrived, allowing the latter to be avoided.

3. *If the Plot Isn't Cracked, Maybe the Event Horizon Is.* Incorrect Fiction. An event horizon MIGHT not be smooth and symmetrical, allowing it to appear "cracked."

4. *How Solid a Guy Is the Doctor?* Correct Fiction. A hologram image can't be magnetically confined. However, a hologram might be so confined. Also, spin would allow uncharged particles to interact with a magnetic field (weakly).

5. *To InterPhase or Not To InterPhase.* Probably Correct Fiction, but seems to have a bug.

6. *Sweeping Out the Baby With the Bath Water.* Same as 5: Sweeping the baryons off the Enterprise might just leave it shinier (if not all were removed).

7. *How Cold is Cold?* Correct Fiction: Can't get to -295 degrees Celsius.

8. *I Have Seen the Light.* Incorrect Fiction. Space IS filled with dust, as the astronauts servicing the Hubble found to their dismay. Also, dense enough energy might cavitate the vacuum enough to make the beam visible in all directions.

9. *Astronomers Get Picky*. Incorrect Fiction. Yes, a geosynchronously orbiting vehicle would remain stationary relative to any point on the equator (ignoring secular corrections). However, seen in a perspective other than from a point through a diameter of the planet and through the vehicle, the vehicle WOULD appear to move against the planet's surface.

10. *Those Darned Neutrinos*. Incorrect Fiction. For a vehicle by assumption able to exceed the speed of neutrinos, passing a neutrino in flight would make it RIGHT-handed. This is the "symmetry-breaking" referred to in theories that allow the neutrino to be massive (and thus be passed by a beam of light).

**John Michael Williams**
*Redwood City, CA*

### The High Cost of Tenure

The June 1998 Back Page "Keep Tenure: Fix the Problems" by Frank Franz is clear and obviously from an expert. However, has anybody considered the *cost* of the proposed *annual reviews*? Just to remove a few (1% ?) incompetent (or inadequate) tenured professors, 100% of them (and their staff) have to spend hours and hours *each year* to pass such annual reviews if they are done properly. Just another way to increase bureaucracy and with it overhead.

**M. Drosg**
*University of Vienna*

### Why God Never Got Tenure

I very much enjoyed the April 1998 Zero Gravity column but I have one very serious criticism: the title should be "Why God Never Got Tenure," rather than a PhD. The criteria cited are not particularly pertinent to obtaining a doctorate, but are among the reasons cited for denying tenure.

**Leo Silber**
*Brooklyn, NY*

zero gravity

# *APS News* T-Shirt/Bumper Sticker Slogan Contest Finalists

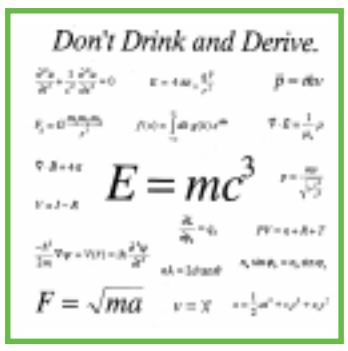
We received several hundred responses to our announcement of the T-Shirt/Bumper Sticker Slogan Contest in the April 1998 issue of *APS News*. Many, many submissions played on the familiar theme, "Physicists Do It....." By far the most frequent entry was, **Physicists Do It With Models** versions of which were submitted by Damian Handzy, W. Yeung, Dirk Jan Bukman, and John Hornstein.

However, frequency of citation is not the sole defining criteria for any given slogan's success. Thus, we've selected a number of our personal favorites as finalists, as well as some additional runners-up. Members are encouraged to review the selections below and vote for their favorites by email [TEESHIRT@aps.org]. Winning entries will appear on assorted T-shirts, bumper stickers and coffee mugs that will be available for sale at the upcoming APS Centennial Meeting in Atlanta, Georgia, in March 1999.

Barrett Ripin
Editor, *APS News*

## FINALISTS

Three of our selected finalists submitted slogans requiring visual clues or graphics that play on popular physics concepts. Eric Weeks of the University of Pennsylvania was the first to suggest a T-shirt with the caption, "Don't Drink and Derive," along with accompanying graphics (see right) [Mike Famiano submitted a similar entry without the graphics.] Eric Jones of Case Western Reserve University suggested the following




**If this sticker is blue, you're driving too fast.**

And John Pierre of San Francisco, California, submitted a physicists' alternative to the popular "Darwin Fish" bumper sticker:


John Edwards struck a humorous chord with numerous APS staff members with the slogan,

**Flirt Harder—I'm a Physicist**

**Maxwell's Little Demon**

Devlin Gualtieri of Allied Signal suggested the above as an apt slogan for a children's tee-shirt for beleaguered parents. Roger Johnson of Los Alamos National Laboratory submitted several pages of slogans, many of which we selected as runners-up in addition to his finalist entry:

**God does not play dice with the universe. It's more like whiffle ball**

Meanwhile, Sir Denys Wilkinson of East Sussex, England, took a more literate approach, borrowing his submission from an undisputed master:

**"...we delight in physics..."**
W. Shakespeare, Macbeth II.iii

## RUNNERS-UP

Other entries along the "Physicists Do It..." lines included:

### Physicists Do It....

**with the least action** (Devlin Gualtieri)
**discretely** (Steven Watanabe, Bryan Dorland, Caroline Ritz-Gold)
**with a Big Bang** {Damian Handzy)
**in Super-Positions** (Todd Pittman)
**with gravity** (Roald Wangsness)
**with increasing entropy** (John Hornstein)
**with chaotic motion** (John Hornstein)
**quantum coherently** (John Hornstein)
**with minimal coupling** (Lewis Orphanos)
**with momentum** (James McGee)
**relatively well**
**with uncertainty**

**Sex is the physics urge sublimated** (Daniel Grupp)
**Old physicists never die; they just accelerate to light speed!** (Bill Martin)
**This car brakes for Schroedinger's Cat** (Devlin Gualtieri)
**Maintain chirality: Pass on the left only** (Devlin Gualtieri)
**Conserve energy: Don't be a joule thief** (Joel Liebman)
**Conserve energy: Commute with a Hamiltonian** (Enid Sichel)
**Ψs Matters!** (Chris Paul)
**Gravity Gets Me Down** (Seyffie Maleki)
**Excuse me while I collapse my wave function** (Leonard Anderson)
**Know a Good Quantum Mechanic?** (Loren Booda)
**Honk if you love phonons** (Loren Booda)

And finally, from the prolific Roger Johnson:
**I'm a physicist; I don't need people skills**
**Pseudo Science Sucks**
**Chirality is twisted**
**Keeper of the hidden variables**

### Stop Physics Hooliganism:

**symmetry breaking**
**collapsing state vectors**
**degeneracy**
**chaos**
**turbulence**

### Physicists To-Do List:

**develop grand unified theory**
**find missing dark matter**
**solve solar neutrino problem**
**time travel**
**find tachyons and magnetic monopoles**
**change underwear**

## Centennial Events *(continued from page 1)*

the Fernbank Museum of Natural History. Expected to attract as many as 2,000 participants, the evening will also include continuous showings of the IMAX film "Cosmic Voyage," as well as a multimedia presentation celebrating the achievements of physics, and physics-related entertainers.

### Physics Festival

A community-wide Physics Festival is in development for Atlanta for the week prior and the week during the Centennial Celebration and Meeting. Activities throughout the academic and public community in Atlanta will include Popular Physics Topic lectures both at the Georgia World Congress Center (GWCC) and in venues around the city. These general interest talks will focus on topics more easily accessible to students and the public, such as the Physics of Dance, Physics of the Rainbow, and Physics of Sports. A 21st Century Dialogue series will be held in larger auditoriums and theatres in Atlanta and will feature some very interesting and well-known speakers.

A number of exhibits are planned including the Nobel Discoveries Exhibit, an APS History and Journal Exhibit, *A Century of Physics* timeline wallchart, APS Unit Exhibits, as well as exhibits of funding agencies and an expanded commercial exhibit show at the GWCC. In addition, art and photography in science will be featured in area galleries. Several on-campus activities arranged by colleges and universities in the region such as a Conference on Communication of Science to the Public at Emory University and a symposium on "Fractals and Chaos" at Georgia Tech are scheduled. Finally, several science education outreach groups will perform physics demonstrations and programs in Centennial Park and in other locations around Atlanta.

### International Banquet and Symposium

A special banquet is being organized to celebrate the international nature of physics, and to honor representatives attending the Centennial meeting. In addition, a symposium on international science will feature the following distinguished speakers and topics:

- Predhiman Kaw, Institute for Plasma Research, Gujarat, India, "International Energy Research: Sources, Consumption and Alternatives"
- Luciano Maiani, director general, CERN, "International Cooperation at CERN"
- Jan S. Nilsson, Knut and Alice Wallenberg Foundation, "The International Unions and Other Institutions Promoting International Scientific Collaboration"
- Tadahiro Sekimoto, chairman, NEC Corporation, "Telecommunications and Physics"
- Cylon Goncalves da Silva, director general, Brazilian Association of Synchrotron Light Source Technology, "International Cooperation in Latin America"

# Bill Phillips To Be Honored at DLS' ILS-XIV Conference

William D. Phillips of the National Institute of Standards and Technology (NIST) in Gaithersburg, Maryland, will be awarded the 1998 APS Arthur L. Schawlow Prize in Laser Science during the 19th annual Interdisciplinary Laser Science (ILS) conference, in conjunction with the annual meeting of the Optical Society of America, to be held 4-9 October 1998 in Baltimore, Maryland. Sponsored by the NEC Corporation, the Schawlow prize is intended to recognize outstanding contributions to basic research that uses lasers to advance our knowledge of the fundamental physical properties of materials and their interaction with light.

Phillips was cited "For pioneering experiments in laser cooling and trapping, including the first demonstrations of Zeeman cooling, the magnetic trapping of neutral atoms and the extension of laser cooling below the Doppler limit." He received his BS in physics from Juniata College in Huntington, Pennsylvania, in 1970 and his PhD from the Massachusetts Institute of Technology (MIT) in 1976. After two years as a postdoctoral fellow at MIT, he joined the staff of NIST (then known as the National Bureau of Standards) in 1978. He is the leader of the Laser Cooling and Trapping Group in the Atomic Physics Division of NIST's Physics Laboratory.

Phillips has received many awards and honors, most recently the 1997 Nobel Prize in Physics for his work in laser cooling and trapping, which he shared with Steven Chu of Stanford University and Claude Cohen-Tannoudji of the Ecolé Normale Superieure in France. The scientists were recognized for their development of methods to cool and trap atoms with laser light. With his laser setup, Phillips can create "optical lattices," crystal-like arrays of atoms held in place by light waves. He is continuing his research on ultra-cold atoms with spin-off applications for improved accuracy in atomic clocks, and in the fabrication of nanostructures.

# World's Top Science Students Gathered in Dallas for 1998 ISEF

The APS contributed to the more than $2 million in scholarships and prizes that were awarded to some of the world's brightest high school students at the 1998 Intel International Science and Engineering Fair (ISEF). ISEF was held 13-15 May in Fort Worth, Texas. Each year, the Intel ISEF brings together over 1,000 students from all 50 states and 40 nations to compete for scholarships, tuition grants, internships, scientific field trips and the grand prize: a trip to attend the Nobel Prize Ceremonies in Stockholm, Sweden.

Science Services, a non-profit organization dedicated to advancing the understanding and appreciation of science among people of all ages through publications and annual programs, founded the event in 1950. The organization describes ISEF as "the Olympics, the World Cup and the World Series of science competition." Although Intel and other corporate sponsors support most of the prizes awarded at the fair, a large number of non-profit scientific organizations and universities also participate by sponsoring their own awards in specific disciplines, including the APS, the American Chemical Society and the American Association of Physics Teachers (AAPT).

An active participant in the fair since 1985, the AAPT was joined this year for the first time by the APS. The two societies jointly sponsored three top prizes in physics, and three honorable mentions. In addition to the monetary awards, all winners received a one-year AAPT membership, a one-year APS student membership, a certificate from both AAPT and APS, as well as an AAPT coffee mug and APS book bag. The 1998 judges who volunteered to judge exhibits for the two societies were Andrew Cordell, Fort Worthy Country Day School; William Graham, Texas Christian University; Norman Schaeffer of Fort Worth, Texas; and Ransom Stephens of the University of Texas in Arlington.

The first place APS/AAPT award of $1,000 went to Charina Terranova Cameron of Horton District High School in Greenwich, Nova Scotia, Canada, for her development of a sonic bee detector. Second place, and an award of $400, went to 16-year-old Karen Mendelson of Worcester, MA, for her project entitled, "Noninvasive Optical Method for Measuring Hemoglobin in a Fingertip." A junior at Massachusetts Academy of Math and Sciences who plans to pursue a career in medicine, Mendelson developed a device that measures blood hemoglobin quickly and painlessly, eliminating the risk of infection currently associated with blood-handling. She believes the new device could be used in blood donation centers, rural- area physician offices, and third world countries.

The third place award of $300 went to Natalie Shaubie Lui of Saint Edward's School in Vero Beach, Florida, for her work on elucidating the mechanics of binary systems. Three students also received honorable mentions: Jeremiah Daniel Brown of Covenant Christian Academy in Huntsville, Alabama, for his project, "Single Element Anamorphic Lens for Correcting Laser Diodes"; Amul Dinesh Tevar of Macomb High School in Illinois, for his project, "Effect of Coachella Doping on an $YBa_2Cu_3O_{7-x}$ Superconductor;" and Justin Ryan Traunero of Riverside High School in Greeg, South Carolina, for his project, "Potassium Sodium Tartrate Crystals as Piezoelectric Resonators."

A 1997 recipient of a $40,000 Intel Young Scientist Scholarship for her project last year, Mendelson was one of the winners of this year's Glenn T. Seaborg Nobel Trip Award, along with Geoffrey Schmidt of Little Rock, Arkansas. Schmidt's project, entitled "3-D computer graphics Visible-Surface Determination Using Heirarchical Beam Tree Clipping," makes it possible for computer graphics imaging software to render larger, more complex 3-D models in less time than with current applications available on the market. Mendelson and Schmidt were also honored with $5,000 awards for having the highest score in their respective categories of physics and computer science, and Schmidt received a $40,000 Intel Young Scientist Scholarship. As the top all-around competitors at the event, the two students will attend the Nobel Prize ceremonies in Stockholm, Sweden in December.

For a complete list of the awards presented at the 1998 Intel International Science and Engineering Fair, go to http://www.intel.com/education/isef. For more information about the ISEF program itself, see the Science Services Web site at http://www.sciserv.org.

Photos courtesy of Intel Corporation

First place APS/AAPT award winner Charina Cameron of Nova Scotia assembles her "Sonic Bee Detector" for the 1998 Intel International Science and Engineering Fair.


Karen Mendelson, a returning Intel ISEF participant and second place APS/AAPT winner, won a Pinnacle Award for her project, "A Noninvasive Optical Method for Measuring Hemoglobin in a Fingertip." Last year, Karen went home with a $40,000 scholarship.

# APS Awards 1998-1999 Scholarships to Minority Undergrads

The APS has awarded Campaign for Physics-sponsored scholarships for the 1998-1999 academic year to 30 minority students who are majoring, or plan to major, in physics. Since its inception in 1980, the scholarship program has helped more than 225 minority students pursue physics degrees. Each scholarship consists of $2000, which may be renewed once, and which may be used for tuition, room and board.

"We are extremely proud of these scholars and look forward to watching them evolve into productive scientists, as well as outstanding models for the next generation of young minority scholars," said Alexandro DeLozanne, Chair of the APS Committee on Minorities.

Out of nearly 100 applicants, 20 new scholarships and 10 renewal applicants were selected. The new scholars for 1998-1999 are Justin Baca, Andrew Baughns, Jr., Eric Brown, Carl Chan-Aldebol, Kelle Cruz, Edwin Diaz, Sasha Dos Santos, Gary Dwork, Marieke Guillen-Treadway, Philip Jones, Lexyne McNealy, Tami Meverden, Ryan Morfin, Monica O'Neill, Javier Rivera, Marcus Rollins, Felipe Salinas, Jose Sandoval, Hasani Wooten, and Alicia Wright. Students whose scholarships were renewed for 1998-1999 are Danon Price (Emory University), Juan Nieto (Harvard University), Robert Villareal (Southwest Texas State University), Jason Morrow (Harvard University), Edward Little (California Institute of Technology), Elvis Dieguez (University of Miami), Taran Villoch (Ball State University), Seth Guinals-Kupperman (MIT), Joanne Byers (University of Chicago), and Michael Boss (Case Western University).

Several new scholars have participated in summer internships in governmental, industrial or academic research as a means of broadening their science education. For example, Justin Baca, a senior from Albuquerque, NM, with a strong interest in renewable energy sources, interned at Sandia National Laboratories, where he has assisted with the development of a proposal to construct a radiation sensor for landing and orbiting craft for the 2001 Mars mission. He also developed a concept for a radiation shield for a nuclear reactor on Mars, and is currently helping build an experiment to study the effects of neutron radiation on bacteria.

Gary Dwork, a senior from Smithtown, NY, is interning at Brookhaven National Laboratory this summer at the Alternating Gradient Synchrotron, working on alternative theories of gravity to duplicate dark matter. His interest was piqued by a school lecture on electromagnetism by BNL physicist Michael Blaskiewicz, who subsequently hired him as an intern. Chicago-based senior Marieke Guillen-Treadway spent two weeks in the University of Illinois, Chicago's Physics Department, conducting her own research project measuring the thickness of thin films grown on various substrates by graphing the reflectivity of laser light reflected from their surfaces. "I learned a great deal about optics and what it is really like to be engaged in research in a laboratory," she said of the experience.

Hasani Omar Wooten, who just completed his first year at Morehouse College, spent the summer of 1996 as an intern at the Walter Reed Army Medical Center, learning the basic methods of cell cultivation and laboratory procedure and studying the effects of cyclosporin on intracellular calcium. For the last two summers, he has been a research assistant at the University of Pittsburgh, where he learned to use Raman scattering techniques to image the complex chemical bonds of polymer fibers. St. Paul senior Marcus Rollins interned at 3M Company's Pharmaceuticals Division last summer. He is especially interested in the company's recent development of the green laser under the spinoff company Imation, and hopes to work for Imation full time following graduation from college.

By far the youngest new scholar is 15-year-old Carl Chan-Aldebol of Westford, MA, who was home-schooled for several years before being admitted to the prestigious Massachusetts Academy of Math and Science, a specialized school for high achieving math and science students. During his senior year, he was also enrolled in college courses at Worcester Polytechnic Institute, and spent the summer of 1995 as a participant in the Young Scholars Program at MIT's Haystack Observatory — the youngest student ever admitted to the program. His project while there involved an analysis of global warming, calculating the average annual increase in temperature as measured at 28 stations in different climate regions around the world. Chan-Aldebol plans to major in either astrophysics or quantum physics, because "I am fascinated by concepts that seem to contradict common sense, such as quantum interference and Einstein's theory of relativity."

Many scholars cited the writings of Stephen Hawking as an influence on their desire to study physics, but their interests range far beyond the purely scientific and academic. Rollins has five years of martial arts training in karate, kung-fu and aiki- jujutsu. Guillen-Treadway is an accomplished classical cellist who has received superior ratings in music competitions. An accomplished writer, Alicia Wright, who lives in Bethesda, MD, recently wrote a detective story about a young amateur detective who takes on the investigation of her brother's murder for a creative writing project. She is also a member of women's varsity basketball and track teams, despite being diagnosed with dermatomyositis, a disease involving inflammation of the muscles, her freshman year.

The APS scholarship program operates under the auspices of the APS Committee on Minorities, and is supported by funds allocated from the APS Campaign for Physics. Scholarships are awarded to African-American, Hispanic American or Native American students who are high school seniors, college freshmen, or sophomores. The Selection Committee especially encourages applications from students enrolled in institutions with historically or predominantly Black, Hispanic, or Native American enrollment. After being selected, each scholar is matched with an available scholarship, as well as an accomplished physicist to act as a mentor.

For applications for the 1999-2000 competition, please contact Arlene Modeste at modeste@aps.org.

# Announcements

## AWARD FOR OUTSTANDING DOCTORAL THESIS RESEARCH IN ATOMIC, MOLECULAR OR OPTICAL PHYSICS

Sponsored by members and friends of the APS Division of Atomic, Molecular, and Optical Physics.

***Purpose:*** To recognize doctoral thesis research of outstanding quality and achievement in atomic, molecular or optical physics, and to encourage effective written and oral presentation of research results.

***Nature:*** The award, which is given annually, consists of $1,000 and a certificate citing the contributions made by the recipient. The award will be presented at the APS Centennial Meeting in Atlanta, Georgia in March 1999. Nominees must submit an abstract for presentation at the meeting. The selection committee will choose finalists who will be required to present their work orally in a special invited paper session devoted solely to such presentations. The selection committee will choose the recipient from among the finalists based on both oral presentation and the written material described below. All finalists will receive a travel stipend of $500.

***Rules and Eligibility:*** Doctoral students at any university in the U.S. or abroad who passed their thesis defense for the Ph.D. in the disciplines of atomic, molecular or optical physics after October 30, 1996 are eligible for the award, except for those whose thesis advisors serve on the current selection committee. Any APS member may submit a nomination for this award.

The complete nomination package must be submitted **by October 30, 1998** to the chair of the selection committee: Prof. Hossein R Sadeghpour, Harvard-Smithsonian CFA, 60 Garden St, Cambridge MA 02138, Phone (617) 495-7022, Fax (617) 496-7668, Email: hsadeghpour@cfa.harvard.edu.

## *Now Appearing in RMP...*

***Reviews of Modern Physics* is a quarterly journal featuring review articles and colloquia on a wide range of topics in physics. Titles and brief descriptions of the articles in the October 1998 issue are provided below. George Bertsch, Editor.**

**Part I**
**Metal-insulator transitions**
Masatoshi Imada, Atsushi Fujimori, and Yoshinori Tokura review the theory and experimental phenomena of the metal-insulator transition, in which huge resistivity changes take place under the control of external parameters. The article describes the many outstanding examples among transition-metal materials.

**Part II**
**Solar fusion cross sections**
An important link in the puzzling deficit of solar neutrinos is the nuclear reaction network responsible for their production. Eric G. Adelberger and collaborators review the present knowledge of the reaction rates, to assess their reliability and point out areas for improvement.

**Proton-antiproton annihilation and meson spectroscopy with the Crystal Barrel**
Claude Amsler reviews the physics learned from $p\bar{p}$ annihilation, as studied at the LEAR facility in CERN. Particularly noteworthy is the new information provided on meson spectroscopy.

**Precision measurements with high-energy neutrino beams**
Janet M. Conrad, Michael H. Shaevitz, and Tim A. Bolton review high-energy neutrino scattering, a reaction that has provided unique information on parton distributions in the nucleon, as well as providing tests of perturbative quantum chromodynamics.

**Astrometry and geodesy with radio interferometry: experiments, models, results**
Ojars Sovers, John L. Fanselow, and Christopher Jacobs review radio interferometry with very long baseline detectors. The article emphasizes the challenges and achievements associated with the exquisite angular precision of the technique.

**Topological analysis of chaotic dynamical systems**
Robert Gilmore discusses the topological characteristics of the phase-space evolution in chaotic dynamical systems, applying topological invariants to the analysis of experimental data sets.

**Polymer solutions: A geometric introduction (colloquium)**
T. A. Witten describes dissolved polymers in geometric terms, showing how their fractal behavior affects their dynamics.

**Quasinormal-mode expansion for waves in open systems (colloquium)**
E. S. C. Ching et al. describe the quasinormal-mode approach to open systems, which allows one to carry over familiar methods that are used for closed systems.

If you would like to subscribe to the paper or online version of RMP, please contact the APS Membership Department at membership@aps.org or (301) 209-3280.

## *Physical Review* Editorial Staff Changes

### New Editorial Board Members Appointed in *Physical Review Letters*

The following individuals were recently appointed or reappointed as members of the Editorial Board of *Physical Review Letters*:

| | |
|---|---|
| Rolf Allenspach | IBM Research Laboratory, Zurich |
| Ennio Arimondo | Universita di Pisa |
| Naftali Auerbach | Tel-Aviv University |
| W. E. Bron | University of California, Irvine |
| M. Buttiker | Universite de Geneve |
| George Crabtree | Argonne National Laboratory |
| Uriel Frisch | Observatoire de la Cote d'Azur |
| Rolf Heuer | Centre Europeen de Recherches Nucleaires |
| Kwang-Je Kim | Argonne National Laboratory |
| Paul Langacker | University of Pennsylvania |
| Reinhard Schumacher | Carnegie-Mellon University |
| Stephen M. Shapiro | Brookhaven National Laboratory |
| David Stroud | Ohio State University |
| Christopher Thompson | University of North Carolina |
| M. Wakatani | Kyoto University |
| Andrew Zangwill | Georgia Institute of Technology |

### New Adjunct Associate Editor Appointed in *Physical Review Letters*

Martin Blume, Editor-in-Chief of The American Physical Society, and Jack Sandweiss, George Basbas, Stanley Brown, and Gene Wells, Editors of *Physical Review Letters*, announce the recent appointment of M. Muthukumar (University of Massachusetts, Amherst) as an Adjunct Associate Editor of *Physical Review Letters* with responsibility for papers in polymer and liquid crystal physics, colloids, and complex fluids.

### New Associate Editor Appointed in *Physical Review D*

Martin Blume, Editor-in-Chief of The American Physical Society, and Erick Weinberg and Dennis Nordstrom, Editors of *Physical Review D*, announce the recent appointment of Jonathan Bagger (Johns Hopkins University) as Associate Editor of *Physical Review D*.

## APS Membership Directory Errata

During production of the 1998-99 APS Membership Directory, there were some errors that went undetected until final copies were mailed to the membership. Below is a listing of APS Fellows who should have an (*) asterisk, noting fellowship, in their Directory listing. Corrections have been made and the Online Membership Directory is now accurate regarding fellowship. Our sincerest apologies for this oversight.

Additional corrections can be sent to membership@aps.org or given to a Membership Representative at 301-209-3280. Inquiries regarding the login and password for access to the Online Directory can be directed to the same.

Jeeva S Anandan
John N Bahcall
Nicolaas Bloembergen
Maria-Ester Brandan
John E Brolley Jr
Carter D Broyles
A D Buckingham
David B Chang
Brian Joseph Cantwell
Francisco H Claro
Thomas Michael Cormier
Ray R Crittenden
Janusz Dabrowski
Wilfried W Daehnick
J P Davidson
Sumner P Davis
J J de Swart
Bryce S DeWitt
Dirck L Dimock
Thomas L Estle
James E Felten
Peter Fong
Robert J Gould
Chris H Greene
H D Holmgren
Louis N Howard
George J Igo
Daniel E Kaplan
Mark B Ketchen
J G King
Nicholas A Krall
Richard H Kropschot
Behram Kursunoglu
Jerzy M Langer
Ralph A Logan
Bogdan C Maglich
Willem V R Malkus
Dudley T F Marple
Ronald L Martin
Leonard F Mattheiss
Richard Lee Morse
Robert F Mozley
Miguel Octavio
Murray Peshkin
Edward H Poindexter
Hernan C Praddaude
John M Richardson
Rufus H Ritchie
Allen B Robbins
Ivor Robinson
Frank Scherb
George Schmidt
Johanna M H Levelt Sengers
William A Sibley
Rolf M Sinclair
Charles V Stephenson
George Malcolm Stocks
Alfred C Switendick
Eric D Thompson
William C Turner
Richard Palmer Van Duyne
C J Waddington
Andrew W Weiss
Zdzislaw Wilhelmi
Xi-De Xie

## CAUGHT IN THE WEB

*Notable additions to the APS Web Server. The APS Web Server can be found at http://www.aps.org*

**APS News Online latest edition**

**APS Committees and Governance**
- POPA - Science, Technology, and Economic Growth Committee Report
- Directory of Congressional Fellows updated
- APS Contact List updated

**Units**
- Precision Measurement & Fundamental Constants TG homepage now available!
- DPB homepage now on APS Server
- Newsletters Posted: DAMOP, DCMP, DPF
- 4 Corners Section Election Info
- DAMOP Governance updated

**Meetings**
- Centennial Meeting Abstract and Registration
- DMP Focused Sessions for APS Centennial Meeting
- New York Section Fall Meeting
- DNP, DPP, and DFD Annual Meetings

centennial webpage
www.aps.org/centennial

# THE BACK PAGE

## Adventures of a Scientist in TV Land

*by Gerald F. Wheeler*

### *Would you like to have your own TV show?*

I had just finished my first television appearance — explaining energy concepts on a late-night talk show — when the show's producer asked me that question. As a traditional nuclear physicist, I normally would have said no immediately: any project this far from research must be avoided. However, at the time, I was spending more and more time in the classroom and less and less with accelerators. Although I harbored no secret hopes of being "discovered," the possibility of expanding the size of my classes from hundreds to thousands was too good to pass up. Without much thought about whether I was good enough, whether I had the time, or whether I could even think of topics for the show, I said, "Sure."

This was the beginning of rich experiences that taught me about television, and consequently about the differences between the worlds of television and science. These differences are important to anyone planning to exploit the TV medium to get science to the public.

Science is our collective interpretation of the entire universe. Our descriptions go forward and backward in time and span distances from the subnuclear to uncountable light years. Getting science on TV means presenting an unimaginably large variety of phenomena, many of which are beyond the human experience. Television offers options not found in the classroom. Its magic allows one to walk through 99 million miles of empty space, to travel at relativistic velocities, and to peer into the core of an atom. However, the power of television comes with some definite constraints. In the past two decades I've been involved in about a dozen science-on-television projects, three of which, in hindsight, turned out to have common messages for a scientist in TV land.

### *Sidewalk Science*

The first thing I learned has followed me through all subsequent productions: what a scientist calls interesting is worlds apart from what the general public calls interesting. I learned this when I developed my own Saturday afternoon science show for a local station, aimed at a young audience, called "Sidewalk Science". My first show was going to be on forces. I made a list of all the cute demonstrations I could think of; gathered my ropes, springs, bathroom scales and other paraphernalia; and made a rough draft of the script from my Physics 101 lecture notes. Then I arranged a meeting with the producer to put on the final touches before the taping session.

His first question was, "What's your tease?" A tease, I was told, is a short lead-in that entices the viewer to stay tuned for exciting things to come. After a little thought, I announced that I would stand in front of the camera and, in a very excited voice, say, "Today we are going to experiment with forces!" The producer dismissed my suggestion as boring and detailed his idea, which involved a gorilla playing tug-of-war with me. We had these battles each week. Each week I would tell him about the inherent beauty of physics and he would remind me that there would be no show if we didn't interest the viewers. In retrospect, I suppose he won. I relaxed and submitted to ideas that would make any self-respecting physicist cringe. We created some good teases, but I did draw the line at gorillas.

My premiere aired on a spring Saturday afternoon. I felt it was the best half-hour presentation on forces that I had ever done, and most of my colleagues conceded that they also liked it. But one frank critic, a non-scientist, said, "You did a good job, your demos were clear, but who cares about forces?" I was flabbergasted. Obviously, I thought, this critic just didn't appreciate the importance of forces in our understanding of nature. With each new show, my critic returned with the same question: "Who cares?" It took quite a while for me to realize that most people don't care, at least not in the way that scientists care about these staples of physics. Ask a ten-year- old, "Would you like to talk about forces?" The response will probably be, "No thanks, but may it always be with you."

In addition to misreading the public, I also misread the medium of television. I tried to change television to match science, rather than change my style to match television. Television moves fast, and success in front of the camera means moving at a high pace. Scientists are trained to be cautious, not to make quick, glib statements. When we write research articles, we carefully moderate our statements with qualifications. On television, where the audience is the general public, things are said more simply. But whenever we stray from the precise mathematical structure of physics, whenever we attempt to put mathematical ideas into words, we reproduce the phenomena with less fidelity. On television, scientists are translators, and a good translator must know both languages well.

Television's fast delivery style plus the need to translate science results in a tension between two imperatives. There's a complementary principle in modern physics that says there are certain pairs of quantities in the universe that seem to hold an investigator hostage. As he or she attempts to know one of the pair better, the other becomes less and less knowable. There's an analogous "complementary pair" in television called "Accuracy and Clarity." We can make something very clear as long as we don't worry too much about accuracy. On the other hand, if we go for total accuracy, we make it unclear in this medium, because television demands minimal explanation. As soon as one tries to get very accurate, clarity slips beyond the viewer's grasp.

Producing "Sidewalk Science" taught me that my classroom and research experience were a necessary but by no means sufficient background for getting science on television. I had to learn more about what interests the general public; I had to change my presentation; and I had to come to grips with the fact that I couldn't be as accurate as I would have liked.

### *3-2-1 Contact*

A few years later, I joined Children's Television Workshop in the production of "3-2-1 Contact," a series on science and technology for young viewers. This time, I was behind the camera in a consulting and development role. I was now part of a very large professional team with what seemed like limitless resources, and I assumed that my team experience in nuclear physics would be good training. I was wrong. On research teams, arguments are related to the substance of the data, but we are all talking from the same world view. In television, we were all talking different languages.

One team decision sent a crew to interview an engineer who used an infrared TV system to measure heat losses in buildings. At the end of the rough cut of the final piece, the interviewer turned to the engineer and said, "So, hot things reflect hot colors and cold things reflect cold colors." The engineer, probably nervous in front of the camera and completely unfamiliar with television's pace, incorrectly said, "Right." I immediately jumped up shouting, "Wrong!" The producer argued that I was being picky. It was just right for the piece since it concluded the segment and visually cued the ending.

The producer was missing the point of my argument. In science, one word, or one result, can make something totally wrong. This type of falsification, so central to the process of science, is nonexistent on television. But television people demand excellence in a way that's strange to scientists, and *I* was missing the point in *his* argument. In deciding what is right or wrong in television, there is more debate, there are more valid opinions, and there is more intuition than is used in science. In television, it's the people; in science, it's the data. The executive producer understood both languages, and she changed the piece so that an off-camera narrator gave the correct explanation, leaving the visual tone nearly untouched.

While my science colleagues didn't quibble with me about the correctness of the science in "3-2-1 Contact," some wondered why we didn't do more. Why, for example, didn't we explicitly talk about Newton's Laws of Motion? We didn't because the show had to capture the attention of youngsters and hold it for the entire episode. It was inappropriate to do the same things one would do in a classroom. I'm sure we could have created situation comedy about action/reaction or centrifugal forces, but we didn't, because at this level, children aren't even aware of the idea of forces as they are conceptualized in the physics world view. By looking at the motion of a roller coaster or a Frisbee, by talking about the actions of a football player or a figure skater, "3-2-1 Contact" provided the experiences that, while seeming casual, were actually carefully filled with words like "friction," "forces," and "gravity."

I left the premier season of Children's Television Workshop with a new sense of the importance of teams, of the value of different kinds of experts, and of the need to get those experts communicating. The scientist has to have a limited veto power on a science show, but he or she should not have the freedom to control the whole production. "3-2-1 Contact" succeeded in creating interesting and scientifically meaningful experiences for its viewers. This happened by carefully defining the boundary conditions of expertise.

### *Skywatch*

My involvement with a production at a university TV center grew from a desire to capitalize on the public's general interest in astronomy. I worked with a faculty member from the film and television department to produce 12 short programs, called "Skywatch," that have been inserted into existing regional programs. This series had me highlighting the upcoming constellations. Since the constellations are relatively constant, this particular series has the unique feature of having reruns that will remain current years later.

Gerald F. Wheeler

The most important insight I gained from "Skywatch" is related to the role that television can play in raising the scientific literacy of the public. My relationship with television had been rocky. After starting with a false hope of its power to educate the public, I recoiled to a feeling of powerlessness. I began to believe that commercial television couldn't be much help to science communicators. I lamented that the gap between scientists and the general public was too big for television to span: good television was just inherently too superficial.

The "Skywatch" experience helped me realize that television can be part of a larger conduit for reaching the public. I became convinced that increasing the scientific literacy of my audience is not a continuous process, but rather, a layered one. Television naturally lends itself as a springboard to other layers, or conduits, which strengthen, deepen and expand the superficial layer initially presented.

Some of the developments in telecommunications — videotext, interactive cable television, and low-power broadcasting, to name a few — also hold exciting possibilities for new experiments. The number of "Skywatch" viewers is too small for a national broadcast project, but it is manageable as a university or small community project. Whichever way science-on-television projects evolve, the payoff in terms of the numbers of viewers is mind-boggling to scientists. "Skywatch" and "Sidewalk Science" had "classes" numbering in the thousands, while millions of children around the world see "3-2-1 Contact." These numbers alone make an investment of time, money and effort in science on television a wise one.

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