Odd quantum effect may spawn new applications

Improved efficiency could enable research, military and medical uses

David Chandler
News Office

A bizarre but well-established aspect of quantum physics could open up a new era of electronic detectors and imaging systems that would be far more efficient than any now in existence, according to new insights by a leader in the field.

MIT Professor of Mechanical Engineering Seth Lloyd has found that a peculiar quantum-physics property called entanglement can be harnessed to make detectors — similar in principle to radar systems used to track airplanes in flight or ships at sea — to sweep across a scene, and then use an infrared detector to reconstruct an image from the light that is reflected back. A more efficient system, using the quantum-entanglement effect, would make it much more difficult for an adversary to detect the fact that such a system was being used,

"It should be possible to have at least a proof-of-principle demonstration within six months to a year," Lloyd said.

For example, military applications could include improved night-vision systems, which send out beams of infrared light invisible to the naked eye — to sweep across a scene, and then use an infrared detector to reconstruct an image from the light that is reflected back. A more efficient system, using the quantum-entanglement effect, would make it much more difficult for advertising to detect the fact that such a system was being used.

The new findings, reported this month in the journal Science, are purely theoretical, but Lloyd says that laboratory experiments have already proven the feasibility of both the light sources and the detectors needed for such a quantum-based photodetection system, so he anticipates that within a year it should be possible to build a laboratory-scale system to demonstrate the new concept.

"We have already demonstrated the feasibility of the light sources and the detectors needed for such a system," Lloyd said.

"It is that which within a year it should be possible to build a laboratory-scale system to demonstrate the new concept."

Cecilia d’Oliveira, ’77, SM ’79, has been named executive director of MIT OpenCourseWare, having led the groundbreaking organization on an interim basis for the past year, Provost L. Rafael Reif announced this week. D’Oliveira will be responsible for leading OCW, the highly successful initiative that has published virtually the entire MIT undergraduate and graduate curricula online, in the next phase of its development. Reporting to the Office of the Provost, and with the assistance of a distinguished 18-member external advisory committee, d’Oliveira will guide the development of programmatic initiatives, institutional partnerships and external support for OCW.

"With her strong technical background, decades of experience at MIT and proven ability to build and lead teams, Cecilia is ideally qualified to lead OCW as it enters an exciting, new phase. I look forward to working with her as we realize the full potential of the OCW web site," Reif said.

D’Oliveira said among her key goals as executive director is to make OCW as useful as possible for the MIT community while building on MIT’s worldwide leadership in the field of open education.

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Today

• MITST Open House. 12 p.m.—2 p.m. in W20-202. Where do you want to go next summer? Learn about internship and study opportunities available around the world through MITST. URL: mitst-info.html.

• Faculty meeting. 3:30 p.m. in Room 10-230. Agenda includes voting on Master in Management Studies resolution from the MIT Sloan School of Management, update on the Broad Insti-
   tute and remarks from President Susan Hockfield.

• Diversity Reception hosted by Cisco, Medtronic and Hewlett Packard. 4-6 p.m. in 10-105. If you are an underrepresented minority student, this would be a great opportunity to meet with employers truly committed to hiring the best and the brightest.

Thursday, Sept. 18

• The MIT Center for International Studies’ Starr Forum, “Foreign Policy and the next U.S. administration: America’s defining moment.” MIT Tang Center, E51-115, 70 Memorial Drive, Cambridge, 6 p.m. A roundtable discus-
   sion with MIT scholars Barry Posen, Carol Svetz and Taylor Favel. URL: web.mit.edu/cis/returntp_f_p_next_u_admin.html

• Compton Lecture by His Excellency Paul Kagame, president of the Republic of Rwanda. Kagame’s speech will focus on “The Imperative of Science and Technology in accelerating African and Rwandan Development.” Starts at 3:30 p.m. (doors open at 3:15 p.m.) in W16. URL: http://web.mit.edu/compton/

• MADMEC finals and awards. In the Making and Designing of Materials Engi-
   neering Contest (MADMEC), student teams create prototypes that develop and utilize alternative forms of energy using principles of materials science and engineering. Poster session at 6 p.m. in 6-140. Presentations at 7 p.m. in 6-120. URL: http://dme.mit.edu/madmecc

• Brandeis/Harvard/MIT/Northeasten Joint Mathematics Colloquium. Jordan Ellenberg of the University of Wisconsin will speak. 4:30-5:30 p.m. in 2-417.

Saturday, Sept. 20

• Alumni Leadership Conference 2008. The annual Alumni Leadership Conference (ALC) includes leadership workshops, networking events, and useful information sessions related to various areas of volunteer activity. In addition, general sessions with senior Institute administrators provide volun-
   teers with an insider’s view of the latest happenings at MIT. The Institute’s leadership awards are also celebrated during ALC. URL: alumni.mit.edu/al/index.html
Panel to address foreign challenges awaiting next president
Stephanie Schorow
News Office correspondent
How will the United States counter rising violence in Afghanistan? Should the U.S. military continue to draw down in Iraq? What should be done about Iran's nuclear ambitions? China's economic might and Russia's reawakened assertiveness? There are no easy answers.

FALLON: Admiral says MIT ‘focused on solutions to problems’
Continued from Page 1
a military hearing and admits to being “pretty strongly opinionated.”
Fallon says he wanted to come to MIT because the school was “focused on solutions to problems, and there’s quite a few of them out there.”
He rejects a sound-bite approach to foreign policy, saying, “It’s not enough; they turn from active to just waiting on the ground.”
Also, “The Iraqi people had just had enough.” They turned from active supports or passive acceptance of insurgents to helping American forces, Fallon says.
Fallon envisions a continued drawdown of American forces in Iraq but he is very clear that a long-term security agreement between the two countries would be in the best interest of both. “There are far more things the Iraqis are not quite capable of doing today. We can do them. They want to do them. But there needs to be an agreement in principle and then you can work on the details,” he says.

AWARDS & HONORS

Sloan student wins prestigious award
Charles A. Gamal III, a graduate student in the Sloan School of Management, was recently awarded the Outstanding Electrical Engineering Student Award. Eki Kappa Ni (IHK), the Electrical and Computer Engineering Honor Society. HKN recognizes one student nationally for the award.

Graduates named AAS award fellows
Three recent MIT graduates are among the newest group of AAAS Science & Technology Policy Fellows. The fellows, Federica Sarro (Materials Science and Engineering, PhD 04), Marco Serpelloni (86, PhD 07), and Joyce Yang PhD ’06 — are scientists and engineers from the resources to meet them are stretched thin,” he said. “Hard choices will need to be made about foreign policy problems, and between foreign policy problems and domestic priorities. The presidential campaign could educate the public about these fundamental issues, but so far it has not.”

The forum participants bring a wide range of expertise. Saivetz, an expert on Soviet and now Russian issues, is currently working on a book on Russian Prime Minister Vladimir Putin’s foreign policy. Posen, who studies international relations with a focus on international security, has examined China security in his recent book, “Strong Borders, Secure Nations.”

“Through economic issues loom large in the presidential campaign, and for good reason, foreign policy deserves equal billing,” says Saivetz, who recently testified before Congress about a new grand strategy for the presidency. “The last seven years have not gone well. A Qaeda seems almost as strong now as it was when it first attacked the U.S., significant military resources have been misdirected in Iraq, Afghanistan is a bloody stalemate; Iran’s nuclear research and development programs proceed apace; Russia is no longer a weak and malleable remnant of the Soviet Union; China’s economy grows rapidly; the tragedy in Darfur persists.”

The mửa of foreign policy problems likely to face the next president is long, and

Rwandan President Paul Kagame, who as a boy had to flee his homeland to escape ethnic violence, will present the Karl Taylor Compton Lecture 18 from 3:30-5 p.m. on Thursday, Sept. 18, in MIT’s Kresge Auditorium.

Kagame became president of the Republic of Rwanda in 2000, six years after the country was wracked by ethnic violence that left more than a million people dead. He had been the leader of the guerrilla Rwandan Patriotic Front, whose invasion of Rwanda helped end the Rwandan genocide of 1994.

Born a Tutsi in 1957, Kagame and his family took refuge in a refugee camp in 1979 to escape the violence of a revolt sparked by the Belgian military and carried out by the Hutu regime. Kagame later was among those launch-

Rwandan President Paul Kagame, his honors include the 2003 Global Leadership Award for his efforts to bring stability, and with people who have contributed much to modern thought. Recent Figure 1. African forces have been the lead in the Tactical Combat Training Center (TCTC) at Fort Irwin, California. Survivors of the 1994 Rwandan Genocide are estimated to number between 800,000 and one million. Survivors have been given the opportunity to return to Rwanda; his efforts to accelerate economic development have been recognized by the 2003 Global Leadership Award and the African National Achievement Award, the African Gender Award, and several honorary doctorates. He also received international recognition for his efforts to bring stability and peace to Rwanda; his honors include the 2003 Global Leadership Award and the African National Achievement Award, the African Gender Award, and several honorary doctorates. He also received international recognition for his efforts to bring stability and peace to Rwanda; his honors include the 2003 Global Leadership Award and

Submit your events! Log on to events.mit.edu to add your events to MIT’s online calendar. Select events will be featured on the online calendar to be published in TechTalk each Wednesday.

Vendor fairs this week
The 10th Annual Travel Vendor Fair will be held from 10 a.m. to 2 p.m. on Tuesday, Sept. 23, in Lobby 15. Invitations will go out to all faculty, staff and students. Indviduals who travel on MIT business or are responsible for making travel arrangements will find this event informative and fun. On Thursday, Sept. 18, members of the MIT community are invited to visit with more than 100 suppliers/vendors of goods and services for MIT. Vendors will display products such as scientific/laboratory supplies, office supplies, computer equipment, legal services and more. For more information, please contact Diane Sha, Director of Procurement, at bsheath@mit.edu.

S$25K X-Prize offered for best ‘green idea’ video
It took the wealth of Microsoft co-founder Paul Allen to win the original $10 million X-Prize four years ago for the first privately financed craft to make it to space and back. But a smaller-scale X-Prize was announced at MIT last week opens the door to anyone with a video camera.

The new competition, titled “What’s Your Crazy Green Idea?,” asks contestants to upload a two-minute video to YouTube, proposing a large X-Prize for work relating to energy and the environment. Judges will select three finalists and the winner will be named in December. The new prize was announced at last week’s X-Prize Energy Forum, which featured talks by inventor Ray Kurzweil ’70, general partner at Harvard, inventor Saul Griffith SM ’01, PhD ’04, and MIT Energy Initiative Director Ernest Moniz. The event was sponsored by the new X-Prize Lab@MIT, a collaboration headed by Erica Wagner of Aero-Astro. After being deposed from power in 1994, Kagame was exiled to lead the Rwandan Patriotic Front in Uganda. In October 1994, Kagame returned to Rwanda after 30 years in exile to lead the Rwandan Patriotic Front in its five-year liberation war in Uganda. Kagame later was among those launch-

Awards & Honors

Charles A. Gamal III, a graduate student in the MIT Sloan School of Management, was recently awarded the Outstanding Electrical Engineering Student Award. Eki Kappa Ni (IHK), the Electrical and Computer Engineering Honor Society. HKN recognizes one student nationally for the award.

The National Multiple Sclerosis Society, Michigan Chapter, has named Hugh Herr associate professor in media arts and sciences, and health sciences and technology, the 2008 Spirit of da Vinci Award winner. The award is presented annually to an indi-

Fallon, admitted, “We actually got our people out to enforce security in some parts of the world ...”
Scientists seeking to protect the soldier of the future can learn a lot from a relic of the past, according to an MIT study of a primitive fish that could point to more-effective ways of designing human body armor.

The creature in question is Polypterus senegalus, a fish whose family tree can be traced back 96 million years and who still inhabits muddy, freshwater pools in Africa. Unlike the vast majority of fish today, P. senegalus sports a full-body armored “suit” that most fish would have had millions of years ago—a throwback that helps explain why it is nicknamed the “dinosaur eel.”

It was known that the fish’s individual armored scales were comprised of multiple material layers — each of them about 100 microns of a meter thick. But in a U.S. Army-funded study carried out through the MIT Institute for Soldier Nanotechnologies and featured as the September cover story of the journal Nature Materials, a team of researchers unraveled exactly how the layers complement one another to protect the soft tissues inside the fish body — particularly from a penetrating biting attack. P. senegalus is known to be territorial and attack members of its own species that are of similar or smaller size. Specifically, the team used nanotechnological methods to measure the material properties through the thickness of one individual fish scale — about 500 microns of a meter thick — and its four different layer materials. The different materials, the geometry and thickness of each layer, the sequence of the layers and the junctions between layers all contribute to an efficient design that helps the fish survive a penetrating attack such as a bite.

This research will help to better understand the relationship between a specific threat and the corresponding design of a protective armor, the team said.

“Such fundamental knowledge holds great potential for the development of improved biologically inspired structural materials, for example soldier, first-responder and military vehicle armor applications,” said lead author Christine Ortiz, an associate professor in MIT’s Department of Materials Science and Engineering.

“Many of the design principles we describe — durable interfaces and energy-disrupting mechanisms, for instance — may be translatable to human armor systems,” she said.

One way in which the researchers tested the fish armor was by experimentally mimicking a biting attack on top of an individual scale that had been surgically removed from a living fish. The team found that the design of the P. senegalus armor kept the crack localized by forcing it to run in a circle around the penetration site, rather than spreading through the entire scale and leading to catastrophic failure, like many ceramic materials.

This study was carried out in collaboration with co-author Professor Mary Boyce, chair of MIT’s Department of Mechanical Engineering. The study has two first authors: Benjamin Bruet, a former member of Ortiz’s lab who recently received a PhD in materials science and engineering from MIT, and Jula Song, a joint doctoral student between Ortiz and Boyce.

Watch and learn: Time teaches us how to recognize visual objects

In work that could aid efforts to develop more brain-like computer vision systems, MIT neuroscientists have tricked the visual brain into confusing one object with another, thereby demonstrating that time teaches us how to recognize objects. It may sound strange, but human eyes never see the same image twice. An object such as a cat can produce innumerable impressions on the retina, depending on the direction of gaze, angle of view, distance and so forth. Every time our eyes move, the pattern of neural activity changes, yet our perception of the cat remains stable.

“This stability, which is called ‘invariance,’ is fundamental to our ability to recognize objects — it feels effortless, but it is a central challenge for computational neuroscience,” explained James DiCarlo of the McGovern Institute for Brain Research at MIT, the senior author of the new study appearing in the Sept. 12 issue of Science.

“We want to understand how our brains acquire invariance, and how we might incorporate it into computer vision systems.”

A possible explanation is suggested by the fact that our eyes tend to move rapidly (about three times per second), whereas physical objects usually change more slowly. Therefore, differing patterns of activity in rapid vision often reflect different images of the same object. Could the brain take advantage of this simple rule of thumbs to learn object invariance?

In previous work, DiCarlo and colleagues tested this “temporal contiguity” idea in humans by creating an altered visual world in which the normal rule did not apply. An object would appear in peripheral vision, but as the eyes moved to examine it, the object would be swapped for a different object. Although the subjects did not perceive the change, they soon began to confuse the two objects, consistent with the temporal contiguity hypothesis.

In the new study, DiCarlo and graduate student Nuo Li sought to understand the brain mechanisms behind this effect. They had monkeys watch a similarly altered world while recording from neurons in the inferior temporal (IT) cortex — a high-level visual brain area where object invariance is thought to arise. IT neurons “prefer” certain objects and respond to them regardless of where they appear within the visual field.

“We first identified an object that an IT neuron preferred, such as a sailboat, and another, less preferred object, maybe a teacup,” Li said. “Then we presented objects at different locations in the monkeys’ peripheral vision, they would naturally move their eyes there. One location was a swap location. If a sailboat appeared there, it suddenly became a teacup the time the eyes moved there. But a sailboat appearing in other locations remained unchanged.”

After the monkeys spent time in this altered world, their IT neurons became confused, just like the previous human subjects. The sailboat neuron, for example, still preferred sailboats at all locations except at the swap location, where it learned to prefer teacups. The longer the manipulation, the greater the confusion, exactly as predicted by the temporal contiguity hypothesis.

Importantly, just as human infants can learn to see without adult supervision, the monkeys received no feedback from the researchers. Instead, the changes in their brain occurred spontaneously as the monkeys looked freely around the computer screen.

“We were surprised by the strength of this neuronal learning, especially after only one or two hours of exposure,” DiCarlo said. “Even in adulthood, it seems that the object-recognition system is constantly being retrained by natural experience. Considering that a person makes about 100 million eye movements per year, this mechanism could be fundamental to how we recognize objects so easily.”

The team is now testing this idea further using computer vision systems viewing real-world videos. This work was funded by the NIH, the McKnight Endowment Fund for Neuroscience and a gift from Marjorie and Gerald Burnett.
MIT awaits data from world’s biggest physics experiment

Underground collider comes to life in Europe

Anne Trafton
News Office

Dozens of MIT physicists are waiting anxiously to sift through data from the world’s biggest physics experiment, which officially started last week when scientists sent the first beam of protons zooming at nearly the speed of light around the 17-mile Large Hadron Collider near Geneva, Switzerland.

Some MIT researchers are among the thousands of physicists from around the world collaborating on the LHC, the world’s most powerful particle accelerator. MIT has the largest American university group working on one of the collider’s four detectors, known as the CMS (compact muon solenoid) detector, and a smaller group working on another LHC detector known as ATLAS (a toroidal LHC apparatus).

The first circulating beam is a major accomplishment on the way to the ultimate goal: high-energy beams colliding in the centers of the LHC’s particle detectors. Scientists participating in these experiments will analyze these collisions in the coming years and decades to learn more about the nature of the physical universe. Beyond revealing a new world of unknown particles, the LHC experiments could explain why those particles exist and behave as they do. They could reveal the origins of mass, shed light on dark matter, uncover hidden symmetries of the universe, and possibly find extra dimensions of space.

“The start of the LHC culminates about 20 years of design and construction work. The accelerator and the experiments are ready to go. We expect LHC data to arrive on MIT campus very shortly,” says Professor Bolek Wysocki of CMS. “We hope to see new particles and new processes that may explain probably the most fundamental properties of matter.”

For physicists, the excitement about the first beam event is unparalleled. “For much of my career, starting in the early 70s, the Standard Model of high-energy physics has worked marvelously well but some of its foundations still remain untested,” says MIT physicist Frank Taylor, the U.S. ATLAS muon project leader. “Theoretically, physicists have been very creative over the last three and a half decades with many beautiful ideas, which are mathematically consistent but may not represent nature. Now we have an instrument to check these theories and perhaps to find something not even dreamed of. We’re very excited.”

Added Professor Steven Nahn, another member of the CMS team, “The LHC represents the first opportunity in a long time to both close the chapter on the prevailing model of how our world works on the most fundamental levels, and, at the same time, perhaps start a whole new chapter. I feel like I’m Vasco De Balboa seeing the Pacific for the first time — a whole new ocean out there — not sure how big it is or what it contains, but it is certainly worth exploring.”

Other MIT members of the CMS team are Associate Professors Christoph Paus and Gunther Roland, Professor Wit Baczia and senior research scientist George Stephens.

The LHC is operated by the European Organization for Nuclear Research (CERN). The accelerator is located on the outskirts of Geneva near the French border, lying below farmland at depths ranging from 60 to 120 meters.

A ceremony is held as the last of 1,746 superconducting magnets is lowered into the 27-kilometer circumference tunnel that houses the LHC.

QUANTUM: Odd effect may spawn new applications

Continued from Page 1 used, because there would be so much less infrared light needed to provide the illumination.

Theoretically, such a system could be used to allow medical diagnostic systems such as CT scan to work with a vastly reduced X-ray output, thereby making them much safer for the patient, but such applications would be much further in the future. It could also someday be used for safer microscopic imaging of living organisms.

Entanglement is a strange property that was deduced theoretically on the basis of the laws of quantum physics, and has been demonstrated over the last several years in a variety of laboratory experiments. Under certain circumstances, when an atom gives off two photons of light at the same time, the two are “entangled” even as they go off in different directions, so that anything that changes one of the photons simultaneously changes the other as well.

This odd property makes it possible to perform seemingly impossible feats such as “quantum teleportation,” in which all of the properties of one subatomic particle are recreated in a different particle some distance away. It has also been demonstrated as a way of producing seemingly foolproof encryption systems for data transmission. But explanations of exactly what underlies the entanglement phenomena remain controversial.

Lloyd says that he cannot provide a simple, intuitive explanation for why the quantum illumination system described in this report actually works, but is certain that the theoretical calculations demonstrating it are correct. “It is as if the two entangled photons retain a memory of each other long after any such memory should have faded away,” he said.

Gold goes beyond jewelry

The glitter of gold may hold more than just beauty, or so says a team of MIT researchers that is working on ways to use tiny gold nanorods to fight cancer, deliver drugs and more.

But before gold nanorods can live up to their potential as a cancer weapon, scientists must figure out how to overcome one major difficulty: The surfaces of the tiny particles are coated with an uncooperative molecule that prevents researchers from creating perfect nanorods.

“The surface chemistry is really key to everything,” said Kimberly Hamad-Schifferli, assistant professor of biological and mechanical engineering at MIT. “For all of these nifty applications to work, someone’s got to sit down and do the dirty work of understanding the surface.”

MIT engineers work toward cell-sized batteries

Forget 9-volts, AAAs, AAAAs or D-batteries. The energy for tomorrow's miniature electronic devices could come from tiny microbatteries about half the size of a human cell and built with viruses.

MIT engineers have developed a way to at once create and install such microbatteries — which could one day power a range of miniature devices, from labs-on-a-chip to implantable medical sensors — by stamping them onto a variety of surfaces.

In the Proceedings of the National Academy of Sciences (PNAS) that appeared the week of Aug. 18, the team describes assembling and successfully testing two of the three key components of a battery. A complete battery is on its way.

“To our knowledge, this is the first instance in which microcontact printing has been used to fabricate and position microbattery electrodes and the first use of virus-based assembly in such a process,” wrote MIT professors Paula Hammond, Angela M. Belcher, Yet Ming Chiang and colleagues.

MIT researchers see alternative to common colorectal cancer drug

A compound that accumulates in cells more readily than a commonly used colorectal cancer drug may be just as useful in treating colorectal tumors, but with fewer side effects, MIT researchers have found.

Both compounds are analogues of cisplatin, a potent anticancer agent, but the newly investigated compound, known as cZPCF, may better target colorectal cells, potentially sparing other body tissues from damage.

“This compound, the antitumor properties of which were established in mice over 20 years ago, emerged in our search for platinum anticancer drug candidates with cellular uptake properties analogous or superior to those of cisplatin,” said Stephen Lippard, the Arthur Amos Noyes Professor of Chemistry and a member of the David H. Koch Institute for Integrative Cancer Research at MIT.

Gold research
MIT to Congress: Spark ‘energy revolution’ with boost in R&D funding

Hockfield delivers message of urgency on Capitol Hill

David Chandler

MIT President Susan Hockfield urged Congress to sharply increase federal funding for energy research during testimony on Sept. 10, saying such a move could help unleash an “energy revolution” capable of resolving several of America’s problems at once.

“We stand on the verge of a global energy technology revolution,” Hockfield said in testimony before the House Select Committee on Energy Independence and Global Warming in Washington this week.

“The question before us is: Will America lead and reap the rewards? Or will we surrender that advantage to other countries with clearer vision?”

At the hearing, titled “Investing in the future: R&D needs to meet America’s energy and climate challenges,” Hockfield said boosting federal energy research could simultaneously help address the problems of a shaky economy, geopolitical instabilities linked to energy consumption and security, and the growing evidence of climate change.

“Some advance could transform America’s prospects,” she said, “it would be having a range of clean, renewable, low-carbon energy technologies, ready to power our cars, our buildings and our industries, at scale, while creating jobs and protecting the planet.”

“Toward that end, the MIT Energy Initiative, in addition to a range of important scientific and engineering advances, has already generated landmark reports on nuclear, geothermal and coal technologies, and has additional reports in the works on solar power, cap-and-trade policy and other solutions.

“Chaired by Massachusetts Congress-
man Edward Markey, the House Select Committee on Energy Independence and Global Warming was created last year to address issues related to the urgent challenges of oil dependence and climate change. In addition to Hockfield, the committee heard testimony from
Stephen Forrest, vice president of research at the University of Michi-
gan; Jack Fellows, vice president of the University Co-
orporate; Daniel Kammen, professor at UC-Berkeley.

While federal funding for energy research has helped power the economy in the past, Hockfield noted, it has dwindled alarmingly in recent years, from 18 percent of the federal research budget in 1980 to just 2 percent today, a time frame during which R&D by energy companies has also plummeted, she said, to less than one-quarter of 1 percent of revenues, compared to the 18 percent invested by pharmaceutical companies.

“We need work going on across a range of technologies,” Hockfield said. “We need to develop everything we can get our hands on.”

By doing so, she said, “we can turn this global energy challenge into a global opportunity.”

Hockfield was asked for her impression of how much interest there was among students in working on such energy technolo-
gies. “The students’ interest level is absolutely deafening,” she said. “Students are wildly enthusiastic.”

The event will highlight the importance of the magnitude of the problems.

We stand on the verge of a global energy technology revolution. The question before us is: Will America lead and reap the rewards? Or will we surrender that advantage to other countries with clearer vision?

Susan Hockfield

On Capitol Hill, Deutch stresses all-out energy approach

Calls for carbon tax, efficiency improvements and new agencies

David Chandler

MIT President Susan Hockfield sits with three other witnesses during testimony in front of the House Select Committee on Energy Independence and Global Warming.

We can't choose winners now, we don't know what they will be,” she said.

First, he said, charging for greenhouse gas emissions is essential, whether in the form of a direct carbon tax or a cap-and-trade system. Second, a major 10-year program to demonstrate carbon sequestration is essential to make clean coal a reality.

Third, a push is needed to improve the efficiency of energy use in buildings, cars, and appliances.

Deutch offered seven recommendations and emphasized that these represent not a menu of choices, but a package of actions that are all essential in order to reach a sustainable future.

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Finally, Deutch said, there must be improvements in the coordination of energy policy across multiple government agencies, by creating an energy coordinating council.

Deutch rejected calls for an energy research program akin to the Apollo program or Manhattan Project. Unlike those focused government programs with very specific, clearly defined objectives, he said, “Here, we’re talking about having a technology deployed in the real economy, and the issues are much more complex.”

Deutch, who has served in major roles in several administrations including director of energy research under President Carter and undersecretary and deputy secretary of defense as well as director of central intelligence under President Clinton, said, “The fact is that the United States has not been, and is not now, on a path to a secure and sustainable energy future.”

The nation’s overall importation and consumption of fossil fuels is projected to go on increasing, he said.

While there are several factors that have prevented the adoption of a sustained national energy policy, he said, the key cause is that “political leaders find it difficult to speak the truth about energy security.”

The reality is that progress will be slow because of the magnitude of the problems.

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MIT Institute Professor John Deutch stressed the importance of pursuing every available avenue on energy, in testimony on Sept. 12 before the U.S. Senate’s Committee on Energy and Natural Resources.

Deutch, who has served in major roles in several administrations including director of energy research under President Carter and undersecretary and deputy secretary of defense as well as director of central intelligence under President Clinton, said, “The fact is that the United States has not been, and is not now, on a path to a secure and sustainable energy future.”

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First, he said, charging for greenhouse gas emissions is essential, whether in the form of a direct carbon tax or a cap-and-trade system. Second, a major 10-year program to demonstrate carbon sequestration is essential to make clean coal a reality.

Third, a push is needed to improve the efficiency of energy use in buildings, cars, and appliances.

Fourth, much more research is needed on potential energy solutions. This requires at least a doubling of federal research funding, the creation of a new energy innovation council to develop a multiyear research strategy across all government agencies, and an energy technology corporation to manage demonstration projects, he said.

Fifth, there should be an expansion of domestic oil and gas production, which he said is important to add credibility to U.S. efforts to encourage other nations to increase their production. Sixth, commercial nuclear power should be expanded, although this requires addressing issues of cost, waste management, and nuclear weapons proliferation.

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After a question and answer period during which each of the 20 senators on the committee expressed their views, Deutch said, “I’m impressed that all of you are saying that we need to do ‘all of the above’ — that is, that every possible alternative should be aggressively pursued, as he recommended. Given that support, he then asked, why isn’t it happening?”

Hockfield was asked for her impression of how much interest there was among students in working on such energy technologies. “The students’ interest level is absolutely deafening,” she said. “Students are wildly enthusiastic.”

As an example, she pointed to work done by the student-led MIT Energy Club, with its more than 700 members.

To take the lead in developing the new energy technologies the world needs, Hockfield said, the United States should triple its investment in energy research promptly, then move to a higher level as the Department of Energy builds its capacity to translate basic research to the marketplace. She called for indus-
try, government and universities to work together on a collaborative “road map” to plan those next steps for coming years.

And she emphasized the importance of spreading that research money broadly across a portfolio of energy research areas, not just those that seem poised for the most immediate return.

“We can’t choose winners now, we don’t know what they will be,” she said.

The first step, she suggested, is to set up the collaborative panel to create a detailed strategic plan for the coming years.

“So, we need work going on across a range of technologies,” Hockfield said. “We need to develop everything we can get our hands on.”

By doing so, she said, “we can turn this global energy challenge into a global opportunity.”

“Political leaders find it difficult to speak the truth about energy security.”

The reality is that progress will be slow because of the magnitude of the problems.

Deutch offered seven recommendations and emphasized that these represent not

First, he said, charging for greenhouse gas emissions is essential, whether in the form of a direct carbon tax or a cap-and-trade system. Second, a major 10-year program to demonstrate carbon sequestration is essential to make clean coal a reality.

Third, a push is needed to improve the efficiency of energy use in buildings, cars, and appliances.

Fourth, much more research is needed on potential energy solutions. This requires at least a doubling of federal research funding, the creation of a new energy innovation council to develop a multiyear research strategy across all government agencies, and an energy technology corporation to manage demonstration projects, he said.

Fifth, there should be an expansion of domestic oil and gas production, which he said is important to add credibility to U.S. efforts to encourage other nations to increase their production. Sixth, commercial nuclear power should be expanded, although this requires addressing issues of cost, waste management, and nuclear weapons proliferation.

Finally, Deutch said, there must be improvements in the coordination of energy policy across multiple government agencies, by creating an energy coordinating council.

Deutch rejected calls for an energy research program akin to the Apollo program or Manhattan Project. Unlike those focused government programs with very specific, clearly defined objectives, he said, “Here, we’re talking about having a technology deployed in the real economy, and the issues are much more complex.”

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Lecture examines anti-evolution movement

Mandana Sassanfar
Department of Biology

In an early kickoff to the 200th anniversary celebration of English naturalist Charles Darwin's birth, members of the MIT community gathered Wednesday, Sept. 10, to hear an expert offer a historical perspective on the movement against the teaching of evolution.

Louise Mead of the National Center for Science Education, founded to defend and promote the teaching of evolution in public schools, traced the morphing of creationism in schools, others wondered if discussion of creationism in public schools while being sensitive to religious faith and how to diminish the current clash between science and religion.

The event was organized by biology graduate students Emiko Fire, Sarah Bagby, Brian Chin, and Matt Wohlever, and Professor of Molecular Biology Jonathan King.

After her presentation, Mead answered many questions from the audience, and heard suggestions and comments about promoting the teaching of evolution in public schools while being sensitive to religious faith and how to diminish the current clash between science and religion. Some in the audience agreed with a need to compromise and teach evolution while also mentioning intelligent design in public school, others wondered if discussion of intelligent design in science classes would legitimize its theory, while one member of the audience wondered how much the general public trusted scientists and therefore scientific evidence that supports the theory of evolution.
MIT assistant publishes her 20th children's book

Sally Lee, an administrative assistant in the Computer Science and Artificial Intelligence Laboratory, poses with one of her children's books and one of her paintings, which can be found hanging throughout the Stata Center.

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**MIT** is home to many published authors, but Sally Lee may be the only one whose target audience is under 6 years old.

Lee, an administrative assistant in CSAIL, has just published her 20th children's book, "The Tutu Ballet." Her self-published books, which are available on her web site and on Amazon.com, focus on the importance of accepting yourself and others.

"I'm kind of a kid myself. I'm trying to write books that appeal to kids and not necessarily offer a moral lesson, although they do have a little bit of that," Lee says.

Lee, who started writing and illustrating children's books about five years ago, said she never intended to write so many. After finishing a book, "I always say, 'This is it, I'm not doing another one,' and then I get a new idea," she says.

Though she's relatively new to writing books, Lee has been painting and drawing her whole life. She didn't plan to pursue art as a career, but one of her college professors encouraged her to do so. She painted for a while and did several gallery shows, but found she didn't enjoy it as much as she thought she would.

"Painting is very isolating," she says. "It's kind of a lonely business." She did her first children's book with her mother, then decided to keep at it on her own. When she first started, she tried to get a traditional publisher to produce her books, with no luck. Then she discovered BookSurge, a company that allows authors to self-publish books through the Internet.

Inspiration for "The Tutu Ballet" came after Lee saw a children's ballet class at the YMCA. A couple of the girls, about 3 years old, were wandering around in circles, having fun and not really paying attention to the teacher.

She ended up writing a book about a ballet class in which each student only wants to practice a particular position. The teacher gets frustrated, until she decides that the best thing to do is to create a dance routine that takes advantage of each student's strengths.

"It's a story about tolerance and adapting but still having a good final result that makes everybody happy," Lee says. "I wanted to stress the joy of doing something with your friends, as opposed to doing it completely perfectly."

Lee, who is deaf in one ear, has also written a 10-book series on a rabbit named Lucy who has the same handicap.

Though her books aren't sold in bookstores, they can be bought on Amazon.com, where dozens of customers have posted positive reviews.

Her colleagues in CSAIL have also been very supportive of her work, she says, and about 20 of her paintings hang in various locations around the Stata Center, including her group's office and CSAIL headquarters.

"Sally livens up the eighth floor, treating us all to sweets and stories, and bringing out the 6-year-old in both students and faculty," said Manolis Kellis, associate professor of computer science, whose office is in Lee's group. "Her children's books are relevant, by their simplicity and timelessness, to much beyond her target age group."

Lee, who has been at MIT for 14 years, says she enjoys working in an academic environment because "it allows me to be around a lot of different people and also pursue my own talent, and they are very supportive of that."

For more information on Lee's books, visit www.leepublishing.net.