Electron Beam Lithography Creates World’s Tiniest Trophy

The “world’s smallest trophy” is a silicon chip etched with a design consisting of nested football fields, with a helmet in the center of each field. The largest field, about 12 mm long, is visible with the naked eye; within that lies a 120-micrometer-long football field that is visible with an ordinary optical microscope; and within that is a 2-micrometer-long football field that requires an electron microscope to view. The smallest football fields, the yard lines are about 60 nanometers wide, 1000 times thinner than a human hair. The chip itself is about the size of a penny.

The trophy was designed and produced by Phil Waggoner, a graduate student in Harold Craighead’s research group at Cornell University. The group is known for producing the nanoguitar in 1997. The football field design and the words “Physics Central Nano Bowl Champion 2008” were etched onto a silicon nitride film that had been deposited on a silicon wafer. The largest football field was created using standard photolithography, in which a light beam wears away a coating called photoresist in the pattern desired. The exposed areas are then etched out of the silicon chip, and the remaining photoresist is washed away. The smaller two football fields were patterned using electron beam lithography, which is similar to photolithography, but uses a beam of tightly focused electrons instead of light to create the pattern.

“Toshiba’s incredible efforts to help increase diversity in physics and expand education on the physics education. we were very happy with the contest results and look forward to future opportunities to continue the program,” said Waggoner.

While the photolithography process is standard and has been optimized the exposure dose given to the electron-beam photoresist in defining the smallest field pattern,” said Waggoner.

Workshop Will Demystify Running for Public Office

A workshop to be held in Washington on May 10 is designed to help other physicists do what Mike Fortner has done—run successfully for local office. Fortner, who has a physics PhD from Brandeis, does research at Fermilab and is on the faculty at Northern Illinois University. He now represents the 95th district in the Illinois General Assembly, but he started as a Historical Preservation Commissioner, and then served on his local school board before being elected as alderman and then mayor of West Chicago, moving on from there to the Illinois state legislature.

The day-long May workshop will focus on the nuts and bolts of running a local campaign, and is designed for scientists and engineers who are motivated by a desire for public service, possibly because their discipline plays such a crucial role in many policy questions or because it is important to maintain and improve science education standards.

“The workshop will demystify the political process so we can get more scientists and engineers involved in positions that make a difference from school board to Congress,” said SEA. “The workshop will be offered to tenants and homeowners interested in learning about running for local office.”

On February 23, about 80 officers of APS Division, Topical Groups, Forums and Sections gathered at APS headquarters in College Park for the annual Unit Convocation, to discuss important issues like grassroots lobbying by APS members, and encouraging diversity in physics. They also gained information from APS staff on the services that are available to help units with their activities. Here APS Director of Finance and Controller Michael Stephen (standing) goes over the financial points of unit finances with William Heidbrink of DPP (left) and Christopher Lee, who is a unit leader for the National High School Science Olympiads. APS will review new experimental methods for the indirect detection of dark matter, including space-based satellites, ground-based gamma-ray telescopes, and neutrino telescopes. Leslie Rosenberg of the University of Washington will discuss the possible role of axions as dark matter. (Sessions B.5 and M2)

April Meeting Features Fundamental Science and Societal Issues

The April Meeting will feature talks on a wide variety of science and societal issues, including the evidence for weakly interacting massive particles (WIMPs) as candidates for dark matter, as well as current experimental techniques used in detecting dark matter directly, including the latest results from the Cryogenic Dark Matter Search in the Soudan Mine in Minnesota. Tom Shutt of Case University will describe new detectors based on liquid noble elements and next-generation experiments, such as the proposed DUSEL laboratory in South Dakota. Elliott Bloom (SLAC/Stanford) will review new experimental methods for the indirect detection of dark matter, including space-based satellites, ground-based gamma-ray telescopes, and neutrino telescopes. Leslie Rosenberg of the University of Washington will discuss the possible role of axions as dark matter. (Sessions B.5 and M2)

Space Junk. The space age has brought many benefits, but also new problems, including the increasing amount of space debris: defunct satellites, discarded equipment, satellite fragments, and the remains of rocket stages. Even small pieces can damage or destroy operational satellites should they collide. There are currently 860 active satellites in orbit but...
April 1, 1948: The alpha beta gamma paper explains the origin of the elements

On April 1, 1948, a paper was published in the journal Physical Review by Alpher, Bethe, and Gamow, entitled “The Origin of Chemical Elements.” The authors’ names were a bit of a joke (Hans Bethe hadn’t really thought it would work), but the paper contains a significant scientific discovery. Ralph Alpher and George Gamow explained how the extreme conditions shortly after the big bang could explain the observed abundances of the most common elements in the universe.

Physicist George Gamow was born in Odessa (now in Ukraine), in 1904. He grew discouraged with the Soviet Union, and after one failed attempt, he fled and immigrated to the United States in 1934. He took a position at George Washington University in Washington, DC.

In the early 1940s, Gamow was working on explaining the observed abundances of elements. It had already been shown that in the cores of stars, hydrogen nuclei fuse to form helium. But this process happens too slowly to account for the observed abundance of helium in the universe (about 27%). For every 10 atoms of hydrogen, it didn’t account for the existence of elements much heavier than helium. Gamow wondered if the conditions of the early universe could have produced the observed helium and other elements.

The research needed knowledge of nuclear physics, but most nuclear physicists in the US at the time had been recruited to the Manhattan project, so Gamow was essentially alone in working on the problem of nucleosynthesis.

He started making calculations, beginning by looking at the density of matter in the universe and essentially running the expansion of the universe backwards to get an estimate of what the early universe might have looked like. He then began trying to figure out the probability of nucleosynthesis in the early universe. As the universe expanded, the hot compressed neutrons would decay into a mixture of protons and neutrons. Then the protons would capture a neutron to form a deuteron.

Further neutron capture would build up heavier and heavier atomic nuclei. The process would continue as the universe expanded until it was too cool for further reactions to take place.

Alpher’s calculations of nuclear processes used some of the first electronic digital computers, which had been developed during World War II. He was also able to use new data on nuclear reaction cross sections that had become available after the war ended. The calculations agreed with the known abundance of helium. Pleased with their result, Alpher and Gamow submitted a brief press release to the journal Physical Review, titled “The Origin of Chemical Elements.” They celebrated with a bottle of liqueur, which Gamow relabeled “thymol.

Gamow, who was known for his sense of humor, saw that the paper they had submitted to Phys. Rev. was to appear on April 1, 1948. He added the name “Alpher Bethe and Gamow” to the list of authors, who were known for work on nuclear reactions in stars, among other things, to the paper, so the authors would be Alpher, Bethe, and Gamow, a pun on the first three letters of the Greek alphabet.

Alpher, as a PhD student struggling to make a name for himself, objected to the addition, feigning that the name of the famous Bethe would overshadow his own, reducing the credit he received for his crucial contribution to an important piece of research. But Gamow published it with Bethe’s name, despite Alpher’s objections.

The paper, still known as the alpha-beta-gamma paper, not only explained the origin of the most abundant element in the universe, but also provided the first support for the big bang model since Hubble’s discovery in 1929 that distant galaxies are redshifted in proportion to their distance from us.

It later became clear that most elements actually cannot be produced by the successive neutron capture process Alpher and Gamow originally proposed, as there is not enough neutrons in 10 maccros. Another process was needed to bridge the gap to create heavier elements. The Alpher-Bethe-Gamow theory does, however, correctly explains the abundances of hydrogen and helium, which together account for more than 99 percent of the baryonic matter in the universe.

Following the publication, Alpher still had to complete his PhD. Scientists and the press heard about the Alpher-Bethe-Gamow result, and 300 people crowd-ded in to hear Alpher’s thesis defense at George Washing ton University in the spring of 1948. The Washington Post, hearing Alpher’s statement that the creation of hydrogen and helium in the hot big bang took just 300 seconds, reported that the “World began in Five Minutes.”

Alpher was awarded his PhD, but his 15 minutes of fame soon faded. After finishing his PhD, Alpher and Robert Oppenheimer (the latter’s efforts to get him to change his name to Delton) continued work on the early universe. That research led them to predict the cosmic microwave background, but their prediction was ignored, and they were not given credit when the CMB was discovered in 1964. Alpher later became a researcher at General Electric. Gamow went on to study other topics as well, dabbling in the chemistry of DNA. Alpher died in 2007, shortly after receiving the National Medal of Science.
Free E-Journal Access For Minority-Serving Institutions

In a project initiated by the National Society of Black Physicists (NSBP), the National Society of Hispanic Physicists (NSHP), and the Southeastern Universities Research Association (SURA), APS and the American Institute of Physics (AIP) have offered to provide a collection of both publishers. Some get all, some get none, but none of the institutions of the currently that subscribe to some AIP or APS journals will need to maintain those subscriptions, but with the trial they will gain online access to the entire collection of both publishers. These institutions can then acquire this entire collection of physics journals at very low prices in 2009.

“The journals initiative with AIP and APS has planted a seed that we hope will grow,” says Helen Hafemeister, Van Deusen Director, executive officer of NSHP, and SURA Fellow. AIP and APS are accepting applications for the 2008 free trial from HBCUs and IPI institutions, and the collection of both publishers.

Workshop Emphasizes Systems Approach to Sustainable Energy

In 2007, the state passed legislation to cut down on energy consumed by so-called “vampire appliances” chargers for cell phones, PDAs, and other devices that consume energy even when the devices aren’t being charged. California is also beginning to phase out commercial use of incandescent lights. “We can’t just look at developing renewable energy sources,” says physicist David Hafemeister (Cal Poly), one of the conference organizers, has given his full attention to building efficiency, a great deal of thought. He has made detailed calculations of his home’s heating needs, taken into account such variables as square footage, ceiling height, inevitable thermal losses, local climate, double-paned windows, air ducts, winter fog, and body heat given off by inhabitants. He also considered a “free temperature” effect, in which it is 3 degrees warmer if the house is outside. Based on Hafemeister’s calculations, this means that for furnace heating is needed to maintain an indoor temp of 68 F until the outside temperature hits 65 F.

All those factors combine to determine your home’s total energy usage. Because of this, small incremental improvements in energy efficiency in a building “system” can add up significantly over time, according to David Harvey of the University of Toronto, who spent years developing climate change models before turning his attention to building efficiencies. In developed countries, building and appliance standards have reduced electricity use compared to the US as a whole. This was accomplished in part through improved utility efficiencies, and high-rise buildings and appliance standards.

Much progress has been made on maximizing the efficiency of individual energy-related greenhouse gas emissions.

APS Joins Call for Science Debate in 2008

Will they or won’t they? As APS News goes to press, the three major remaining candidates for US President are weighing an invitation to participate in a “Science Debate,” slated for April 18 at the Franklin Institute in Philadelphia. The debate will take place at least one of them, which would be a bargain for scientific information in political decision making, and the vital role scientific innovation plays in spurring economic growth and competitiveness, we call for a public debate in which the US press and the public can hear from our nation’s experts on science and technology, Nobel Prize winner, university presidents, and leaders of the scientific community. APS joined the call when the Executive Board voted to endorse the debate at its February meeting.

“This debate is important for two reasons,” says astrophysicist Lawrence Krauss, “to explore important policy issues and allow voters a better chance to make an informed decision about the candidates.” Krauss is cautiously optimistic, saying “I now give the likelihood of such a debate in Philadelphia a fighting chance.”

The Night is Young

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Conference Connects Physics Teacher Educators

By Gabriel Popkin

The fourth annual Physics Teacher Education Coalition (PTEC) Conference took place Austin, Texas, on February 29th and March 1st. This conference provides a once-a-year opportunity for physics educators to connect with a community of people who share a commitment to improving physics and physical science teacher education. PTEC is a project of APS, AIP, and AAPT to organize a coalition of universities, colleges, and national labs that support physics department engagement in teacher education. Over 100 institutions have joined PTEC.

For the second straight year, the conference attracted a capacity crowd of around 120 physics and education faculty, administrators, teachers, and students, who soaked up two packed days of one-and-a-half hour workshops led by national experts on master teachers, assessment and evaluation, curriculum and teaching methods, and institutional partnerships. Among the best-attended sessions were the workshop on interactive pedagogy, “Are you really teaching if no one is learning?” conducted by Ed Prather of the University of Arizona, and the workshop on “Student-Centered Activities for Large Enrollment Undergraduate Physics (SC-AU LP),” led by Bob Beichner of North Carolina State. Also popular was a full-day workshop at the University of Delaware, led by Karen Ziemba of the best-known and most successful science teacher preparation programs, which is now being replicated at universities across the country through grants from the National Math and Science Initiative (NMSI).

Along with workshops and plenary sessions, the conference provided an opportunity for members of the physics education community to build bridges with colleagues in other disciplines and with university administrators. Representatives from the National Association of State Universities and Land-Grant Colleges, the American Chemical Society, and Math for America attended the conference and organized several conversations and plenary sessions for future multi-disciplinary initiatives in science and math teacher education.

Conference attendees were overwhelmingly positive about the program, commenting that the meeting’s compact size and intense focus created a particularly rich environment for teaching, learning, and networking. Valerie O’Hearn, a University of Colorado Colorado Professor, remarked on the collegial atmosphere. "There were no ‘knowers’, only learners. The problem of preparing qualified physics teachers is so hard that everyone is looking for someone who knows how to do it.”

The 2009 PTEC Conference, with the theme “Institutional Change,” will take place in Pittsburgh on March 13th and 14th, preceding the APS March Meeting. Another topical workshop similar to last fall’s Learning Assistant workshop (reported in the February APS News) is also being planned, and the project will continue to conference continued on page 7
What Would a Physicist Do?

Rep. Ehlers (February APS News, Back Page) has shared his thoughts on having a physicist (or other scientist) in the Oval Office. While I certainly would not argue with his points on education, innovation and analytical thinking, I otherwise find his discussion narrow and parochial.

As a physicist who has a son in his FOURTH tour of duty in Iraq, I would like to make a few comments.

What would a physicist do about the Iraq War? We know Rep. Ehlers other reasons, like running against Democratic candidates.

Number of Physicists in Congress Jumps by Fifty Percent

Federal Fermilab physicist Bill Foster, a Democrat, has proudly announced that the number of physicists in Congress has jumped by fifty percent. APS members will be able to read more about this in the July issue of APS News.

On its back page, the New York Times magazine runs a weekly caption contest. Ever on the lookout for good ideas, and not ashamed to copy them slavishly, APS News provides, as part of its own caption contest, the major difference being that we want the cartoon - caption not to be funny, but also to have something to do with physics. APS News cartoonist Paul Dlugokencky has drawn the cartoon at right, and has deliberately omitted the caption. For all we know, he may have no idea what the caption should be. But it looks like there's a physics joke in there somewhere.

Readers of APS News are invited to submit suggested captions by e-mail to captions@aps.org. The deadline for submissions is May 31. The three best captions, as decided by APS News editors, will appear in the July issue of APS News, and APS members will be able to vote for their favorite online at APS News web site, www.aps.org/publications/apsnews. The winner will be announced in the October issue, and will receive a print of the cartoon signed by the artist, as well as a copy of the book “Physics in the 20th Century” and an APS tee shirt. The full contest rules appear online on the APS News web site.

Physicists Feel the Pain, Too

By Michael S. Lubell, APS Director of Public Affairs

Get me some Ambien or Lunesta! I'm exhausted, but the racket won't stop. No, I don't mean my upstairs neighbor, who is aconsiderable, hard-working member of Congress-definitely not the party type. It's the endless presidential campaign, which on the Democratic side promises to continue in primary mode until the September convention, as I suggested almost a year ago.

If the 24-hour news channels, the endless campaign provides them with a raison d'être. For weary me, it's becoming a mind-numbing din. Barack Obama and John McCain inspired tens of thousands of young people to take voting seriously. And the idea of having a new occupant of the White House who is a woman, a black, at least on his father's side-or a septuagenarian is certainly going to re- present a substantial change from the status quo.

But what have we really learned about the potential new occupant over the last year, other than their individual claims to be agents of change? Hillary Clinton wants to provide healthcare for the 45 million Americans who currently go without, and she wants to give our veterans their due when they come home. John McCain wants to clean up the swamp of corruption, eliminate torture and keep American troops in Iraq for a century. And Barack Obama wants to do away with partisanship, bring our troops home, and fill us with hope.

If you go to the campaign websites, you find a lot more, but since the candidates rarely talk about the issues, we're pretty much left with the roar of emotion generators. But for good reason: political campaigns are all about arousing feelings, as I noted a few months ago.

Still, I'm getting tired of hav- ing my passions jacked. I'm tired of watching Obama play cheerleader to the chant of "Yes, we can!" I'm tired of watching Clinton clap her hands in time to "You will!" And when John McCain starts every sentence with "My friends," I'm wondering why he doesn't think some people out there might be his enemies.

There are plenty of problems fac- ing our country that demand atten- tion: the crumbling infrastructure, the sinking dollar, the liquidity crisis, the mortgage implosion, climate change, energy security, the national debt, sagging innovation, lagging competitiveness, Medicare shortfalls, a national healthcare crisis, etc...

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New Ultrasonic Medical Applications Based on Acoustically-Induced Microbubbles

Researchers continue to develop innovative new medical technologies and applications, and ultrasonics is no exception. In particular, the use of microbubbles specifically, those in the ultrasonic region. First introduced in 1942 by the American physicist Edward N. doppler, ultrasonic imaging remains one of the most reliable, safe, and simple imaging techniques in medicine. Yet today, ultrasonics is being applied in so many different ways more than basic medical imaging.

At greater intensities, focused ultrasonic pulses are now used to break up or to enhance the delivery of therapeutic agents. This can be accomplished by introducing microbubbles or smaller particulates into the bloodstream and then focusing ultrasound waves on the desired target. As the ultrasound waves interact with the microbubbles, the bubbles oscillate, causing a force to be exerted on the surrounding tissues. The energy released by the oscillating bubbles can disrupt or destroy the targeted tissue or cell.

Several other prizes were awarded at the American Physics Society's 2007 Mini-sciplars competition. Xiao Wang of the University of Maryland received $1000 dollars cash. He has gotten some people interested, so he thinks their video might be good. Physics aren't part of the high school curriculum, so it is easier to distinguish between basic and advanced placement physics students.

Alizad and his colleagues have developed a novel non-invasive imaging technique called vibro-acoustography (VA) that is especially sensitive to tissue stiffness, and also produces high resolution and high contrast images. The technique employs ultrasound to vibrate thyroid tissue at low frequencies, and the resulting vibrations are detected by a highly sensitive microphone.

The research is still in the early stages, but Everbach believes the technique could be applied in personal-ized wash sterilization systems, and to fight hospital-acquired infections more effectively.

The biggest and most significant part of the research is that microbubbles can be used for other things besides drug delivery, to rupture the brain. The effect on brain tissue is under study, but the technique is still in the early stages. The patient is dead,“ Lewis says. He likens it to how dentists will warm up the tooth to get a better idea of what’s going on. The research is still in the early stages, but Everbach believes the technique could be applied in personalized wash sterilization systems, and to fight hospital-acquired infections more effectively.

Trophy continued on page 6

Physics aren’t part of the high school curriculum, and several other prizes were awarded.

The award for “Most heart-warming” went to “Physics: An Advanced Placement Test Prep” by the UCCLA Society of Physics Students. The award for “Most inspirational” went to “Angelo State Physics: From Classroom to Classroom” by the Angelo State SAPS and the Rams Football Team. The award for “Most Creative” went to “The Fysics of Phoiball” by a group of advanced placement physics students at Greendale High School in Greendale, WI.

A People’s Choice Award went to “Theoretical Football” by The College of Wooster Society of Physics Students. These winners each received a trophy full of Victoria’s Secret merchandise. The videos can be viewed at: http://www.phys ticscentral.com/nanobowl/index.html

Angelo State Physics professor Tony Sauney said in an email that the video contest inspired him and his students to do better with his football players, but it grew well beyond my expectations. So, I consider the project an overwhelming success. It brought together the community of learners on many levels.”

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Trophy continued on page 6

Physics aren’t part of the high school curriculum, and several other prizes were awarded.

The award for “Most heart-warming” went to “Physics: An Advanced Placement Test Prep” by the UCCLA Society of Physics Students. The award for “Most inspirational” went to “Angelo State Physics: From Classroom to Classroom” by the Angelo State SAPS and the Rams Football Team. The award for “Most Creative” went to “The Fysics of Phoiball” by a group of advanced placement physics students at Greendale High School in Greendale, WI.

A People’s Choice Award went to “Theoretical Football” by The College of Wooster Society of Physics Students. These winners each received a trophy full of Victoria’s Secret merchandise. The videos can be viewed at: http://www.physicscenter.com/nanobowl/index.html

Angelo State Physics professor Tony Sauney said in an email that the video contest inspired him and his students to do better with his football players, but it grew well beyond my expectations. So, I consider the project an overwhelming success. It brought together the community of learners on many levels.”

The research is still in the early stages, but Everbach believes the technique could be applied in personalized wash sterilization systems, and to fight hospital-acquired infections more effectively.
more than half a million pieces of or-
biting debris larger than one centime-
ter in size. David Wright of the Un-
ion of Concerned Scientists will discus-
s the practical implications of the grow-
th of space debris and reduce the threat
to orbiting satellites. Carolyn Reilly of
RAND Corporation will demon-
strate how possible systems-level savings
could result in systems-level savings
to data, mostly gas giants composed
dimensionally of dense fluid hydrogen
and helium at pressures millions of
drives great leap forward in our under-
at and at very high temperatures. Bur-
kadador Mictec of UC Berkeley will
discuss the challenges of character-
ing such extreme systems, and some
recently successful with space ex-
pirations. Diana Valencia of Har-
radigan School University will discuss on-
going investigations into the composi-
tion and structure of Super-Earths.
LLNL’s Jon Eggert will talk about repro-
ducing planetary cores in the labora-
tory. (H1E)

The Most Extreme Environ-
mientos in the Universe. There are
looks very different when viewed in
gamma rays, with remarkable
features and large variations on all
scales. A few large gamma-ray
bubbles are emitted from the most
environments, such as supervern-
acular supernova remnants and neutron stars.
In the next few months, the Gamma-
ray Large Area Space Telescope (GLAST)
will be launched into or-
bit, where it will survey the sky from
outside Earth’s atmosphere, which
absorbs gamma rays. With its large
at key all key capabilities, the novel
voyager telescope will allow astrophys-
ics to observe this almost completely
uncolored part of the electromagnetic
spectrum over the entire sky ev-
evitably. Steven J. (Mainz University) will
discuss the GLAST mission and its scheduled May 16
lauch. (M5E)

High Energy Gamma Rays
Ever Detected. In the mountains
just above Los Alamos, NM lies the
Milagro Gamma-Ray Observatory, a
large manmade pond filled with
water and surrounded by photodetectors.
Whenever gamma rays hit Earth’s
atmosphere, they create showers of
cosmic rays that hit the pool and become
visible blue light. As Earth rotates on its axle, the obser-
atory continually turns and maps
out high-energy sources in northern
and southern hemispheres. Jordana
(University of Maryland) will describe
how the observatory recently identified
a source of the highest-energy gamma
rays ever seen. At the April Meeting,
he will describe the Milagro results
along with observations from the HESS telescope, a powerful gamma-ray
detector in the southern African
country of Namibia. Together these
observatories mapped and measured
this significant source, which as yet
has not been identified. (M3)

High Energy Physics. Dozens
of sessions report on the latest news
from experiments placed far underground
ning investigations into the compo-
sition and structure of Super-Earths.
LLNL’s Jon Eggert will talk about repro-
ducing planetary cores in the labora-
tory. (H1E)

Hodapp says, “At a time when policy
makers are requiring more students to
understaffed classrooms, it is critical
that we take physics in our nation’s already
achieved efficiencies and made it pos-
sible for this technology employed more broadly than in
the niche applications it currently occu-
pies, according to Steve DenBaars of the University of California, Santa
Barbara. Years of research have im-
proved efficiencies and made it pos-
sible to build white LEDs with the
same broadband spectrum as con-
ventional incandescent bulbs. Current-
ly, researchers are achieving 152 lumens per watt
with efficiencies between 65%
and 85%; by 2012, they should
reach 280 lumens per watt with 90% efficiencies.

Marvin Harvey, who is seeking a
job that will allow him to continue
working on this research. Harvey believes
that this research could result in
systems-level savings many times higher than what
he has achieved if he simply continues
to address just the individual compo-
nents. For example, standard heat pump
technology is designed to transfer
heat from one place to another. However,
there are some fundamental physical limits
to how efficient the heat pump can
be, as French physicist Sadri Carnot
proved in the 18th century. But Har-
vay found that by cutting the flow
rate through ducts or pipes in half, he

M. Hildred Blewett Scholarship
for Women Physicists

This scholarship has been established to enable women to return to physics research careers after having had to interrupt those careers for family reasons. The scholarship consists of an award of up to $10,000 per year, which may be renewed for up to two additional years, contingent upon receipt of the scholarship for at least one additional year, and availability of funding. Applicants are due June 2, 2008. Award of the announcement is expected to be made by August 1, 2008.

Details and on-line application can be found at "http://www.aps.org/programs/women/scholarships/blewett/index.cfm"

Contact: Sue Oettle in the APS office at blewett@aps.org

In the March APS News Prizes and Awards Insert, the institutional affiliation of one of the recipients of the Dissertation Award in Nuclear Physics was incorrectly given. The correct affiliation of Deepshikha Choudhury is Ohio University.

CONFERENCE continued from page 3

Gravity is perhaps the most familiar
force, but it’s also one of the weakest,
which makes it difficult to test. Ses-
ion T10 features a number of talks
focusing on new ways to test the lim-
its of gravity. Quentin Bailey (Embry-
-Rayleigh Aeronautical University)
looks at the ways that measurements
of the Earth-moon distance could be
to check gravity at long ranges,
since recent proposals of modi-
fications to the Standard Model of
physics. Josh Long (Indiana Univer-
sity) describes tests at the other end
of the size scale with flat, vibrating
surfaces that check on gravity at a
range of 50 millionths of a meter.
Nicolas Vayas (Penn State) discuss-
es the possibility that gravitational
probes could be used to check string
theory and quantum gravity, which
is important because researchers have
yet to find another feasible way to
test the theories. (Session T10)

Mergers and Acquisitions.
Physicists believe that mergers
between two black holes could be
key source of gravitational waves
strong enough to be detected by both
ground-based (LIGO) and space-
based (LISA) detectors, depending
on their masses. Michael Coleman
Miller of the University of Maryland
and Scott Hughes of MIT will dis-

Nuclear forensics is the technical means by which nuclear materials, whether interrupted intact or retrieved from post-explosion debris, are characterized (as to composition, physical condition, age, and origin) to aid in rapid and accurate identification (as to provenance, industrial history and implications for nuclear device design). It is a relatively young subject; the field has a long history. During the first fifty years of the nuclear era, nuclear forensics techniques were developed and used to determine the characteristics of nuclear explosions. The basic techniques (such as yield, material, design details) of nuclear explosions carried out by the US and by other countries. That application can still come into play if a nuclear explosion is detonated or a recovered nuclear device is interrogated (as to provenance, industrial history and implications for nuclear device design). The focus of the field was the detection and identification of nuclear materials present in the environment. Those have not been recovered. Among the material intercepted, ported incidents of lost or stolen radioactive materials, there have been 1340 reported cases. By the US and by other countries. That application was diagnosing an explosion from forensics techniques to help attribute either intercepted materials or an actual explosion to its originator. Those differences place different emphasis on the required technological analysis. In general, detection and identification of nuclear materials and sample archives from various countries much more important than was the case when the principal application was diagnosing an explosion from a known nuclear device. According to International Atomic Energy Agency (IAEA) data, there have been 1340 reported cases of lost or stolen radioactive materials intercepted between 1993 and 2007. Most of those have not been recovered. Among the material intercepted, a number of such identifications have been made of uranium (HEU) or plutonium, in amounts ranging from grams to hundreds of grams as shown in the picture above, also from IAEA data. There are approximately 35-50 uranium elements in Karlsruhe, Germany, for this example. The pocket as he bicycled away from an allied detachment nearing his laboratory. with near certainty to the 1940s, perhaps falling from Werner Heisenberg's laboratory. There is evidence in some approximation of what the real situation is. Structured to involve senior decision-makers differently. The only way to assure that those decisions are correct, which has not happened. In the case of a nuclear detonation in a city, nevertheless much can be done to make sure that top-level leadership is prepared to promulgate realistic decisions in the event of an actual attack. Military action. Exercises should be structured so as to illustrate the strengths and limitations of nuclear forensics as well as to test capability and coordination in life of both the time-urgent needs of the situation and also the ability to communicate to the public and manage expectations. Review and Evaluation Groups: Neither the ongoing program nor the exercises are made full use of from the standpoint of incorporating their lessons into the culture of the relevant organizations. In addition to the work of the working group's panel to advise top level leadership of the meaning of developing exercises in event of an emergency. The US government should establish two groups, one to systematically review, evaluate and keep records of both the results of exercises and the recommendations advised above; the other to advise the US government in real time on the results of nuclear forensics and what they mean in the event of an actual nuclear explosion. The second group would provide technical information in case of a nuclear emergency. Its function would be somewhat similar to that of the Cold War Bethe Panel, which advised the US government as to the physical results of foreign nuclear tests and the implication of those results. Both groups should have international participation, as appropriate. No one knows if a terrorist group is likely to set off a nuclear explosion. We know that there is a black market in nuclear weapons materials. We know that there are huge quantities of these materials stored in the United States, Russia, Pakistan and other countries, and we know that the security in many countries is not as good as it could be. We know that a small crew that includes some specialists and has some protection would be able to steal a primitive nuclear weapon from stolen or otherwise acquired materials, and we know that the weapon could be transmitted in a small truck. A terrorist group would be capable to as many obstacles—gaps, borders, crossing countries, intelligence operations from several countries, technical countermeasures, but a nuclear detonation is possible. We believe the recommendations made above would improve US ability to deal with it. A strong international program aimed at strengthening forensics capabilities may also help dissuade a state from cooperation with terrorist groups and encourage it to improve the security of the nuclear material it owns. Michael May was the Chair of the APS/AAS working group on nuclear forensics. He is Professor Emeritus at the University of California, Los Angeles, and a Fellow with the Center for International Security and Cooperation and the Freeman-Spogli Institute for International Studies at Stanford University. He is Director Emeritus of the Lawrence Livermore National Laboratory.

By Michael May

Nuclear Forensics: Reported weapons-useable nuclear material seizures

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APS News welcomes and encourages letters and submissions from its members responding to these and other issues. Responses may be sent to: letters@aps.org