SPECTRA

THE NEWSLETTER OF THE CARNEGIE INSTITUTION (FALL 2002

New Horizons for Science


[PAGE 7]


[PAGE 11]


[PAGE 8]

INSIDE

DISCIPLINE: Important in Science and Investing

A decade ago, the trustees embarked on a new course for managing the Carnegie endowment. And I'm happy to report that the strategy has proved to be highly successful, particularly during this time of market volatility. In 1992, the finance committee decided to allocate the endowment portfolio among three broad asset classes: alternative assets such as real estate and energy investments, domestic and international stocks, and fixed income and cash. The major component to our strategy, spearheaded by David Swensen, the chairman of the finance committee, is a relatively large allocation to alternative assets. The result of this approach is that over the past five years the Carnegie endowment has grown by 10.3% versus an average growth of 6.1% at similar institutions. Our success continued through the fiscal year ending June 30, 2002. During that period, similar endowments *declined* by 4% on average, while the Carnegie endowment *grew* by 3.1%.

The key to our healthy financial situation has been sound decision making and discipline. When markets behave erratically, the temptation is to chase gains. But the Carnegie trustees stayed firmly on track, and this discipline has paid off.

We have also been disciplined spenders and cost conscious in other ways. Through the efforts of Carnegie president Maxine Singer and the department directors, we continue to maintain our goal of keeping endowment spending below 5% of the endowment's value. A decade of successful fund-raising activities, orchestrated by Director of External Affairs Susanne Garvey, has also brought money into the institution and raised our public profile.

Because of these fiscal strengths, Carnegie's long-term debt rating was raised by Moody's to a triple A status—a rating level achieved by only some 20 other institutions in the country. This status, in turn, will help us keep down the costs of financing the construction of Embryology's new Maxine F. Singer Building in Baltimore.

The scientific staff has also contributed to our fiscal health. Many researchers have been very successful in obtaining grants and initiating collaborations with outside organizations, which pool collective resources. Others have come up with ingenious and cost-efficient ways to design instrumentation.

As we all know, first-rate science requires first-rate facilities. The fiscal responsibility of everyone in the institution has helped us sustain and improve these essential resources. And this helps us achieve our ultimate goal—to maintain world leadership in basic research. I thank you all for your contributions.

—Tom Urban
Chairman

Carnegie Institution of Washington

1530 P Street, NW
Washington, D.C.
20005-1910

202.387.6400
www.CarnegieInstitution.org

Image courtesy NASA

The Living Planet

The Carnegie Institution of Washington Geophysical Laboratory Centennial Symposium

As a part of the 2002 Carnegie centennial celebrations, the Geophysical Laboratory organized a four-day symposium, from September 23 through September 26, entitled *The Living Planet*. The event examined the interactions between inorganic, organic, and biological materials based on observations, theory, and experiment. The aim was to address properties and processes of these materials as they influenced the evolution of our planet. The symposium had presentations on the formation of precursor materials and bodies in the early solar nebula, processes of planet formation, and the establishment of the differentiated Earth from its core, its surface, and near-surface environments.

Scientists came from all over the world and all over the U.S. Members of the organizing committee included George Cody, Yingwei Fei, Wes Huntress, Bjørn Mysen, and Andrew Steele. The event began with a barbecue at the Broad Branch Road campus on September 22. Carnegie scientists from both the Geophysical Laboratory (GL) and the Department of Terrestrial Magnetism (DTM) participated. Larry Nittler, Conel Alexander, Steve Shirey, Erik Hauri, and Sean Solomon from DTM gave talks. GL scientists who spoke included Russell Hemley, Jie Li, Yingwei Fei, George Cody, Robert Hazen, Doug Rumble, Bjørn Mysen, Anurag Sharma, James Scott, Andrew Steele, and Marilyn Fogel. •

Global Ecology Is Born!

The Department of Global Ecology was officially established on July 1, 2002, with balloons and champagne. Chris Field, the director of the department, gave a brief speech and popped the cork. Staff Member Greg Asner and son unveiled a new campus sign for the Plant Biology/Global Ecology campus in Stanford, California.

The IN News

USA Today quoted Carnegie president **Maxine Singer** in an August 14 story about human cloning. Singer served on a National Academy of Sciences panel that recommended banning the cloning of human beings.

A front-page article in the August 6 *Wall Street Journal* talked about Embryology's **Andrew Fire**'s groundbreaking discovery with Craig Mello in 1998 of using double-stranded RNA to silence targeted genes. The process is known as RNA interference. The story said that the commercial sector is using the technique extensively and that the discovery has significantly advanced our understanding of how genes operate.

National Geographic magazine ran a sidebar in its July issue that talked about Carnegie's centennial and its astrobiology work. **James Scott**, Staff Associate at the Geophysical Laboratory, was quoted about his research with common bacteria that were subjected to extreme conditions and lived.

An article about Mercury and the MESSENGER mission to the innermost planet appeared in the October *Astronomy Magazine*. It quoted **Sean Solomon**, mission Principal Investigator and director of the Department of Terrestrial Magnetism, extensively.

George Cody of the Geophysical Laboratory was quoted in the June 4 *New York Times* in an article about astrobiology. **Sara Seager**, the newest Staff Member at the Department of Terrestrial Magnetism (DTM), was also quoted. In addition, the article noted the work of DTM's **Paul Butler** in the search for extrasolar planets.

News outlets from around the world reported on the announcement made by **Paul Butler** and team of the first solar system found that is analogous to our own. The system is around a Sun-like star, 55 Cancri, and features a planet with a mass and orbit similar to Jupiter's. On June 15 Butler was interviewed about the discovery on *NBC's Today*. The story appeared in national publications such as *Time* magazine, the *New York Times*, the *Washington Post*, *USA Today*, and the *L.A. Times*. Many local papers, science publications, and international media including the *BBC* and the *Sydney Morning Herald* also carried the news. In addition to Butler, **Alycia Weinberger** of DTM participated in the NASA news briefing announcing the find.

A monumental roundup on the state of cosmology that appeared in the July 23 *New York Times* featured several Carnegie scientists: **Allan Sandage**, Staff Member Emeritus of the Observatories; **Alan Dressler**, also of the Observatories; and **Vera Rubin** of DTM.

The work to determine the expansion rate of the universe, headed by Observatories' **Wendy Freedman**, was cited in the May 4 *Science News*.

The Chilean publication *La Segunda* ran an article in June about the different observatories in Chile. It described Las Campanas and the Magellan Project, and talked about **George Preston**'s work on first-generation stars. It also mentioned night assistant and comic illustrator **Herman Olivares** and **Oscar Duhalde**, instrument specialist and codiscoverer of Supernova 1987A.

DTM's **Alan Boss** answered a question on why the Earth spins, posed by an 11-year-old reader, for the *Washington Post*'s Kids Post section. A paper he cowrote with DTM's **George Wetherill** and **Nader Haghighipour**, which appeared in the March issue of *Icarus*, attracted a lot of attention. The paper explained how Uranus and Neptune could have formed under the disk instability model in a chaotic nascent solar system. The work was featured in the June 17 *San Francisco Chronicle*, the July *Sky & Telescope*, *Astrobiology Magazine*, and *SPACE.com*, among other publications. Images from Boss's model on planet formation were also featured in the August *Sky & Telescope*.

Attention-Getting Conference at Carnegie

The field of extrasolar planets is one of the most intriguing areas in science today. On June 18-21 Carnegie and NASA cosponsored a conference on the subject titled "Scientific Frontiers in Research on Extrasolar Planets." DTM's **Sara Seager** and **Alan Boss** helped organize the meeting. Researchers came from all over the world to the conference site at Carnegie's administration building in Washington, D.C. Many members of the press also attended.

A press conference was held in the library on June 19. William Herbst, an astronomer at Wesleyan University who was a postdoc at DTM between 1976 and 1978, announced that his team found evidence suggesting that dust and gas, the precursors to planets, and possibly something larger may be orbiting the distant star KH 15D. The find could give scientists a view of what goes on during early planet formation. Reporters from news organizations such as **CBS News**, the **Associated Press**, **United Press International**, the **Voice of America**, and the publications ***USA Today***, ***Nature***, and ***Sky & Telescope*** were present at the announcement. Others watched the proceedings via a live webcast conducted by Carnegie's Web manager, John Strom. Alan Boss participated in the event by fielding questions from reporters. News coverage was extensive.

REACHING OUT
at the Observatories

In the last several months the Observatories has been a beehive of activity in the Pasadena community. Director Gus Oemler and staff astronomers Alan Dressler, Wendy Freedman, Luis Ho, Paul Martini, Pat McCarthy, John Mulchaey, Eric Persson, George Preston, and Steve Shectman have all become involved. They are currently assisting Nancy Davis, the new regional director for external affairs, with a wide variety of new initiatives—educational programs, collaborations with other organizations, open houses, tours of the Observatories, astrophysics symposia, and public lectures. All of these efforts are benefiting both the community and Carnegie.

CORAL KIDS In a whirlwind few months beginning in April, Observatories Staff Member John Mulchaey developed a curriculum and cotaught a seven-week hands-on multidisciplinary course, "Our Place in the Universe," for 36 Pasadena high school students—four days a week, eight hours a day. The program was designed to expose students to astronomy, including the real-world array of different career options.

It began when the director of the Observatories, Gus Oemler, called on the new mayor of Pasadena, Bill Bogaard, to explore ways in which Carnegie could help the local schools with science education. The mayor jumped at the opportunity and hosted two luncheons with area educators to discuss possibilities. Communities Organizing Resources to Advance Learning (CORAL) enlisted Carnegie's help, and the synergy began.

CORAL is funded by the James Irvine Foundation to improve academic achievement in grades K through 12 in five California cities including Pasadena. The group relies on outside organizations, communities, parents, and noneducation resources to help students, who are mostly low-income, become "more productive learners."

Mulchaey had never taught high school. But with a keen instinct for teaching and help from two teachers employed by CORAL, he developed a curriculum that was so successful the students opted to work on their projects even on their days off and on Saturdays, when there was no CORAL-sponsored transportation to their school. They produced scientifically based travel brochures for the planets in the solar system and designed aliens that could live on each one. They built a scale model of the solar system and painted a giant mural on the CORAL building showing 15 items that should be included on a spacecraft from Earth to represent what our planet is like. "It went way beyond astronomy," said Mulchaey. "In addition to learning about other sciences, they had to read and write every day—something they were not used to doing."

In addition to weeklong projects, the students each made an astronomy movie on topics ranging from the life cycle of a star to volcanoes on Mars. They toured Mount Wilson and had a "star party" with a local chapter of the Sidewalk Astronomers, who provided telescopes and talks about the night sky. They also visited Santa Barbara Street. Mulchaey was amused that the students enjoyed the Observatories headquarters more than Mount Wilson because they got to walk the halls where Einstein walked. They also saw the photographic plate of Halley's Comet in 1910 and were introduced to the different kinds of employment opportunities that are available. They were particularly taken with the machine shop and instrument maker Robert Storts, who ex-

The CORAL students were particularly taken with the Observatories machine shop. Jerson Castillo (second from right) and Robert Storts (far right) explain how the machine shop is used to build instruments and parts for the telescopes.

Observatories Staff Member John Mulchaey (left) talks to students in the CORAL program about the Inamori Magellan Areal Camera and Spectrograph (IMACS). The most powerful tool of its kind, it will allow astronomers to view hundreds of distant objects in the universe simultaneously.

[CONTINUED ON PAGE 6]

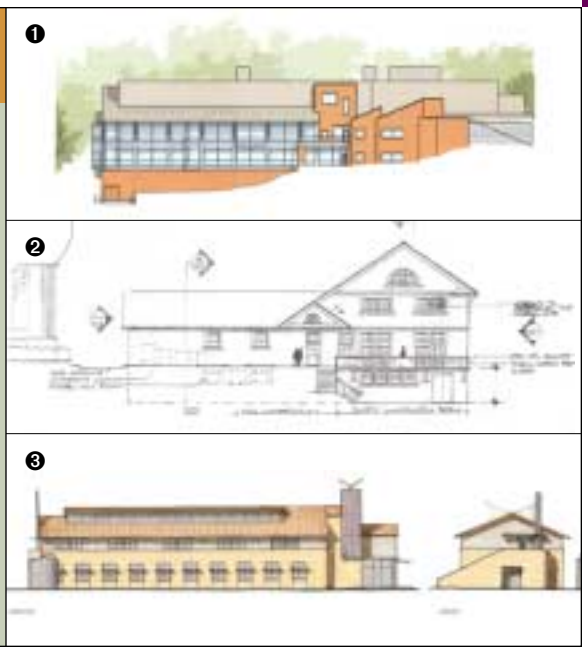
Carnegie Keeps Architects Busy

As part of *The Carnegie Campaign* for Science, the institution is experiencing a building boom. The departments of Embryology and Global Ecology have commissioned new main buildings, while Terrestrial Magnetism and the Geophysical Laboratory are renovating and expanding the old Experiment Building on their joint Broad Branch Road campus. Despite the different locations and different architects, the environmentally sensitive structures are all similar. As seen in these working elevations, the structures are long and low, and hug their terrains.

❶ Zimmer Gunsul Frasca Partnership has designed the new Maxine F. Singer Building at Embryology.

❷ The modified Experiment Building, on the Broad Branch Road campus, is being designed by Archeus Studio.

❸ The firm of Esherick Homsey Dodge and Davis (EHDD) is the architect for the new Global Ecology building, which will occupy the same campus as Plant Biology.



Active BLACK HOLES in Galaxy Cluster Bring into Question How Clusters Evolve

Until now astronomers thought that old, red cluster galaxies were past their prime and subdued. Only about 1 percent were supposed to have Active Galactic Nuclei (AGN)—violent centers where supermassive black holes gobble up surrounding material and emit it as X-rays. A surprising find by a team of Carnegie astronomers, led by Starr Fellow Paul Martini at the Observatories, has changed this view. Using a combination of space-based X-ray and Earth-based optical instrumentation, the scientists found that six times the expected number of galaxies in a nearby cluster have active centers. "This alters our view of galaxy clusters as the retirement homes for old and quiet black holes," said team member Dan Kelson. "The question now is, How do these black holes turn themselves on again?" The discovery has also brought into question how galaxies evolve and how stars form in these environments.

Image courtesy NASA and John Mulchaey

The Carnegie group, which also included John Mulchaey and Scott Trager, published their results in the September 10 issue of *Astrophysical Journal Letters*. They took an unusual approach to their study by using NASA's X-ray *Chandra* satellite in concert with Carnegie's new 6.5-meter Walter Baade optical telescope at the Las Campanas Observatory in Chile. Using the *Chandra* data, they discovered six X-ray sources in galaxy cluster Abell 2104, about 700 million light-years from Earth. They then used the Carnegie telescope to confirm that all of the galaxies are in the cluster and not in the foreground or background. "If we had used optical data alone, we would have missed these hidden monsters," said John Mulchaey. "If we'd used only X-ray data, we would not have been sure that all the AGNs were in the cluster."

Galaxy clusters typically have hundreds to thousands of galaxy members. The researchers surveyed the 100 brightest galaxies in Abell 2104. It is believed that old, red galaxies generally populate clusters because during cluster formation the raw material for making stars and feeding black holes—gas—is burned off and nothing is left to fuel these systems. "The presence of these AGNs indicates that supermassive black holes have somehow retained a fuel source," said Martini. "Despite the harsh treatment these galaxies suffered as a cluster, they seem to be having the black hole equivalent of a midlife crisis. They aren't over the hill after all." The group has already started studying other clusters to see if similar activity is present elsewhere.

This is a false-color X-ray of the Abell 2104 cluster of galaxies taken with NASA's Chandra X-ray Observatory overlaid on an optical image taken with Carnegie's 6.5-meter Walter Baade telescope in Las Campanas, Chile. The image reveals X-ray emissions produced both by hot gas (the blue area near the center of the image) and by accretion of dust and gas onto supermassive black holes (the smaller blue patches on the outer edges of the image). The number of active, supermassive black holes found in this cluster is six times the amount found using other techniques. The finding suggests that active black holes are much more common in clusters of galaxies than previously believed.

FIRST BEAM: *HPCAT Gets Closer*

Image courtesy Argonne National Laboratory

"These advances will make the facility the best and most flexible in the world for high-pressure/temperature experimentation."

Three years after the project partners formally signed the agreement to construct a new sector at the Advanced Photon Source (APS) in Argonne, Illinois, the facility experienced the synchrotron version of first light. Daniel Häusermann, project manager, announced that the High Pressure Collaborative Access Team (HPCAT) successfully acquired its first ultrabrilliant X-ray beam on July 19, 2002, at 7:00 p.m. The official ceremony recognizing the milestone was July 26. Häusermann began the event by welcoming participants from the partner organizations—Carnegie, APS, Lawrence Livermore National Laboratory, the University of Nevada-Las Vegas, and their guests. After representatives from each of the organizations talked about their work and their expectations, Häusermann led the group on a tour of the facility, where various researchers spoke about how they will use the instrumentation for their high-pressure experiments. The ceremony concluded with a luncheon at the nearby Argonne Guest House.

Why Synchrotrons?

During the 1990s, three third-generation synchrotron facilities came on line: the European Synchrotron Radiation Facility in France, SPring-8 in Japan, and APS at Argonne National Laboratory in the U.S. The APS is a circular particle storage ring, which produces short-wavelength, or "hard," X-rays when high-energy positrons (the positively charged antiparticles of the electrons) are accelerated inside an injection system and then forced along a curved trajectory in the storage ring. Each 10-degree portion, or sector, of the 0.7-mile synchrotron ring consists of two bending magnets and two straight sections where X-rays are produced by accelerating the positrons in intense magnetic fields. These X-rays shine at a tangent to the central circle and feed "beamlines," where the research is performed. Most sectors are built for a specific kind of research on materials. The short-wavelength X-rays are comparable in size to the distances between atoms and can therefore be used to determine the minute structures and other properties of a vast array of substances, from viruses to nuclear materials. Collaborative Access Teams (CATs) at the APS study everything from molecular biology to fundamental physics and planetary science.

Each research sector around the ring consists of an arrangement of lead "enclosures," or hutches. Some house the optics required to harness the X-rays while others, the experiment enclosures, contain a range of sophisticated, and often custom-designed, remote-controlled equipment used for research. The high-intensity, sharply focused X-rays at the APS are effectively superbrilliant laserlike beams, which are 10,000 times brighter than those available at previous-generation facilities. The advancement in beam quality allows X-ray diffraction—the scattering pattern that can reveal the atomic structure of a crystal—of much smaller samples than before. For high-pressure work, researchers will be able to make much finer measurements of materials to well above 300 gigapascals, which is equivalent to the pressure at the center of the Earth, and to temperatures exceeding 6000 K. A host of spectroscopic devices can also be used to identify specific atoms in a sample. And the ability of the APS to pulse the beam at intervals of 20 trillionths of a second will allow investigators to provoke and view atomic vibrations and displacements in samples in real time.

High-pressure researchers will be able to use the APS to measure crystal and liquid structures, the transitions of materials from one phase to another, melting, vibrational dynamics, elasticity, plasticity, texture development, bonding, electronic and magnetic struc-

to Science with Innovations Galore

tures, and chemical reactions, and determine equations of state—formulas that relate the variables of pressure, temperature, and volume—all with unprecedented accuracy. The studies will contribute to many discoveries in an extremely broad range of subjects in materials and planetary science, and will provide information on the behavior of materials currently secured in nuclear stockpiles.

Carnegie's Innovations in High-Pressure Science

The new HPCAT sector will employ some of the "old" workhorses of high-pressure physics, such as diamond-anvil cells, in addition to the latest generation of advanced instrumentation, much of which has been developed by members of Carnegie's high-pressure team. Beginning in the 1970s, the Geophysical Lab's Ho-kwang Mao (now HPCAT team director) and Peter Bell used the diamond-anvil cell to break the 1-million-atmosphere mark—a milestone in high-pressure physics. Currently Russell Hemley, Mao, and colleagues are recognized as world leaders in the field, and new research using the HPCAT facility will propel the team even further.

Some of the more recent advances that have come from Carnegie scientists include a technique developed at APS sector 13, where questions in Earth science are the primary focus. This technique improves the way samples are subjected to extreme heat for diffraction studies. The standard method for extreme heating had been limited in that it could heat a sample from only one side using an infrared laser beam, which was cumbersome and prone to error. The Carnegie team invented a double-sided laser heating system, which includes improved temperature measurements. It has allowed researchers to obtain accurate temperatures to above 1000 K at pressures of millions of atmospheres. Working at Brookhaven National Laboratory, Carnegie scientists also pioneered the use of infrared microspectroscopy by taking advantage of the flux available from lower-energy synchrotron radiation sources so that new types of experiments can be conducted on extremely small samples at millions of atmospheres.

There are several unique features that have been developed specifically for the HPCAT facility, and with the sector nearing completion, these advances will make the facility the best and most flexible in the world for high-pressure/temperature experimentation. Four out of five experiment enclosures will be able to operate simultaneously. To accomplish this increase in productivity, the researchers devised a way to effectively double the X-ray beams, thus doubling the experiment capacity. They designed a system in which one wavelength of the X-ray is selected and channeled to one experiment enclosure for high-pressure spectroscopy measurements, while at the same time another wavelength is selected from the remainder of the radiation spectrum for high-pressure diffraction studies in another experiment enclosure. The instruments, called the Double Crystal Monochromator and the Branching Double Crystal Monochromator, exploit both the X-ray transparent and crystal optics properties of near-perfect diamonds to selectively divert the different wavelengths required for experiments. This doubling of the experimental capacity has been accomplished at minimal extra cost.

Even at a laserlike size, the beam is far too big for some of the high-pressure samples that scientists want to study. To study minute samples, the collaborators came up with novel ways of "demagnifying" the beam to produce X-ray beam sizes where the sample is positioned 10 to 40 times smaller than the size of the X-ray-emitting positron beam, which is the width of a human hair. They fashioned small mirrors into adjustable parabolic shapes that focus the X-rays to micron, and even submicron, sizes, and coupled this with ultra-accurate positioning systems for the optics and high-pressure equipment. The experiment and mirrors are located on separate high-stability tables that move on tracks. The track layout allows the sample in the pressure cell to be moved farther from or closer to the mirrors, thus changing the focal spot size to that needed for a given experiment. The team has also constructed a new system where two detectors can be used in the same experiment. In a parallel development in their lab in Washington, Hemley and Mao are currently developing ways to grow large diamonds (up to 25 carats as opposed to the 0.25 carat typically used today), which will be used in a new generation of anvil cells that will be able to accommodate much larger samples and compress them to ultrahigh pressures.

[CONTINUED ON PAGE 10]

The High Pressure Collaborative Access Team (HPCAT) is located at the Advanced Photon Source (APS) at Argonne National Laboratory in Argonne, Illinois. Shown far left is the APS synchrotron. The HPCAT sector is located at approximately 12 o'clock.

The Geophysical Lab's Ho-kwang (Dave) Mao (center) is director of the HPCAT. He talks with colleagues before the dedication.

Daniel Häusermann, project manager for the HPCAT, takes visitors on a tour of the new sector as part of the dedication program. He is describing the equipment inside a hutch.

As part of the tour of the HPCAT sector, researchers explained many of the investigations they are conducting. Russell Hemley of the Geophysical Lab talks about high-pressure, high-temperature X-ray studies that use the diamond-anvil cell.

[*First Beam,* CONTINUED FROM PAGE 9]

As if these and other innovations were not enough, the HPCAT staff is also exploring the use of a "virtual laboratory" to automatically align and control experiments. This system would also allow partners to use the facility from remote locations. Since the enclosures are closed during measurements because of the very high radiation levels anyway, and all activities are computer controlled, this possibility is an attractive way to save time and money required for travel.

What's Next?

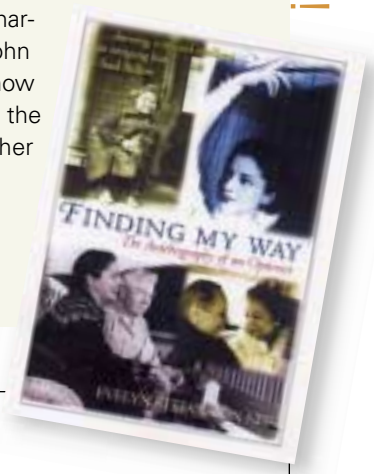
The three years it has taken to get to this point have been a long, hard haul with many unexpected challenges along the way. But, Häusermann says, the team is looking forward to beginning scientific experiments this October in the first experiment enclosure. And it is determined to start solving key scientific problems from day one. After this, it is expected that another enclosure will be brought into operation every three months until the full completion of the construction phase at the end of summer 2003.

Read all about it!

Finding My Way:

The Autobiography of an Optimist

Longtime Carnegie friend Evelyn Stefansson Nef recently published her autobiography, *Finding My Way: The Autobiography of an Optimist*. The daughter of Hungarian-Jewish immigrants, Nef has had an extraordinary life. She was virtually on her own as an adolescent in New York and became part of that city's art community in the 1930s. She became a puppeteer with Bil Baird and then his wife. Later she worked as a researcher and writer for the Arctic explorer Vilhjalmur Stefansson, whom she married. After his death, she married John Nef, through whom she came to know some of the most famous artists of the day. In her late fifties, Nef changed her course again and became a psychotherapist—a profession she retired from at age 80. Her stories make a fascinating read.



Diamonds are Much More Than Just Pretty Gemstones

Steven Shirey and David James, staff scientists at the Department of Terrestrial Magnetism (DTM), and their colleagues have found that diamonds, and the smaller minerals sometimes included in them, can reveal the details of how and when the oldest parts of our planet formed. Their results were published in the September 6 *Science*.

For their research, the scientists looked at evidence documented over the past two decades from 4,000 diamonds, and at data from seismic P-waves from the Kaapvaal-Zimbabwe Craton in southern Africa. Their goal was to determine if the composition and age of the diamonds correlate to the geologic structure of their deep-seated source region. They found that there was a correlation, and that diamonds can reveal a lot about the evolution of the cratonic roots in the area.

Cratons contain the oldest rocks on the planet and provide the nucleus around which younger continental material assembles. They also hold much of the Earth's mineral wealth including diamonds, which typically form beneath the cratonic crust in rootlike structures called mantle keels. These keels extend to depths of more than 200 kilometers, where pressure is high enough for diamond formation. They date to the Archean period (3.9 to 2.5 billion years ago), are thought to be as old as the overlying crust, and have long been a focus of Carnegie scientists, notably Joe Boyd and Richard Carlson. Diamonds in the Kaapvaal Craton are found in much younger volcanic eruptions of kimberlite—a volatile-rich magma that carries diamonds to the surface from deep within the cratonic mantle keel. The scientists looked at the trace element and isotopic composition of the diamonds, and the age and composition of mineral inclusions. Based on the seismic velocity of P-waves, they also constructed maps of the cratonic mantle keel. The resulting imagery of the deep structure showed the type of mantle above which diamond mines are located. "When the picture emerged, we wondered if regional patterns of diamond age and composition would fit the seismic structure. What we found was the first general framework for diamond formation that is applicable on a continental scale," says Shirey.

Through detailed analysis, the researchers determined that diamond formation in the cratonic mantle keel occurred episodically rather than continuously—there were multiple generations of diamonds. Their examination suggested that the craton formed in at least two stages and was subsequently modified in a third stage. The cratonic nuclei were created first by a process of mantle melting, which was followed by an accretion process involving old oceanic lithosphere—the rigid layer of crust and mantle under the ocean basins. This latter stage helped stabilize the cratonic mantle keel. Subsequent tectonic and magmatic events added new diamonds whose inclusion compositions closely corresponded with changes in the composition of the cratonic mantle keel.

Support for this work came from the National Science Foundation (NSF), Continental Dynamics Program, the South African National Research Foundation (NRF), and the Diamond Trading Company (De Beers).

Postdoc Profile
Embryology's RACHEL BREWSTER

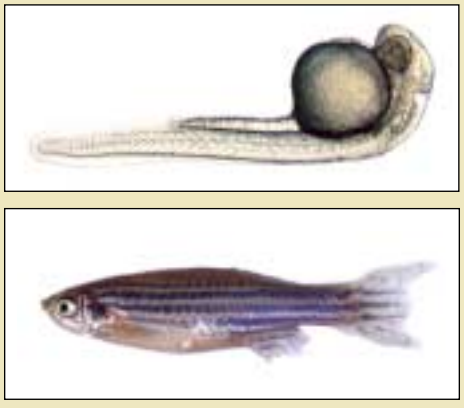
"Marnie and Carnegie have offered me a precious gift—the freedom to pursue my own scientific quest in a high-quality research environment, without the coldness and tension present in some other top institutions. I hope I can carry on this tradition in my own laboratory."

Swiss-Jamaican Rachel Brewster studies how the neural tube—the precursor to the brain and spinal cord—is shaped during early development. In humans and other higher vertebrates, failures in this process result in congenital defects, including spina bifida. Since the fall of 2000, Brewster has been at the Department of Embryology in Marnie Halpern's lab, where researchers study the development of the vertebrate nervous system using the zebrafish as a model system. In the fall of 2003, Brewster will be joining the faculty of the University of Maryland, Baltimore County (UMBC), where she will teach and have her own lab.

Brewster's goal is to identify genes that control the folding of the neural tissue as it undergoes neurulation—the developmental process shaping the neural tube. The zebrafish is particularly suited for this research because the embryo is entirely clear, allowing the cell movements to be seen during early development.

Along with Halpern postdocs Ararat Ablooglu, Christian Brösamle, and Josh Gamse, Brewster performs genetic screens to find zebrafish mutants defective in nervous system development. She focuses on mutations that specifically cause an arrest of neurulation. Once the mutants are identified, she can backtrack using genetic mapping tools to find the responsible mutant genes. She hopes eventually to reconstruct the normal genetic pathway that controls the neurulation process.

After graduating from the University of Geneva, Brewster came to the U.S. in 1990 to study for her Ph.D. in biology at the University of Michigan, Ann Arbor, where she worked with Dr. Rolf Bodmer. She received her degree in 1996 and joined Dr. Ariel Ruiz I Altaba's lab at the Skirball Institute of Biomolecular Medicine at New York University School of Medicine. Both her graduate and her postdoctoral work focused on how cells of the nervous system acquire a specific identity, or specialized function, as they develop. From Skirball she went to Haverford College, where she taught biology and pursued her research. However, she was interested in doing more intensive research on vertebrate genetics. That, coupled with her long-distance marriage to Mark Van Doren, a faculty member at Johns Hopkins University, made Carnegie particularly attractive.



Postdoctoral fellow Rachel Brewster with her model organism, the zebrafish, at two stages of development.

Earlier this year Brewster was one of 10 postdocs awarded a fellowship by the United Negro College Fund (UNCF) /Merck Science Initiative on the basis of competitive proposals. The proposals were assessed by members of the Merck research staff and educators. The company initiated the program in 1995 by providing $20 million to fund a 10-year initiative. The goal of the program is to help build the pool of African-American scientists in biomedical fields. Brewster, like the other fellows, is paired with a Merck mentor with whom she has regular contact. Her mentor, Thomas Vogt, a developmental biologist who focuses on the genetics of retinal disease, is impressed by Brewster's accomplishments and her future promise as she begins her independent research and teaching position. He describes her as a "terrific young scientist who will be a role model to the next generation of researchers, especially effective in encouraging and attracting talented young women and minorities currently underrepresented in careers in science and health."

As Brewster looked to her future beyond Carnegie, she hoped to find a position that would allow her to balance her interest in teaching with her research. She found that opportunity at the University of Maryland, Baltimore County. Coincidentally, the president of UMBC, Freeman Hrabowski III, is one of Carnegie's newest trustees. He became the school's president in 1992 and has changed the university from a commuter school to an international powerhouse in producing minorities who earn their Ph.D.s in engineering and science. UMBC often outcompetes Ivy League schools in attracting the best students. Hrabowski did this through the Meyerhoff Scholarship Program, which now trains about 50 mostly minority students a year to prepare them for careers in science and engineering. Brewster was attracted by the program and the possibility of teaching highly motivated students already interested in careers in science. When she met with Hrabowski during her interview, they talked about the possibility of really making a difference through Meyerhoff. Brewster accepted the position of assistant professor.

Although she'll be leaving Carnegie, she, like other members of the Halpern lab, will become part of the growing network of zebrafish researchers who are advancing our understanding of what our own genes do. Her future has an added bonus—the opportunity to influence a new generation of professionals to experience for themselves the rigors and rewards of research.

IN Brief

Trustee and astronomer Sandra Faber was elected to the American Philosophical Society this spring. In addition, the DEIMOS spectrograph for the Keck telescope, a project she has worked on for eight years, saw first light June 3. The DEIMOS-Keck combination makes the instrument the most powerful in the world for faint-object work. Faber and team plan to conduct the DEEP Survey of the distant universe, which will collect 65,000 spectra of galaxies at the edge of the visible universe and will chart galaxy formation. Faber is shown here (first row, second from left) at first light with her team.

Faber and DEIMOS See First Light

Trustees

Washington State University has named a building for former Carnegie president and current trustee **Philip Abelson** and his wife, Neva.

Administration

Maxine Singer was recognized for her outstanding accomplishments as a scientist, her dedication to the community, and her service to the Weizmann Institute with the Weizmann Award in the Sciences and Humanities.

—

Sue Humphreys, secretary to President Maxine Singer, left Carnegie Aug. 2 to spend more time with her two young daughters. **Rhoda Mathias** has joined Carnegie as the new secretary to the president.

—

Sue White, director of mathematics for CASE, has left to become the national project director for an NSF-funded science education project called Science and Everyday Experiences (SEE), a joint effort between Delta Research and Education Foundation, Delta Sigma Theta Sorority, and the AAAS.

—

Marjorie Burger joined Carnegie's accounting department in Apr. She was previously the director of finance for the Alliance to Save Energy.

—

Sherrill Burger, administrative assistant and events coordinator for External Affairs, left Carnegie June 30. **Ellen Carpenter** moved from Publications to External Affairs to become the public events and publications coordinator.

Longtime Embryology Staff Member Joseph Gall received an honorary Doctor of Medicine degree from Charles U., Prague, Czech Republic, in Apr. The university was founded in 1348 by Charles IV of Bohemia and is the oldest university in central Europe. In the image at left, Gall delivers his acceptance speech. At right, he is receiving the degree from his sponsor, Ivan Raska.

Embryology

Don Brown presented one of the keynote speeches at the *Xenopus* meeting in Cambridge, UK.

—

Marnie Halpern lectured in the MBL Embryology Course at Woods Hole in July. Postdoctoral fellow in her lab, **Joshua Gamse**, ran the zebrafish techniques component of the course. The lab's **Rachel Brewster** received a United Negro College Fund/Merck postdoctoral science research fellowship.

—

Christian Brösamle received the Barbara McClintock postdoctoral award for 2002-03, and **Suzanne Hall** joined the Halpern lab as an animal care technician.

—

A party was held in May to honor **Dianne Stewart**, lab manager in Allan Spradling's lab, who began her Carnegie career 20 years ago as a departmental dishwasher. Many former Spradling lab members traveled to Baltimore for the occasion.

—

Former graduate student **Horacio Frydman** left the Spradling lab for Princeton U., where he will study the intracellular parasitic bacterium, *Wolbachia*.

—

Ben Ohlstein (Ph.D., M.D., U. Texas Southwestern Medical Center) started his postdoctoral research in the Spradling lab to study intestinal stem cells. **Mike Busczcak** (Ph.D., Yale U.) also joined the lab as a postdoctoral researcher. He is initiating a novel approach to identify genes encoding proteins that localize within specific cellular regions.

—

Reiko Nakajima (Ph.D., Osaka U.) started her postdoctoral work in the Zheng lab to study postmitotic regulation.

Observatories

Staff Member **Patrick McCarthy** chaired the extragalactic telescope time allocation committee for the National Optical Astronomy Observatories. He was also part of the technical reviews of space flight qualified infrared detectors and detector assemblies for the Hubble Space Telescope at the Ball Aerospace Corporation and Rockwell Scientific.

—

François Schweizer gave two invited talks at a June 24-28 meeting in Padova, Italy, also attended by **Luis Ho.** The meeting honored **Ivan R. King** (U. Washington), who, on his 75th birthday, received a Laurea ad Honorem degree in astronomy from the University of Padova. King acknowledged the Observatories for giving him valuable access to telescopes and plate collections as a guest investigator during 1960-1963.

—

In June **Barry Madore** attended a summer workshop, "Large-scale Structure," in Aspen, CO, and later attended the Library and Information Services in Astronomy meeting in Prague.

—

Michael Rauch gave an invited talk at the workshop "Early Cosmic Structures and the End of the Dark Ages" in Elba, Italy, in June. He spent three weeks as a Scientific Visitor at Cambridge U. in July and Aug.

—

Hubble Fellow **Scott Trager** left with his wife, Kate McIntyre, for the Netherlands, where he joined the faculty of the Kapteyn Astronomical Institute at U. Groningen.

—

Postdoctoral fellow **Jason Prochaska** presented an invited talk on protogalactic chemical abundances at a workshop in Minneapolis. He also presented a scientific case for a Next Generation UV Telescope at the Hubble Science Legacy Symposium in Chicago. Prochaska left with his family to join the faculty of U. California-Santa Cruz.

—

J. Christopher Mihos (Case Western Reserve U., Cleveland) spent May as a Scientific Visitor and presented a talk, "Tidal Tales: Using Tidal Debris to Probe Galaxies and Galaxy Clusters."

Plant Biology

Plant Biology and the Biological Sciences Dept. at Stanford U. jointly hosted 75 people from UC-Davis, UC-Berkeley, USDA-Plant Gene Expression Center, and SFSU for the Bay Area Plant Pathology meeting on Mar. 27.

—

❶ On Aug. 7 **Arthur Grossman** was awarded the Darbarker Prize by the Botanical Society of America. This prize has been given since 1955 for significant contributions to the study of microscopic algae.

—

On July 5 **Winslow Briggs** was awarded an honorary doctorate, Honoris Causa, by U. Freiburg, Germany. He was an invited speaker at the Gordon Conference on Photoreceptors and Signal Transduction held in Il Ciocco, Italy, in Apr. and an invited speaker at the Gordon Conference on Plant Molecular Biology in July.

—

Chris Somerville was elected to the Academia Europaea in July. In May, he was an invited speaker at the Lake

❶ Arthur Grossman (left) poses with selection committee head, Louise Lewis of U. Connecticut-Storrs, during the Botanical Society of America banquet in Madison, WI, on Aug. 7.

Arrowhead Cell Wall meeting and was invited by the students at the Max Planck Institute in Cologne, U. Wageningen, U. Gent, and the CNRS Institute in Gif-sur-Yvette to present a series of talks. On June 8 he presented a talk on the application of genomics methods at a meeting sponsored by the National Research Council at NAS in Washington. Also at this meeting, colleague **Sue Rhee** presented a talk on the future of bioinformatics. In June Somerville presented a talk on the future of plant genomics at a symposium on proteomics at Iowa State U. On Aug. 1 he presented a talk at the International *Arabidopsis* Congress in Seville, Spain, and on Aug. 2 he spoke on "Future Applications of Plant Biotechnology" at the annual meeting of the Spanish Biotechnology Society in Seville.

—

Zhi-yong Wang was awarded an R01 research grant from NIH. He gave a talk at the International Plant Growth Substance Association meeting in July in Brno, Czech Republic. Wang also attended the Gordon Conference in Plant Molecular Biology in July and gave a poster talk.

—

Pablo Jenik, a postdoc in Kathy Barton's lab, was awarded a three-year LSRF fellowship beginning in June.

—

Marjorie Santamaria joined Shauna Somerville's lab on May 1 as a new postdoctoral fellow from U. Edinburgh. **Kelly Wetmore**, a UCLA undergraduate, rejoined the lab for her second summer to work as a lab assistant. **Noelle Lapcevic** and **Yen Hoang** also arrived in June as assistants in the Somerville labs and were joined by lab assistant **Rosanna Ruelos** in July.

—

Jason Hom joined Devaki Bhaya's lab for the summer as an undergraduate research associate funded by an REU award from the NSF.

—

Arthur Grossman's lab welcomed **Jeffrey Moseley** in July as an LSRF Fellow under a three-year award.

—

The department bid farewell to **Stewart Gillmor** in July. He will be joining his wife in Mexico and starting a new postdoc position.

—

Yangli Yang left the department on June 30 to start her new position at Roche Bioscience. Yangli was a senior lab technician in Zhi-yong Wang's lab.

—

On July 23-24 the department hosted a working group organized by the US National Academy to develop guidelines for the US National Plant Genome Initiative.

Global Ecology

Greg Asner presented new results showing the rate and dynamics of forest destruction in the Amazon at an international conference in Manaus, Brazil, in July. **Thomas Harris** joined Asner's lab on June 1 as a lab technician from U. Colorado-Boulder.

—

Joining Chris Field's lab to assist with the seasonal harvesting at Jasper Ridge are **Claire Phillips, John Juarez, Mackenzie Cooper**, and **Emily Keenan**. **Brian Thomas** (Stanford U.) joined the Field lab as a postdoctoral research assistant on July 1 after receiving his Ph.D. in June.

—

Thuriane Mahe, a predoctoral research associate from France, has completed her appointment in the Field lab and has returned to France.

—

Chris Lund received his Ph.D. under Chris Field in June and left the department for San Francisco.

Geophysical Lab

Wesley T. Huntress, Jr., served on the NASA-charted National Research Council's Solar System Exploration Decadal Study to review the nation's planetary exploration program and provide recommendations for planetary research and missions for the next decade.

—

The 1986 Nobel Prize winner in chemistry, Professor **Dudley R. Herschbach,** has been appointed the Cecil and Ida Green Senior Fellow at GL. Herschbach is from Harvard's Dept. of Chemistry and shared the 1986 honor for "contributions concerning the dynamics of chemical elementary processes."

—

Russell Hemley presented the opening scientific talks at a conference in Collonges La Rouge, France, May 27-31; at the Gordon Research Conference in Tilton, NH, June 16-21; and at the Gordon Research Conference in Meriden, NH, June 23-28. He also gave a plenary talk at the International Symposium on the Physics and Chemistry of Ice (PCI 2002) in St. Johns, Newfoundland, July 14-19. He gave invited talks at the Livermore, Sandia, and Los Alamos National Laboratories in May as part of a proposed Carnegie Center of Excellence in high-pressure research to be coordinated with the National Labs, and at the IR and X-ray microscopy workshop at Brookhaven National Lab, May 22.

—

Ho-kwang (David) Mao presented three invited talks at the spring AGU meeting in Washington, DC. He also gave invited talks at the 2002 Gordon Research Conference on Research at High Pressure at Kimball Union Academy, Meriden, NH, June 23-28 and at the 2002 Gordon Research Conference on Correlated Electron Systems at Colby College, Waterville, ME, June 29-July 3. In addition, Mao presented an invited talk at the High Pressure Mineral Physics Seminar in Verbania, Italy, Aug. 26-31, and an invited paper at the International Symposium on the Physics and Chemistry of Ice (PCI 2002) at Memorial U., St. John's, Newfoundland, July 14-19.

—

George Cody presented invited talks at the Astrophysics of Life Conference at the Space Telescope Institute and at the NASA Astrobiology Institute's Directors symposium. He also gave a talk, "A Chemical Comparison of the Organic Residues of the Orgueil, Murchison, and Tagish Lake Meteorites."

—

Robert Hazen presented a keynote lecture, "The Diamond Makers," to the Eighth International Conference on Diamond Science and Technology in Melbourne, Australia, and gave a lecture on "Emergence and the Origin of Life" for U. Melbourne's popular Physics in July series. Hazen also visited the Australian Centre for Astrobiology at Macquarie U. in Sydney to begin a collaborative project on organic matter preserved in 3.5-billion-year-old black chert from northwest Australia.

—

Ronald Cohen attended the "Electronic Structure and Computational Magnetism" meeting July 15-17 at Georgetown U. There is a growing interest in using iron and iron oxides as new materials for semiconductors in electronics and in the magnetic behavior of iron and its alloys in the context of magnetic storage media.

—

Ronald Cohen, Yingwei Fei, Dave Mao, and others attended the High Pressure Mineral Physics Seminar (HPMPS-6) in Verbania, Italy, Aug. 26-31. Fei is on the organizing committee.

—

A special issue of *Geochimica et Cosmochimica Acta* was dedicated to **Hatten S. Yoder, Jr.**, in June. Forty-three authors contributed to the journal, including **Bjørn Mysen**, who wrote an introduction to mark Yoder's 80th birthday. Yoder's nomination as an International Scientist for the year 2002 was confirmed by the International Biographical Centre, Cambridge, UK.

—

Sébastien Merkel is the 2002 winner of the AGU Mineral and Rock Physics Award. He will be formally honored at the fall meeting.

—

Gerd Steinle-Neumann, a current Carnegie Fellow, was awarded the Ralph B. Baldwin Prize in Astrophysics and Space Sciences from U. Michigan for his thesis. He will present a lecture and receive the award on Oct. 1 in Ann Arbor.

—

Alycia Weinberger of DTM was awarded the Vainu Bappu Gold Medal of the Astronomical Society of India for the year 2000. The award, granted every two years, honors exceptional contributions in the field of astronomy and astrophysics by a young scientist not yet 36. It is named in memory of M. K. Vainu Bappu, founding president of the Astronomical Society of India and past president of the International Astronomical Union. Alycia will share the award with Biswajit Paul, an X-ray astronomer at the Tata Institute of Fundamental Research in Mumbai, India.

Wim Van Westrenen also left in Aug. for a postdoctoral fellowship at the ETH Zürich in the high-pressure research group led by Max Schmidt and **Peter Ulmer** (former GL postdoc). Van Westrenen will be joining his wife, former Visiting Investigator **Fraukje Brouwer** (ETH Zürich), who returned to Switzerland in Feb.

—

Heather Watson (Dept. of Earth and Environmental Science, RPI) has been appointed a predoctoral fellow with Yingwei Fei. She is studying the siderophile element diffusion in the Fe-Ni system at high pressure and temperature.

—

Matthew Wooller has accepted a position as assistant professor (Stable Isotope Biogeochemist) at U. Alaska-Fairbanks. Working in Marilyn Fogel's lab, he patented a device called variously the Woollerizer, Wooller-matic, or Wooller device.

—

Shuangmeng Zhai, former predoctoral fellow in Fei's laboratory, has returned to China to continue at the Dept. of Earth Sciences, Zhejiang U. He worked with Fei on the role of alumina and ferric iron in mantle minerals at high pressure.

—

❷ Sara Seager joined the DTM scientific staff in August.

Quinn Roberts will leave her job as a lab technician in Marilyn Fogel's laboratory to enter a Ph.D. program in marine science at U. Southern California. **Diane O'Brien** (Ph.D., Princeton U.), who worked with Fogel as a visiting research scientist last year, will return this fall as a Visiting Investigator. Smithsonian-Carnegie intern **Denise Akob** worked in Fogel's lab this summer. **Felicitas (Lizzi) Wiedemann**, from George Washington U., is working on her dissertation in the Fogel laboratory. Other visitors to the Fogel lab this fall include **Melissa Southwell** (U. North Carolina) and **Valery Terwilliger** (U. Kansas).

—

John Robert Thomas, who worked as an instrument maker at GL from 1951 to 1970, died Aug. 8 in Washington, DC.

Terrestrial Magnetism

The Meteoritical Society announced that the 2003 Alfred O. Nier Prize will go to **Steven Desch**, a Carnegie Fellow and NASA Astrobiology Institute Fellow. The prize, which honors the memory of Alfred Nier, is given annually "for a significant contribution in the field of meteoritics and closely allied fields of research." The recipient must be younger than 35. Desch will receive the prize at the next annual meeting of the society, in Münster, Germany. Larry Nittler received this same prize last year at the society's meeting in Rome.

—

Vera Rubin received an honorary Doctor of Science degree from Grinnell College, Grinnell, Iowa, at its May commencement.

—

Larry Nittler was honored in July by having an asteroid named for him. Asteroid 5992 Nittler was discovered in 1981, has a perihelion distance of 2.45 AU, and is estimated to be 6 to 12 km in diameter.

—

Alan Boss was named a fellow of the Meteoritical Society at the Los Angeles meeting, also attended by Steven Desch and Larry Nittler. He was also appointed an editor for the new Cambridge University Press astrobiology series of monographs. Boss chaired a panel discussion on naming very low mass objects at IAU Symposium 211: Brown Dwarfs, in Waikoloa, HI, in May. He also presented his models of the formation of planetary-mass brown dwarfs and gave a series of five lectures on planet formation for a summer school at the National Observatory in Rio de Janeiro in July.

—

Former DTM Fellow **Mizuho Ishida** (1982-1983) was awarded the Medal of Honor with Purple Ribbon at the spring 2002 meeting of the Japan Seismological Society. She is director of earth science research, National Research Institute for Earth Science and Disaster Prevention, Tsukuba, Ibaraki, Japan.

—

Prof. **Hiromu Okada** (Hokkaido U.), who worked with Selwyn Sacks as a predoctoral research associate from 1971 to 1974, was commended at a special ceremony by Prime Minister Junichiro Koizumi for his activities at the time of the disasters caused by the eruption of Mount Usu in 2000. Prof. Okada was the first individual since 1984 to receive this honor.

—

❷ **Sara Seager** joined the scientific staff in early Aug. She received her Ph.D. in astronomy from Harvard in 1999 and then joined the Institute for Advanced Study in Princeton. Her research is twofold—cosmology and extrasolar planets. In her extrasolar planets research, she develops models characterizing the atmospheres of extrasolar planets, collaborating with both theoretical and observational groups. In addition, she is co-leading a search for short-period transiting extrasolar planets. In cosmology, she studies what happened in the early universe when electrons and protons combined to form hydrogen and helium.

—

Sean Solomon chaired a meeting in June of the Advisory Committee to the Institute of Earth Sciences, Academia Sinica of Taiwan. Typhoon Lee, former member of the DTM research staff, is the director of the institute.

—

Carnegie Fellow **Aki Roberge** arrived in July after completing her Ph.D. in astrophysics at Johns Hopkins U., where she studied UV spectroscopy of circumstellar (CS) disks around young stars. She works with the Far Ultraviolet Spectroscopic Explorer (FUSE) spacecraft and the Space Telescope Imaging Spectrograph (STIS) on the Hubble Space Telescope to determine the abundances of several gaseous species in CS disks and their relationship to disk evolution. At DTM, she is planning a range of CS disk observations across a broad wavelength band.

—

Carnegie Fellow **Mark Behn** arrived in Aug. after completing his Ph.D. in marine geology and geophysics at MIT/WHOI. His research focuses on the characteristics of faulting along mid-ocean ridges and their implications for the mechanical structure of oceanic crust and lithosphere.

—

Carnegie Fellow **Ambre Luguet** arrived in early Sept. A geochemist, Luguet obtained her Ph.D. in 2000 at the Muséum

Shown (from left) are DTM's Alan Linde, Pascal Bernard (L'Institut de Physique du Globe de Paris), Brian Schleigh, Nelson McWhorter, a local driller, and Selwyn Sacks. They are standing behind a hole for a strainmeter they installed in June on the island of Trizonia in the Gulf of Corinth. The installation is part of a large program to investigate the tectonics of the area.

Shown (left to right) are Pamela and Sean Solomon and S. M. Krimigis, head of the Space Dept. at Johns Hopkins U. Applied Physics Laboratory, at a reception and viewing of the centennial exhibition, *Our Expanding Universe: Celebrating a Century of Carnegie Science,* at Carnegie's administration building on May 28. The reception was held in conjunction with the annual meeting of the American Geophysical Union (AGU) in Washington.

National d'Histoire Naturelle in Paris, where she also held a postdoc. She studies sulfides and platinum-group metal abundances in mantle rocks exposed along submarine fracture zones on the Mid-Atlantic and Southwest Indian Ocean Ridges to understand the melting processes and fluid-rock interactions at slow-spreading rates.

—

Michael Smoliar arrived at DTM in Sept. as a NASA Astrobiology Institute Research Associate. A geochemist, he received his Ph.D. from U. Maryland in 1997. After a two-year term in the laboratory there, he took a position in the chemical industry. He is investigating hydrothermal alteration of chondritic meteorite parent bodies by means of Re-Os isotope systematics and platinum-group element distributions.

—

Jay Frogel, a professor of astronomy at Ohio State U., has been appointed a Visiting Investigator. Prof. Frogel is on sabbatical as Infrared Discipline Scientist and Infrared Program Scientist at NASA headquarters. A former member of the Visiting Committee to the Carnegie Observatories, he hopes to complete several infrared imaging projects while at DTM.

—

Myung Gyoon Lee, an associate professor of astronomy at Seoul National U., has been appointed a Visiting Investigator. A former fellow at the Carnegie Observatories, Lee is an expert in extragalactic astronomy and observational cosmology.

—

The AGU 2002 spring meeting was held in Washington, DC, May 28-31. Participants included **Conel Alexander, Richard Carlson, Erik Hauri, David James, Petrus le Roux, Alan Linde, Fenglin Niu, Selwyn Sacks, Mark Schmitz, Steven Shirey, Paul Silver, Sean Solomon, Fouad Tera,** and **James Van Orman.**

—

DTM was well represented at the recent and final Kaapvaal Workshop held in July in Cape Town, South Africa. **David James, Paul Silver, Richard Carlson, Steven Shirey, Mark Schmitz,** and former DTM fellow **Matthew Fouch** (Arizona State U.) met and presented their ideas on the seismology, geochemistry, and geochronology of the Kaapvaal Craton to South African colleagues.

—

Conel Alexander, Richard Carlson, Erik Hauri, Sujoy Mukhopadhyay, Larry Nittler, Steven Shirey, and **Sean Solomon** attended the 12th Annual VM Goldschmidt Conference in Davos, Switzerland, in Aug.

—

Andrew Dombard, a Carnegie Fellow and NASA Astrobiology Institute Fellow, left DTM in July to become a research associate in the Dept. of Earth and Planetary Sciences, Washington U.

—

NASA associate **Jon Aurnou** left DTM in early Aug. for UCLA to become an assistant professor of planetary physics.

—

NSF associate and Carnegie Fellow **Fenglin Niu** left DTM in July to become an assistant professor in the Dept. of Earth Science at Rice U.

—

Visiting Investigator **Mark Richards** returned in July to his position as professor of geology and geophysics at U. California-Berkeley after spending his sabbatical at DTM. He is one of the world's leaders in linking mantle dynamics to geological and geophysical observations and while at DTM worked on the dynamical evolution of Venus and Mars.

—

Predoctoral fellow **Anna Lucia Novaes Arauho,** who worked with Rick Carlson this spring on mantle xenoliths and alkalic lavas from central Brazil, has returned to the U. of Federal Fluminense, Rio de Janeiro.

—

Ph.D. student **Kalle Westerlund** returned to U. Cape Town in May after spending several months working with Rick Carlson and Steven Shirey on the Re-Os analyses of sulfide diamond inclusions and xenoliths from the Panda kimberlite of the Slave Craton, Canada.

—

Twins Sofie Ernestine and John Hendrik were born on June 4 to former DTM fellow **Emilie Hooft Toomey** and DTM Visiting Investigator **Douglas Toomey**.

—

Ananya Johanna Visweswaran was born in Richterswil, Switzerland, on June 9 to former Wood Fellow **Suzan van der Lee** and Vishy Visweswaran.

DTM/GL

DTM/GL Visiting Investigator **Kevin Burke** left in June to visit Prof. Lewis Ashwal at the School of Geosciences, Rand Afrikaans U., South Africa.

—

DTM/GL Visiting Investigator **V. Rama Murthy** returned to U. Minnesota in July. An Institute of Technology Distinguished Professor in the Dept. of Geology and Geophysics, he plans to return to DTM/GL to continue his experiments in the high-pressure lab of GL's Yingwei Fei.

—

Steven Shirey and **Shaun Hardy** organized a session, "Geophysics in the 20th Century: Contributions from Washington," at the AGU meeting in May. **Margaret Hazen, David James,** and **Bob Hazen** were among the presenters, who highlighted the contributions of Carnegie and other Washington-area organizations to the development of the geophysical sciences.

—

James Van Orman left in Aug. for Case Western Reserve U. to begin an assistant professorship. He studied diffusion rates in minerals at very high pressures in collaboration with Yingwei Fei (GL) and Erik Hauri (DTM).

—

Shaun Hardy was elected to the American Institute of Physics (AIP) Advisory Committee on the History of Physics in July. The committee evaluates the programs and activities of the Center for the History of Physics.

—

In July **Rosa Maria Torres** moved from DTM administrative assistant to become administrative technical assistant at GL with Ronald Cohen and Russell Hemley. In May she married Jaime Torres at an outdoor wedding ceremony held on the BBR campus.

Lawrence (Pat) Patrick, a maintenance technician at GL, DTM, and BBR, is shown at his retirement picnic on June 4. He started at the Geophysical Laboratory in 1968 and joined the BBR staff when the departments co-located in 1991. His cordial nature and willingness to help the staff in whatever was needed contributed greatly to the regard in which he was held by everyone at both departments. He will be missed.

Progress on Magellan, MIKE, and IMACS

As scheduled, the 6.5-meter Clay telescope started science operations on September 7. Scott Burles, from MIT, was the first observer. He used the MIT/Harvard Magellan Instant Camera (MagIC) CCD for the first part of his observing run. Matt Johns, who manages the Magellan project, reports that the Clay "will be operating at the same level of performance and efficiency as the Baade in the near future."

The Echelle spectrograph (Magellan Inamori Kyocera Echelle, known as MIKE) that Steve Shectman and Rebecca Bernstein have been building was completed and shipped to Las Campanas at the end of August. The optics have been reassembled in their cells. Shectman and Bernstein will start reassembling the spectrograph body at Las Campanas. The target is to use MIKE for science observations beginning in mid-October.

IMACS, the Inamori Magellan Areal Camera and Spectrograph, had a good summer, according to Alan Dressler, Principal Investigator on the project. Greg Burley and Ian Thompson got the CCD camera assembled, and Bruce Bigelow and Greg installed it on the structure. Christoph Birk has been writing the image-producing software. Early indications are that the images are good over the entire field.

The flexure, which causes the image to move around as IMACS is rotated, was tested and also works well. Among the last hurdles the team has is the second IMACS camera, which Bruce Bigelow is assembling. It is a faster camera and will provide the full half-degree field. This feature distinguishes IMACS from any other large-telescope spectrograph. It includes two very special lenses that have strongly aspheric figures—the surfaces are sections of spheres—which are almost complete. The tilting mechanisms that hold the gratings that disperse the light for spectral analysis were redesigned and refabricated by Tyson Hare and Alan Dressler and are already good enough to provide a working instrument.

The exterior panels were installed for the first time by Steve Gunnels and his son Garrett and daughter Valerie, who worked on them as a summer project. The outer enclosure will be finished by the end of September, including a 6-foot-diameter "cable wrap" that allows the 30-odd IMACS cables to run from fixed equipment racks into the instrument even as it rotates through more than one revolution. Alan Bagish and Joe Asa are well along in cable fabrication, and this too should be complete by the end of September. If all goes well the team hopes to ship IMACS to Las Campanas before the New Year. •

Steve Gunnels, with his daughter Valerie and his son Garrett, are making the exterior panels for IMACS.

Capital Science Lectures

Now available via live webcast.
See **www.CarnegieInstitution.org**
and click on "Events" for more information.

Carnegie Institution of Washington
1530 P Street, NW
Washington, D.C. 20005-1910