Gala Laser Celebration Sparks in the Snow

By Michael Lucibella

APS and the Optical Society of America held a gala event at the Smithsonian Museum of American History to kick off the year’s physics outreach program LaserFest. Energy Secretary and Nobel Laureate Steven Chu delivered the keynote address, highlighting the history of the laser, and laser innovations over time.

“Lasers are everywhere in society. Many times society doesn’t know how deeply embedded they are,” Chu said, “the first fifty years have been great, hopefully the next fifty years will be even better.” Chu won the Nobel Prize in 1997 for optically trapping and cooling atoms using lasers.

LaserFest is a yearlong series of events celebrating fifty years of laser innovations and applications. APS has joined with the OSA, SPIE, and IEEE Photonics to put together events throughout the year aimed at making the public aware of the importance of lasers in modern society and honoring the physicists and engineers who made it all possible.

Kavli Plenary Session Examines STEM Education

By Calla Cofield and Gabriel Popkin

On Saturday, February 13, the APS “April” Meeting featured a plenary session entitled “Re-Energizing America’s Focus in STEM Education,” which was funded by the Kavli Foundation and organized jointly by the APS, the American Association of Physics Teachers (AAPT), the National Society of Black Physicists, and the National Society of Hispanic Physicists. Speakers included Linda Slakey of the National Science Foundation (NSF), Shirley Malcom of the American Association for the Advancement of Science (AAAS), and Robert P. Moses of the Algebra Project.

Slakey, the Acting Executive Officer of the Education and Human Resources Directorate at the NSF, opened the session with her talk titled “Catalyzing Widespread Implementation of Good Teaching Practices.”

At the high school level, the key challenge to implementing good teaching practices is simply that, as Slakey put it, “we don’t have physics teachers teaching physics. Without teachers who are deeply conversant with the subject, students are not receiving the feedback they need to their questions, or finding professional role models.”

On the other hand, college level education suffers because for the most part it does not incorporate a growing understanding of how students learn STEM subjects.

“Many of our colleagues have a deeply held misconception that lecturing is the most effective way to teach,” said Slakey, “when in fact there is a lot of evidence to the contrary.” Slakey said she looks largely to member societies like the APS to positively confirm the creation of the much sought after spark of the meeting.

Blockbuster Meeting Set for Portland

The APS March Meeting, the largest physics meeting of the year, will take place at the Oregon Convention Center and the HiltonPortland and Executive Tower Hotel in Portland, Oregon from March 15–19. Meeting attendees will present over 7,000 research papers in a wide variety of fields including condensed matter, computational physics, chemical and biological physics, new materials, polymers and fluids. A number of sessions will also look to explore the role of physics in different segments of society including its role in industry, national security, human dynamics, sustainable energy, and energy storage.

This year’s meeting coincides with the fiftieth anniversary of the construction of the first working laser. To mark this important milestone, APS has partnered with the Optical Society of America, SPIE, and IEEE Photonics to put on LaserFest, a yearlong celebration of laser innovations and applications. LaserFest events at the March Meeting will focus on the importance of lasers in society, including session 1B “Five Legacies from the Laser,” and 18 “LaserFest: Laser Education and Outreach,” as well as the LaserFest booth.

RHIC Sets Temperature Record

At the “April” meeting, physicists from Brookhaven National Lab announced that they measured the hottest temperature ever recorded, thus recreating an exotic form of matter that hasn’t existed since microseconds after the Big Bang. This is the first time that physicists were able to positively confirm the creation of the much sought after quark–gluon plasma.

“The RHIC at Brookhaven created matter that seems to be at a temperature of 4 trillion degrees Celsius. This is the hottest matter ever created in a laboratory,” said Steven Vigdor, Associate Laboratory Director for Nuclear Particle Physics at the Lab, “We’re talking about a computer chip the size of a fingernail. We’re talking about stacking layers of graphene on top of graphene. We’re talking about being able to get energy out of the universe, and we’re doing it in a lab.”

Record Snow Doesn’t Faze Meeting Attendees

The record amounts of snow falling on Washington DC just days earlier had little effect on the joint APS “April” Meeting and AAPT Winter Meeting held in the city.

The two snowstorms, locally dubbed “Snowmageddon” and “Snowweekend,” wallowed the DC region with over 38 inches of the white stuff in just six days. This made it the snowiest winter in the nation’s capital, closing the federal government for an unprecedented four and a half days.

But even with the snowstorms and a further dusting on Monday, the joint APS/AAPT meeting went on almost as expected. The snow did slightly delay the start of an affiliated conference of the Physicists Teacher Education Coalition (PTEC) and force cancellation of Friday’s Professional Skills Development Workshop and High School Teachers Day.

Continued efforts by the local department of transportation to remove snow drifted snarled traffic all around the city throughout the weekend of the meeting.

However, nearly all of the scheduled sessions and events from Saturday forward went ahead with only minimal interruption. Preliminary attendance numbers available at press time indicate that the number of people forced to cancel their plans to attend the meeting was surprisingly small.

Most meeting attendees said that overall the snow had little impact on them.

“I don’t think it’s really affected the meeting too much. We’re from Michigan so we’re pretty used to this,” said Aaron Siebold at the Andrews University Physics Enterprises Booth, “We were kind of surprised at how they didn’t know how to clear the streets around here.”

Donald Koeck from Valparaiso University reflected this sentiment, “You’ve got to be very careful when you’re out walking, but we got in with no problem.”

Others, however, were more averse to the wintry conditions. “I’m from Texas so we don’t do snow,” said Toni Sauncy, president of the Society of Physics Students, “I brought a gigantic грizzly bear coat because I was afraid of the snow, and I didn’t leave the hotel for three days.”
**Industrial Applications Prize Set for Round Two**

AIPS will select the second recipient of its new Prize for the Industrial Applications of Physics this year. Preliminary nominations, consisting of a letter of at most one page, plus one additional optional letter of support, are due this April. The selection committee will then choose a list of finalists from among the preliminary nominations, and these will be asked to submit a complete nomination. The recipient(s), recommended by the selection committee from among the finalists, will be approved by the AIPS Executive Board at its September meeting.

Preliminary nominations are designed to make it as simple as possible to submit nominations, in recognition of the fact that many industrial physicists are at smaller companies, and may not have the time and resources comparable to their academic colleagues. As the prize website states, "The Prize will be awarded for innovative, lead-edge ap..."

*PRIZE continued on page 7*

---

**This Month in Physics History**

**March 21, 1768: Birth of Jean-Baptiste Joseph Fourier**

Jean-Baptiste Joseph Fourier (in Latin, Joannes Baptista Josephus Fourier) was born on March 21, 1768 in Auxerre, in Burgundy, France. Fourier is best known for his work on the mathematical representation of heat flow. His theorem states that any function can be represented by a series of sine functions, now known as Fourier series. Fourier's work paved the way for the development of Fourier transforms, which are used in many fields, including signal processing, image compression, and quantum mechanics.

---

**The Midwest is just too flat and we wanted to be somewhere in the West,”**

Glen Wagner, on why he re-...
NIH Recruits Physicists to Battle Cancer

By Alaina G. Levine

The National Cancer Institute (NCI) is investing millions of dollars in a collaborative network of 12 Physical Science-Oncology Centers that will provide new insight into the war on cancer. The new centers were announced February 11.

“This is the first time that biologists are asking physicists for concepts,” and not just technological knowhow, notes Robert Austin, physics professor and Principal Investigator (PI) of the new Princeton University Physical Sciences-Oncology Center.

Larry Nagahara, NCI Program Director for Nonbiological Sciences, notes that until now, the NCI has relied on physicists mostly for the technology they can develop to support cancer research. For the first time, “rather than [provide] the technology, we actually want [the physicists] to ask the questions,” he says, which will vary greatly from those asked by biologists.

“...what is the energy required for a cancer cell to metastasize?...What are the forces required for a cancer cell to move?” suggests Nagahara. “Hopefully [this] will shed light on how cancer develops as a disease.”

Each center, which received approximately $15 million in October 2009 for a period of five years, was created with “spectacular foresight and imagination,” says Paul Davies, professor of physics and head of Arizona State University’s Physical Sciences-Oncology Center. “The purpose...is to break with tradition in cancer research which has been dominated by cell biologists and geneticists...and to borrow from the style of thinking that physical scientists bring to bear on complex problems and open up a new front on the war on cancer.”

Several fields of physics are involved, including the study of light at the microscopic level, better understanding of the forces required for a cancer to grow, and the development of technologies to image and destroy cancer cells.

“...the forces required for a cancer cell to move?” suggests Nagahara. “Hopefully [this] will shed light on how cancer develops as a disease.”

Each center, which received approximately $15 million in October 2009 for a period of five years, was created with “spectacular foresight and imagination,” says Paul Davies, professor of physics and head of Arizona State University’s Physical Sciences-Oncology Center. “The purpose...is to break with tradition in cancer research which has been dominated by cell biologists and geneticists...and to borrow from the style of thinking that physical scientists bring to bear on complex problems and open up a new front on the war on cancer.”

Several fields of physics are involved, including the study of light at the microscopic level, better understanding of the forces required for a cancer to grow, and the development of technologies to image and destroy cancer cells.
Gravity Probe B Funding Source Clarified

It was good to see the Feb 2010 APS News identify Gravity Probe B as “One of the Top Ten Physics Newsmakers of the Decade”. As you report, the data analysis continues with increasingly accu-
rate results. The final announce-
ment Watch Your Language!
While Michael Lubell’s analy-
sis of the danger to big government and crony capitalists posed by the Tea Party movement (“Vox Populi,” Feb 2010 APS News) is largely correct, his language is any-
thing but. The term “Tea-Baggers” Sinister Tale Elaborates on History Column
The article about Heaviside [This Month in Physics History, APS News, February 2010] reminds me of a lunch at MIT some fifty years ago at which Norbert Wiener was present and at which he was asked about the novel he had recently written (The Tempter, Ran-
don House, New York, 1959). It was in fact based on the story of Heaviside, Pupin, and AT&T and
Need to Engage More People in Science
Virginia Corless’s Back Page article [APS News, February 2010], “Theater Deepens the Vision of Physics,” was moving. Her use of the word “deeper” I think was very powerful, suggesting that expand-
ing physics onto the stage will not only broaden and popularize it, but that it should further the science. Virginia’s recounting of various scientific plays made clear what a beautiful and human struggle the history of science has been and must con-
tinue to be. Most of today’s science is funded by the public, but most of its results are not published openly for public evaluation. As we who share the responsibility and desire to “convince people that the science of the world we live in belongs to them,” let’s think of ways to en-
geage more people in the scientific
Stoppard’s Arcadia has Physics Theme
I very much enjoyed Virginia Corless’s Back Page, “Theater Deepens the Vision of Physics,” in the February APS News. But I don’t think Michael Frayn’s Copenhagen was “first on the scene,” as she says, among recent plays with physics-related themes. Tom Stoppard’s Arcadia, written a few years earlier, deals with chaos theory as one of its major themes, though, as you might expect from a Stoppard play, it has several other interlocking themes as well. It has been one of my favorite plays since I saw a high school pro-
duction that my son was involved in about 10 years ago, and I highly rec-
ommend it to other physicists.

Michael Gerver
Raanana, Israel

Human Spaceflight Provides Needed Pension

Retired director of Lockheed Martin’s Norcross, Georgia, office, chaired NASA’s Review of U.S. Human Spaceflight Plans Com-
mittee, spoke candidly at the April meeting about the future prospects of human spaceflight.

“The NASA administration needs the authority to manage NASA,” Augustine said, adding that he felt that increasing bureaucra-
icy at NASA meant “they’re told by Congress to, ‘Manage NASA, but don’t lay anybody off or close any facilities.’

In September of 2009 the Au-
gustine commission delivered its report to the President’s Office of Science and Technology Policy about the future of manned space flight. At his talk, Augustine stopped short of criticizing the administration’s plan to cancel NASA’s Constellation Program, the planned spacecraft that would replace the aging shuttle fleet. It was his first public appearance since the official announcement to cancel the program.

“It goes somewhat beyond any of our options,” he said, “I would hope the nation could af-
ford additional funds. I do realize we are in a tough financial period and [research] is one of the few places in the budget that got ad-
ditional money.”

According to the president’s proposed budget, NASA received a $276 million budget increase, while funds from the Constel-
lation program would be spread around to other research within the agency. About $1.2 billion would be added to research pro-
grams devoted to developing new technologies for human space-
flight.

He said that one of the major roles of human spaceflight is to inspire people and to get them and awe, even. Of nothing that inspires quite like space and dinosaurs, and we don’t have any more dinosaurs.”

RHIC continued from page 1

RHIC continued from page 1

The Relativistic Heavy Ion Collider smashed gold ions to-
gether resulting in collisions close to 370 MeV per nucleon-
enron. But we looked for signal pro-
tons into their constituent parts. As these temperatures, roughly 250 times hotter than the core of the Sun, the bonds that hold quarks together in protons and neutrons break apart, pro-
ducing a free flowing liquid-like state of matter. For less than a billionth of a trillionth of a sec-
don, quarks and gluons flowed freely in a “perfect” frictionless fluid that hadn’t existed for 13.7 billion years.

Members of the PHENIX col-
aboration used a technique that measured the energy distribution of the gamma rays emitted by the hot plasma to definitively record the temperature of the matter for the first time.

In 2005, physicists at RHIC announced from their experiments indic-
ated that the quark-gluon plasma would behave more akin to a liquid rather than a gas as pre-
viously predicted. At the time, however, they were unable to pin down the precise temperature of the collisions, and it was unclear if the quark-gluon plasma had been produced.

Anzing this exotic state of matter, sometimes referred to as “quark soup,” offers insight into the universe at a very young age. By recreating conditions shortly after the Big Bang on a small scale, physicists can “try to explain why protons and neutrons from its energetic state to the universe of protons and neu-
trons that exists today.

“We can model some of the phenomena that occur at even earlier stages in the universe, such as the generation of matter-antimatter asymmetry,” said Dmitri Khar-
kee, a theoretical physicist at the Lab.

Brookhaven physicists ana-
lyzing the behavior of the quark-
gluon plasma created at the lab, believe it is a state called “bub-
bles” of broken symmetry in the movements of charged quarks.

Observations by the STAR col-
aboration found that magnetic fields induced by the high-speed ions caused positively charged quarks to move preferentially in one direction along magnetic field lines while negatively charged quarks tended to move in the opposite direction. These preferences were slight, only a few parts per 10,000, but signifi-
cantly enough to pique interest.

These bubbles really are twists in the gluon field called “bubbles” of broken symmetry in the movements of charged quarks. We are not yet claim-
ing observation of this, but it is very suggestive.

Physicists hope that this could lead to greater insights about the fundamental asymmetry of mat-
er and antimatter in the early universe. The full results of the experiments were published in a recent edition of Physical Re-
view Letters.

The temperature record is likely to stand until after the LHC starts its heavy ion col-
imizations near the end of 2010. Once they begin, Vigilor estimates that it could take four to five years before they are able to make a definitive measurement of a higher temperature.

Visit us on the web at
http://www.aps.org/
vital in cancer investigations, including condemned matter, bordering the successes of complex systems, and the physics of modeling, say the PIs. The chaotic morphotype of a tumor is better understood by applying our knowledge of packing physics and spin glasses, says Davies and Austin. A tumor “is a very chaotic state.” It is the ever-changing, evolving system, continues Austin. “There are many areas of the physics of complexity and emergent behavior that I think map over in our study of cancer.” At Princeton, Austin’s group is researching how to control the evolution of cancer resistance to chemotherapy. In addition, his team is developing microfabrication techniques to design and build chips that represent “an artificial world…a very complex place where [cancer] cells can grow…and evolve.” They will provide these chips to other centers to study using their own techniques, he says.

W. Daniel Hills, physicist, entrepreneur, and director of the USU Physics-Sciences-Oncology Center, is focusing on crafting a predictive model of a specific cancer that will allow scientists to better understand the tumor’s responses. With a background in the physics of dynamical systems, he contemplates the use of models similar to the Metropolis Algorithm.

While it is a “familiar idea to physiologists that you would build a predictive mathematical model of a system…that’s a very unfamilial concept in biology,” Hills points out. “Typically biologists tend to study a system at a single level of mechanism.” But the technique of modeling complex systems has an extremely productive area in physics, he says, and “physicists are very good at bringing together these multi-scale models and then calibrating them with very specific experiments from lots of different levels…If we could do something like that for cancer, then it would be a completely different paradigm for treating cancer.”

Hills sees cancer as a complex failure of a complex system, and imagines “it would be much more complicated than a single failure…very similar to global climate models…[with which] we can simulate different courses of action.”

Davies’ team, which like the others includes faculty from the host university and other institutions, is interested in the physical environment in which cancer grows. “Cells are remarkably responsive to the physical environment...and they probably respond to bioelectricity as well,” he suggests. “So we are thinking that we may control cancer by controlling the physical environment.”

Understanding information exchange between the cancer and its adjacent environments is key. “It’s now becoming clear that this a code in the cancer and the surrounding tissue exchange information and change each others’ properties.” The point of cancer, Davies continues, is not the tumor itself, but rather the invasion, or metastasis of cancer to another. And no one knows why this happens, he says. “All we know is that they deploy all sorts of clever tricks to get there and then when they’re there, they change the properties of the site in which to take up residence. So we think the physical properties of those sites are important for site selection.”

Davies furthermore intends to use Atomic Force Microscopy in combination with a confocal microscope to examine and try to correlate the physical and morphological properties of cancer cells.

Other centers’ endeavors range from Hills’ assembly of a three-dimensional tumor model (Cornell), to exploring the mechanical forces in cancer (Johns Hopkins). Although every center has a physical science heart, USC, Cornell, Princeton, and ASU are the only universities whose center PIs are physicists, as opposed to engineers, biologists and oncologists.

As is to be expected with physicists, controversial viewpoints have already blossomed. Austin, for example, posits that “cancer is not a disease. It is a programmed event which the body tolerates, which might give rise to a fitness advantage for the species or the individual.” We “have to rethink the way we deal with cancer,” he says. “We’re going to learn some fundamental rules about evolution and how evolution proceeds in non-random ways. And we might discover that cancer has been so recalcitrant because it is viewed perhaps as a good thing by the body and there may be ways to disrupt that subtle rat race.”

Although he admits that this perspective can make people up set, Austin says that “one thing physicists can be is heretical. We’re supposed to be skeptics and look at things a different way...So that’s another thing physicists can bring to the table—the willingness to be skeptical and think forbidden thoughts.”

Hills agrees with Austin’s maverick hypothesis regarding cancer, and adds that “cancer should be a verb, not a noun. “Cancer is...something your body is doing,” he suggests. “We shouldn’t say someone has cancer; we should say someone is cancering,” like we say someone is crying or sweating.”

It will be too speculative to quote about therapeutic outcomes, says Nagahara, although already some of the centers are reporting data. “If we project that as a result of this work, new measurements based on physical science contributions could some day be part of standardized tests that are used in doctors’ offices. For example, in the future, in addition to heart disease which is today predicted by the energy output of your cells may also be tested when you go for your yearly physical.

The researchers expect that the benefits of these projects will extend beyond a better comprehension of cancer. New physics ideas are always innovative. This initiative will yield new physics insights into complex adaptive systems,” proposes Hills. “Right now, we don’t understand complex systems very well. The edge of our understanding is a spin glass. I suspect that some of the [complex systems] phenomena we’re going to discover in these basic systems are applicable to physical systems in general.”

Austin believes that another positive outcome of this work will be a change in physics curricula at the graduate level. “Cancer is all about information and communication and evolution,” he says. “Physicists don’t usually learn these subjects as part of the traditional physics American curriculum. We have to start teaching the physics of information and game theory…on a more regular basis.”

Either way, new information about and novel approaches to combatting cancer, at least one physicist believes there may be resistance from traditional cancer researchers to this innovative initiative. “I am absolutely sure they’ll think we’re a bunch of crazy people who don’t know what were talking about,” says Davies. “If I were to go to a cancer biologist and say ‘I realize you don’t know anything but we want you to do a research project on the application of quantum entanglement and rotation of black holes, you can imagine how the physics community would react to that.” Yet “it’s exciting stuff,” says Davies, and with millions and millions of dollars being spent on cancer research, “the hope is by spending some small fraction on a radically new approach that might be brought to bear on the cancer problem, there’s a chance that we could get a novel treatment.”

For more information: http://physics.cancer.org
As you may have read in the February 2010 issue of APS NEWS, the African Physical Society (APS) was launched on the 12th of January at the First Meeting of the African Council of Ministers of Education held on the occasion of the Universal Year of Science Education, in the presence of the President of His Excellence Maj- tre Abdoulaye Wade, President of the Republic of Senegal. There were 28 nations from Africa, 21 African countries; 10 national physical societies were represented. We are very grateful for the support and goodwill the African Physical Society has enjoyed from researchers and teachers from all over Africa and from other societies around the world. As the first President of the APS, I would like to share some of the history and background that led to its forma- tion.

The African Physical Society is actually a re-launch of the Society of African Physicists and Mathematicians (SAPAM) which was formally inaugurated at the Abdus Salam International Cen- tre for Theoretical Physics (ICTP), in October, 1984 at a Pan African Symposium on the “State of Physics in Africa,” attended by over 120 African sci- entists from 26 countries in Africa. Some of the reasons for the formation of SAPAM, included the lack of cohesive and functional links among African Physicists and Mathematicians and the observa- tion that there was a great scientif- ic and technological gap between the industrialized and developing countries of the world, particularly in the fields of technology and education. The society believed that the field of science and technology and education are the basis of modern science, technology, and development in industry. The inauguration of SAPAM coincided with the opening cer- emony of the 20th anniversary celebration of ICTP. It was extended into a broader International Centre for Theoreti- cal Physics (ICTP), which the then Italian Foreign Affairs Minister, later the Prime Minister of Italy, His Excellency Giulio Andreotti attended. During the same period, the meeting of Physics for Devel- opment and the 18th General As- sembly of the International Union of Pure and Applied Physics (IUPAP) were held.

At the symposium, it was ob- served that among the problems contributing to the poor state of physics and mathematics in Africa were inadequate numbers of stu- dents, shortage of teachers, lack of infrastructure, lack of effective poor experimental facilities, short- age of textbooks and journals, inadequate interaction among Af- rican physicists and mathematici- ans, and lack of support by Afri- can governments.

Many of the problems listed above are interrelated. These lack of adequate support by Afri- can governments and development partners is a cause that cannot be ignored. It is a major priority. It should be stated that African governments are not un- aware of the role of science and technology for economic development, for as recently as 1994, at the Organization of African Unity (OAU), now African Union, Technology and Industry: A Plan of Action for sustainable socio-economic development of Africa and requested its member coun- tries to submit their plans to the scientific community for GDF and science for technology in order to achieve the objectives of the plan. So far there are only two countries in Africa that have achieved this target.

Some leaders in Africa and even some in the developed coun- try such as the United States include, question the need for spending scarce financial resources in education for science and teaching. They argue that African countries should buy finished technol- ogical products that have been developed elsewhere. Even until very early the World Bank and International Monetary Fund were recommending to African countries to de- serve to work on the question of how to achieve the goal of tertiary education in Africa.

However, transfer of technol- ogy can only take place between individuals with the same edu- cational level. No technological package will ever be opened, if it can be opened at all, if the na- tion concerned does not have at least a small number of individuals with scientific and technical competence at the same level as those in the nations that developed it. Georg Heinrich Von PERSPECTIVES continued on page 7

Moses gave a portion of his time to physics and mathematics educa- tor Bill Crombie, who leads the Al- gebra Project at the Boys and Girls High School in Brooklyn, New York. Crombie stated that the proj- ect works with students who have previously found “no particular rea- son to learn these subjects, or to be interested in them.” Rather than what he called a “proce- dural approach” to math, the Alge- bra Project uses “pictorial represen- tations [which] become geometric representations.”

The following day, Crombie brought a group of 14- to 16-year-old boys from the Students and Girls and Boys Club where they engaged in a discussion and answer period with some of the attending physicists. The core of the students’ learning experience was focused on developing a deep un- derstanding of the number line, and of positive and negative numbers. The students made number lines that featured pictures they took on a trip to the New York Botanical Gardens that enabled them to measure and scale numbers in context.

The final speaker of the session was Robert Farris Moses, a civic leader and educator, and of the Science for the Student Nonviolent Coordi- nating Committee (SNCC). In the 1960s, Moses saw literacy as the key to economic and political free- dom for the African American popu- lation. Today, Moses believes that education is the only way to protect the decisions that shape the world and to gain economic freedom, they must have mathematical literacy. It is this that motivated him to start the Algebra Project, an organization that (from the Algebra Project web- site) “uses mathematics as an orga- nizing tool to encourage curiosity public school education for every child in America.”

As physics and mathematics educators, we need to work very diligently to change the community’s mind about… that unless they had the sense that they were being used, they would not be more diverse.”

Malcom posited that diversity in- creases the richness of ideas brought to a field, provides additional role models for minority and female stu- dents, and increases the number of potential STEM professionals. Lack of diversity can impact public sup- port and funding for science because the STEM community does not cur- rently look like the general popula- tion.

The final speaker of the session was Robert Farris Moses, a civic leader and educator, and of the Science for the Student Nonviolent Coordi- nating Committee (SNCC). In the 1960s, Moses saw literacy as the key to economic and political free- dom for the African American popu- lation. Today, Moses believes that education is the only way to protect the decisions that shape the world and to gain economic freedom, they must have mathematical literacy. It is this that motivated him to start the Algebra Project, an organization that (from the Algebra Project web- site) “uses mathematics as an orga- nizing tool to encourage curiosity public school education for every child in America.”

As you may have read in the February 2010 issue of APS NEWS, the African Physical Society (APS) was launched on the 12th of January at the First Meeting of the African Council of Ministers of Education held on the occasion of the Universal Year of Science Education, in the presence of the President of His Excellency Maj- tre Abdoulaye Wade, President of the Republic of Senegal. There were 28 nations from Africa, 21 African countries; 10 national physical societies were represented. We are very grateful for the support and goodwill the African Physical Society has enjoyed from researchers and teachers from all over Africa and from other societies around the world. As the first President of the APS, I would like to share some of the history and background that led to its forma- tion.

The African Physical Society is actually a re-launch of the Society of African Physicists and Mathematicians (SAPAM) which was formally inaugurated at the Abdus Salam International Cen- tre for Theoretical Physics (ICTP), in October, 1984 at a Pan African Symposium on the “State of Physics in Africa,” attended by over 120 African sci- entists from 26 countries in Africa. Some of the reasons for the formation of SAPAM, included, “There will always be work -
ANNOUNCEMENTS

PTEC Topical Workshop: Pedagogical Content Knowledge

Rutgers University, New Brunswick, NJ
April 19-20, 2010

Rutgers University, in cooperation with the Physics Teacher Education Coalition (PTEC), invites you to attend a workshop that will change how you think about preparing physics teachers. This two-day topical workshop will highlight the unique Pedagogical Content Knowledge (PCK)-based curriculum developed at Rutgers.

For more information, please see www.ptec.org/conferences/CK2010

Wright, a Finnish philosopher, defined modernity as consisting of two major components: science and technology on one hand and good governance on the other.

Over the past 25 years, SAPAM has had a long list of accomplishments, organizing conferences and workshops, building links amongst physicists working in Africa, and building links with physicists worldwide. In recognition of its activities and initiatives, then OAU granted the society Observer status in 1990. With limited resources, SAPAM has made tremendous impact on the continent.

Long before climate change became a topical and global issue, SAPAM initiated in 1987 the APEPMA (Applicability of Environmental Physics and Meteorology in Africa) series of workshops to sensitize the physical science community and African policy makers with respect to issues related to climate and environment. The first workshop took place in Addis Ababa, Ethiopia, at the time that that part of the world experienced one of the most devastating droughts in the 20th century. The 8th in the series of these workshops will take place in Botswana from 19-23 April 2010.

Before energy became the concern of governments in Africa, SAPAM has been running the Kansas (Ghana) College on Renewable Energy since 1986. Some of the participants at these workshops have held and some are now holding positions such as ministers in charge of energy or members of energy commissions in their countries.

Two years after its founding, SAPAM recognized the need for capacity-building for sustainability in Physics and Mathematics Education in Africa and has been equipping and encouraging the younger generation in these disciplines. For example, SAPAM organized in 1986 a pan-African workshop in Nairobi, Kenya, on harmonization of curricula in Physics, Mathematics and Computer Science at the tertiary level of education in Africa. At the same workshop the production of low-cost scientific equipment for education in the sciences was initiated. The founding and relative success of SAPAM led to the formation of the Edward Bouchet Abdus Salam Institute (EBASI) in 1988 in Trieste, Italy.

The 6th EBASI meeting of over 200 physicists from all over Africa took place on 24th January, 2007 at the iThemba Laboratory, South Africa. At this meeting, it was resolved that SAPAM should be transformed and become known as the African Physical Society (APS). It was recognized that we need a professional society that is an advocate for physics and physicists in Africa. SAPAM has had a long list of accomplishments, organizing conferences and workshops, building links amongst physicists working in Africa, and building links with physicists worldwide. In recognition of its activities and initiatives, then OAU granted the society Observer status in 1990. With limited resources, SAPAM has made tremendous impact on the continent.

Impertently, the African Physical Society will incorporate, as a subcommittee, the African Association of Physics Students. Because there is always a change in the student body from year to year, a student organization does much better if there is a permanent organization of professionals that help keep the organization.

Again, the plan is not to replace any national association of physics students on the continent, but rather to link those that already exist and provide a way for physics students to connect to the larger physics world where a student association does not exist.

One of the important acts at the meeting was a resolution supporting the Square Kilometre Array radio telescope. Among the reasons given for the support were that the Square Kilometre Array will underscore Africa’s capability in sciences and innovation. In addition, the enormous investment in instrumentation will contribute to economic growth in the region, and the requirement for ultra-high speed internet across Africa to operate the square Kilometre Array will lead to improved IT infrastructure and access for millions of people.

Francis K. A. Atuete is Consulting Director of the Institute of Mathematical Sciences in Ghana.
H ow should we teach physics to future life scientists and physicians? The physics community has seized this unique opportunity to reshape introductory physics courses for our audience. A June 2009 report from the American Association of Medical Colleges (AAMC) and the Howard Hughes Medical Institute (HHMI), as well as the National Research Council’s Bio2010 report, clearly articulated the critical role of physics in understanding life science phenomena.

The SFFP report asks us to respond to another important constituency. A June 2009 report from the American Medical Association (AMA) and the American Association of Colleges of Osteopathic Medicine (AOCOM), through the National Organization for Graduate Medical Education (NAGME),2 commissioned a study under NSF grant DUE-0965156. This report calls for removing the gaps between undergraduate and graduate education. It encourages universities to invest time retooling their usual course examples to this life science-oriented approach. Those of us who have taught courses including biologically-inspired content find our students enthusiastic about the real-world relevance of physics.

Well-designed introductory physics courses can also help students master broad scientific and quantitative skills, and the physics community is recognized as being at the forefront of undergraduate science education in teaching these skills effectively. Challenging, multi-step problem-solving and critical thinking skills as well as the ability to critically use mathematical models. Laboratories can offer practice analyzing and interpreting quantitative data, as well as learning the connections between physical principles and biological systems through experimentation. As described in How People Learn (National Academy Press, 1999), the transfer of skills and knowledge to different contexts is among the greatest challenges for students. For example, as our students develop and test physical models of biological phenomena will be particularly important in this regard, and an introductory physics for the life sciences course offers a rich context in which to explore these strategies.

Next Steps

Efforts to revise IMLS courses across the country will require resources and infrastructural support, including new curricular materials (textbooks, in-class activities, model homework and exam problems, laboratory experiments, etc.) and equipment for new life science-related demonstrations and laboratories. Many of the physics faculty who have taught IMLS courses have found that the practice of teaching for interdisciplinary audiences require new curricular materials. At least one third of IMLS courses are struggling to implement these changes, at least on a small scale.

The physics community faces a challenging opportunity as it addresses the issues surrounding IMLS courses. A senior faculty steering committee was charged with articulating a clear set of skills and competencies that students should master as a result of their physics education. We have for a number of decades incorporated engineering examples into our physics classes. The SFFP report asks us to respond to another important constituency. Are we ready to develop courses that will teach our students how to apply basic physical principles to the life sciences? The challenges of making significant changes in IMLS courses are daunting if we each individually try to take on the task. But with a community-wide effort, we should be able to meet this challenge. The physics community is already moving to develop and implement changes in IMLS courses, and the motivations for change are strong.

The Back Page

Photo by Margaret Thrashmorton

Biology students studying diffusion are measuring Brownian motion of polystyrene beads

AAMC.html) However, the SFFP report especially calls for developing the ability to apply physics knowledge in the context of understanding living organisms.

The content competencies most closely associated with physics include much material found in a traditional introductory physics course, but with significant ommissions and some novel additions. These can be addressed through modifying the balance of topics and choice of examples in the introductory course. For example, while Newton’s laws remain central (indeed, biophysics requires this), an extended discussion of kinematics and projectile motion could be replaced by more studies of fluids and simple continuum mechanics. A more complete study of energy, with attention given to biologically appropriate topics such as diffusion and open systems, could replace the current focus on heat engines and equilibrium thermal situations.

In addition to content-based competencies, the SFFP report echoes the Bio2010 call for enhanced training in a broad range of scientific and quantitative skills—what many of us might be tempted to call “thinking like a physicist.” Students should acquire both a rigorous grasp of physics concepts and the ability to understand and use quantitative models of physical systems based on those concepts. Specific skills mentioned in the SFFP report include: interpretation of a variety of representations of scientific information, including statistical and graphical analysis of data; dimensional analysis; the design and execution of experiments to test hypotheses, and the ability to critically read scientific literature and to form and defend hypotheses. The emphasis of the SFFP report is that “effective clinical problem-solving and the ability to evaluate competing claims” are essential skills for future physicians.

Creating new IMLS courses

The primary purpose of an IMLS course is to teach fundamental physical principles, while examining how they shape and enable the organization and activity of living systems. As mentioned previously, the core topics covered by an IMLS course will look familiar to any physicist: mechanics, statistical and thermal physics, fluids, electricity and magnetism, waves and imaging, and some aspects of modern physics. Such a course need not venture far into the full interdisciplinarity of modern biophysics. However, most current introductory physics courses for example, use little if any biological topics, with more extensive changes to the examples used to illustrate the core topics. Sample syllabi and lists of biologically relevant examples are available at the website for the October workshop.

We argue that it is not difficult for physics faculty members to shift to a competency model is viewed very favorably. Although questions about implementation remain, it is certain to influence the revisions underway for the Medical College Admission Test (MCAT).

The call issued by these reports represents both a challenge and an opportunity for the physics community. The challenge is to offer courses that cultivate general quantitative and scientific thinking skills, while grounding in basic physics principles and the ability to apply those principles to living systems, all without increasing the number of courses needed to prepare for medical school. The opportunity is to craft new courses that not only serve life science students but reveal and celebrate the rich contributions that physicists have made to our understanding of life.

The Back Page

The Back Page

Physics for Future Physicians and Life Scientists: a moment of opportunity

by Catherine H. Crouch, Robert Hilborn, Suzanne Amador Kane, Timothy McKay, and Mark Reeves

The SFFP report identifies scientific and mathematical competencies that future physicians should acquire as under-