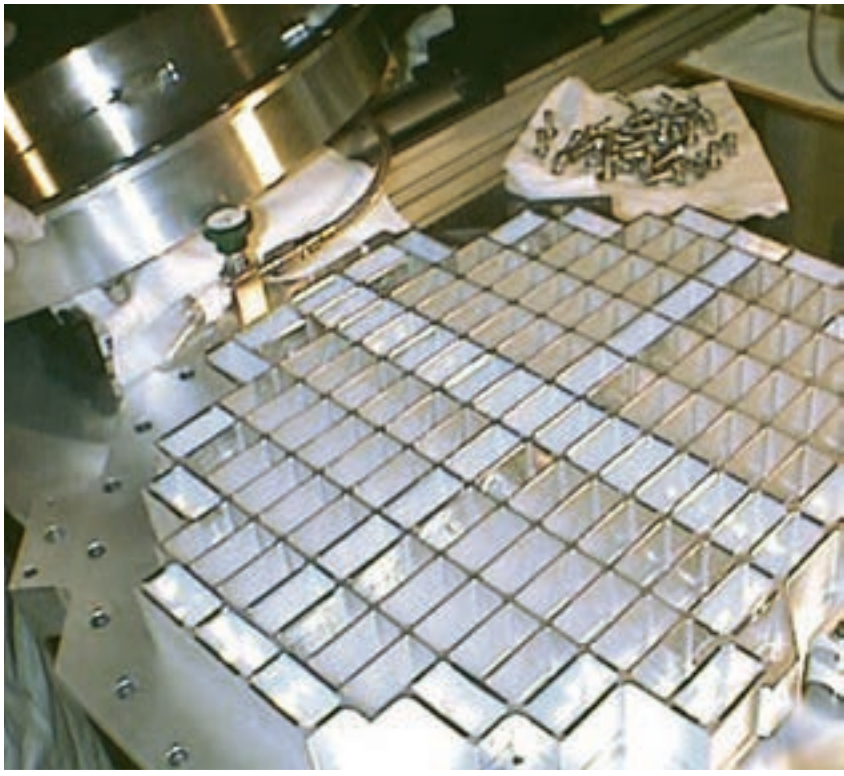
CarnegieScience

The Newsletter of the Carnegie Institution

SUMMER 2011

EMBRYOLOGY □ GEOPHYSICAL LABORATORY □ GLOBAL ECOLOGY □ THE OBSERVATORIES □
PLANT BIOLOGY □ TERRESTRIAL MAGNETISM □ CASE: CARNEGIE ACADEMY FOR SCIENCE EDUCATION



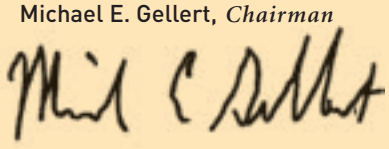
On the Inside

I am happy to report that the Carnegie endowment is recovering from the financial crisis that struck in 2008. Over the last decade, roughly 50% of Carnegie's budget has come from income from the endowment. In June 2008 the endowment was at a high of $870 million. But, it fell to $609 million by March of 2009. At the most recent board meetings in May, the endowment was back up to $772 million. During the first quarter of this year, Carnegie's endowment return was 5.6%, and it was 13.3% over the 12-month period ending March 31. Even with the downturn, the endowment has achieved an annualized return of 6% over the last five years. This compares favorably with the State Street Endowments & Foundations Universe benchmark and the S&P 500 equity index. They have achieved annualized returns of 4.5% and 2.6%, respectively, over the same five-year period. In early May, the credit-rating agency Standard & Poor's reaffirmed Carnegie's AA+ long-term rating and stable outlook. This high rating is based on "Carnegie's large endowment . . .; its considerable financial resources relative to expenses and debt; manageable 3.5% interest-only maximum debt service relative to fiscal 2010 expenses; history of surpluses on a cash basis; and budgetary flexibility."

Of course, we attend to the institution's financial health because it sustains our exceptional science. Because of the endowment's recovery, we have been able to loosen the tight belt and recruit several new and remarkable researchers (see page 8). For over 100 years the caliber of our research staff has determined the success of the institution. New blood is essential, and we look forward to our new scientists' future success.

At the same time, we must not lose sight of the continuing economic drama. We will remain cautious with our spending. In addition to our endowment, about 10% of Carnegie science is supported by private gifts, and over 33% comes from federal contracts and grants—confirmation of the quality of our research. But we know there are many demands on the federal budget. And there is a renewed emphasis on fiscal discipline. Although many lawmakers share the belief that the long-term economic vitality of our country depends on basic scientific research, we must have contingency plans for the possible diminution of federal support. I am confident that, with proper management, our track record will remain as strong as ever and Carnegie science will continue to flourish.

Michael E. Gellert, *Chairman*



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TrusteeNews

Trustees Updated on Science

The 134th meeting of the Carnegie board of trustees took place at the administration building in Washington, D.C., on May 5 and 6. The first day saw meetings of the Employee Affairs, Finance, and Development committees, followed by the first session of the board. On the second day a meeting of the Nominating Committee was followed by the second session of the board, where trustees were treated to research updates from around the institution.

Director of the Observatories Wendy Freedman reported on the technical progress of the Giant Magellan Telescope (GMT). The first, so-called off-axis, mirror is in the final stages of testing at the University of Arizona Mirror Lab. Three different laser tests all agreed on the surface quality. The mirror is expected to be finished by the end of the year. Glass has been purchased for other mirror segments, and a detailed design should be complete in about 18 months. Freedman also discussed the GMT schedule and its organizational status, and summarized recent successes in project fundraising.

Director of Terrestrial Magnetism Sean Solomon brought the group up to date on the MESSENGER mission, which was successfully inserted into Mercury orbit March 17 and has been collecting data since April 4. Solomon reviewed the science questions the craft will address. He described its elliptical 12-hour orbit, where the farthest point allows the instruments to cool off from the searing temperatures it encounters when it's close to the hot, dayside of the innermost planet. He showed the first historic photograph from orbit and data indicating that one polar crater, at least, is deep enough that the bottom is in permanent shadow. The speculation that there is water ice in permanently shadowed craters awaits confirmation from chemical analysis.

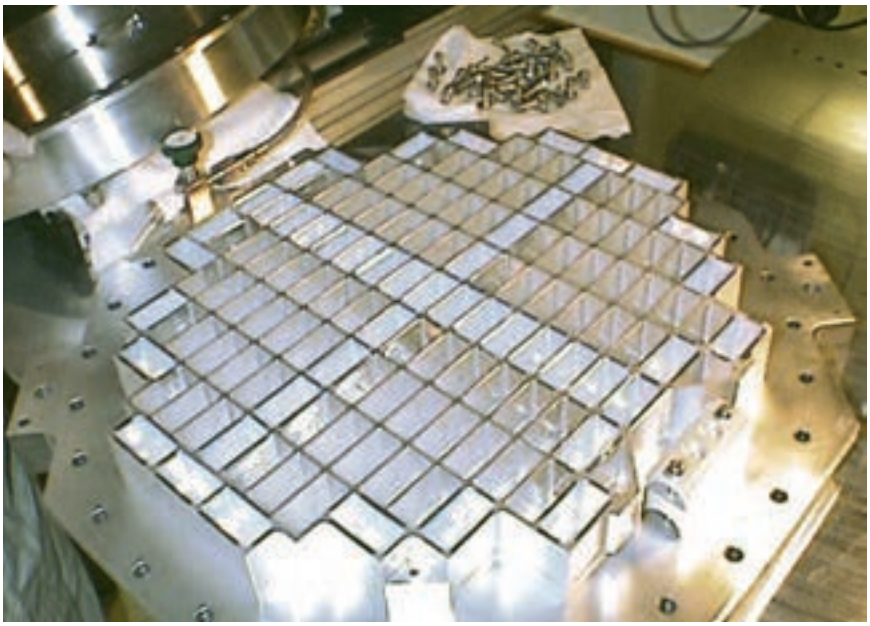
Chris Field, director of Global Ecology, talked about the Asner group's Carnegie Airborne Observatory (CAO). Flying on a fixed-wing aircraft, CAO instruments reveal the chemistry and vegetation of a landscape in striking 3-D colors. The technology allows researchers to determine the carbon content of a region, which can provide offsets to fossil fuels under the United Nations Reducing Emissions from Deforestation and Forest Degradation (REDD) program. He also mentioned some unanticipated uses of the technology, such as the observations of predator behavior and habitat choices. A new Carnegie/JPL spectral sensor debuted this summer.

Geophysical Laboratory director Rus Hemley talked about the 10-year Sloan-initiated Deep Carbon Observatory, an international multidisciplinary project for studying Earth's deep carbon cycle. He described how the directorates are structured around the research areas of deep carbon reservoirs and flow, deep life, and deep energy, and the physics and chemistry of carbon in different environments. The scientific objectives are to monitor volcano emissions in real time, drill to Earth's mantle, understand deep microbial life, and design and implement new scientific instruments to carry out the work. He also mentioned an effort to develop a four-dimensional visualization of the findings.

Steve Farber, a staff member at Embryology, talked about how lipids are absorbed and function—research that is important to the medical community. He uses the tiny zebrafish, which, when young, are entirely transparent, allowing cellular function to be observed in real time in live fish. He labels lipids with fluorescent material to watch how they are taken up in the intestine. He found that cholesterol alone is not taken in by cells in the gut; cholesterol needs fatty acids to be absorbed by the intestine. His lab is using techniques to look at similar processes in other tissues, such as those of the liver.

Anat Shahar, a staff member in the Geophysical Lab, concluded the review with her pioneering work blending isotopic geochemistry and high-pressure experiments in the lab to replicate conditions of Earth's core to determine its composition. She studies meteorites, which contain chemical fingerprints from the time of early planetary formation. Lighter isotopes, versions of an element with a different number of neutrons, separate from heavier isotopes, and their ratios reveal the chemical and physical changes that the material experienced. Shahar found that under the pressure and temperature conditions of the core, the region could contain silicon-28, long suspected to be there. □

Peeking at the Primitive Solar System



For George Cody of Carnegie's Geophysical Laboratory, studying the origins of our Solar System means studying carbon. Cody discussed his research in his talk "Shining Light on the Dark History of the Early Solar System" at May's Carnegie Evening lecture in Washington.

Other scientists have observed evidence of a very strong signature of organic carbon in the molecular clouds of star-forming regions. But it has not been clear in what form this carbon exists. When it comes to analyzing objects at such great distances, there is only so much that can be learned. But looking closer at our Solar System can provide more detail.

"We only have our Solar System to study," Cody told the assembled crowd. "So the question is: Are we special?"

Cody said this question is best answered by studying objects from the Kuiper Belt and the Oort Cloud—both located farther out in the Solar System. Objects there have been perturbed in their orbits and have made their way as comets to the inner Solar System. They were probably transformed by heating and chemical processing during the journey and NASA is able to send missions to study them and analyze their carbon content.

NASA also has missions to get samples of interplanetary dust particles, or IDPs, which are some of the Solar System's most primitive objects and can also be analyzed for carbon. Lastly, carbonaceous chondrites, a type of organic-rich meteorite, are also studied as a basis for comparison with the comets and IDPs.

Once samples are collected, Cody analyzes them with different types of spectroscopy—which is the

"light" part of his talk's title. He uses so-called XANES, or X-ray Absorption Near Edge Structure, spectroscopy and Nuclear Magnetic Resonance (NMR) spectroscopy to reveal information about the carbon. Spectroscopy can help provide essential clues about the origin of the carbon in these samples and about the chemical and thermal processing they endured when the protosolar molecular cloud coalesced into the Solar System billions of years ago.

Cody is especially interested in how carbon was retained during the cataclysmic early period of the inner Solar System's formation. That period's extreme temperatures meant that much of the organic carbon not trapped in primitive bodies was lost to space, along with much of the water.

Cody found that it is very likely carbon was retained on Earth and in our Solar System in the form of formaldehyde molecules. "I can say with a 98% confidence level that organic solids in our Solar System derive from formaldehyde," Cody told the group, meaning that life on Earth may owe its existence to this molecule.

The poisonous formaldehyde is very common throughout the universe. Because of this, finding carbon on a potentially habitable planet is likely, Cody said, and thus a carbon cycle could exist there.

Looking backward, "The early Solar System is still a dark place in that there is so much we don't know and can't see," Cody said. But more research remains to be done, and it could yield results as surprising and exciting as Cody's pinpointing of formaldehyde's role in our early Solar System. □

(Top left) This photograph shows the aerogel dust collector aboard NASA's *Stardust* spacecraft, which collected interplanetary dust particles. Cody analyzed the organic material found in IDPs collected by this mission.
Image courtesy NASA's Jet Propulsion Laboratory

(Bottom left) George Cody delivers the Carnegie Science Evening lecture, "Shining Light on the Dark History of the Early Solar System."

(Bottom right) George Cody shown left, this year's Carnegie Evening speaker, son Sean, and father George attend a reception before the lecture.

Annual Dinner 2011

New members of the Carnegie giving societies were honored at this year's annual dinner May 5. Paul and Carolyn Kokulis were inducted into to the Vannevar Bush Society, which recognizes individuals who have made lifetime contributions of $100,000 or more. William and Cynthia Gayden became new members of the Edwin Hubble Society. Members of that society have made lifetime contributions of $1,000,000 or more.

Charles Vest, president of the National Academy of Engineering, was this year's speaker. Vest talked about the continued declining U.S. competitiveness in the 21st century, particularly in science and technology education. He referenced the report, *Rising Above the Gathering Storm, Revisited: Rapidly Approaching Category 5*, and said that the we can regain our can-do spirit if we have the political will to do so. The evening concluded with a solo cello tribute by Lori Barnet. □

(Top left) Paul and Carolyn Kokulis are the newest members of the Vannevar Bush Society. • (Top right) Trustee Bill Gayden (shown) and his wife, Cynthia, were inducted into the Edwin Hubble Society. Gayden said a few words to encourage others to support the institution. • (Bottom) President of the National Academy of Engineering Charles Vest was this year's annual dinner speaker.

Sweetly Cooling the Climate

Brazilians are world leaders in using biofuels for gasoline. About a quarter of their automobile fuel consumption comes from sugarcane, which significantly reduces carbon dioxide emissions that would otherwise come from using gasoline. Now scientists at the Department of Global Ecology have found that growing sugarcane in Brazil has a double benefit. Expanding the crop in areas previously occupied by other crops cools the local climate. The surrounding air temperature drops because sugarcane reflects sunlight back into space and because the plants "exhale" cooler water.

The research team, led by Carnegie's Scott Loarie, is the first to quantify the direct effects on the climate from sugarcane expansion into areas of existing crop and pastureland of the cerrado, in central Brazil. The study was published in the April 17, 2011, online issue of *Nature Climate Change*.

The researchers used data from hundreds of satellite images over 733,000 square miles—an area larger than the state of Alaska. They measured temperature, reflectivity, and evapotranspiration—the water loss from the soil and from plants as they exhale water vapor.

As Loarie explained, "We found that shifting from natural vegetation to crops or pasture results in local warming because the plants give off less beneficial water. But the bamboolike sugarcane is more reflective and gives off more water—much like the natural vegetation. It's a potential win-win for the climate—using sugarcane to power vehicles reduces carbon emissions, while growing it lowers the local air temperature."

The scientists found that converting from natural vegetation to crops or pastureland warmed the cerrado, on average, by 2.79°F (1.55°C), but that subsequent conversion to sugarcane cooled the surrounding air, on average, by 1.67°F (0.93°C).

The researchers emphasize that the beneficial effects are contingent on sugarcane's being grown in areas previously occupied by crops or pastureland, and not in areas converted from natural vegetation. It is also important that other crops or pastureland do not move to natural vegetation areas, which would contribute to deforestation.

So far, most of the thinking about ecosystem effects on climate considers only impacts from greenhouse-gas emissions. But according to coauthor Greg Asner, "It's becoming increasingly clear that direct climate effects on local climate from land-use decisions constitute significant impacts that need to be considered core elements of human-caused climate change." □

(Top left) Sugarcane cools the surrounding air temperature by reflecting sunlight back into space and because the plants "exhale" cooler water vapor. • (Center) The study area was in the cerrado, in central Brazil. • (Top right) Global Ecology's Scott Loarie

Coauthors on the study are David Lobell of the Program on Food Security and the Environment at Stanford University, Gregory Asner and Christopher Field of Carnegie's Department of Global Ecology, and Qiaozhen Mu of the University of Montana. The work was made possible through the support of the Stanford University Global Climate and Energy Project.

HONORING TWO WHO SERVE SCIENCE

★

Carnegie president Richard Meserve awarded the Service to Science Award to two employees during the Carnegie Evening on May 4, 2011—Ona Martin of the Department of Embryology and Terry Stahl of the Department of Terrestrial Magnetism (DTM). The award recognizes outstanding and/or unique contributions to science made by employees who work in administration, support, and technical positions at Carnegie.

Ona Martin

has been at the Department of Embryology for 32 years. For the last 14, she has been the senior technician in Yixian Zheng's lab. Martin's skills in molecular biology, biochemistry, and tissue culture have been essential in enabling the lab to move into new research areas.

Martin played a key role in identifying components necessary for cell division—the so-called gamma-tubulin ring complex that is critical in regulating the creation of stringlike structures called microtubles that form a spindle and move chromosomes into two new cells. Her work resulted in a paper on which she was the lead author. In pursuing this research she also generated numerous antibodies that have been vital in labs around the world.

Most recently, the Zheng lab decided to use the mouse as a model system to study how cell division and cellular formation are involved in development. The investigation required working with embryonic stem cells. Martin took the lead in learning the specialized techniques at NIH and brought those skills back to Zheng's lab.

Carnegie is fortunate to have Ona Martin as one of the many dedicated persons who support its science.

Embryology's Ona Martin receives her Service to Science award from Carnegie president Richard Meserve.

Terry Stahl

has been the business manager at DTM since 1978, a role that has changed as the department has grown. With just one assistant over most of these three decades, Stahl efficiently and effectively managed an increasingly complex workload, tackling ever-increasing requirements for federal grants while providing outstanding service to staff members and postdoctoral researchers.

Stahl's responsibilities have included personnel administration, accounting and finance, and administration. Over the last decade he has managed the multidepartmental, multi-institutional cooperative agreements supporting Carnegie's participation in the NASA Astrobiology Institute. For over a decade he has managed the multimillion-dollar NASA contract for the Science, Navigation, and Education and Public Outreach teams for the MESSENGER Mission to Mercury.

Department director Sean Solomon describes Stahl as "the archetype of the generally unsung member of our support staff, whose tireless work for more than three decades has been absolutely essential to the general scientific productivity of an entire Carnegie department."

President Meserve presents Terry Stahl with the Service to Science Award.

A BEVY OF NEW STAFF

Carnegie welcomes four new staff researchers. **Anna M. Michalak** joins the Department of Global Ecology. Prior to joining Carnegie, she was the Frank and Brooke Transue Faculty Scholar and an associate professor at the University of Michigan, and recently completed a sabbatical as a faculty fellow at the Institute for Mathematics Applied to Geosciences at the National Center for Atmospheric Research in Boulder, Colorado. Her research focuses on characterizing complexity and quantifying uncertainty in environmental systems. Examples of her recent work include the quantification of atmospheric greenhouse gas emissions and sequestration, and the assessment of potential climate impacts on water quality.

Plant Biology has appointed **José Dinneny** to the staff. Dinneny comes from Temasek Life Sciences Laboratory and is an assistant professor at the National University of Singapore. He studies plant developmental genetics to understand what guides environmental response in multicellular systems. His work includes research into responses of the roots of the model plant *Arabidopsis* to stresses such as salt. He also identifies dominant expression patterns using fluorescence-activated cell sorting to generate high-resolution gene expression maps.

In addition to a new director (page 13), the Department of Terrestrial Magnetism (DTM) welcomes two new staff members. **Matthew Fouch** was the Harry Oscar Wood Postdoctoral Research Fellow at DTM in seismology in 1999 and 2000, and spent a sabbatical year at DTM in 2007-2008. He comes from Arizona State University, where he has been an assistant and associate professor since 2001. Fouch is interested in planetary and terrestrial seismology, the structure and dynamics of the mantle, crustal deformation, and seismic instrumentation.

Diana Roman also joins DTM from the University of South Florida, where she has been an assistant professor. She studies volcanoes; specifically, how magma moves through the Earth's crust and how volcanic conduits evolve and operate. She focuses on how stress and seismicity are affected by magma migrating through the Earth's crust. She also develops monitoring techniques based on the analysis of high-frequency volcanic seismicity. □

JOSÉ DINNENY

José Dinneny recently joined the Department of Plant Biology.

Image courtesy José Dinneny

DIANA ROMAN

Diana Roman joins DTM to continue her research on volcanoes.

ANNA M. MICHALAK

Global Ecology's newest staff member, Anna M. Michalak

Image courtesy University of Michigan

MATTHEW FOUCH

DTM's Matthew Fouch returns to Carnegie as a staff member. He was a postdoctoral fellow at DTM in 1999 and 2000.

Approaching the Beginning of Time

Astronomers, including coauthor Ivo Labbé shown at left, of the Observatories, have found what they believe to be the most distant object seen yet in the universe. It is 13.2 billion light-years away, some 3% of the universe's age. The object is roughly 150 million light-years more distant than the previous record holder and will provide insights into the birth of the first stars and galaxies and the evolution of the universe. The research was published in the January 27, 2011, issue of *Nature*.

The dim object is a compact galaxy made of blue stars that existed only 480 million years after the Big Bang. It is tiny—over 100 times smaller than the Milky Way. "We are thrilled to have discovered this galaxy, but we're equally surprised to have found only one. This tells us that the universe was changing very rapidly in early times," remarked Labbé.

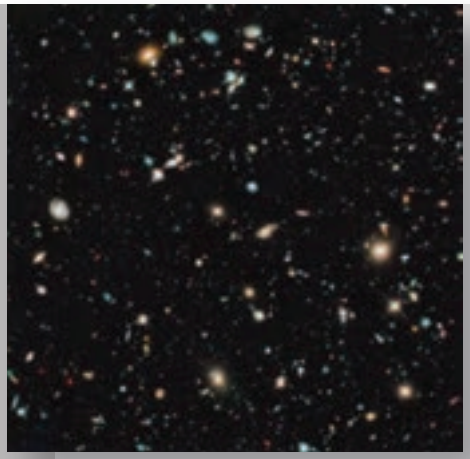
Previous searches had found 47 galaxies when the universe was about 650 million years old. The rate of star birth therefore increased by about 10 times in the interval from 480 million years to 650 million years. "This is an astonishing increase in such a short period—just 1% of the age of the universe," said Labbé.

Astronomers don't know exactly when the first stars appeared in the universe, but every step back in time takes them deeper into the early universe's "formative years," when stars and galaxies were just beginning to emerge after the Big Bang.

The galaxy was identified in the Hubble Ultra-Deep Field Infrared (HUDF-IR). The data were taken in the summers of 2009 and 2010 with the Wide Field Planetary Camera 3 (WFPC3) shortly after it was installed. Though individual stars can't be resolved by Hubble, the evidence suggests that this is a compact galaxy of hot stars that first started to form over 100 to 200 million years earlier in a pocket of dark matter.

Astronomers plumb the depths of the universe by measuring how much the light from an object has been stretched by the expansion of space, which is called redshift, or z. Before Hubble was launched, astronomers could only see galaxies to about 6 billion years after the Big Bang. The Hubble Deep Field, taken in 1995, was a huge step, going roughly 90% of the way back to the beginning of time. The new Advanced Camera and the Hubble Ultra-Deep Field pushed back the limit more, but the WFC3/IR has now plausibly penetrated for the first time to z=10, which is about 500 million years after the Big Bang.

The hypothesized hierarchical growth of galaxies—from stellar clumps to spirals—didn't become evident until the Hubble Space Telescope deep field exposures. The first 500 million years of the universe's existence is now the missing chapter in galaxy evolution. □



This is the image of the sky in the region of the Hubble Ultra-Deep Field taken with the new Wide Field Camera 3 infrared imager (WFC3/IR) by the HUDF09 team. The WFC3 was added to Hubble in 2009.This is the deepest image of the sky ever taken in the near infrared. This tiny patch of sky, about one-tenth the diameter of the full Moon, allows astronomers to probe for galaxies far back in time to when the universe was just 3.5% of its current age. That is, we are looking back through 96.5% of all time to see early, very young galaxies as they grow and develop to become the great galaxies of today.

This image of the Hubble Ultra-Deep Field is a small part of the deepest infrared image ever taken of the universe. The small blue box outlines the area where astronomers found what may be the most distant galaxy ever seen, 13.2 billion light-years away, when its light was emitted just 480 million years after the Big Bang. It is small and very faint and is shown separately in the larger box. The galaxy is shown as blue because it emitted very blue light from its high rate of star birth. By the time the light reached Hubble it had been stretched into the infrared by the expansion of space, giving it a redshift value (z) of about 10. Its official name is UDFj-39546284, but astronomers refer to it as the "redshift 10 galaxy candidate."

Images courtesy NASA, ESA, Garth Illingworth (University of California, Santa Cruz) and Rychard Bouwens (University of California, Santa Cruz and Leiden University) and the HUDF09 Team.

Fresh Eyes on Photosynthetic Efficiency

Martin Jonikas, a recent addition to the Department of Plant Biology, studied engineering in college and had no interest in his current profession until his junior year, when he was compelled to take a biochemistry class as a graduation requirement. But once his eyes were opened to biology, they never closed again. "I'd never really realized that biology was full of molecular machines," he said in an interview. "Once I realized that, I started to believe that biology is the next frontier for engineering and has immense potential to change the world in this century."

Jonikas's research aims to determine the functions of about 300 uncharacterized, but widespread plant genes found in the single-celled alga *Chlamydomonas*, with a focus on those necessary for photosynthesis.

According to Jonikas, much about the photosynthetic process is still not understood, particularly how plants deal with stress and how the photosynthetic mechanism is assembled. This latter aspect is principally complex because the genes encoding the photosynthetic machinery are split between the plant cell nucleus and the DNA present in the cell's chloroplast—the part that conducts photosynthesis.

"So much is unknown that there are likely to be areas where we aren't even aware of the existence of a fundamentally important biological process," he said. "But the main reason why I'm studying photosynthesis is that I really believe there will be opportunities for using the information we learn to do good things for the world."

In March, Jonikas received one of four grants from the National Science Foundation and the U.K. Biotechnology and Biological Sciences Research Council to fund research on increasing photosynthetic efficiency.

It turns out that the photosynthetic machinery of many organisms may not be completely optimized for today's environment. When photosynthesis first evolved, the atmosphere had much more carbon dioxide and much less oxygen. The protein responsible for fixing carbon dioxide—called Rubisco—worked very well under these conditions. As photosynthetic organisms spread around the world, they absorbed carbon dioxide and released oxygen at such a rate that atmospheric levels of oxygen rose and levels of carbon dioxide fell dramatically. The decreased carbon dioxide concentrations revealed a critical flaw in Rubisco. Under the low concentrations of carbon present in today's atmosphere, it functions extremely slowly and often costs plants metabolic energy because of its imprecise activity. However, Rubisco is such a central component of the photosynthetic metabolism that it cannot be removed or replaced, despite its inefficiency.

This is where Jonikas and his grant come into the picture.

He and his colleagues are looking at the special mechanism by which *Chlamydomonas* is able to increase the concentration of carbon dioxide in proximity to Rubisco, thus dramatically improving its performance and improving the overall photosynthetic efficiency.

Some crops, such as corn, are similarly capable of concentrating carbon dioxide, through a more complicated process. But others are not. If Jonikas and his colleagues can transfer this carbon dioxide-concentrating ability to non-carbon-dioxide-concentrating plants, such as rice, they might improve food production around the world.

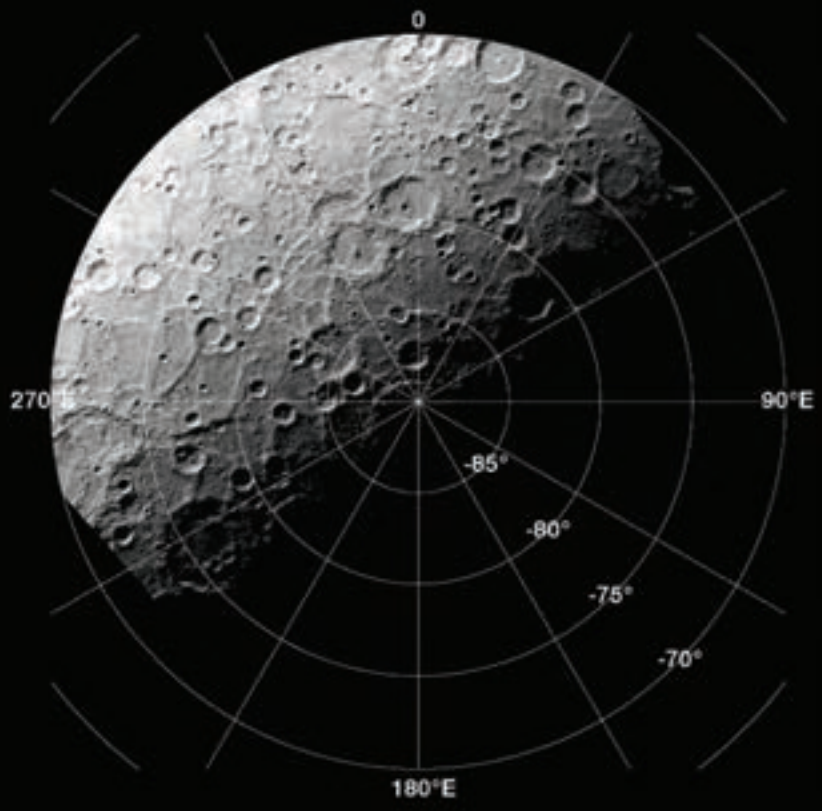
"I'm only at the beginning of learning about photosynthesis, but it's very exciting stuff, and I'm thrilled to be entering this field," Jonikas said. "Plants have an incredible ability to do chemistry on such a huge scale that it boggles the mind. If we can harness this ability, we might be able to do good for the world." □

The members of Martin Jonikas's team pose outside their new lab. From left to right are Ute Armbruster, Jonikas, Ru Zhang, Weronika Patena, and Spencer Gang.

Image courtesy Martin Jonikas

Corn is a crop plant that is able to concentrate carbon dioxide in the vicinity of the photosynthetic protein Rubisco. This improves the plant's efficiency. Rice is not able to perform this concentrating activity, making its growth less efficient. Jonikas and his colleagues are studying ways to make the photosynthetic process more efficient.

Rice image courtesy USDA/Keith Weller; corn image courtesy Public Domain Pictures/Petr Kratochvil



SUCCESS!
MESSENGER ORBITS MERCURY

At 8:45 p.m. EDT on March 17, 2011, the tiny MESSENGER craft began its successful burn to become the first spacecraft in history to orbit the innermost planet, Mercury. Director of Terrestrial Magnetism Sean Solomon is the mission's principal investigator. At about 10:00 p.m. engineers in the MESSENGER Mission Operations Center at the Johns Hopkins University Applied Physics Laboratory (APL) in Laurel, Maryland, confirmed that the craft made a "perfect" transition into orbit. It began science operations on April 4.

MESSENGER's main thruster fired for approximately 15 minutes at 8:45 p.m., slowing the spacecraft by 1,929 miles per hour (862 meters per second) to enter the planned highly eccentric orbit. The rendezvous took place about 96 million miles (155 million kilometers) from Earth.

Achieving Mercury orbit was by far the biggest milestone since MESSENGER was launched more than six and a half years ago and during its 4.9-billion-mile (7.9-billion-kilometer) journey. "Despite its proximity to Earth, the planet Mercury has for decades been comparatively unexplored," remarked Solomon. "For the first time in history, a scientific observatory is in orbit about our Solar System's innermost planet." □

On May 4, 2011, the U.S. Postal Service issued a forever stamp featuring the tiny MESSENGER spacecraft, the first ever to orbit Mercury.
Image courtesy USPS

One of the six questions scientists hope to answer about Mercury is the nature of the highly reflective material detected in permanently shadowed craters at Mercury's poles. The material was identified from Earth using radar, and there is speculation that it is water ice. The diameter of this south polar image is 1,060 miles (1,700 kilometers). The image was taken on April 13, 2011. Image courtesy NASA/Johns Hopkins University Applied Physics Laboratory/Carnegie Institution of Washington

RETRO EXPERIMENT REVIVAL

In the 1950s, the biochemist Stanley Miller performed a series of experiments to demonstrate that organic compounds could be created under conditions mimicking the primordial Earth. His work was the first to demonstrate that subjecting hydrogen-rich gases to an electric spark could create the basic molecules of life. The samples used were created in 1958 and were never previously analyzed. A team of scientists, including the Geophysical Laboratory's Jim Cleaves, recently revisited Miller's work, with some interesting results.

In the years since Miller's initial experiments, scientists have come to believe that the atmosphere of primitive Earth wasn't made up of the same gases that Miller used in his initial study. However, volcanic eruptions were likely very common during the early history of the planet, and these volcanoes could have emitted clouds rich in hydrogen, methane, and hydrogen sulfide, which would create conditions similar to Miller's experiments in limited geographic areas. The spark could have been supplied by lightning, which is commonly associated with volcanic clouds.

Cleaves and his team uncovered some preserved but unused samples from Miller's research, which had been collected, cataloged, and stored, but never analyzed. The team used modern techniques to study these samples. The techniques Miller used in the 1950s were only capable of detecting a few amino acids, but today's equipment is much more sophisticated. The recent findings indicate the possible importance of volcanoes and sulfur in the formation of amino acids and, possibly, life on Earth.

The team was able to identify 23 types of amino acids, some of which are the building blocks of proteins necessary for life, including the sulfur-containing amino acid methionine, as well as four other types of organic compounds known as amines. The structures of several of the amino acids indicate that they were clearly synthesized in the experiment and not contaminants, although traces of contamination from 50 years of storage were also evident. The results showed the first known synthesis of sulfur-containing amino acids using the spark method developed by Miller.

The team checked its work by comparing the amino acids created by Miller in the presence of hydrogen sulfide to organic compounds found in carbonaceous chondrites, a type of organic-rich meteorite. It found the greatest similarity between the experiments with hydrogen sulfide and the carbonaceous chondrites, indicating that hydrogen sulfide may have played a role in the creation of the meteorite amino acids. □

This is a photo of the Augustine Volcano in Alaska. Cleaves and his coresearchers demonstrated that gas from volcanic clouds reacting with lightning could have created the conditions whereby amino acids, the building blocks of life, were first created on Earth.

Lindy Elkins-Tanton

to Direct Carnegie's Department of Terrestrial Magnetism

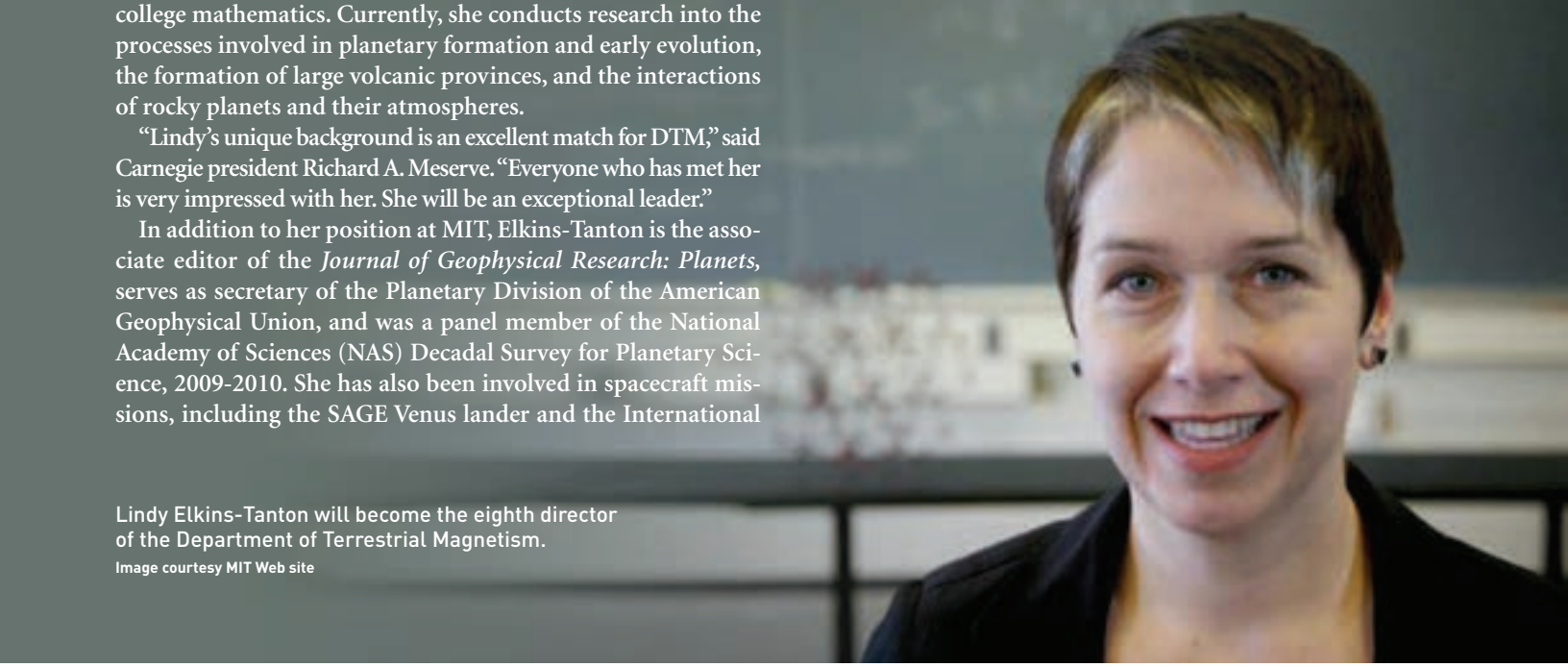
Linda Elkins-Tanton, Mitsui Career Development Associate Professor of Geology at the Massachusetts Institute of Technology (MIT), will become the eighth director of Carnegie's Department of Terrestrial Magnetism (DTM). She succeeds Sean C. Solomon, who has been at the helm since 1992 and will stay on as a staff member. Elkins-Tanton begins her directorship in the fall of 2011.

Elkins-Tanton received her B.S., M.S., and Ph.D. from MIT in geology, geochemistry, and geophysics, respectively. Between her master's and doctorate, she spent 10 years in the private sector working in finance and publishing. She has also taught college mathematics. Currently, she conducts research into the processes involved in planetary formation and early evolution, the formation of large volcanic provinces, and the interactions of rocky planets and their atmospheres.

"Lindy's unique background is an excellent match for DTM," said Carnegie president Richard A. Meserve. "Everyone who has met her is very impressed with her. She will be an exceptional leader."

In addition to her position at MIT, Elkins-Tanton is the associate editor of the *Journal of Geophysical Research: Planets,* serves as secretary of the Planetary Division of the American Geophysical Union, and was a panel member of the National Academy of Sciences (NAS) Decadal Survey for Planetary Science, 2009-2010. She has also been involved in spacecraft missions, including the SAGE Venus lander and the International Lunar Network. Among her awards are the Lowell Thomas Award from the Explorers Club (2010), the Outstanding MIT Faculty Undergraduate Research Mentor Award (2008-2009), and the National Science Foundation CAREER Award (2008).

Speaking of Elkins-Tanton, geophysicist Mary Lou Zoback, Carnegie trustee and leader of the search committee, said, "We were extremely fortunate to have had an outstanding pool of candidates for the position. But members of the committee and the department staff all agreed that the focus and breadth of Lindy's research, as well as her leadership, diverse experience, and enthusiasm, made her the perfect fit." □



Lindy Elkins-Tanton will become the eighth director of the Department of Terrestrial Magnetism.
Image courtesy MIT Web site

Discovering Distortion

Colossal magnetoresistance (CMR) is a property that promises important applications in the fields of magnetic sensors, magnetic random access memories, and spintronic devices. As a result, chemical compounds called manganites, which demonstrate CMR, are a hot research topic. However, understanding—and ultimately controlling—this effect remains a challenge because much about manganite physics is still not known. Research from Maria Baldini, Viktor Struzhkin, and Alexander Goncharov has made an important breakthrough in our understanding of the mysterious ways manganites respond when subjected to intense pressure.

At ambient conditions, manganites have insulating properties, meaning they do not conduct electric charges. When pressure of about 340,000 atmospheres is applied, these compounds change from an insulating state to a metallic state, which easily conducts charges. Scientists have long debated about the trigger for this change in conductivity.

The research team's new evidence shows that for the manganite $LaMnO_3$, this insulator-to-metal transition is strongly linked to a phenomenon called the Jahn-Teller effect. This effect actually causes a unique distortion of the compound's structure. The team's measurements were carried out at Carnegie's Geophysical Laboratory.

Counter to expectations, the Jahn-Teller

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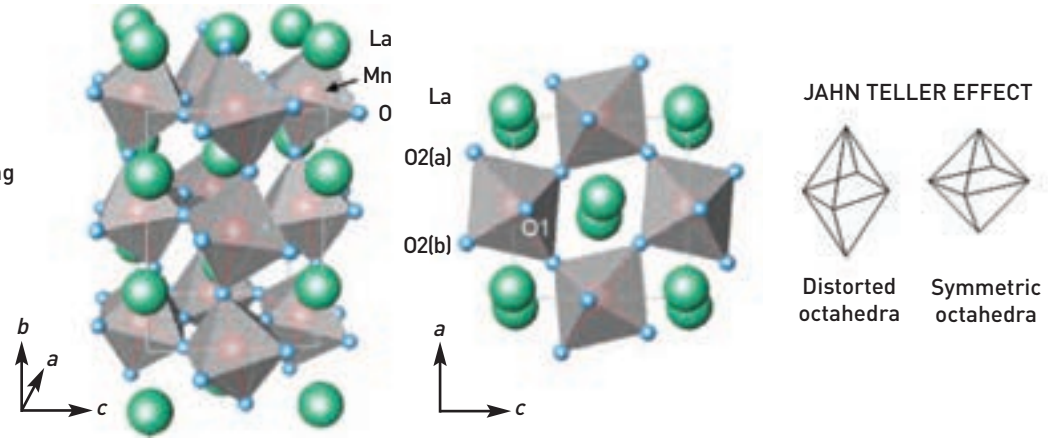
distortion is observed until $LaMnO_3$ is in a nonconductive insulating state. Therefore, it is reasonable to believe that the switch from insulator to metal occurs when the distortion is suppressed, settling a longstanding debate about the nature of manganite's insulating state. The formation of inhomogeneous domains—some with and some without distortion—was also observed. This evidence suggests that the manganite becomes metallic when the breakdown of undistorted to distorted molecules hits a critical threshold in favor of the undistorted.

"Separation into domains may be a ubiquitous phenomenon at high pressure and opens up the possibility of inducing colossal magnetoresistance by applying pressure," Baldini explained. □



At left is a picture of the structure of $LaMnO_3$ shown from two different angles. At right is a diagram showing the difference between symmetrical and distorted aspects of manganite due to the Jahn-Teller effect.

Image courtesy Maria Baldini

George Mitchell Gives $25 Million to the Giant Magellan Telescope

Image courtesy Texas A&M

Texas A&M alumnus George P. Mitchell gave the GMT Project an extraordinarily generous $25 million gift. Half the donation will go to Carnegie and half will go to Texas A&M.

The Carnegie Institution will receive half of a $25 million gift from George P. Mitchell, founder of Mitchell Energy and Development Corporation and the Cynthia and George Mitchell Foundation, for the Giant Magellan Telescope (GMT) Project. The other half will go to Texas A&M University, Mitchell's alma mater, for its contribution to the project. The gift is unprecedented in size and will help support the GMT Project for the next five years. Carnegie and Texas A&M are two of the project's 10 partners.*

"George Mitchell has been a driving force behind this project from the beginning," commented Wendy Freedman, chair of the board of directors for the Giant Magellan Telescope Organization (GMTO) and director of the Carnegie Observatories. "His generosity, vision, and dedication to the project will help define the future of astronomy."

The GMT features an innovative design of seven primary mirrors, each 8.4 meters (27 feet) in diameter, arranged in a hexagon. The seven mirrors, six of which are off-axis, will produce a single telescope 24.5 meters (80 feet) in diameter. The mirrors are under development at the Steward Observatory Mirror Laboratory (SOML) at the University of Arizona, another GMT partner. The first off-axis mirror is in the final stages of polishing and is expected to be completed by the end of the year.

The GMT, set to begin operations at Carnegie's Las Campanas Observatory in the Atacama Desert in northern Chile in 2019, will open a new window on the universe. Its resolving power will be far larger than that of any other telescope ever built and will allow astronomers to answer the most pressing questions of the day on such subjects as the nature of dark matter, dark energy, black holes, planets orbiting other stars in our galaxy, and the evolution of stars and galaxies in the earliest phases of the universe.

"This is an extraordinary time for astronomy given the many mysteries, including dark energy and dark matter, that we do not understand," said Carnegie president Richard Meserve. "George Mitchell's exceptional generosity will help us to solve them." □

*The Giant Magellan Telescope Organization (GMTO) is a nonprofit corporation based in Pasadena, California, that manages the GMT Project on behalf of its international partners. Those partners include Astronomy Australia Ltd., the Australian National University, the Carnegie Institution for Science, Harvard University, the Korea Astronomy and Space Science Institute, the Smithsonian Institution, Texas A&M University, the University of Arizona, the University of Texas at Austin, and the University of Chicago. For more information, visit www.gmto.org.

InBrief

❶ Carnegie trustee Sandra Faber

❸ Yixian Zheng (left) and Benjamin Goodman (right) celebrate Goodman's Ph.D. defense.
Image courtesy Youngjo Kim

❹ MiNDS program graduate student Valeriya Gaysinskaya (left) and Kiara Parker (right) look into a fluorescent confocal microscope at mouse sperm cells.
Image courtesy Kim Hairston

❺ Former GL postdoctoral researcher Nick Arndt answers questions after a talk at the Institut de Physique du Globe de Paris.
Image courtesy Douglas Rumble

TRUSTEES AND ADMINISTRATION

❶ Trustee and astronomer **Sandra Faber** is the 2011 recipient of the Henry Norris Russell Lectureship of the American Astronomical Society. The award is given annually "on the basis of a lifetime of eminence in astronomical research."

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Carnegie president **Richard Meserve** was elected councilor of the National Academy of Engineering. He attended meetings of the Blue Ribbon Commission on America's Nuclear Future on Mar. 14-15 and May 13. He was a panelist at the International Nuclear Policy Conference, sponsored by the Carnegie Endowment for International Peace, on Mar. 28. He hosted an event in NYC in support of the Giant Magellan Telescope on Apr. 13. He cochaired a meeting on the National Academies' Committee on Science, Technology, and Law on Apr. 11-12. He participated in meetings of the Harvard Board of Overseers on Apr. 2-3 and May 24-25. He received the Tufts Vannevar Bush Dean's Medal and delivered a lecture on the Fukushima accident on Apr. 4 in Medford, MA. Meserve chaired a meeting of the IAEA's International Nuclear Safety Group in Vienna, Austria, on May 30-Jun. 1, then served as a session chairman at an IAEA ministerial meeting on the Fukushima accident on Jun. 20-24. He cochaired a workshop sponsored by the National Academies and the Russian Academy of Sciences on the conversion of U.S. and Russian research reactors in Moscow on Jun. 8-10. He also gave a lecture on the international nuclear safety regime at the Nuclear Plant Safety Summer Course at MIT on Jun. 13.

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Mira Thompson left the office of advancement in May to pursue a fellowship in public health in Kenya. **Irene Chen** took her place.

EMBRYOLOGY

Director **Allan Spradling** attended the Genetics Society of America board meeting and the annual *Drosophila* meeting in San Diego.

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Joe Gall presented the opening lecture at the European Molecular Biology Organization Workshop on "Chromatin Structure, Organization and Dynamics" held in Prague Apr. 9-13. He also presented lectures at the Kirchhoff Institute for Physics in Heidelberg and at U. Pisa.

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Marnie Halpern presented her work at U. Wyoming and participated in the NICHD Vision Workshop on Development for the Eunice Kennedy Shriver National Institute of Child Health and Human Development.

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❷ **Steve Farber** presented a talk at Johns Hopkins U.'s Colloquium Series and at the Massachusetts General Hospital Cardiovascular Research Center. He also gave a lecture titled "How Science Outreach Impacts Urban Science Education: Project BioEYES Inspires the Next Generation of Scientists" as part of the Johns Hopkins Provost's Lecture Series. He will serve on the Baltimore City STEM advisory committee, helping city schools make decisions on the best way to move science education forward for their students. Farber was invited to participate in the three-year review of the Center for Metabolism and Obesity Research at the Johns Hopkins Institute for Basic Biomedical Sciences.

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Nick Ingolia presented his work at the Cold Spring Harbor Asia Conference on High Throughput Biology, the Bioinformatics Seminar Series at U. Iowa, and at NIH.

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Spradling lab members **Alexis Marianes**, **Jianjun Sun**, and **Megha Ghildiyal** attended the annual *Drosophila* meeting in San Diego.

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Halpern lab postdoctoral fellow **Dan Gorelick** was an invited speaker at Smith College.

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Graduate student **Courtney Akitake** defended her Ph.D. thesis, "Developing GAL4/UAS Transgenic Tools to Probe Zebrafish Neural Function."

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❸ Yixian Zheng lab graduate student **Benjamin Goodman** defended his Ph.D. thesis, "Lamin B3: Connecting the Spindle Matrix and Spindle Assembly." **Haiyang Chen** arrived at the Zheng lab to work on the role of the cytoskeleton in development. Visiting researcher **Hao Jiang** arrived to work on the function of the spindle matrix in spindle morphogenesis, cell division, and survival.

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Vitor Bortolo de Rezende, a visiting graduate student in the Farber lab from Federal U. Minas Gerais, Brazil, uses the larval zebrafish as a model for the abnormalities in lipid metabolism observed in humans treated with antipsychotic medications. **Oni Mapp** comes to the lab from U. Chicago, where she studied neuronal migration with Victoria Prince. In the Farber lab she plans to image neurons to visualize lipoproteins in live zebrafish.

❷ Embryology's Steve Farber
Image courtesy Matt Roth

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❹ Students from the Baltimore Talent Development High School visited the dept. in Mar. as part of the Hopkins graduate student MiNDS program.

GEOPHYSICAL LABORATORY

Director **Russell Hemley** gave the following invited talks: "The Deep Carbon Observatory" at the Dynamics Phenomena under Extremes Workshop in Austin on Jan. 26; "Developments at CDAC—The Carnegie/DOE Alliance Center: A Center of Excellence in High Pressure Science and Technology" at the Stewardship Science Academic Alliances Symposium in Washington, DC, Feb. 15; "Effects of Extreme Environments on Materials" at the Russian Ministry of Education and Science in Moscow Mar. 1; and "Overview of Research at the Geophysical Laboratory" at the EFree Scientific Advisory Committee Meeting in Washington, DC, Mar. 23. He also co-led the Deep Carbon Observatory Executive Committee Meeting, which was held Mar. 3-4 in Warrenton, VA.

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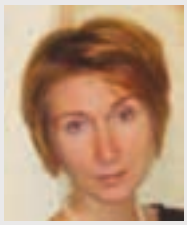
❺ Since Jan. **Douglas Rumble** has been working at the Institut de Physique du Globe de Paris (IPGP) to help develop analysis for the oxygen isotopes ^{16}O, ^{17}O,

Patrick Parker, former staff member and postdoctoral fellow at the Geophysical Lab, died Apr. 9 at age 78. He was a postdoctoral fellow at GL after getting his Ph.D. at U. Arkansas. Parker was appointed a staff member at the lab for two years in the 1950s before going to U. Texas Marine Science Institute. He and Tom Hoering, his advisor at Arkansas and GL, made the first compound-specific stable isotope measurements, published in 1964.

❻ Adrian Villegas-Jimenez

❼ Jesse Smith



❽ Olga Shebanova

❾ Katherine Lazarz

and ^{18}O. He gave invited seminars at the Ruhr-Universität Bochum and Freie Universität Berlin in Mar. and Apr. He attended the seminar presented by Nick Arndt, former GL postdoctoral researcher (1975-1977) and a professor in the French U. system, at the IPGP on May 5 about the severe impact of huge volcanic eruptions on life and the possibility of extinctions.

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Ho-kwang (Dave) Mao delivered a talk at the Zhongguancun Forum at the Institute of Physics, Chinese Academy of Sciences, on Jan. 10 in Beijing. He gave an invited talk at the Institute of Geology and Geophysics, Chinese Academy of Sciences, on Jan. 11. On Mar. 22 he gave an invited talk at the APS Spring Meeting in Dallas. Finally, he delivered a chair lectureship, "High Pressure: A New Dimension in the 21st Century Physical Sciences," at U. Nebraska-Lincoln on Apr. 22.

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Robert Hazen presented the Linnaeus Lecture at U. Uppsala, Sweden, on complex evolving systems. He presented lectures on mineral evolution and the origins of life at the Space Telescope Science Institute, Johns Hopkins U., and at the annual meeting of the Materials Research Society in San Francisco. He gave a keynote lecture on the Deep Carbon Observatory at the annual meeting of AAAS in Washington, DC, as well as invited lectures on deep carbon at SUNY-Stony Brook, U. Southern California, the NSF, and Tohoku U., where he left just a few hours before the great earthquake of Mar. 11 struck Sendai. He was in Tokyo's Narita Airport when the quake struck.

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In Mar. **Yingwei Fei** attended the 42nd Lunar and Planetary Science Conference in Houston and presented his research on the structure and composition of Mercury's core. In Apr. he gave an invited talk on Martian interiors at the International Space Science Institute—Europlanet Workshop "Quantifying the Martian Geochemical Reservoirs" in Bern, Switzerland.

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Nabil Boctor presented a paper at the Lunar and Planetary Science Conference in Houston in Mar.

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❻ Postdoctoral fellow **Adrian Villegas-Jimenez** attended the Marine Geoscience Leadership Symposium organized by the Consortium for Ocean Leadership in Washington, DC, Apr.18-22.

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High Pressure Collaborative Access Team (HPCAT)

Yoshio Kono joined HPCAT as a research scientist on Apr. 1 to work at the bending magnet beamlines, specifically with PE-Cell.

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Ligang Bai, a postdoc from U. Nevada-Las Vegas (UNLV) stationed at HPCAT, will be conducting research on energetic materials and rare earth and transition metal oxides under extreme conditions. He will also be supporting users from UNLV.

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❼ Also on Apr. 1, **Jesse Smith** joined as a postdoctoral research associate. He will be conducting research at all beamlines and will participate in R&D projects, mainly at ID-B and ID-D.

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❽ Former postdoctoral associate **Olga Shebanova** returned to HPCAT as a visiting scientist in Jan. to conduct experiments on metal alloys.

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❾ **Katherine Lazarz**, a senior at U. Wisconsin-Madison, will be working at HPCAT this summer to create a database for HPCAT user registration and various statistics.

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Erik Wang, an undergraduate at U. Chicago, will continue his research on the nitrogen-xenon system at high pressure with his mentor, **Guoyin Shen**. The project started in 2009.

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Rong Huang departed in Apr. for a new position at Cornell U.

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Energy Frontier Research in Extreme Environments Center (EFree)

EFree's Science Advisory Committee met at the Broad Branch Road campus on Apr. 14. Attendees included Rodney C. Ewing, U. Michigan; Giulia Galli, UC-Davis; Gabrielle G. Long, Argonne National Laboratory; Christian Mailhiot, Lawrence Livermore National Laboratory; Stanley W. Tozer, Florida State U.; Alexandra Navrotsky, NEAT ORU; Edward Roessler , UC-Davis; and John Sarrao, MaRIE, Los Alamos National Laboratory.

GLOBAL ECOLOGY

Dept. director **Chris Field** testified before the House Subcommittee on Energy and Power on Mar. 8 at a hearing, "Climate Science and EPA's Greenhouse Gas Regulations." He discussed the science behind climate change on Mar. 4 in the *Wall Street Journal*'s meeting titled "Eco-Nomics." He spoke at IPCC meetings on ocean acidification on Jan. 16-21 in Okinawa; on the Global Earth Observation System of Systems on Feb. 1-4 in Geneva, Switzerland; and on infrastructure and climate change in Kolkata, India, Mar. 22-24. He also participated in an IPCC meeting on training Asian scientists for international assessments in Dhaka, Bangladesh, Mar. 18-20. On Mar. 26 he taped a segment of the TV show *Tea with The Economist* in London.

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❿ **Julie Pongratz** of the Caldeira lab recently received the Wladimir Peter Koeppen Award given by the KlimaCampus in Hamburg for an outstanding Ph.D. thesis in climate research. She gave invited talks at Laboratoire des Sciences du Climat et de l'Environnement (LSCE) in Gif-sur-Yvette, France, and at a workshop for Holocene land use at the Max Planck Institute for Meteorology in Hamburg. She also had five minutes on the BBC World Service on Jan. 27 and was quoted on several Web sites in response to her paper with **Ken Caldeira**, Christian Reick, and Martin Claussen in which they modeled the effects of wars and epidemics on atmospheric CO_2 between AD 800 and AD 1850.

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The Field lab's **Kyla Dahlin** was awarded an NSF Doctoral Dissertation Improvement Grant.

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HPCAT hosted a group of high school girls for the Science Careers in Search of Women conference held at Argonne.

Director Emeritus Leonard Searle died at his home in July 2010. On Feb. 11 the Observatories hosted a memorial in honor of Searle, which was attended by Searle's family, friends, and Observatories and Caltech faculty.

Greg Asner's lab hosted "The Launching of the Carnegie Airborne Observatory (CAO) II" on June 2 at the Hiller Aviation Museum. The event showcased the next generation Airborne Taxonomic Mapping System, or AToMS. AToMS will provide higher-resolution laser and hyperspectral information extending from the visible through the shortwave-infrared region of the spectrum. It will ride on its new Dornier 228 aircraft. The dramatic increase in measurement capability provided by AToMS will provide a major leap forward for CAO science in support of Earth exploration, biological conservation, and resource policy development.

(Top right) The leader of the CAO project, Greg Asner (right), stands at the plane with the spectrometer in view. Next to him is Robert Green, the lead engineer for the AToMS VSWIR spectrometer at JPL. At left is Tom Painter, an Asner colleague.

(Bottom right) Longtime trustee and supporter of the Carnegie Airborne Observatory (CAO), William R. Hearst, III (left) stands with department director Chris Field in front of the next-generation airborne observatory CAO-II.

❿ Julie Pongratz

⓫ Steve Shectman

⓬ Barry Madore

⓭ Alan Dressler

⓮ Josh Simon

Arrivals: Dawn Chadwick and **Lena Maatoug** joined the Asner lab as interns. **Lena Schulte-Uebbing** worked with the IPCC Working Group II task force as a volunteer intern for several months.

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Departures: James Kellner left the Asner lab in Jan. for a faculty position at U. Maryland-College Park.

OBSERVATORIES

⓫ The Observatories hosted the scientific conference "A Decade of Exploration with the Magellan Telescopes" Apr. 25-28 at the Huntington Library, Art Collections, and Botanical Gardens in San Marino, CA. Over 90 scientists attended, and 41 presentations highlighted results from the Magellan telescopes. The conference also featured a dinner in honor of **Stephen Shectman**, who served as project manager for the Magellan telescopes.

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KASI president Seok Jae Park visited the Observatories on Feb. 8. Park stepped down as KASI president on May 24. Director **Wendy Freedman** presented him with a commemorative poster to thank him for his significant contributions to the Giant Magellan Telescope (GMT) project. On Apr. 4 she chaired the Gruber Cosmology Prize Nominations Committee Meeting in New York City. She was Columbia U.'s invited speaker for the 37th Bampton Lectures in America. She gave four lectures: Apr. 5 at the American Museum of Natural History, followed by three lectures at Columbia U. on Apr. 7, 12, and 14. She participated in the conference "A Decade of Exploration with Magellan Telescopes" at the Huntington Library Apr. 26-28. This meeting was in honor of Stephen Shectman, Magellan Telescopes project scientist.

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In Jan. **Ian Thompson** attended the AAS meeting in Seattle and the conference "RR Lyrae Stars, Metal-Poor Stars, and the Galaxy" honoring George Preston at 80 held at the Observatories.

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⓬ **Barry Madore** gave an invited colloquium at the Science Operations Center of the National Radio Astronomy Observatory in Socorro, NM, titled "What Is This Thing Called the Schmidt Law?"

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In Jan. **Luis Ho** gave colloquia at Shanghai Astronomical Observatory; at the Institute of High-Energy Physics, the National Astronomical Observatory, and the Chinese Academy of Sciences in Beijing; and at the Institute of Mathematics and Physics of the Universe, U. Tokyo. In Mar. he gave colloquia at U. Washington and in Apr. at the NASA Goddard Space Flight Center and U. Maryland.

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⓭ **Alan Dressler** gave the Schopp Memorial Lecture in Astronomy at San Diego State U. on Mar. 25. The title of the lecture was "The Lights of Cosmic Dawn."

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Andy McWilliam organized the international conference "RR Lyrae Stars, Metal-Poor Stars, and the Galaxy" celebrating **George Preston's** 80th birthday held at the Observatories in Jan.

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⓮ Staff astronomer **Josh Simon** gave invited talks at the following events: the Indirect and Direct Detection of Dark Matter conference in Aspen, CO, Feb. 7; the Center for Galaxy Evolution Inaugural Workshop in Irvine, CA, Mar. 1; and the Pioneering into the Extragalactic Frontier with the Giant Magellan Telescope workshop in College Station, TX, Mar. 14.

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Postdoctoral research associate **Nimish Hathi** attended and gave a talk at the AAS meeting held Jan. 9-13 in Seattle. His talk presented preliminary results from his work on searching for distant, so-called z=7 galaxy candidates in the GOODS-N field. He presented a poster at the Southern California Center for Galaxy Evolution (CGE) two-day workshop held Mar. 1-2 at UC-Irvine. His poster was based on his published paper on first results from the WFC3 UVIS camera on the Hubble Space Telescope.

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In Apr. **Paul Butler** was named a Fellow of the American Academy of Arts and Sciences. The new members will be inducted at a ceremony on Oct. 1 at the academy's headquarters in Cambridge, MA. Butler was recognized for discovering more than 330 planets outside our Solar System.

DTM's Paul Butler | Image courtesy NSF

⓯ Sean Solomon

⓰ Vera Rubin

Carnegie Fellow **Janice Lee** gave a colloquium at Indiana U. in Jan. and at Seoul National U. in Korea in Mar. She participated in the NASA Extragalactic Database Users Committee meeting at Caltech in Jan.

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NSF Astronomy and Astrophysics Postdoctoral Fellow **Karín Menéndez-Delmestre** presented her research on the environment of high-redshift submillimeter galaxies with the Magellan/IMACS instrument at the 2011 NSF Fellows' Symposium in Jan. in Seattle. She attended the 2011 American Astronomical Society Meeting in Seattle and was a judge for the Chambliss Poster Award; she gave a talk on her current investigation of UV-luminous galaxies at low redshift with IMACS. She attended the ALMA Spectroscopy 2011 Workshop in Victoria, BC, and was invited to serve on an extragalactic panel for the Spitzer Cycle-8 proposal review held in Mar. She has accepted a professorship at the Valongo Observatory, Federal U. Rio de Janeiro, starting this fall.

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Postdoctoral research associate **Rik Williams** gave a presentation at the Science from UKIDSS 3 workshop, Royal Astronomical Society, London, Jan. 6-7.

PLANT BIOLOGY

Winslow Briggs gave a talk on Feb. 14 at the Institute of Biochemistry, Academia Sinica, Taipei, Taiwan, about LOV domains. On Feb. 17 he gave a talk at Taiwan National U., Taipei, titled "Vegetation Recovery after a California Wildfire: A New Class of Plant Growth Regulators in Smoke. On Apr. 14 he presented a talk at the International Conference on Karrikins and Strigolactones held at U. Western Australia, Perth, and on Apr. 17 he also talked at U. Western Australia.

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Arthur Grossman attended the EAGER Meeting held in Orono, ME, Jan. 20-27.

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Zhiyong Wang presented a talk at the Croucher ASI symposium "Functional Phosphoproteomics in Study of Plant Cell Signaling and Molecular Systems Biology" on Jan. 2-7 in Hong Kong. On Mar. 14 he gave the seminar "The Brassinosteroid Signaling Network" at Capital Normal U. in Beijing, China, and at Nankai U., Tianjin, China, on Apr. 12.

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Eva Huala, director of TAIR, **Kate Dreher**, TAIR curator, and **Bob Muller**, technical lead curator, gave talks at the Plant & Animal Genome XIX Conference in San Diego on Jan. 15-18. Huala spoke on "Phenotype Ontology RCN Plants, Animals, Etc.," Dreher on "Assessing Information in Plant Metabolic Pathway Databases at the PMN, Gramene, and SGN. Part I: Contents, Search Strategies, and Data Sharing Opportunities," and Muller on "TAIR Interoperability."

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On Mar. 29 **Sue Rhee** gave a talk, "Building and Applying Genome-wide Biological Networks to Uncover Functions of Genes and Pathways," at U. Florida.

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Mark Heinnickel, postdoctoral research associate in the Grossman lab, presented a talk at the 20th Western Photosynthesis Conference held in Monterey, CA, on Jan. 6-7 on "Comparative Genomic & Targeted Photosynthesis to Elucidate Photosynthesis Function."

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Antony Chettoor, **Yongxian Lu**, and **Allison Phillips**, postdoctoral research associates in the Evans's lab, attended the 53rd Annual Maize Genetics Conference in St. Charles, IL. Phillips presented a poster titled "Analysis of *stunter1*, a Maize Mutant with Reduced Gametophyte Size and Maternal Effects on Seed Development;" Chettoor's poster was titled "Characterization of Indeterminant Gametophyte 2 Maize Mutant Defective in Embryo Sac Development;" and Lu's was titled "Clone and Characterize the Tcb1 Factor(s) that Forms Cross Barrier between Maize and Teosinte."

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Arrivals: Purva Karia, a visiting student from India, joined the Rhee lab on Jan. 3 for a six-month internship. Postdoctoral research associate **Tae Hyong Kim** arrived on Feb. 28.

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Postdoctoral research associate **Tingting Xiang** (China Agricultural U.) joined the Grossman lab on Jan. 16. Also joining the lab was postdoctoral research associate **Dimitri Tolleter**, who arrived on Apr. 1 from the Commissariat à l'Energie Atomique in France. On Apr. 1 **Chan Ho Park**, a postdoctoral research associate from **Chung-Ang U**. in South Korea, joined the Wang lab. **Mayuri Sadoine**, a visiting student from IBMM in Gosselies, Belgium, joined the Frommer lab on Apr. 1 as an intern. Postdoctoral research associate **Ute Armbruster**, from Ludwig-Maximilians-Universität, Munich, started in the Jonikas lab on Mar. 1.

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The TAIR group welcomed new programmer **William Nelson** on Apr. 18.

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Departures: On Jan. 26 **Woei-Jiun Guo**, a postdoctoral research associate in the Frommer lab, left to take up an assistant professorship at the Institute of Plant Biology in Taiwan. Postdoctoral research associate **David Dewez** left the Grossman lab on Mar. 31 to return to Canada. Visiting researcher **Hak Soo Lee** returned to Yonsei U. in South Korea.

TERRESTRIAL MAGNETISM

⓯ In Feb. **Sean Solomon** served on an external review committee for the Dept. of Geology at U. Kansas. He gave an invited topical lecture at the annual meeting of the American Association for the Advancement of Science (AAAS) in Washington, DC, and he delivered an astronomy colloquium at Princeton U. In Mar., with the insertion of the MESSENGER spacecraft into orbit about Mercury, he made presentations to the NASA Museum Alliance and the NASA Thrill of Discovery Educator Workshop, and he gave interviews to PBS, BBC News, National Public Radio, Planetary Radio, and to writers for numerous print and Web media. In May Solomon hosted the 22nd meeting of the MESSENGER Science Team, gave an Exploring Space Lecture at the National Air and Space Museum, and presented an invited paper on MESSENGER's exploration of Mercury at the annual meeting of the Geological Association of Canada in Ottawa.

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⓰ **Vera Rubin** received an honorary degree from American U. in Washington, DC, in May and gave remarks, "Years from 1900, 2000, and 3000."

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In Mar. **David James** gave a seminar on the origin of the Snake River Plain and Yellowstone hotspot at Rice U. In Apr. he and **Rick Carlson** gave keynote presentations at the International Conference on Craton Formation and Destruction, in Beijing. James spoke on the formation and evolution of the Kaapvaal Craton, and Carlson compared western U.S. and China craton evolution.

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Rick Carlson presented a colloquium at U. British Columbia in Mar.

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In Apr. **Conel Alexander** delivered a lecture, "The Origin of Organics and Water in Chondrites, and Implications for Transport in the Solar Protoplanetary Disk," at the American Museum of Natural History in New York City.

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Alan Boss participated in a review of the NASA Star and Exoplanet Database at Caltech in Pasadena, CA, in Feb. Boss also organized and chaired a special session on the latest results from NASA's Kepler mission at the AAAS annual meeting in Washington, DC. In Feb. and Apr. Boss chaired meetings of the

In May DTM postdoctoral scientist **Jonathan O'Neil** was presented the 2011 Léopold Gélinas Gold Medal by the Volcanology and Igneous Petrology Division of the Geological Association of Canada (GAC) at the 2011 Joint Annual Meeting of the GAC with the Mineralogical Association of Canada, the Society of Economic Geologists, and the Society for Geology Applied to Mineral Deposits.

NASA Advisory Council's (NAC) Astrophysics Subcommittee and attended meetings of the NAC Science Committee, all in Washington, DC. He also chaired the annual business meeting of the AAAS Astronomy Section. In Mar. he gave a seminar about the search for habitable planets to the Mid-Atlantic Senior Physicists Group, in College Park, MD. In Apr. he spoke about the crowded universe and about the M-dwarf planet search effort at Las Campanas Observatory during the 25th Annual Southern Star Astronomical Convention, in Little Switzerland, NC. In May he gave an overview of recent results from NASA's Kepler mission at the conference, "Exploring Strange New Worlds: From Giant Planets to Super Earths," in Flagstaff, AZ. He also spoke about searching for habitable worlds at the inaugural AAAS Cutting Edge Lecture Series, broadcast from AAAS headquarters, and attended a meeting of the Kepler mission science team at the Harvard-Smithsonian Center for Astrophysics, in Cambridge, MA.

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In Mar. **Larry Nittler** attended a meeting of the Genesis mission science team in Houston. In Apr. he hosted a visit by Genesis principal investigator Don Burnett for ion probe measurements. In May he attended the 22nd MESSENGER Science Team meeting held at DTM.

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In Feb. **Steve Shirey** was an invited lecturer at the International School on "Diamonds, the Mantle Petrologist's Best Friends" at U. Padua. Shirey spoke on "Mantle Sulfides and Re-Os Isotopes."

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At the 42nd Lunar and Planetary Science Conference in The Woodlands, TX, in Mar., 10 DTM scientists delivered papers: **Conel Alexander**, **Alan Boss**, **Rick Carlson**, **Mary Horan**, **Frank Gyngard**, **Nicholas Moskovitz**, **Larry Nittler**, **Zan Peeters**, **Sean Solomon**, and **Shoshana Weider**.

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Arrivals: During Feb. Alycia Weinberger hosted the visit of **Joseph Rodriguez**, a student from George Mason U., for the semester. Also that month, **Shoshana Weider** joined DTM as a MESSENGER Fellow after receiving her Ph.D. from Birkbeck College, U. London. Ph.D. student **Grant Bybee**, hosted by Steve Shirey, arrived at DTM in Apr. from U. Witwatersrand, South Africa. His dissertation research is on the origin of anorthositic rocks from Labrador. Also that month, visiting investigator **Yaru Hsu,** from Academia Sinica, Republic of China, spent two weeks at DTM to collaborate with Alan Linde on the analysis of data from strainmeter installations in Taiwan.Visitor **Gina Moseley** from U. Manchester worked with Rick Carlson on Cr isotope analyses directed at determining the age of formation of primitive meteorites. Rick Carlson also hosted visitor **Dmitri Ionov** of U. Jean Monnet in St. Étienne, France. Ionov analyzed the Re-Os isotope systematics of mantle samples from Siberia and Mongolia as part of a collaborative effort. Carnegie Fellow **Matt Gardine** arrived in May. He received his Ph.D. from U. Alaska-Fairbanks. MESSENGER Fellow **Christian Klimczak**, who received his Ph.D. from U. Nevada-Reno, also arrived in May.

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Departure: Visiting investigator **Tetsuo Takanami** left in Apr. to return to Japan. He collaborated with Alan Linde and Selwyn Sacks for two years on the analysis of data from borehole strainmeters in Hokkaido.

DTM/GL

Shaun Hardy participated in a meeting of science librarians and the American Geophysical Union's publications division in San Diego in Mar. □

Carnegie's newest trustee, Michael Wilson

Michael Gregg Wilson
Joins the Carnegie Board

Born in New York City, Michael G. Wilson graduated from Harvey Mudd College in 1963 as an electrical engineer and later studied law at Stanford University. After graduating, he worked for the U.S. government and then for a firm located in Washington, D.C., that specialized in international law.

In 1972 Wilson joined EON Productions, the production company responsible for the James Bond film series. He began in the legal department, then assisted producer Cubby Broccoli on the film *The Spy Who Loved Me*. In 1979 Wilson became executive producer of the film *Moonraker* and since has been an executive producer or producer of every James Bond film. In addition to his production duties, he co-wrote *For Your Eyes Only, Octopussy, A View to a Kill, The Living Daylights,* and *License to Kill.*

Wilson has made numerous cameo appearances in the Bond films. He is an accomplished photographer and collects rare photographs from around the world. In 2008 he was made an Officer of the British Empire by Queen Elizabeth II. □

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2011

September 15 — **100TH ANNIVERSARY OF MARIA SKLODOWSKA-CURIE'S 2ND NOBEL PRIZE**
Cosponsored with the Embassies of France and Poland
SPEAKERS: Kris Matyjaszewski, Carnegie-Mellon University
Nicole Moreau, President, International Union of Pure and Applied Chemistry
FILM: *The Life of Madame Curie*

October 5 — **BALZAN PRIZE LECTURE**
Cosponsored with the Embassies of Italy and Switzerland
SPEAKER: Carlo Ginzburg, Scuola Normale Superiore di Pisa

October 26 — **MARC KAUFMAN OF *THE WASHINGTON POST*** **Special Event!**
Cosponsored with *The Washington Post*
SPEAKER: Marc Kaufman, Author of the book *First Contact: Scientific Breakthroughs in the Hunt for Life Beyond Earth.* He speaks with planet hunter Paul Butler.

November 30 — **KAVLI PRIZE LECTURE**
Cosponsored with the Royal Embassy of Norway, the Norwegian Academy of Science, and the Kavli Foundation
SPEAKER: Don Eigler, Almaden Research Center, IBM

2012

January 12 — **CARNEGIE LECTURE**
Cosponsored with the National Security Agency
SPEAKER: Erik Demaine, MIT Associate Professor of Computer Science & MacArthur Fellow

February 29 — **CARNEGIE LECTURE**
Cosponsored with the Embassy of Australia
SPEAKER: Brian Schmidt, Mt. Stromlo Observatory

March 28 — **CARNEGIE LECTURE**
SPEAKER: Dianne Newman, CALTECH and Howard Hughes Medical Institute Investigator

April 26 — **WITTGENSTEIN PRIZE LECTURE**
Cosponsored with the Embassy of Austria
SPEAKER: Jurgen Knoblick, Institute of Molecular Biotechnology of the Austrian Academy of Sciences