APS NEWS

A PUBLICATION OF THE AMERICAN PHYSICAL SOCIETY • WWW.APS.ORG/PUBLICATIONS/APSNEWS

May 2009
Volume 18, No. 5
www.aps.org/publications/apsnews

Mass Appeal Cuts Both Ways
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March Meeting Highlights Energy Storage, Generation

By Gabriel Popkin

Energy was a hot topic at the 2009 APS March Meeting. Eleven sessions had titles explicitly addressing energy generation or storage, compared to zero at least year's meeting, and two at the 2007 meeting. An additional five sessions at this year's meeting were devoted to hydrogen storage, which is crucial if hydrogen is to be used as a motor fuel.

A number of talks focused on the use of polymers in the development of new batteries, fuel cells, and photovoltaics. In batteries, the race is on to improve on the current generation of lithium-ion batteries found in our laptops and cell phones, with the goal of creating batteries that can power the electric cars we have all heard so much about.

According to Mohit Singh, co-founder of the startup company

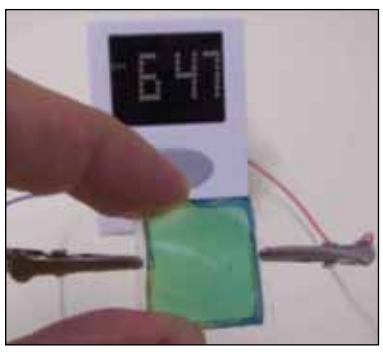

Photo courtesy of Hiroyuki Nishide

A flexible organic battery

Seeo, "we need high-performance, high-density, low-cost energy storage…but we are facing thermodynamic limits" with the current lithium-ion battery, in which "the weakest link is the electrolyte." Singh is developing a lithium-ion battery electrolyte using a "block copolymer" approach, in which a polymer that has good mechanical properties is combined with one that has good ion conductivity.

Singh's plastic electrolytes are more chemically stable than the liquid electrolyte solutions in current use, which are flammable, and which react with the battery's electrodes, causing the battery's capacity to fade over a few years. Singh's electrolytes allow him to use lithium metal rather than a compound such as lithium cobalt oxide as an anode material, leading to higher energy densities. His main challenge right now is to improve the conductivity of the plastic electrolyte at room temperature.

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Supercomputers Simulate Stars, Cars, Hurricanes, and Blood

Recent advances in computing technology have brought about unprecedented new levels of understanding of the complexities in fluid dynamics. Researchers and scientists at the APS March Meeting demonstrated how they have been employing the fastest supercomputers in the world to better model how dynamic systems behave in a variety of contexts.

"Despite its intrinsic chaotic nature, there is also a level of order, some kind of organization, and we take advantage of that," said Paolo Padoan of UC San Diego, "There is a sort of universality and in turbulent flows there are universal scientific properties."

To better understand formation of stars Padoan developed a program to model the granular flow of astrophysical dust clouds. Using one of the world's fastest supercomputers, at NASA's Ames Research Center, he has been able to create virtual stellar nebula up to several light years across. The program tracks the evolution of these turbulent nebulae over millennia as gravity pulls and twists interstellar dust into star-forming tendrils.

The program created by Padoan can finely model these clouds by breaking down the cloud's physical behavior into different levels of detail based on its density. In closely packed regions, a secondary physics engine kicks in to better simulate

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A Nanoscale Peek Inside the Cell

By Nadia Ramlagan

Super resolution fluorescence microscopy has emerged as a powerful research tool, allowing biologists to resolve the features of living cells on the nanometer scale, an unprecedented feat, according to APS March Meeting session speakers W.E. Moerner of Stanford University, recipient of this year's APS Langmuir Prize, and Stefan Hell of the Max Planck Institute for Biophysical Chemistry in Gottingen, Germany.

By surpassing the diffraction limit of conventional microscopes, super resolution microscopy has revealed previously uncharted cellular territory. Researchers have used the technique to study biological systems exhaustively, from seeing and counting individual proteins and single live cells to reconstructing 3D images of dendritic spines in a living neuron.

"50 years ago you couldn't imagine getting inside the cell and viewing cellular processes unfolding with such clarity", said Moerner, who pioneered the technique of single-molecule spec-

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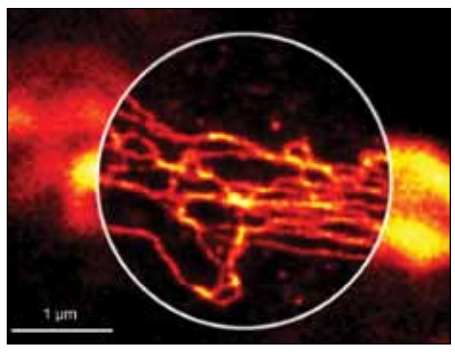

The vimentin network of a neuron imaged under confocal (outer) and nanoscale resolution STED (inner part) modalities. The STED image reveals single filaments which appear in the confocal reference as blurs. STED recording as described in D. Wildanger et al, *Opt. Express* 16, 9614 (2008).

60 Minutes Got It Wrong

On April 19, CBS's *60 Minutes* ran a segment about cold fusion, in the course of which they stated that *60 Minutes* "asked the American Physical Society, the top physics organization in America, to recommend an independent scientist. They gave us Rob Duncan, vice chancellor of research at the University of Missouri and an expert in measuring energy." As a result of this statement, a number of viewers have been left with the impression that APS endorses cold fusion. But the statement contains significant errors.

CBS never asked APS to recommend anybody, and APS did not give them anybody. They did ask Allen Goldman of the University of Minnesota, who happened to be Chair of the APS Division of Condensed Matter Physics at the time. Acting solely as an individual, and never claiming to represent either APS or DCMP, Goldman gave CBS a list of names, among whom was Rob Duncan. Despite the claim on *60 Minutes*, and despite the background shot of APS headquarters that accompanied it, APS had absolutely no involvement in this exchange of information.

60 Minutes got it wrong.

Evolution Stirs Tempest in Turkish Teapot

Turkish academics from a range of disciplines united in early March to oppose the apparent government censorship of Darwin's theory of evolution. The science community was quick to mount a concerted defense of Turkey's reputation as a secular and progressive Islamic nation.

The news broke on March 11th that the government-run Scientific and Technological Research Council of Turkey (TÜBİTAK) had tried to quietly remove a story about Charles Darwin from the upcoming issue of its popular science magazine. The magazine *Bilim ve Teknik* (Science and Technology) was due to publish a 17-page cover story celebrating the 150th anniversary of Darwin's theory of evolution. Just before going to press, the magazine was unexpectedly delayed for a week while the Darwin story was removed and replaced by one about global warming. Top officials at TÜBİTAK then relieved *Bilim ve Teknik's* editor-in-chief Çiğdem Atakuman of her post.

The controversy quickly erupted onto the front pages of the major Turkish newspapers. TÜBİTAK officials issued a press release charging that Atakuman had exceeded her authority by inserting the Darwin article at the last minute. Atakuman shot back in a press release of her own. In it she said that the deputy head of TÜBİTAK, Professor Ömar Cebeci told her the subject of evolution was too controversial for the popular magazine, and had pulled it to align with the conservative government's outlook.

Writing in the third person, Atakuman said that "Cebeci stated that 'she [Atakuman] acted irresponsibly in the sensitive environment of Turkey by placing a controversial topic as Darwin and Evolution on the cover of TÜBİTAK's well known magazine' and that 'it would be impossible for him to work closely

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If Only Beethoven Had Some of These

Photo by Edward Lee

At the APS March Meeting Teachers' Day in Pittsburgh, this trio was part of a larger group playing Beethoven's "Ode to Joy" on Boomwhackers™, a set of tuned plastic tubes. Pictured here are teachers Amy Barley (on left) and Marita Howell (right), and in the middle Gary White, director of the Society of Physics Students and the presenter for the waves workshop. Fifty-seven teachers from around the Pittsburgh area participated in various workshops, and heard research talks by Diandra Leslie-Pelecky of the University of Texas, Dallas, and Brian Swartzentruber of Sandia National Laboratories.

Members in the Media

"In a bureaucracy, if you start something in motion, it either stops or gets derailed…You have to keep applying force."

***Steven Chu**, Energy Secretary, describing how his new job as head of the Department of Energy is different from academia,* The New York Times*, March 22, 2009.*

"The purpose of thinking about the future is not to predict it but to raise people's hopes."

***Freeman Dyson**, Institute for Advanced Study, explaining what he sees as the role of a futurist,* New York Times Magazine*, March 25, 2009.*

"Everybody's talking about this [recession] as a structural change in our economy, in which some jobs that are lost are never going to come back, so we are interested in making sure we create new jobs and new industries,"

***Claude Canizares,** MIT, on how his university plans to utilize the stimulus money,* The Boston Globe*, March 23, 2009.*

"It turns out a lot of people in Hollywood think science is cool,"

***Jennifer Ouellette** National Academy of Sciences,* USA Today*, March 25, 2009.*

"These funds will allow us to make new investments in SLAC and in the scientific future of our country…We will be able to accelerate the delivery of science from our premier new facility."

***Persis Drell,** SLAC, on how the economic stimulus package will benefit research at the Linac Coherent Light Source.* The San Francisco Chronicle*, March 24, 2009.*

"The ability to charge and discharge batteries in a matter of seconds rather than hours may open up new technological applications and induce lifestyle changes,"

***Gerbrand Ceder,** MIT,* US News and World Report*, March 16, 2009.*

"This process will create temperatures of 100 million degrees and pressures billions of times greater than Earth's atmospheric pressure, forcing the hydrogen nuclei to fuse and release many times more energy than the laser energy required to spark the reaction,"

***Edward Moses**, National Ignition Facility,* BBC News*, March 31, 2009.*

"I like the planet we live on. I hope we leave a thoughtful planet to our society and our children."

***Alex Cronin**, University of Arizona, on his work to improve the efficiency of solar collectors,* Arizona Daily Star*, April 5, 2009*

"If we want scientific literacy, then we want teachers to teach the beauty of science, the fun in it, the humor in it, and to bring examples of modern science into the classroom,"

***Leon Lederman**, Fermilab.* UPI*, April 10, 2009.*

Boola Boola

Photo by Darlene Logan

On March 31, about 90 Fellows from around the New York City region convened at the Yale Club in Manhattan for a reception sponsored by APS. Besides the refreshments, they enjoyed presentations by APS President Cherry Murray, Executive Officer Judy Franz, Director of Public Affairs Michael Lubell, and Director of Education Ted Hodapp. In this photo, Fellows (l to r) Patricia Cladis of Advanced Liquid Crystal Tech, David Bishop of LGS, and Ronald Pindak of Brookhaven share a few moments before the program begins.

This Month in Physics History

May 31, 1957: DeWitt's Letter on Everett's "Many Worlds" Theory

In the 1950s, a young physicist named Hugh Everett III first postulated the existence of other worlds, in which every possible forking of every possible path is ultimately realized in its own separate universe. Dubbed the "Many Worlds" interpretation of quantum mechanics, the notion remains controversial among theoretical physicists, although it launched an entire subgenre of science fiction.

Born and raised in the Washington, DC, area, Everett evinced an early interest in math and science. When he was 12, the young Hugh wrote to Albert Einstein asking if it was "something random or unifying that held the universe together." Einstein's response: "There is no such thing like an irresistible force and immovable body. But there seems to be a very stubborn boy who has forced his way victoriously through strange difficulties created by himself for this purpose."

Everett earned a degree in chemical engineering from the Catholic University of America and then won an NSF fellowship for graduate study at Princeton. Initially he focused on math, specifically game theory, but soon drifted into physics, where he became fascinated by quantum mechanics.

Like many physicists of his day, Everett was dissatisfied with the troubling implications of quantum mechanics, specifically the "measurement problem," i.e., the question of what happens to every other possible outcome in a subatomic superposition of states once the wave function collapses. The "Copenhagen Interpretation" embraced by Niels Bohr and other early quantum pioneers assumed that other potential outcomes vanish by necessity once a measurement is made.

Everett took a different tack. In 1954, while indulging in a spot of sherry with Princeton classmate Charles Misner and a visiting physicist named Aage Petersen, the colleagues began brainstorming "ridiculous things about the implications of quantum mechanics." That conversation gave Everett the germ of an idea, which he subsequently developed into a dissertation. He called it the "relative state" formulation; it eventually became known as "Many Worlds."

Everett reasoned that a wave function merely appears to collapse from the vantage point of the observer. In "reality," it continues to evolve, forever splitting into other wave functions, each branch becoming its own separate universe, with a "copy" of the observer in each one. Once formed, the branches cannot interact with each other, continuing to evolve independently. An observer can only experience one "reality" at a time, Everett argued, but all other possible "realities" were nonetheless realized in parallel universes.

This was a radical departure from the views of Bohr and Heisenberg, introducing the notion of a universal wave function linking observers and objects as components of a single quantum system. It thus dispensed entirely with the need for the discontinuity in the evolution of the wave function engendered by its collapse.

Everett's theory was met with considerable skepticism. His Princeton advisor, John Wheeler, initially championed his brilliant protégé's work, taking the draft dissertation to Copenhagen in hopes that it would be published by the Royal Danish Academy of Sciences and Letters. But the Copenhagen contingent was uncomfortable with the implications of Everett's work, with one prominent scientist dismissing the thesis as "theology."

In April 1957, a thesis committee accepted a drastically abridged version of Everett's dissertation, published three months later in *Reviews of Modern Physics*. On May 31, 1957, Everett received a letter from Bryce DeWitt consisting of a detailed eight-page review of Everett's paper. While DeWitt was not convinced by Many Worlds, Everett nonetheless liked his astute analysis, even sending excerpts to other scientists with whom he was corresponding.

Unfortunately, Everett's published paper soon slipped into obscurity. When Everett first met his future business colleague, Donald Reisler, in 1973, he asked whether Reisler had read his 1957 paper. "Oh my god, you're that Everett, the crazy one who wrote that insane paper," Reisler exclaimed. (The two men nonetheless became good friends.)

Even Wheeler eventually abandoned his early support of the "Many Worlds" hypothesis. Wheeler recalled shortly before his death that Everett "was disappointed, perhaps bitter, at the nonreaction to his theory," and expressed regret that he lost touch with Everett in later years. "The questions he brought up were important." Everett left theoretical physics entirely to work for the Pentagon, and later founded his own companies in defense analysis and worked as a commercial consultant.

Ironically, it was Bryce DeWitt who changed his mind and became a vocal champion of Everett's ideas. He published an article in *Physics Today* in 1970, and included the unabridged version of Everett's thesis in a book of physics papers, *The Many Worlds Interpretation of Quantum Mechanics*. This brought Everett's ideas to the attention of the broader physics community. The concept also became popularized in science fiction circles after the term "many worlds" appeared in the sci-fi magazine *Analog* in 1976.

For all his later business success, Everett was "not a sympathetic person," Reisler recalled. He was a chain-smoker and heavy drinker, often indulging in three-martini lunches he then slept off in his office in the afternoons. Emotionally distant, he barely knew his troubled children, Elizabeth and Mark. Elizabeth suffered from schizophrenia and committed suicide in 1996, after numerous prior unsuccessful attempts. She left a note saying she was going to join her father in a parallel universe.

Mark Everett became a successful musician with the rock band Eels. It was Mark who discovered his father's body in bed one morning on July 19, 1982. The cause: a heart attack, at the relatively young age of 51. He had asked that his ashes be thrown out with the trash, and his wife eventually complied with that request. It was a suitably bleak end to man with a fundamentally bleak outlook. As Everett wrote in his original 1957 dissertation: "Once we have granted that any physical theory is essentially only a model for the world of experience, we must renounce all hope of finding anything like the correct theory … simply because the totality of experience is never accessible to us."

APS NEWS

Series II, Vol. 18, No. 5
May 2009

Coden: ANWSEN ISSN: 1058-8132

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APS News (ISSN: 1058-8132) is published 11X yearly, monthly, except the August/September issue, by the American Physical Society, One Physics Ellipse, College Park, MD 20740-3844, (301) 209-3200. It contains news of the Society and of its Divisions, Topical Groups, Sections, and Forums; advance information on meetings of the Society; and reports to the Society by its committees and task forces, as well as opinions.

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 20740-3844, E-mail: letters@aps.org.

Subscriptions: APS News is an on-membership publication delivered by Periodical Mail. Members residing abroad may receive airfreight delivery for a fee of $15. Nonmembers: Subscription rates are available at http://librarians.aps.org/institutional.html.

Subscription orders, renewals and address changes should be addressed as follows: For APS Members–Membership Department, American Physical Society, One Physics Ellipse, College Park, MD 20740-3844, membership@aps.org.

For Nonmembers–Circulation and Fulfillment Division, American Institute of Physics, Suite 1NO1, 2 Huntington Quadrangle, Melville, NY 11747-4502. Allow at least 6 weeks advance notice. For address changes, please send both the old and new addresses, and, if possible, include a mailing label from a recent issue. Requests from subscribers for missing issues will be honored without charge only if received within 6 months of the issue's actual date of publication. Periodical Postage Paid at College Park, MD and at additional mailing offices. Postmaster: Send address changes to APS News, Membership Department, American Physical Society, One Physics Ellipse, College Park, MD 20740-3844.

HIGHLIGHTS continued from page 1

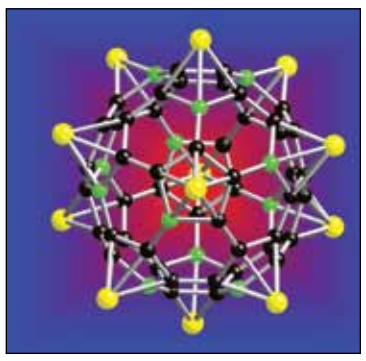
Hiroyuki Nishide of Waseda University in Tokyo is developing a "totally organic battery" using polymer electrodes made of organic radical molecules. Radicals, such as the DNA-attacking free radicals in our bodies that we have heard so much about, have unpaired electrons that make them highly reactive; however, Nishide's group has identified over 500 stable radical structures that can be formed into long, flexible, current-conducting chains.

Combined with a plastic electrolyte, the organic electrodes allow for the construction of bendable batteries that may be ideal for applications such as rollup displays, wearable devices, and integrated circuit smart cards. In addition, because they are made from entirely non-toxic, organic materials, these batteries avoid some of the waste disposal issues associated with batteries that contain metals. Nishide's batteries have the advantage of rapid charging and discharging compared to traditional batteries, but at the cost of decreased energy density.

The hydrogen fuel cell is another promising but challenging technology that has been touted as the future of automotive travel. Klaus Schmidt-Rohr, a researcher at Iowa State University, presented research on Nafion, a fluoropolymer currently considered a "benchmark material" for proton-exchange membranes in hydrogen fuel cells due to its mechanical and thermal stability and fast diffusion of water and protons. Because it is too expensive for large-scale production, "we need to replace Nafion, but first we need to understand how it works," according to Schmidt-Rohr, who used nuclear magnetic resonance and small-angle scattering techniques to develop a model of parallel, randomly packed water channels stabilized by the stiff Nafion fluorocarbon backbone. "Ours is the only model that accounts for all the transport properties" of Nafion, he said. A number of other speakers at the meeting also presented research on Nafion.

Another major technical challenge for commercializing the hydrogen fuel cell is storing hydrogen fuel. As Yong-Hyun Kim of the National Renewable Energy Laboratory put it, "to be useful is to be stored." Storing molecular hydrogen as a gas requires enormous volumes or pressures, whereas liquid hydrogen requires very cold temperatures—neither of which is convenient for a motor fuel. What is needed, says Mei-Yin Chou of the Georgia Institute of Technology, is "solid-state hydrogen storage for low-volume, safe use."

One popular class of material are complex metal hydrides such as sodium alanate ($NaAlH_4$), which contain four atoms of hydrogen and only two light-weight metal atoms. Chou presented research on the role of a titanium catalyst in allowing the hydrogen to bind and be released from the compound with reasonably fast kinetics. According to Puru Jena of Virginia Commonwealth University, however, materials lighter than aluminum are required to achieve high enough energy densities, but these often bind hydrogen either too strongly



Functionalized C_{60} fullerene for hydrogen storage: Courtesy of Q. Sun, Q. Wang, and P. Jena (Q. Sun, Q. Wang, and P. Jena, *Appl. Phys. Lett.* 94, 013111 (2009)). Carbon, Boron, and Lithium atoms are colored black, green, and yellow respectively.

or too weakly. Jena presented research on the use of nanotubes and fullerenes to store hydrogen in "quasi-molecular form," rather than as individual atoms, at an ideal binding energy. He found that a C_{60} molecule doped with lithium and boron atoms can store up to 9% hydrogen by weight in a stable form with a reasonable binding energy.

Of course, batteries and hydrogen compounds do not generate energy; they merely store it for later use. Many speakers presented research on photovoltaics to convert energy from sunlight into electricity. One of the principal challenges facing the solar energy industry is that current high-efficiency solar panels are too expensive for large-scale production. Yueh-Lin Loo of Princeton University is working to create low-cost, sustainable organic solar cells "to help with the energy challenge." Her research focuses on developing solution-processible conductive polymers doped with polymer acids, to replace current, more expensive vacuum deposition techniques.

Another active area of research is artificial photosynthesis, also known as "biologically-inspired solar energy harvesting" in the meeting's scientific program. The hope is to design systems that mimic green plants' ability to store sunlight energy as chemical fuel, but in order to make this possible, there is still a great need for a better understanding of natural photosynthesis. Tessa Calhoun of the University of California, Berkeley presented research on the use of two-dimensional Fourier transform electronic spectroscopy to study the coherences of excitons—delocalized electronic excitations—in Light Harvesting Complex II (LHCII), which is a complex of proteins and chlorophyll molecules that may play a role in allowing plants to capture and transfer light energy with near-zero photonic energy loss. Leonas Valkunas of Vilnius University in Lithuania also presented research on LHCII, specifically its role in helping plants dissipate excess sunlight energy in the form of heat.

At a special symposium on energy and the environment, George Crabtree of Argonne National Laboratory gave an overview of the major sustainable energy materials and technologies that are being developed. Although "sustainable energy technology requires complexity and design, whereas fossil fuels don't," Crabtree believes we may be at the "dawn of a new era in computer modeling, nanoscience, and complex materials," which will allow us to "control complexity, not just observe it, in ultra-small and ultra-fast regimes…We can now design materials on computers and predict their behavior." Ultimately, Crabtree said, "next-generation energy technologies will be developed. The question is, will we be buying or selling them?"

Harvard, APS Reconcile Copyright Policy

The American Physical Society and Harvard University announced in early April an agreement averting a potential conflict over copyrights. The agreement would allow the university to republish articles by its faculty appearing in APS journals, without violating any APS held copyrights.

In February of 2008, Harvard University adopted a new "open access" policy for articles appearing in scholarly journals by members of its faculty. Under its new policy, the university would post all articles published by its faculty available for free download. This policy, one of the first of its kind, raised eyebrows across the publishing world and sparked concerns about potential conflicts with journal copyright policies.

APS, along with other journal publishers, soon began talking with the university to clarify the terms of such a policy. In the agreement worked out with APS, the first such understanding announced, Harvard and its faculty can republish articles featured in APS journals provided that Harvard link back to the original source article, and cannot charge for access to them.

APS has allowed individual authors to republish their own work on personal and employer website since 1996. The agreement with Harvard essentially extends that right from the authors to the university as policy. Up to now, authors could have individually published their works on a Harvard website, but this new policy gives that right to reprint to the university as well.

"[W]e applaud the spirit of the new Harvard open access policies, which we recognize as sharing our fundamental goals for scientific communication, and we are delighted that we and our colleagues at Harvard have reconciled the differences in our policies, to the shared benefit of Harvard authors and of the wider scientific community," said Joseph Serene, Treasurer/Publisher of the American Physical Society.

Prior to this clarification, physicists working at Harvard had to get a waiver from the university excluding their APS published work from its open-access requirements.

INSIDE THE BELTWAY
WASHINGTON ANALYSIS AND OPINION

It's a New Day for Science

by Michael S. Lubell, APS Director of Public Affairs

Barack Obama has been in office for 100 days. It's time to take stock.

Bo, a Portuguese water dog, has taken over the White House quarters that Barney and Miss Beazley, two Scottish terriers, had occupied for eight years with their feline compatriot, India, an American shorthair, who died in January shortly before the Bushes relinquished their home away from the ranch. It's the dawn of a new era!

Seriously, Washington is a different town today, and it's not due just to the changing of the first-animal guard. The mood of the city is palpably altered. Despite the national economic woes, it no longer has a bunker feeling.

George W. Bush was fond of calling himself a "war president." And so he was in so many ways.

He began his eight years in office by declaring war on taxes and ended his two-term presidency hunkered down as three decades of bipartisan financial deregulation and unbridled faith in efficient markets came unwound. In between, he declared war on terrorism, Afghanistan, Iraq, a failed American education system, and any science that didn't conveniently fit a prevailing conservative ideology.

Even Bush partisans have to admit Washington became a pretty gloomy place. War, particularly the fatigue that sets in after years of battle, has a way of reducing vibrant emotional colors to depressingly gray monochromes.

Still, war does have a virtue. It has a simple goal–to win. And in that regard, it has a seductiveness that's often hard to disregard. It reduces complexity to a set of seemingly achievable objectives; it sharpens the focus of the policymaking lens; and it facilitates a communications strategy suited to the thirty-second sound bite.

But not every problem lends itself to a *reductio ad bellum* solution. You can't declare war on the collapse of the financial services industry, a sinking economy, home foreclosures, soaring health care costs, climate change, energy security, mounting public debt, a potentially unstable dollar, or the morass in the Middle East–at least not if you want to make any serious progress. These are the daunting issues facing the Obama White House.

The President has a lot on his plate, and many in the world of wonks and pundits question whether he is tackling too much too fast. Concentrate on fixing the economy now and leave the rest for later, they argue. It's better to have one major political triumph, rather than progressively chip away at the myriad individual problems, no matter the public worth.

But the Obama team responds that the issues they are trying to confront are linked. You can't stop the economy from sinking further without re-establishing a healthy banking system. You can't have a healthy banking system without fixing the mortgage foreclosure problem.

You can't grow the economy and create jobs unless you contain energy and health costs. You can't contain energy costs and have any hope of achieving peace in the Middle East unless you become less dependent on Middle Eastern oil.

You can't stabilize the dollar unless other countries have faith that the federal debt is manageable. You can't even think about reducing the federal debt unless you grow the economy.

And you certainly cannot grow the economy and reduce carbon emissions unless you have a coherent, manageable climate change policy that doesn't excessively penalize consumers and businesses.

The linkages are apparent; the solutions aren't. But what is unmistakable is the centrality of science's role. As a discipline, it is uniquely positioned to address complex problems of the sort our nation faces. Energy security, climate change, health care, economic competitiveness, and even a stable financial services industry require the ingenuity that scientists, mathematicians and engineers can bring to the table.

The Obama Administration seems to understand the nexus and is placing a big bet on America's scientists. The White House has vowed to double the budgets of the federal programs that support basic research, including the Department of Energy's Office of Science, the National Institute of Standards and Technology's Core Programs, and the National Science Foundation. The Administration has also pledged to ramp up applied energy research in the DOE and to reinvigorate science education programs in the Department of Education and the NSF.

It's been decades since America's scientists have heard the call to arms. It may not be a war, but it is a mobilization of the best and the brightest minds our country has to offer. And it's a new day for science in the nation's capital.

Letters

Where Are the Africans?

I am not a fan of Affirmative Action but I think that there is scientific slavery going on and Africans are the victims. I received a copy of *APS News* showing more than 30 scholars who won APS 2009 Spring Prizes. Not a single African is among them. The same pattern happens in Africa where all leading researchers: anthropologists, botanists, zoologists, physicists, chemists, astronomers... have European or Asiatic ancestry. Something is wrong with promoting science to Africans or people of African ancestry and I wish I never belonged to APS and other discriminatory scientific organizations. I do not think that Africans are good at playing ball or dancing and singing only.

Bazeyi Hategekimana
Baltimore, MD

Those Wacky Chemists of 1886

The letter from Philip B. Allen on "The Real Reason Water is Blue" in the March issue brings to mind an article in a spoof issue of *Berichte der Deutschen Chemischen Gesellschaft*, published in 1886. The spoof volume was titled *Berichte der durstigen Chemischen Gesellschaft*, *[Reports of the Thirsty Chemical Society* (Ed.)] with an annotation "From a beer evening of the German Chemical Society". One article purported to explain why the ocean is blue and proposed a demonstration for a freshman lecture course. The author described a long tube filled with water, with a complex array of lenses, prisms, and mirrors to project the blue light out to the lecture room. He admitted, however, that the blue color was very faint and might not convince all the students. His solution to that was simple: just drop a few crystals of copper sulfate into the water before the students arrive!

David R. Lide
Gaithersburg, MD

New Copyright Policy Meets Previous Concerns

In a Back Page article in the June 2008 *APS News*, I expressed concerns about APS's, and other publisher's, copyright transfer policy. Following up, I would like to say that the changes that APS introduced in their copyright transfer agreement in October, 2008 have largely met my concerns. It now reasonably balances the journal's interest in being able to control the subsequent republication of an article, with the author's need to disseminate the results of that research as widely as possible.

I strongly urge all physicists to consider the copyright transfer policies of the journal when they make a decision on where to publish.

While following the usual physicist's practice, of signing a restrictive transfer form and then ignoring the obligations of that signing, is a possible course of action, publishing in journals which recognize the author's interest in the work they created by an enlightened copyright transfer policy (such as The Royal Society of London and the APS) is surely better.

William G. Unruh
Vancouver, BC

Open-minded Research Needed on UFOs

The article on Clyde Tombaugh notes that "he was later known as one of only a few scientists to take UFOs seriously." He no doubt took them seriously primarily as a result of the fact that he had at least three UFO sightings. Tombaugh also had three sightings of the still-mysterious "green fireballs" seen in the Southwest states in 1948 and 1949, that were also observed and studied by Lincoln La Paz, Founder and Head of the Institute of Meteoritics at the University of New Mexico.

It is to be regretted that it remains true that only a few scientists take UFOs seriously. Unlike the SETI search for extraterrestrial intelligent radio signals, that has no data to report, UFO data are voluminous and many cases (such as the Mansfield, Ohio, case of October 18, 1973, the Council Bluffs, Iowa, case of December 17, 1977, and the Haines City, Florida, case of March 20, 1992) are startlingly impressive. (See *The UFO Enigma: A New Review of the Physical Evidence* by Peter A. Sturrock, Warner Books, New York, 1999.)

The Air Force based its decision to end its investigation of UFO reports (and NASA based its decision not to start an investigation) on the recommendation of Edward U. Condon, Director of the University of Colorado Air-Force-funded UFO Project (1966-68). Condon's assertions (*Scientific Study of Unidentified Flying Objects*, Bantam Press, New York, 1969) that "nothing has come from the study of UFOs in the last 21 years that has added to scientific knowledge," and that "further extensive study of UFOs probably cannot be justified in the expectation that science will be advanced thereby" were his own views that–to put it mildly–are difficult to reconcile with the case reports and summaries prepared by his own staff (*Enigma*, pp.18 -44).

In 1997, on the initiative of Laurance S. Rockefeller, a panel of nine distinguished scientists (chaired by Von Eshleman and Tom Holzer) met with eight highly qualified UFO investigators in Pocantico, New York. The panel's salient conclusions were: (1) The UFO problem is not a simple one, and it is unlikely that there is any simple universal answer; and (2) Whenever there are unexplained observations, there is the possibility that scientists will learn something new by studying those observations (*Enigma*, pp. 120-122).

Long-term, open-minded scientific research remains the essential prerequisite for resolving this long-standing puzzle.

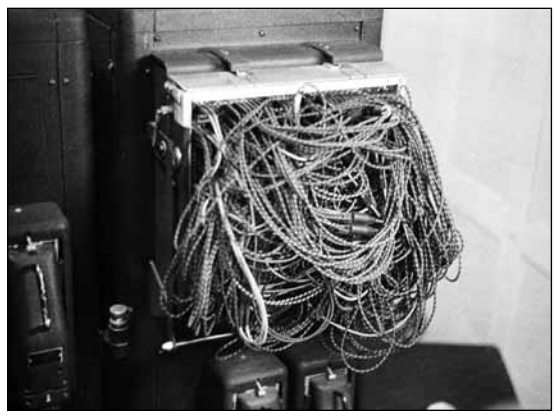
Peter A. Sturrock
Stanford, CA

Discovery in Physics Guided by Theory

I was both gratified and disappointed when I read the March 2009 *APS News*.

First, I noted Michael Turner's Back Page article on the importance of physics to the celebration of 400 years of astronomy. Hear, hear! In this same issue, Jay Pasachoff (who taught my first college course in astronomy at Williams College) reminds us of a remark, unfortunately attributed to Einstein by the diligent prankster George Gamow. Gamow reported in his incomplete autobiography that the cosmological constant (CC) was referred to by Einstein as his "biggest blunder."

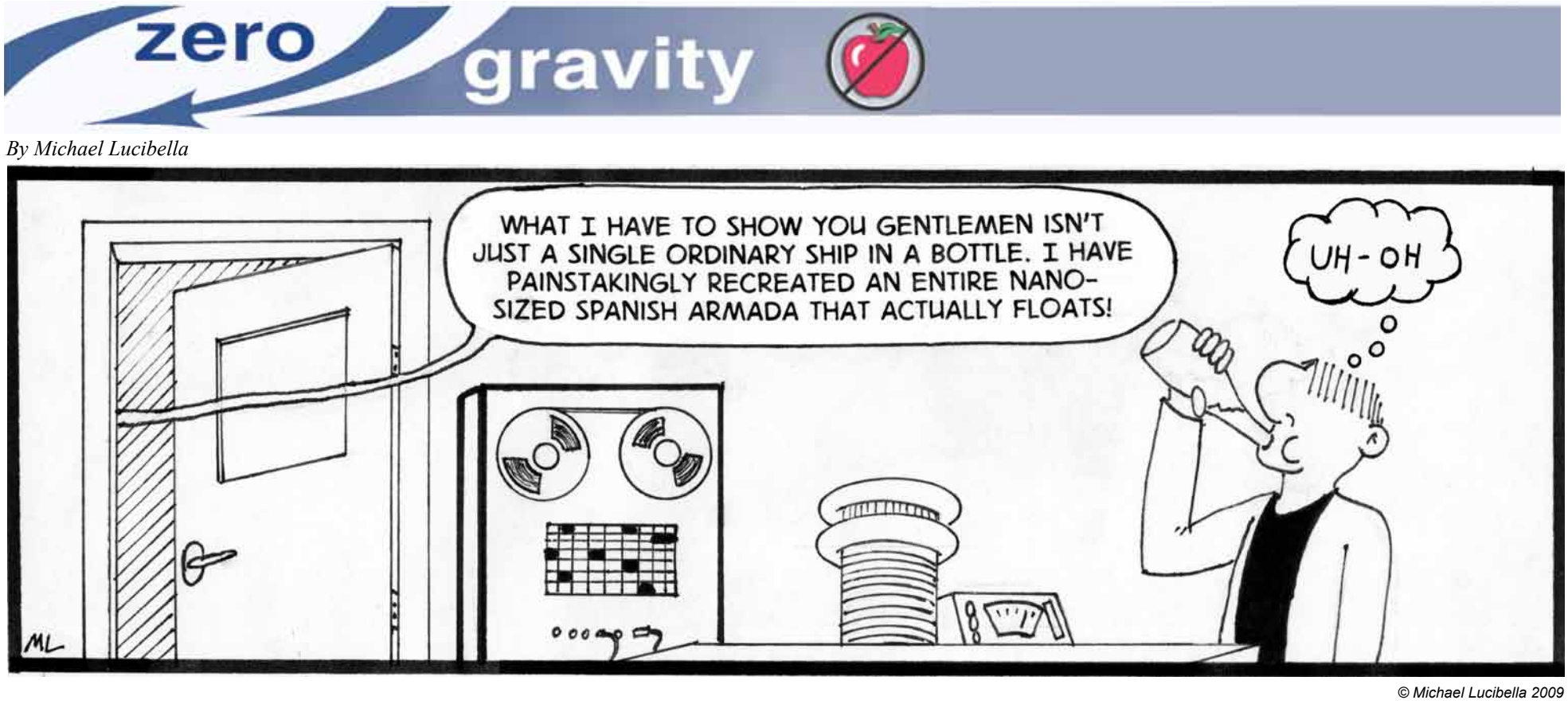
Pasachoff points out that we need to take account of the source of this comment—the jolly Gamow, who added Hans Bethe's name to the publication of my father's [Ralph Alpher–see "This Month in Physics History, *APS News*, April 2008 (Ed.)] dissertation on nucleosynthesis, forever clouding its intellectual origins. Pasachoff's letter invites us, therefore, to reconsider any abandonment of the CC. I would have to agree. I discuss some of these problems in an upcoming paper in the Spring 2009 AIP Journal *Radiations*. I had the opportunity to discuss the CC on many occasions with my father. Although he recognized well some of the problems with this constant, Gamow (his dissertation adviser) had not passed on news of its folly, and he was not ready to suggest that it be altogether abandoned. In the 1940s, my father was a serious student of Gamow and Einstein, and took courses in physics from the likes of Edward Teller and Enrico Fermi.



Programmed IBM computer panel used by Alpher and Herman to make final calculations in their prediction of the CMB. (Source: Estate of Ralph A. Alpher, copyright 2009, with permission of Victor S. Alpher, Executor. Previously unpublished).

Where does this put us today? In his article, Turner lauds the "discovery" of the CMB by Penzias and Wilson. However, their "discovery" was made only in the context of the *interpretation* made by Dicke, Peebles, Roll, and Wilkinson in the July 1965 *Physical Review.* Ralph Alpher had been contacted in late 1964 by the Soviet physicists Igor Novikov and Yuri Zel'dovich, who were working on the problem at the time with Andrei Doroshkevich—had much more time gone by, the "discovery" might have been attributed to some Soviet radio astronomer. Physics is not yet ready to abandon the theoreticians, even though their precise predictions may turn out to be off (see accompanying figure). Even the lowly atom was, at one time, a theory.

Victor S. Alpher
Austin, TX



Education Corner

A column on educational programs and publications

PTEC Conference

The 2009 Physics Teacher Education Coalition (PTEC) Conference was held in Pittsburgh on March 13 and 14, 2009, with the theme of "Institutional Transformation: How do we change departments and universities to embrace the mission of preparing tomorrow's teachers?" Over 100 physics and education faculty members, teachers, and professional society representatives attended workshops, panels, and talks by leaders in physics teacher preparation.

Among the most popular workshops were "Pedagogical content knowledge needed to teach physics," led by Eugenia Etkina of Rutgers, who discussed the need for teachers to be familiar not just with physics content but also with physics-specific pedagogy; and "Facilitating change in undergraduate STEM," given by Noah Finkelstein of the University of Colorado and Charles Henderson of Western Michigan University, who led a conversation on "the need to problematize and improve our approaches to change." Also well attended was a panel on "The university role in teacher preparation," which was led by Howard Gobstein of the Association of Public and Land-Grant Universities, and included the perspectives of a physics department chair, an arts and sciences dean, and a university provost. For more information about the conference, including downloadable presentations, see www.ptec.org/conferences/2009.

PTEC is a joint project of the APS, the American Association of Physics Teachers (AAPT), and the American Institute of Physics (AIP) to improve physics and physical science teacher preparation.

SPIN-UP Workshops

APS, AAPT, and AIP invite teams from physics departments to attend regional workshops to learn how to implement the findings of the 2003 Strategic Partnerships for Innovations in Undergraduate Physics (SPIN-UP) report. The goal of the workshops is to enable physics departments in a wide variety of institutions to build the departmental infrastructure that will produce long-term improvements in undergraduate physics programs and to enhance both the number of students studying physics and the quality of student learning.

The workshops will be held at the following locations:

- Marquette University, Milwaukee, WI: June 18-20, 2009
- Cal Poly, San Luis Obispo, CA: July 10-12, 2009
- North Carolina State University, Raleigh, NC: September 11-13, 2009
- Rutgers University, New Brunswick, NJ: October 2-4, 2009

The Rutgers workshop will be targeted specifically toward departments that grant a Ph.D. in physics.The others address all departments, including those granting a Ph.D.

For more information, see www.aapt.org/Projects/spinup-regional.cfm.

Advanced Laboratory Conference

AAPT, APS, and the Advanced Laboratory Physics Association are organizing a conference on the advanced laboratory. The conference will take place in Ann Arbor, Michigan on July 23-25, just before the Summer AAPT Meeting. This 2.5-day meeting will cover techniques, experiments, and curricular ideas for post-introductory undergraduate labs, whether they are independent or tied to a lecture course. The conference will include invited talks on a variety of topics, presentations by commercial vendors, and lots of opportunities for hands-on experiences with experimental equipment. Meeting participants will be able to present information about their own courses and experiments. For more information and to register, go to advlabs.aapt.org.

Graduate Education Report Published

The final report from the joint APS-AAPT conference "Graduate Education in Physics: Which Way Forward?" has been published. The report describes the findings of the conference, and provides a series of recommendations for physics departments, professional societies, and funding agencies to create an improved, more flexible, and more relevant graduate experience for all students. The conference, which took place in 2008 and grew out of the 2006 report of the joint APS-AAPT Task Force on Graduate Education in Physics, convened the Directors of Graduate Studies from 70 of the nation's Ph.D.-granting institutions as well as representatives from professional societies, the National Science Foundation, the APS Forum on Graduate Student Affairs, and industry to discuss trends and practices in physics graduate education. The report can be read on the APS website at www.aps.org/programs/education/conferences/graduate.

Reminder

Proposals to the NSF's Course, Curriculum, and Laboratory Improvement (CCLI) are due are due May 21st. For more information, go to www.nsf.gov and search on "ccli."

March Meeting Prize and Award Recipients

Photo by Dennis Harsh

Front row, left to right: Chao Cao, Terunobu Miyazaki, Krishnan Raghavachari, Steve Granick, Akihisa Inoue, Salvatore Torquato, Venkat Ganesan, Byron C. Drury, Robert Schoelkopf, B. Sriram Shastry. Back row, left to right: Sujit S. Datta, Paul Tedrow, Yves Chabal, Jagadeesh Moodera, William L. Johnson, Philip J. Wyatt, Terry A. Miller, W. E. Moerner, David J. Bishop, Ramamurti Shankar, Katepalli R. Sreenivasan, A. Peter Young.

Doing Research with Mass Appeal Can Be a Double-edged Sword

By Nadia Ramlagan

Physics has always had a tenuous relationship with the mainstream media—but do physicists who engage in research with popular appeal pay a price when it comes to their academic careers? Garnering media attention for one's research is a sure path towards achieving celebrity as a scientist. Scientists such as Carl Sagan, however, whose wholehearted involvement in the popularization of science resulted in fame and fortune, have often received a much more negative reaction from their colleagues.

Research with popular appeal provides an opportunity for general audiences to hear physicists discuss their work not only in non-technical terms, but in ways that show how physics is both exciting and relevant to society. The physics community certainly agrees this is important. Yet when the media are gobbling up a colleague's research, there may be a sense of bemusement or envy among some, especially in academia.

"Scientists appreciate that there's a need to 'sell' science to the public. But when one of their own focuses on these more accessible fields, and especially when that person spends a big part of their career doing books or TV shows directed at the general public, there is a sense of mystification. They wonder whether the scientist lacks the talent or ambition to do 'real' research," says William Poundstone, author of *Carl Sagan: A life in the Cosmos* (1999).

"I have certainly seen evidence of the 'you aren't doing real physics' attitude," says Katherine Jones-Smith of Case Western Reserve University, whose research exposing the shortfalls of fractal analysis in determining authentic Jackson Pollock paintings received much media attention.

"However, I have also seen a lot of evidence to the contrary. Physicists are generally way more impressed and interested in my research than I expect them to be. It really depends on what the particular topic is, and who is doing the publicity," she adds.

There may even be a reverse phenomenon; a propensity to accept appealing results because they are glamorous. "It seems there is a certain amount of romanticism in the idea of interdisciplinary science… we found that in Pollock's case, the purported physics behind Richard Taylor's [fractal analysis] technique was a sexy idea that turned out to not hold up under scrutiny," says Jones-Smith.

On a more conciliatory note, there are certain areas of physics that have managed to garner lots of public attention and retain respect within the community, for example string theory. "String theorists are certainly very employable and influential within physics academia," notes Jones-Smith.

Nonetheless, physicists who engage in popular research face a unique set of challenges. "To a large degree, the 'celebrity scientist' phenomenon is an instance of the 80/20 rule. About 20 percent of the scientific research gets about 80 percent of the attention. So a very few people in a few accessible fields get disproportionate attention. You can say they're shameless attention-grabbers, and some are, but really, most people like attention. In fact, that's the problem," says Poundstone.

An article in *The New York Times* or coverage in *Science* or *Nature* can catapult a scientist into media stardom overnight, providing the fuel that boosts his or her career. It's no wonder that colleagues, who wouldn't mind a few calls from *The New York Times* themselves, are left grumbling. Poundstone offers this advice: "The high-profile scientist needs good people skills to smooth over the hurt feelings and to keep the lines of communication and collaboration open".

That's not to say scientists are incapable of being supportive when one of their own makes the front page. "I've been invited to present to audiences that are either mostly physicists, or the general public; but it's gotten me a lot of positive attention, and compliments from a large number of senior faculty who probably wouldn't otherwise have any idea who I am. So to the physics community, I'm certainly grateful," says a postdoc who presented at March Meeting.

Another challenge, ironically, is "Getting people to talk or listen to you about anything but your most popular result," says Jones-Smith. An audience may miss the entire point of a lecture because they are so enamored with one tiny aspect of the research only marginally related to the topic.

Young physicists or students interested in studying an unconventional or interdisciplinary topic can keep a few things in mind that may make the path less traveled a bit smoother. "Frank Drake [the radio astronomer and author of the 'Drake Equation' predicting the probability of civilizations elsewhere in our galaxy] always told students that it's important to make your mark in a field where you can show solid results. Then you can try something more speculative," says Poundstone.

"In a sense, scientific research is always a gamble. Some lines of research would have a big, dramatic payoff, but they're long shots. Other lines are less ambitious and have better odds," he continues.

Jones-Smith warns, "It is important to uphold the same standards of rigor in one's publicly appealing work as one upholds in one's not-so-appealing work. You don't get to throw the scientific method out just because you think you might be on to something sexy".

It isn't just the print and broadcast media spotlight that can cause internal skirmishes. These days, extensive blogging and active internet forums contribute to research dissemination and drive media hype. There will always be those who don't agree with the scientist-as-celebrity status, but the physics community can at least acknowledge the ideas and accomplishments of its more "famous" colleagues.

Viewpoint...

Copernicus' Remains: Miraculous discovery or wishful thinking?

By Lidia Smentek

On November 20, 2008, Polish newspapers published an interesting report from Sweden: The remains of the 16th century Polish astronomer and author of the heliocentric cosmology, Nicolaus Copernicus, have finally been identified.

The news quickly spread around the world. But is the conclusion believable? Is there scientifically valid evidence to back it up?

Since 2004, a group of experts under the guidance of Professor Jerzy Gąssowski from the university in Pułtusk, Poland, has been trying to locate Copernicus' burial place. It has been commonly known that the astronomer was buried inside the cathedral in Frombork, Poland, where he had served as a canon for decades until his death in 1543. The exact place of his burial, however, was never marked.

Finally, after years of searching, archeologists discovered the remains of a man who was 70 years old, the same age as Copernicus upon his death. Modern technology allowed the reconstruction of the man's portrait, which, however, is of questionable value because no original pictures of Copernicus have survived.

In order to verify the discovery, Polish archeologists have tried to find remains of the Copernicus family and compare DNA samples with those recently found in Frombork with one purpose: once and for all, to confirm that the recently found remains were those of the famous scientist. Unfortunately the known Copernicus genealogy tree ended in the 17th century, and the search for a DNA donor has yet to yield any results.

In 2006, Professor Gąssowski gave a lecture in Sweden announcing the possible discovery of the remains of Copernicus. Professor Goeran Henriksson of Uppsala decided to look for other artifacts linked to Copernicus. In the library of the University of Uppsala resided a book of astronomical tables by Johannes Stöffler that had belonged to Copernicus but that had been carried off to Sweden in 1626. Miraculously, inside the book he found a hair. With the help of his collaborators, Henriksson ended up finding 10 hairs. One was glued to the cover of the book and belonged to the book's binder, though proof of how this connection was made is as yet unavailable.

The report from Sweden, as well as many interviews given to the media, state that the DNA of the remains found in the Frombork cathedral match the DNA of two of the found hairs. This match is the source of Professor Henriksson's conclusion that the remains are those of Copernicus. How Henriksson arrived at the conclusion from a scientific point of view, however, isn't clear. Indeed, there are many questions to be answered to confirm the finding:

How is it possible that during hundreds of years and conservation procedures applied to the Stöffler book, the hairs were never found before, or lost in the process? And most of all, what is the proof that the hairs found in the book are indeed those of Copernicus?

At this point, the only reliable conclusion is that the DNA of the hairs and of the remains found in Frombork match–nothing more. This means that from a scientific point of view the status of the identification process of the remains is still the same as it was in 2005, except that emotions are now playing an important role.

I asked Professor Michał Kokowski from the Institute of the History of Science, Polish Academy of Sciences in Kraków, for his opinion. Professor Kokowski is an internationally recognized expert on Copernicus, and the author of the recent book *Different faces of Nicholas Copernicus: Meetings with a history of interpretations* (Institute of History of Science, Polish Academy of Sciences and Polish Academy of Arts and Sciences, 2009). This is what he had to say about the discovery of Copernicus' grave:

I will believe that these are indeed Copernicus' remains only if I am able to read a reliable scientific report on the comparison of the DNA of the found remains, DNA of the material found in the book in Uppsala, and the DNA samples of a family member of Copernicus. Since up to now I have been unable to have any access to such documentation, my opinion about the case is suspended. At the same time, the noisy press conferences and perpetuation of unverified information in the media are not a proof for me that the remains found in Frombork are indeed of Copernicus.

House in Toruń, Poland, where Nicolaus Copernicus was born in 1473

The scientific background of this opinion, together with the explanation of many other mysteries and still unknown facts of Copernicus' work and life, are presented by Professor Kokowski in his book.

Thus, is it not too early to discuss what kind of gravestone to prepare for the second funeral of Copernicus? As one also born in Toruń, I believe that for now, while waiting for reliable scientific identification of the remains found in Frombork, it is better to celebrate his birthday.

A celebration of Copernicus' birthday on February 19th of this year in Toruń inaugurated the Polish contribution to the Astronomy Year 2009 proclaimed by UNESCO.

Lidia Smentek is a member of the Executive Committee of the APS Forum on International Physics, and Adjoint Professor of Chemistry at Vanderbilt University.

Nanotech Advances Include Data Storage and Sharper Metal Tips

New advances in nanotechnology keep pushing the smallest limits of what is possible, with this year's March Meeting featuring over one hundred sessions exploring potential technology on the scale of the very tiny. Two physicists were among those asked to present their results in a press conference format as well.

Izhar Medalsy, of the Hebrew University in Jerusalem, described a novel method to store bits of data on a nanoscale. He combined a natural protein with clusters of silicon nanoparticles to create arrays of stored bits of information as close as 11 nanometers apart.

A slightly altered version of the aspen tree's donut-shaped SP1 protein is an ideal scaffolding to suspend the information storing nanoparticles. Medalsy found that the ends of nucleotide strands in the protein could be manipulated to act as hooks for round silicon nanoparticles. These nano-sized semi-conducting spheres do stick out of the protein slightly, like a crystal ball over its wooden base. The individual silicon nanoparticles can then be infused with either a positive or negative electric charge to store individual bits of data. One added advantage of using such a system is that particles can exist in one of three states (positive, neutral and negative) rather than the standard binary that computer systems use today.

"The implementation of two and three states memory unit cells with a protein scaffold that can form large ordered and dense arrays suggests applications such as ultra dense and much more economic memory arrays," Medalsy said.

Medalsy used a Langmuir Blodgett trough to arrange the proteins in a dense honeycomb film over a smooth gold surface. The proteins act as insulators between the conductive surface and the silicon particles. This allows the particles to retain their charge for several minutes under normal atmospheric pressure, and as long as a few hours in a vacuum.

With further development, Medalsy said that the surfaces could potentially be used to store large amounts of data more densely than today's DVDs. Currently devices to efficiently record and later read information stored on such a dense scale do not yet exist.

A further application for Medalsy's protein and nanoparticle combination would be to create nanoscale wires. Instead of compressing the proteins together horizontally to make a film, they could be stacked vertically so that conductive gold nanoparticles would contact each other and transfer charge along the wire. Thus far Medalsy has only been able to bring the stacked nanoparticles within 3.5 nanometers of each other, which is not close enough to transfer charge. He is continuing his research to bring the particles close enough together allow electricity to flow freely.

At the same press conference, Abha Misra of Caltech presented her new technique for manufacturing sharp metal tips for nanoprobes. Probes with carbon nanotube tips have in recent years emerged as an excellent method for technicians to manipulate nanosized objects. However up to now, when a metal coating is applied around the outside of the carbon nanotube, its tip is rounded off, limiting the probe's effectiveness. Misra's new technique allows iron to naturally form a tip sharp enough to work with atomic scale resolution.

"With these tips not only can we resolve problems related to the ultra high resolution imaging of nanostructures but also … to observe magnetic behavior at atomic scale in spite of using a coated material tip." Misra said.

She began by wrapping carbon nanotubes around a thin core of iron. Upon severing these nanowires using a high-energy electron beam, the surrounding carbon tubes retract back from the end. At the same time, the energized iron core flows forward, crystallizing into points sharper than otherwise possible by simply coating the nanotubes.

This process could also be used to weld two of these nanowires together. Misra demonstrated that the excess iron that flowed out from the carbon tubes could be melted by the same high-energy electron beam and rejoined. This process could lead to future nanotechnology repair techniques.

"These probes also provide means for coupling of nanoelectronic devices, by using them as a nanoscaled soldering iron," Misra said, "This technique adds a new functionality in nano-electromechanical systems and offers new avenues for further investigations."

PEEK continued from page 1

troscopy and imaging in the late 1980s. Decades later, the use of single molecules as nanoscale emitters or fluorescent markers for a number of biological and chemical processes have brought unprecedented detail to numerous areas of research.

Moerner has revealed previously unseen shapes of filaments in living bacteria and resolved single molecules in three dimensions far beyond the diffraction limit. "By randomly turning on different molecules which sample different parts of the structure, you can sum up all of those points of localization and get the final structure. This is an idea that has grown into many different technologies, but all build on using single molecules to image," said Moerner.

Stefan Hell theoretically conceived and experimentally developed the first far-field optical microscope that breaks the diffraction limited resolution barrier, as proposed over a hundred years ago by German physicist Ernst Abbe. Dubbed Stimulated Emission Depletion microscopy or STED, this novel method was essential to the realization of super resolution imaging.

In a STED microscope, a synchronized pair of laser pulses excites fluorescence from a dye in the sample, and then shrinks the size of the fluorescent spot by a depletion pulse. Depletion quenches the excited molecules to the ground state by stimulated emission, thereby stopping fluorescence. By spatially arranging the STED pulse in a doughnut shape, only the molecules at the periphery of the spot are quenched—the center of the doughnut, the region closest to the sample being observed, remains fluorescently illuminated. By preventing fluorescence at the outer part of the "donut" or focal spot, resolution is drastically sharpened.

"We use the phenomenon of stimulated emission to annihilate the excitation process. We actually want to reduce the area in which molecules get excited, but that is not possible. So what do we do? We apply a beam of light that is able instantly to annihilate excitation—push it down to the ground state, and technically we do this by modifying the beam so that it forms a donut, and then you squeeze the area of excitation to a much smaller region," said Hell.

Two molecules that would otherwise resemble a blurred blob can now be viewed individually by sequentially switching one of them off through STED, the hallmark of super resolution microscopy.

"One of the things that is exciting about the level of detail and preciseness in images of the different stages of the cell cycle that super resolution microscopy is able to provide is that these are images of living cells—previous experiments usually involved antibodies and the fixing of cells," said Moerner.

ANNOUNCEMENTS

Distinguished Traveling Lecturer Program in Laser Science

The Division of Laser Sciences (DLS) of the American Physical Society announces its lecture program in Laser Science, and invites applications from schools to host a lecturer in 2009/2010. Lecturers will visit selected academic institutions for two days, during which time they will give a public lecture open to the entire academic community and meet informally with students and faculty. They may also give guest lectures in classes related to Laser Science. The purpose of the program is to bring distinguished scientists to colleges and universities in order to convey the excitement of Laser Science to undergraduate students.

The DLS will cover the travel expenses and honorarium of the lecturer. The host institution will be responsible only for the local expenses of the lecturer and for advertising the public lecture. Awards to host institutions will be made by the selection committee after consulting with the lecturers. Priority will be given to those predominantly undergraduate institutions that do not have extensive resources for similar programs.

Applications should be sent to the DTL committee Chair Rainer Grobe (grobe@ilstu.edu) and to the DLS Secretary-Treasurer Anne Myers Kelley (amkelley@ucmerced.edu). **The deadline for application for visits in Fall 2009 is May 30.**

Detailed information about the program and the application procedure is available on the DLS-DTL home page:http://physics.sdsu.edu/~anderson/DTL/

Lecturers for 2009/2010:

Laurie Butler, University of Chicago.
Hui Cao, Yale University
Eric Cornell, University of Colorado.
Jim Kafka, Spectra Physics.
Fleming Krim, University of Wisconsin
Christopher Monroe, University of Maryland.
Luis A. Orozco, University of Maryland.
Carlos Stroud, University of Rochester.
Ron Walsworth, Harvard University.
Linda Young, Argonne National Lab.

ERRATUM

In the Spring Prize and Award insert that was published with the March *APS News*, we inadvertently printed the wrong citation for B. Sriram Shastry of UC, Santa Cruz, recipient of the Lars Onsager Prize. The correct citation is:

"For pioneering work in developing and solving models of strongly correlated systems and for wide-ranging contributions to phenomenological many-body theory, which have advanced the analysis of experiments on strongly correlated materials."

ERRATUM

Two names were inadvertently omitted from the list of 2008 APS Fellows that appeared in the insert to the March *APS News*. They were both nominated by the Division of Particles and Fields, and they are: Robert Roser, Fermilab, "For leadership at many levels in the CDF Collaboration, and for contributions to the characterization of the top quark"; and Alan Schwartz, University of Cincinnati, "For important experimental contributions to the study of weak interactions of heavy quarks."

APS News regrets any inconvenience caused by this omission.

Now Appearing in RMP: Recently Posted Reviews and Colloquia
You will find the following in the online edition of
Reviews of Modern Physics
at
http://rmp.aps.org

Statistical physics of social dynamics

Claudio Castellano, Santo Fortunato and Vittorio Loreto

How can a group of simple atoms or molecules apparently respond and react in a collective fashion? The study of statistical physics has provided a framework to understand this sort of simplicity which arises in many-particle systems. Social organizations, formed out of conspiring and cognizant actors, are the new challenge to the statistical mechanical approach. This review provides a broad overview of the current thinking in the dynamics of opinion, crowds, language, and other cultural structures.

TEAPOT continued from page 1

with someone who is capable of such a major mistake'."

Around the globe, scientists and academics were quick to condemn TÜBİTAK's apparent censorship. In an open letter, APS President Cherry Murray asked the director of TÜBİTAK Nuket Yetis to reverse the decision to censor Darwin and to reinstate Atakuman to her former post.

"This kind of interference with the communication of scientifically valid information for political and ideological reasons poses a severe threat to the scientific enterprise in Turkey. It is especially pernicious because Turkey, like other democracies, needs a scientifically well-educated population in order to prosper in the modern world," Murray wrote.

Public outrage in Turkey against the perceived censorship was also strong. Despite polls in the country that show as little as a quarter of the general population accepts evolution, there was near universal condemnation of the incident by the Turkish press and academic communities. In one public demonstration, high school students presented a book about evolution published by TÜBİTAK to the headquarters of the agency in Ankara.

Scientists have long depended on TÜBİTAK and *Bilim ve Teknik* for reliable scientific information and criticized the firing of its editor and apparent censorship of the Darwin article.

"It's an unfortunate event that happened in Turkey which was established in 1923 as a secular democratic republic," said Dinçer Ülkü, a retired physics professor from Hacettepe University, a member of the Turkish Academy of Sciences and former president of TÜBİTAK from 1997 through 1999, "I am also very saddened that it has definitely hurt Turkey's reputation abroad."

However many do see a silver lining in the controversy. The strong reaction against the censorship has prompted TÜBİTAK to announce that the next issue of *Bilim ve Teknik* will be entirely devoted to Darwin and evolution. Shortly after her removal, Atakuman was also reinstated to her former post.

"This shows clearly that TÜBİTAK realized they weren't right," Ülkü said adding the he was worried that some of the international press was implying a widespread political suppression of the Turkish science community that didn't exist, "Nobody is scared in Turkey because you defend evolution. You don't have to hide."

TÜBİTAK was originally founded in 1963. It is the most prestigious scientific institution and the main promoter of science and technological advancement in the country.

"I would like to remain optimistic about science-based research in Turkey," said Ercan Alp, a senior scientist at Argonne National Laboratory, "With big science projects on the horizon, like the Turkish Accelerator Center, several nano-science centers, and centralized scientific infrastructure developments at many Anatolian Universities, I have every reason to remain hopeful. This controversy, in particular, may have galvanized the students, biology teachers, and university professors to be more aware of their mission, and they may take their responsibilities more seriously."

Alp, who received a grant from TÜBİTAK to teach at Ankara's Bilkent University for two months in 2008, went on to say that the controversy came as a surprise considering the Academy's long and respected track record of promoting science.

COMPUTERS continued from page 1

the more complicated interactions leading up to star formation. In areas that are dense enough that dust and gas collapse and stellar fusion begins, the program taps into a third physics engine to better detail the actual star formation.

Using the program, Padoan found that star-forming tendrils are created in patterns consistent with unexpectedly weak magnetic fields. In this way, Padoan and his team have primarily used the program to understand the underlying dynamic properties of astral clouds.

"What we do is highly idealized," Padoan said, "We don't try to reproduce the shape of a molecular cloud." He added also that a colleague of his was using the program to better understand the formation of the first stars out of the primordial gas cloud.

Recreating existing complex clouds is exactly what Fuqing Zhang of Penn State University is doing. He has been taking Doppler radar information on the paths of hurricanes crossing the Gulf of Mexico in hopes of predicting where they'll hit the coast. This approach to forecasting relies primarily on probabilities derived from estimated cloud turbulence models.

"This will be the future of hurricane predictions," Zhang said, "With better data and a better way to get the data into the model we could potentially make a big difference."

Zhang is able to produce a working forecast within seven hours of storm chasers' data collection. In 2008, with Hurricane Ike bearing down on the Gulf states, his team at the Texas Advanced Computing Center predicted within a few miles where the storm was going to hit.

Zhang's team calculated the hurricane's path more accurately than the national weather service largely because of the finer resolution his model afforded him. The computing power at the TACC was able to process the chaotic hurricane down to roughly 1.5 km scale resolution, rather than the 5 km resolution available at NOAA. In order to further improve predictions, Zhang stressed that a better understanding of the turbulent dynamics of individual clouds was needed.

Hurricanes can be thought of as massive yet inefficient natural engines using heat from the sun to transfer moisture across great distances. Jacqueline Chen of Sandia National Laboratories has been working on the underlying science needed to improve the efficiency of car engines by using some of the world's fastest computers to model ethylene-air jet flames.

"What our group has been doing for the past decade is we use high performance computing to directly simulate some of the gas-based chemical interactions." Chen said.

Chen and her team use over 1.3 billion individual data points to map a lifted autoigniting turbulent jet flame. Taking advantage of peta-scale computing power, Chen's team has been able to glean numerous insights into reactive turbulent mixing and its effect on finite-rate chemical effects. Engineers designing the next generation of energy-efficient cars will be able to adapt these simulations to develop engines that efficiently burn fuel with lower emissions.

"We're at the fundamental science end of the spectrum rather than applied engineering," Chen said, adding that even small boosts in engine efficiency would have a tremendous impact. Currently combustion accounts for roughly 85 percent of energy used in the US while transportation accounts for more than 65 percent of petroleum consumed.

In many ways, the human circulatory system is one of the most complex and efficient feats of engineering. Twenty-four hours a day, the heart pumps 5.5 liters of blood through an intricate network of veins and arteries over 60,000 miles long. Up to now, predicting the effect of medications such as blood thinners in a system so complex has been extremely difficult. To better understand their effects, George Karniadakis is helping to map the blood flow of the entire human circulatory system.

"The job is very complex," Karniadakis said, "We have to simulate everything, both the large scale but also the very small scale. From the arteries down to the very small capillaries."

Blood flows through a complicated network ranging from massive arteries as wide as a roll of quarters, down to capillaries only big enough to let a single blood cell through at a time. To best model the many different sizes and types of junctions Karniadakis split the work among separate computing labs across the country. Each lab modeled the fluid flow through one of the types of arterial intersections. Separately, another team, part of the human physiome project, built a complete three dimensional map of the entire circulatory system. Karniadakis is now in the process of plugging each junction's virtual flow into the detailed circulatory map to creating a complete simulation of blood flow in the body.

To test the computer simulation's accuracy, Karniadakis' partners at Ghent University built a mockup of a highly simplified circulatory system using lengths of flexible tubing and a motorized pump. By first simulating this circulatory mockup, Karniadakis was able to experimentally verify the computer's accuracy after comparing predicted pressures with actual readings taken in the mockup.

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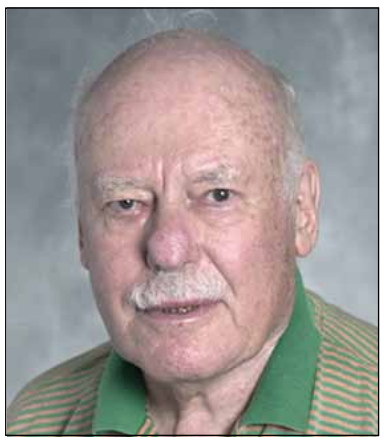
Why talking to physicists tells you what you can't hear elsewhere

By Harry J. Lipkin



As a member of the international community of physicists I have learned more about crucial international problems by talking to physicists than I could ever learn from reading articles and papers by so-called experts. In particular I have learned that many of the myths promulgated by the media are utter nonsense and destroy any sensible analysis of reality. In the middle east these myths include: 1. There is a unified Arab World or Moslem World. 2. The destruction of Israel has a high priority among Arabs and Moslems. 3. If Iran acquires nuclear weapons they will bomb Israel. These myths are not even wrong. But they are accepted by so many American Jews and Israelis that they can lead to catastrophes in crazy wars against imaginary enemies.

1. The June 1967 Six Day War

Several months before the outbreak of the war between Israel and Egypt I heard interesting facts at lunch after our regular Weizmann-Tel Aviv joint particle physics seminar. There had just been an air battle between Israel and Syria in which six Syrian planes had been shot down with no Israeli losses. But the Syrian media showed proudly a faked picture of an Israeli plane going down in flames. Our colleague Yuval Ne'eman noted that it is good for us when the Arabs cover up their defeats with fake victories. The fake victory tells them that they have no need to correct the defect that caused the loss. Yuval was a distinguished particle physicist who had previously been head of Israeli army intelligence.

In the 1956 Sinai War Israel had defeated the Egyptian army in a few days. A reasonable government would have fired the Egyptian Chief Staff, General Amer, and fixed what went wrong. But because the Americans and Soviets intervened and forced the French, British and Israelis out of Egypt, Egyptian President Gamal Abdel Nasser had hailed this as a great Egyptian victory, and had left Amer in charge to lose the next war.

In a recent incident some Egyptian planes had unintentionally crossed the border and were forced to land in Israel. Yuval had been sent by the Israeli army to interrogate the pilots and asked them about their training. They were very proud of their ability and said that they did not need any more flying hours to improve it. But the numbers of their regular flying hours were much lower than the average number required for Israeli pilots.

Shortly after the Six Day War I saw a Pakistani physicist who told me that Pakistani intelligence was not at all surprised by Israel's lightning victory. They did not expect that Israel would destroy all the planes on the ground. But if they had managed to get into the air it would have made no difference; they would have immediately been shot down by the superior Israeli Air Force.

He also told me that shortly afterwards a Russian delegation came to Pakistan trying to sell their MIG fighter planes. The Pakistanis asked why they should buy MIGs when the Israelis flying French Mirages destroyed the Egyptians and their MIGs? The Russians claimed that the victory was due to the inferiority of the Egyptian pilots. The Pakistanis showed them the names of four Soviet pilots who had been shot down in air battles against Israeli Mirages. This information was highly secret; you only hear about it by talking to physicists.

At another conference shortly after the war I met Eastern European physicists who had worked at the Soviet accelerator lab in Dubna. They were happy to tell me that the Soviets had had to change their missile defense of Moscow after the Israelis captured secret Soviet equipment from Egypt. I asked them how it happened that the Soviets were so surprised by the Israeli victory when the Pakistanis were not. They said that the top leadership does not hear directly about the situation but only through a chain of command. It is not politically correct to say that the degenerate capitalist Israelis are so much better than the progressive socialist Egyptians. So that at each stage in the chain there is a slight distortion of the facts which leads to the total surprise at the top.

2. Mideast peace talks and Lebanon

At a time when the media was full of the anger of the Arab world about Israel passing a law taking control of Jerusalem, an American physicist asked me over coffee at Fermilab whether this Jerusalem incident would destroy the peace talks between Israeli Prime Minister Menachem Begin and Egyptian President Anwar Sadat.

Before I could answer, a visiting Arab physicist said "Of course not. Begin and Sadat are negotiating because peace is in the national interest of both sides. No one will sacrifice national interest because of this Jerusalem issue. Sadat will break off talks for two months to pay lip service. Then he will go back to business as usual." The physicist was correct. He then told us that Western media do not understand anything. They talk about Israelis backing Rightist Christians in South Lebanon against Leftist Moslems and Palestinians. There is no left or right here. The leader of one of the "leftist parties" belongs to one of the richest landowning families in Lebanon and he inherited his position from his father.

The main issue in South Lebanon was that Palestinians setting up military camps to fight against Israel were displacing Shiite Moslems from their homes. These Moslems knew that they must fight to save their homes. Even if the Palestinians won and destroyed Israel, the Palestinians settled in Shiite homes would never leave. The Shiites joined with the Christians in the "South Lebanon Army" to throw the Palestinians out of Shiite homes. At that time the number of Shiite Moslems in this "Rightist Christian army" was roughly equal to the number of Christians. The Shiite Moslems were an underprivileged group in Lebanon which was dominated by Sunni Moslems. The Palestinians are Sunnis. The Shiites are now encouraged by the Khomeini revolution in Iran. This situation was bound to explode.

Unfortunately nobody listened to this and the disasters for Israel of two Lebanon wars would have been avoided had the leaders listened to the reality known to physicists instead of to their own pipe dreams and the media.

But the main problem according to the Arab physicist was that the West needed Mideast oil and could only pay for it with tanks. The Egyptian-Israeli peace was destroying the tank market, but the West had already ready found a replacement. In a few months war would break out between Iran and Iraq. Nothing in the media predicted this but the physicist was right. The war went on for eight years. Some time later an Iranian expatriate physicist in America told me that this crazy Iran-Iraq war was completely controlled by outside powers. Both sides were using ammunition, spare parts and other supplies which they needed to procure abroad. These were used at such a rapid rate that foreign suppliers could stop the war any time by turning off the pipeline. But the West was more interested in profits than peace.

3. Learning from talking with Egyptians

In Cairo an Egyptian physicist told me that the people supported Sadat's decision to make peace with Israel. They were fed up with war. But their Vietnam was not against Israel. In Nasser's crazy Yemen war the Egyptian soldier had no idea what he was fighting for and there was an order of magnitude more casualties than in all the wars against Israel.

At that time the Arab League had boycotted Egypt because of the peace with Israel.

This will not last, he told me. Egypt is the natural leader of the Arab world. They will follow us. His prediction was confirmed during the Iran-Iraq war when the Arabs realized that Iran was a much greater danger to the Arabs than Israel. They restored Egypt to its former position. The Arab League refused to let Yasser Arafat speak about Palestine at their meeting because the Iranian threat was much more important.

The Egyptian physicist said that Lebanon was too weak to make peace with Israel and we should get out. Egypt could make peace because Egypt was the strongest power in the Arab world. Iraq was the second strongest and Saddam Hussein might be ready to make peace with Israel in return for support against Iran. But Israelis did not listen to this one.

4. Divisions in the Moslem World

Another Egyptian physicist in Cairo told me: "It was we, the Egyptians and the Jews, who brought civilization to the West when the Arabs were barbarians. It is a disgrace that we must kowtow to these Arabs now because they have oil." He was proud of the fact that Cairo was the only city in the Arab world where a woman could walk alone at any hour of the day or night without being molested by anyone. He took my wife, Malka, and me for a walk through the Moslem quarter of Cairo late in the evening where we saw women walking alone. Another physicist said that he lived modestly even though he could earn fifteen times his Egyptian salary if he accepted an invitation to spend a semester in Kuwait. He did not want to leave his family and Kuwait was no place to take a woman.

But aren't Egyptians also Arabs? This ambiguity is part of the reality which we need to understand. I saw this dichotomy between Islam and the heritage of the Pharaohs in a statue in the center of a traffic circle near the entrance to Cairo University. The inscription under the statue of a woman with her hand on a sphinx stated that this symbolizes the liberation of the Egyptian peasant woman and her reliance on her ancient heritage.

When I asked a Pakistani physicist about this issue, his answer was: "Of course. The Prophet taught us many things. But we had a well developed civilization long before when the Arabs were barbarians." Can you imagine any Christian saying this about Jesus?

You never see such things in media reports with their generalizations about Islam. You learn by talking to physicists that Arabs and Moslems are all very different from one another and are much more involved in these differences than other issues. Most couldn't care less about Israel.

After the attack on the World Trade Center in New York the media was full of general nonsense about Islamic extremism being the cause of the attack. Talking to two Moslem physicists, one from Turkey and one from Bangladesh, gave a very different analysis. The attack had nothing to do with Islam. It was part of a power struggle within the Arab world for control of oil. On CNN I had heard one Arab report which was never repeated. The reason for the attack was because the United States was supporting the King of Saudi Arabia in the same way that they had supported the Shah of Iran and both would go down the same way.

5. The 1982 Lebanon War

In 1981 when the media were full of how the Palestine problem was the main barrier to Mideast Peace, I heard a very different story from Lebanese physicists and published it in the *Guardian* and in the *New York Times*. Here is an excerpt:

"The real threat to Mideast peace might well be in Lebanon. More people had been killed in one year of Lebanese fighting than in over three decades of Arab-Israeli wars. Lebanon was under a brutal Syrian occupation actively massacring innocent people and not recognizing their rights to freedom and self determination. Time was rapidly running out in Lebanon. President Elias Sarkis's term of office was ending and Lebanese law forbade his succeeding himself. New elections, needed to give Lebanon a legal government, were impossible under the Syrian occupation. The people were getting fed up. Some even thought that Lebanon would be better off as a Soviet satellite like Czechoslovakia if a deal with the Russians would get rid of the Syrians. If the West did not take the initiative to get the Syrians out of Lebanon, the Russians would. Then it would be too late."

The action I suggested was based on what I had heard from physicists. It took place when the Israelis on a flimsy pretext invaded Lebanon. American Marines came into Beirut "to protect the Lebanese from the Israelis" and accidentally (?–draw your own conclusions) just in time to drive out the Syrians and make an election possible. I watched the events on TV at Fermilab with a Lebanese colleague who knew every street in Beirut. The operation had evidently been well planned beforehand. On the first day of the war the Israeli Air Force bombed to close the Beirut-Damascus highway at the precise point where the Americans later stopped the Israeli invasion.

This is the kind of information you only get from talking with physicists.

Harry Lipkin is one of the founders of the Physics Department at the Weizmann Institute. He received a bachelor's degree in Electrical Engineering from Cornell University in 1938, worked on microwave radar development during World War II, switched to experimental physics to get a PhD at Princeton, and then immigrated to Israel where he eventually became a phenomenologist.

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