

# CARNEGIE INSTITUTION FOR SCIENCE

1530 P Street, N.W.  
Washington DC 20005

Phone: 202.387.6400

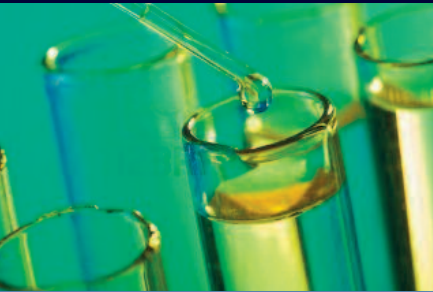
Fax: 202.387.8092

[www.CarnegieScience.edu](http://www.CarnegieScience.edu)

2010-2011 YEAR BOOK

# Carnegie Institution FOR SCIENCE

2010-2011



CARNEGIE INSTITUTION FOR SCIENCE

YEAR BOOK



The paper used in manufacturing this year book contains 30% post-consumer recycled fiber. By using recycled fiber in place of virgin fiber, the Carnegie Institution preserved 13.25 trees, saved 38 pounds of waterborne waste, saved 5,627 gallons of water, and prevented 1,226 pounds of greenhouse gasses. The energy used to print the report was produced by wind power. Using this energy source for printing saved 2,627 pounds of CO<sub>2</sub> emissions, which is the equivalent to saving 1,786 miles of automobile travel.

Design by Tina Taylor, T2 Design  
Printed by Monroe Litho

ISSN 0069-066X

Department of Embryology	3520 San Martin Dr. / Baltimore, MD 21218	410.246.3001
Geophysical Laboratory	5251 Broad Branch Rd., N.W. / Washington, DC 20015-1305	202.478.8900
Department of Global Ecology	260 Panama St. / Stanford, CA 94305-4101	650.462.1047
The Carnegie Observatories	813 Santa Barbara St. / Pasadena, CA 91101-1292	626.577.1122
Las Campanas Observatory	Casilla 601 / La Serena, Chile	
Department of Plant Biology	260 Panama St. / Stanford, CA 94305-4101	650.325.1521
Department of Terrestrial Magnetism	5241 Broad Branch Rd., N.W. / Washington, DC 20015-1305	202.478.8820
Office of Administration	1530 P St., N.W. / Washington, DC 20005-1910	202.387.6400

[www.CarnegieScience.edu](http://www.CarnegieScience.edu)

## A Gift for the Future

One of the most effective ways of supporting the work of the Carnegie Institution is to include the institution in your estate plans. By making a bequest, you can support the institution well into the future.

A bequest is both a tangible demonstration of your dedication to the Carnegie Institution and a way to generate significant tax savings for your estate. Some bequests to Carnegie have been directed to fellowships, chairs, and departmental research projects. Some have been additions to the endowment, while others have been unrestricted.

The following sample language can be used in making a bequest to the Carnegie Institution:

“I give and bequeath the sum of \$\_\_\_\_\_ (or % of my residuary estate) to the Carnegie Institution of Washington, 1530 P Street, N.W., Washington, DC 20005-1910.”

### For Additional Information

**See the Carnegie Website:**

[www.CarnegieScience.edu/support](http://www.CarnegieScience.edu/support)

**Or Call:**

The Office of Advancement  
202.387.6400

**Or Write:**

Rick Sherman  
The Office of Advancement  
Carnegie Institution  
1530 P. Street N.W.  
Washington, D.C. 20005-1910

2010-2011 YEAR BOOK

# The President's Report

*July 1, 2010 - June 30, 2011*

C A R N E G I E   I N S T I T U T I O N   F O R   S C I E N C E

### Former Presidents

Daniel C. Gilman, 1902–1904  
Robert S. Woodward, 1904–1920  
John C. Merriam, 1921–1938  
Vannevar Bush, 1939–1955  
Caryl P. Haskins, 1956–1971  
Philip H. Abelson, 1971–1978  
James D. Ebert, 1978–1987  
Edward E. David, Jr. (Acting President, 1987–1988)  
Maxine F. Singer, 1988–2002  
Michael E. Gellert (Acting President, Jan.–April 2003)

### Former Trustees

Philip H. Abelson, 1978–2004  
Alexander Agassiz, 1904–1905  
Robert O. Anderson, 1976–1983  
Lord Ashby of Brandon, 1967–1974  
J. Paul Austin, 1976–1978  
George G. Baldwin, 1925–1927  
Thomas Barbour, 1934–1946  
Daniel N. Belin, 2000–2009  
James F. Bell, 1935–1961  
John S. Billings, 1902–1913  
Robert Woods Bliss, 1936–1962  
Amory H. Bradford, 1959–1972  
Lindsay Bradford, 1940–1958  
Omar N. Bradley, 1948–1969  
Lewis M. Branscomb, 1973–1990  
Robert S. Brookings, 1910–1929  
James E. Burke, 1989–1993  
Vannevar Bush, 1958–1971  
John L. Cadwalader, 1903–1914  
William W. Campbell, 1929–1938  
John J. Carty, 1916–1932  
Whitefoord R. Cole, 1925–1934  
John T. Connor, 1975–1980  
Tom Cori, 1999–2010  
Frederic A. Delano, 1927–1949  
John Diebold, 1975–2005  
Cleveland H. Dodge, 1903–1923  
William E. Dodge, 1902–1903  
James D. Ebert, 1987–2001  
Gerald M. Edelman, 1980–1987  
Charles P. Fenner, 1914–1924  
Michael Ference, Jr., 1968–1980  
Homer L. Ferguson, 1927–1952  
Simon Flexner, 1910–1914  
W. Cameron Forbes, 1920–1955  
James Forrestal, 1948–1949  
William N. Frew, 1902–1915  
Lyman J. Gage, 1902–1912  
Walter S. Gifford, 1931–1966  
Carl J. Gilbert, 1962–1983  
Cass Gilbert, 1924–1934  
Frederick H. Gillett, 1924–1935  
Daniel C. Gilman, 1902–1908  
William T. Golden, 1969–2007  
Hanna H. Gray, 1974–1978  
Crawford H. Greenewalt, 1952–1984  
David Greenewalt, 1992–2003  
William C. Greenough, 1975–1989  
Patrick E. Haggerty, 1974–1975

Caryl P. Haskins, 1949–1956, 1971–2001  
John Hay, 1902–1905  
Richard Heckert, 1980–2010  
Barklie McKee Henry, 1949–1966  
Myron T. Herrick, 1915–1929  
Abram S. Hewitt, 1902–1903  
William R. Hewlett, 1971–2001  
Henry L. Higginson, 1902–1919  
Ethan A. Hitchcock, 1902–1909  
Henry Hitchcock, 1902  
Herbert Hoover, 1920–1949  
William Wirt Howe, 1903–1909  
Freeman A. Hrabowski III, 2002–2004  
Charles L. Hutchinson, 1902–1904  
Walter A. Jessup, 1938–1944  
Frank B. Jewett, 1933–1949  
George F. Jewett, Jr., 1983–1987  
Antonia Ax:son Johnson, 1980–1994  
William F. Kieschnick, 1985–1991  
Samuel P. Langley, 1904–1906  
Kenneth G. Langone, 1993–1994  
Ernest O. Lawrence, 1944–1958  
Charles A. Lindbergh, 1934–1939  
William Lindsay, 1902–1909  
Henry Cabot Lodge, 1914–1924  
Alfred L. Loomis, 1934–1973  
Robert A. Lovett, 1948–1971  
Seth Low, 1902–1916  
Wayne MacVeagh, 1902–1907  
William McChesney Martin, 1967–1983  
Keith S. McHugh, 1950–1974  
Andrew W. Mellon, 1924–1937  
John C. Merriam, 1921–1938  
Richard A. Meserve, 1992–2003  
J. Irwin Miller, 1988–1991  
Margaret Carnegie Miller, 1955–1967  
Roswell Miller, 1933–1955  
Darius O. Mills, 1902–1909  
S. Weir Mitchell, 1902–1914  
Andrew J. Montague, 1907–1935  
Henry S. Morgan, 1936–1978  
William W. Morrow, 1902–1929  
Seeley G. Mudd, 1940–1968  
Franklin D. Murphy, 1978–1985  
William I. Myers, 1948–1976  
Garrison Norton, 1960–1974  
Paul F. Orefice, 1988–1993  
William Church Osborn, 1927–1934  
Walter H. Page, 1971–1979

James Parmelee, 1917–1931  
William Barclay Parsons, 1907–1932  
Stewart Paton, 1916–1942  
Robert N. Pennoyer, 1968–1989  
George W. Pepper, 1914–1919  
Richard S. Perkins, 1959–2000  
John J. Pershing, 1930–1943  
Henning W. Prentis, Jr., 1942–1959  
Henry S. Pritchett, 1906–1936  
Gordon S. Rentschler, 1946–1948  
Sally K. Ride, 1989–1994  
David Rockefeller, 1952–1956  
Elihu Root, 1902–1937  
Elihu Root, Jr., 1937–1967  
Julius Rosenwald, 1929–1931  
William M. Roth, 1968–1979  
William W. Rubey, 1962–1974  
Martin A. Ryerson, 1908–1928  
Howard A. Schneiderman, 1988–1990  
Robert C. Seamans, 1974–2008  
Henry R. Shepley, 1937–1962  
Theobald Smith, 1914–1934  
John C. Spooner, 1902–1907  
Frank Stanton, 1963–2006  
William Benson Storey, 1924–1939  
Richard P. Strong, 1934–1948  
Charles P. Taft, 1936–1975  
William H. Taft, 1906–1915  
William S. Thayer, 1929–1932  
Juan T. Trippe, 1944–1981  
Hatim A. Tyabji, 2002–2004  
James W. Wadsworth, 1932–1952  
Charles D. Walcott, 1902–1927  
Frederic C. Walcott, 1931–1948  
Henry P. Walcott, 1910–1924  
Lewis H. Weed, 1935–1952  
Sidney J. Weinberg, Jr., 1983–2010  
William H. Welch, 1906–1934  
Gunnar Wessman, 1984–1987  
Andrew D. White, 1902–1916  
Edward D. White, 1902–1903  
Henry White, 1913–1927  
James N. White, 1956–1979  
George W. Wickersham, 1909–1936  
Robert E. Wilson, 1953–1964  
Robert S. Woodward, 1905–1924  
Carroll D. Wright, 1902–1908

## About Carnegie

*“ . . . to encourage, in the broadest and most liberal manner, investigation, research, and discovery, and the application of knowledge to the improvement of mankind . . . ”*

The Carnegie Institution was incorporated with these words in 1902 by its founder, Andrew Carnegie. Since then, the institution has remained true to its mission. At six research departments across the country, the scientific staff and a constantly changing roster of students, postdoctoral fellows, and visiting investigators tackle fundamental questions on the frontiers of biology, earth sciences, and astronomy.

# Carnegie Institution

## Trustees

**Michael E. Gellert**, Chairman  
**Suzanne Nora Johnson**, Vice Chairman  
**Deborah Rose**, Secretary  
**Euan Baird**, Senior Trustee  
**Remi Barbier**  
**Samuel W. Bodman**  
**John C. Botts**  
**Michael Brin**  
**William T. Coleman, Jr.**, Senior Trustee  
**John F. Crawford**  
**Edward E. David, Jr.**, Emeritus  
**Michael A. Duffy**, Senior Trustee  
**W. Gary Ernst**  
**Sandra M. Faber**  
**Bruce W. Ferguson**  
**Stephen P. A. Fodor**  
**William K. Gayden**  
**Robert G. Goelet**  
**William R. Hearst III**  
**Rush Holt**  
**Kazuo Inamori**, Emeritus  
**Mary-Claire King**  
**Gerald D. Laubach**, Emeritus  
**John D. Macomber**, Senior Trustee  
**Steven L. McKnight**, Senior Trustee  
**Burton J. McMurtry**, Emeritus  
**Jaylee Mead**, Senior Trustee  
**Frank Press**, Emeritus  
**William J. Rutter**, Senior Trustee  
**Maxine F. Singer**  
**Christopher T. S. Stone**  
**David F. Swensen**, Senior Trustee  
**Charles H. Townes**, Emeritus  
**William I. M. Turner, Jr.**  
**Thomas N. Urban**, Senior Trustee  
**Michael G. Wilson**  
**Mary Lou Zoback**

## President

**Richard A. Meserve**

## Directors

**Allan C. Spradling**, Department of Embryology  
**Russell J. Hemley**, Geophysical Laboratory  
**Christopher Field**, Department of Global Ecology  
**Wendy L. Freedman**, The Crawford H. Greenewalt Chair, The Observatories  
**Wolf B. Frommer**, Department of Plant Biology  
**G. Gary Kowalczyk**, Administration and Finance  
**Sean C. Solomon**, Department of Terrestrial Magnetism  
**Rick Sherman**, Chief Advancement Officer  
**Gotthard Szághi-Szabó**, Chief Information Officer

# Contents

The President's Commentary	6
Friends, Honors & Transitions	14
Research Highlights	24
Financial Profile	50
Personnel	57
Bibliography	75

# The President's Commentary







Carnegie president  
Richard A. Meserve  
*Image courtesy Jim Johnson*

**A**ndrew Carnegie enjoined the institution “[t]o discover the exceptional man in every department of study whenever and wherever found . . . and enable him to make the work for which he seems specially designed his life work.” This injunction is regularly cited in these essays and, in fact, provides the touchstone that guides our recruitment and evaluation of our scientific staff. (Of course, we do not restrict ourselves as a result of Carnegie’s use of a male noun and pronoun!) We seek scientists with the capacity to choose those scientific questions that can significantly advance humankind’s knowledge and to devise an appropriate research approach for solving them. Indeed, one central component of scientific talent is the vision to choose the particular question and approach that offers the greatest opportunities for significant scientific gains.

In compliance with Carnegie’s directive, we seek to enable each staff member to define his or her scientific agenda with as much freedom as we can provide. We are able to accomplish this, in part, through the expenditure of funds from our endowment, the source of about 50% of our budget. We thus stand apart from most other research institutions that are forced to undertake work for which funding can be obtained from federal or private sources. The institution’s approach is made possible as a consequence of decisions by our board over the years to keep the institution small and thereby to sustain the capacity to support promising research, even if it is then unfashionable. Perhaps the paradigmatic example of the value of this strategy is reflected in the history of Carnegie’s Barbara McClintock, whose work on “jumping genes” was not viewed as pathbreaking at the time it was undertaken, but which ultimately resulted in her Nobel Prize.

The injunction to support exceptional persons in their work may be interpreted by some to suggest that Carnegie scientists are constrained to pursue their ideas by themselves in the solitude of their individual laboratories. Certainly Carnegie’s mission encompasses the support of such people. But the Carnegie directive does not limit the manner in which research is performed. Rather, the watchword is flexibility—a license for our scientists to pursue whatever means can best lead to scientific advance. Some work requires extensive collaboration and, as a result, many of our scientists work with a wide array of colleagues. Indeed, collaborative research is increasingly the norm at Carnegie and elsewhere.

I shall focus here on a few examples of many from which I could draw in which Carnegie scientists have played noteworthy roles in the assembly of collaborators

The tiny MESSENGER spacecraft was launched in August 2004 and, after a complex trajectory, was inserted into orbit about the innermost planet March 18, 2011. After only six months into its orbit, MESSENGER had already shown scientists that Mercury doesn’t conform to theory.



(Above left) Then-director of the Department of Terrestrial Magnetism Sean Solomon, was selected by NASA to be the principal investigator of the MESSENGER mission to Mercury on July 7, 1999. He is shown here at a celebratory event with a model of the spacecraft.

(Above right) One of the major surprises from MESSENGER was the discovery of a class of shallow, irregular depressions, some with halos and bright interiors, which the researchers dubbed hollows. Here, hollows are sprinkled around the crater's smooth ejecta.



Image courtesy NASA/Johns Hopkins University Applied Physics Laboratory/Carnegie Institution of Washington

from other institutions around the world. I single out these examples because they show how Carnegie scientists have shaped fields and have spearheaded scientific projects that are vastly disproportionate to our commitment of treasure and staff.

## MESSENGER

Carnegie's Sean Solomon, formerly the director and now a staff member at the Department of Terrestrial Magnetism (DTM), serves as the principal investigator of the NASA-funded Mercury Surface, Space ENvironment, GEOchemistry, and Ranging (MESSENGER) mission. Sean envisioned and has successfully shepherded a team involving dozens of institutions that has succeeded in placing the first spacecraft in orbit around our innermost planet. The craft was launched in August 2004 and made a flyby of Earth, two of Venus, and three of Mercury in order to enable a successful orbital insertion in March 2011. The scientific bounty from this mission, which is still being harvested, has already required a rewriting of scientific textbooks. The Mercury flybys enabled the imaging of portions of the planet that had never been seen in detail before, confirming the existence of widespread volcanism early in the planet's history. And many scientific surprises have arisen from the early months of measurements by the orbiting spacecraft.



The surprises include the discovery of higher abundances of sulfur and potassium than previously predicted. Because these volatile elements would have been driven off by previously presumed high-temperature events early in the planet's history, the measurements require a total rethinking of the theories surrounding the planet's formation. Images show a huge expanse of volcanic planes surrounding the north pole, including large volcanic vents. They also reveal an unexpected class of landforms of relatively young hollows that appear to have been formed by a previously unrecognized geologic process involving the loss of volatile materials. And Mercury's weak magnetic field has an unexpected structure—it is oddly offset toward the north, reflecting a lack of symmetry in the planet's core.

Although the spacecraft was originally funded for only one year of orbital observation, it has proven so successful that NASA has continued funding for a second year. The scientific returns to date include 25 papers published in *Science* magazine (out of 25 that were submitted!), including special sections devoted to MESSENGER on four occasions.<sup>1</sup> The project has already been memorialized through the issuance of a MESSENGER stamp by the U.S. Postal Service.

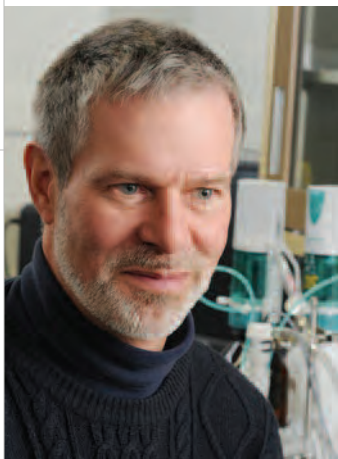
## IPCC

Chris Field, the director of the Department of Global Ecology (DGE), is involved in a different sort of collaboration. Chris has been a major driver in the development of the discipline of global ecology, including especially the study of so-called emergent properties of ecosystems—properties that may not be intrinsic to individual components, but which emerge upon assembly at a large scale. His skill in studying complicated systems resulted in his involvement in the Intergovernmental Panel on Climate Change (IPCC), the United Nations-sponsored effort to develop a world-wide scientific consensus on various aspects of this critical global challenge. He served as a lead coordinating author for a chapter in the report issued in 2007—and was one of two Americans selected to represent the IPCC on its receipt of the Nobel Prize—and is now serving as cochair of Working Group II, the group that is studying impacts, adaptation, and vulnerability for the upcoming assessment. In that role, Chris is coordinating the efforts of over 300 talented scientists from around the globe in a comprehensive effort to distill what the science reveals, along with associated levels of uncertainty. The Technical Support Unit for this effort is located at DGE.



Over the decades Chris Field, director of the Department of Global Ecology, has been a major driver in the development of the discipline of global ecology. He became involved in the United Nations effort, Intergovernmental Panel on Climate Change (IPCC), to develop scientific consensus on various aspects of climate change. He served as a lead coordinating author for a chapter in the report issued in 2007 and is now serving as cochair of Working Group II. That group is studying impacts, adaptation, and vulnerability for the upcoming assessment.

<sup>1</sup>*Science* 333, September 30, 2011; *Science* 329, August 6, 2010; *Science* 324, May 1, 2009; and *Science* 321, July 4, 2008.



(Above left) Geophysical Laboratory's Bob Hazen gave a lecture about life's geochemical origins, which became the catalyst for the interdisciplinary, international Deep Carbon Observatory project.

(Above right) In the late 1970s, scientists discovered that deep, cold, dark seafloor hydrothermal vents unexpectedly harbored life. Tube worms cover the base of this vent. Deep carbon researchers will hunt for signs of life even deeper within the Earth.

(Far right) This image shows liquid carbon at high pressures and temperatures.

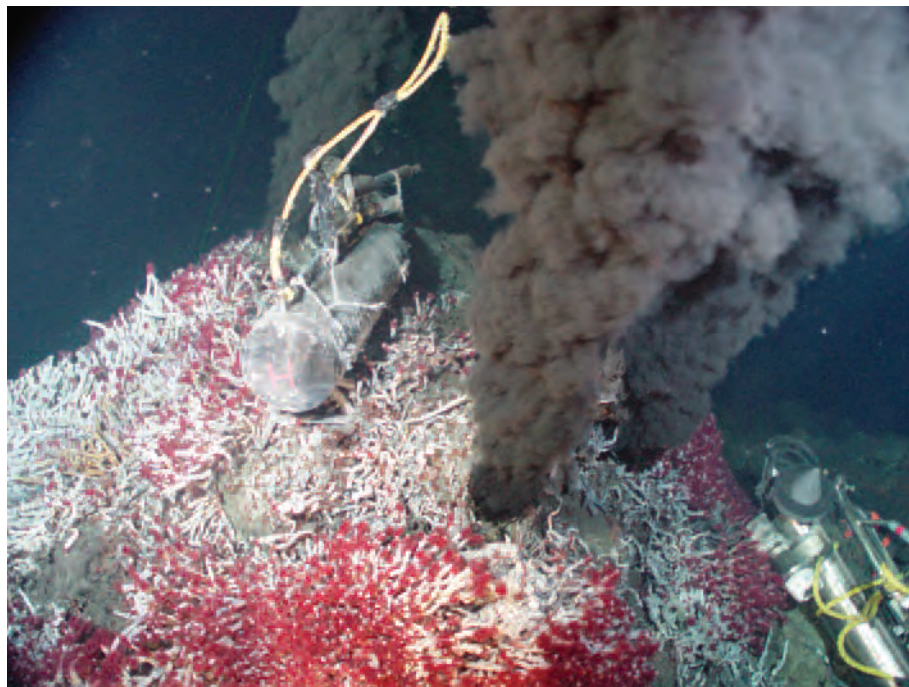


Image courtesy NOAA

The Working Group has recently released a special report on managing the risks of extreme weather events and disasters. Among its many interesting and important findings, the report concludes that weather extremes have changed as a result of anthropogenic influences, including increases in atmospheric concentrations of greenhouse gases. The influences include increases in extreme daily minimum and maximum temperatures on a global scale, an intensification of extreme precipitation averaged across the globe, and increasing extreme coastal high water due to the increase in mean sea level. On the other hand, given the uncertainties in knowledge, the report provides low confidence in attributing changes in tropical cyclone activity to anthropogenic influences. This important report is a prelude to the release of a report on the full scope of the Working Group's efforts in 2014.

## DEEP CARBON OBSERVATORY

Bob Hazen, a staff member in Carnegie's Geophysical Laboratory (GL), explores a wide-ranging set of scientific questions, including life's geochemical origins. As a result of his lecture on this subject, Bob was approached by Jesse Ausubel, a vice president at the Alfred P. Sloan Foundation, about a possible initiative to study the

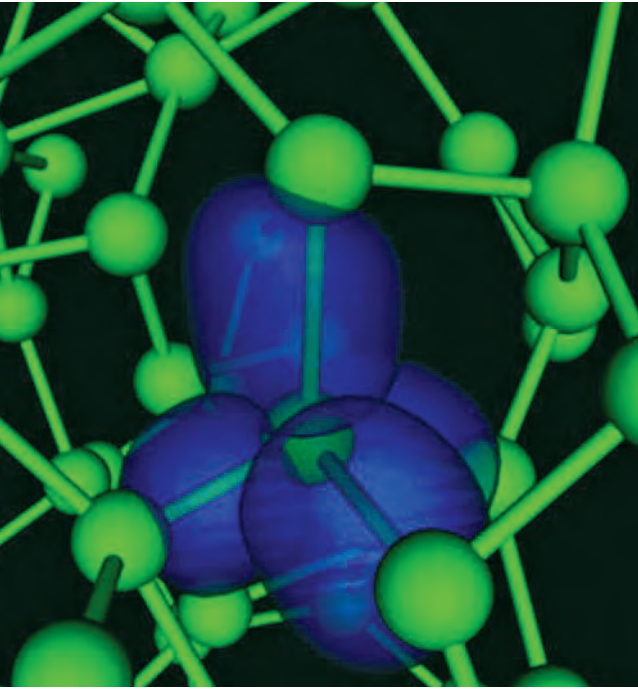


Image courtesy: Alfredo Correa, Lawrence Livermore National Laboratory

origins of life in the Earth's deep subsurface. Bob recognized that biogenesis is just one part of the much larger challenge of understanding the deep carbon cycle—the movement of carbon over time from Earth's surface to its core. Bob thus responded with a counterproposal to launch a broadly interdisciplinary and international effort to characterize the role of carbon on the planet—its chemical, biological, and physical properties, where it is found and how it moves, and how it affects life on Earth.

With support from Sloan and others, a major effort to pursue that vision is now strongly underway. The effort has entailed the creation of four science directorates: deep carbon

reservoirs and fluxes, deep life, deep energy, and the physics and chemistry of carbon. A secretariat was established at our Broad Branch Road campus, and workshops have been held around the world. In addition to numerous researchers from both DTM and GL, nearly 1,000 researchers from 60 countries are now engaged in the project. The effort is opening whole new vistas of previously unexplored science.

## GMT

Carnegie has a long and distinguished history in astronomy, including a leadership role in the construction of many of the telescopes that have provided astonishing insights about the universe. For example, Carnegie's Edwin Hubble used a Carnegie telescope at Mount Wilson to discover that there are galaxies other than our Milky Way and that the universe was expanding. Two exceptional current-generation telescopes, each with a 6.5-meter primary mirror, are now in active use at Carnegie's Las Campanas Observatory in Chile. But, because larger and more capable telescopes invariably have led to astounding new discoveries, Carnegie's astronomers are already pursuing the construction of an even larger telescope, the Giant Magellan Telescope (GMT).



(Above left) Wendy Freedman, the Crawford H. Greenewalt Chair director of the Carnegie Observatories, is also the chair of the Giant Magellan Telescope Organization.

(Above right) The Giant Magellan Telescope is expected to be operational in about a decade at Carnegie's Las Campanas Observatory in Chile.

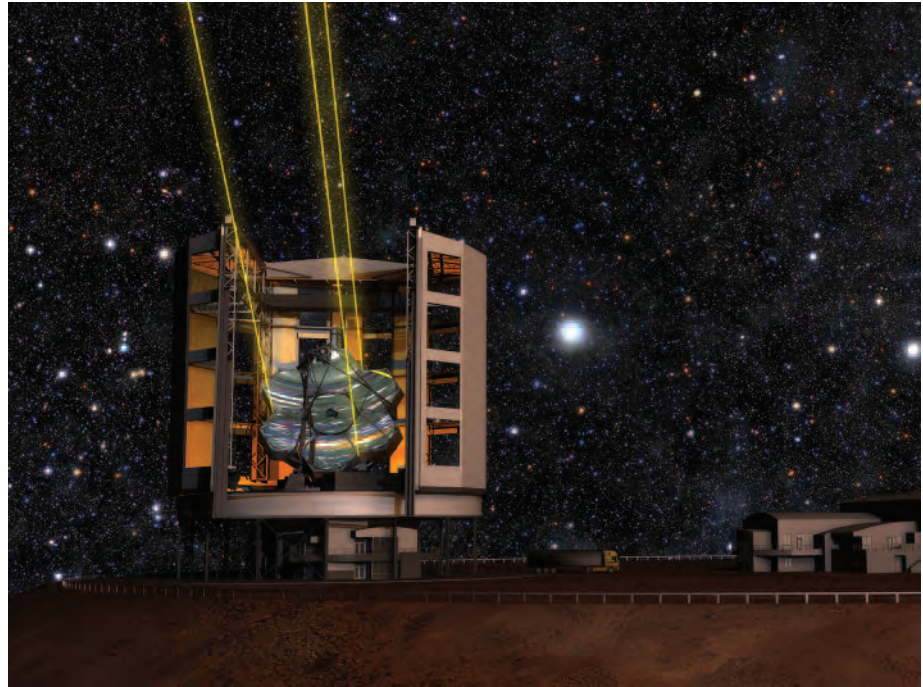


Image courtesy: Giant Magellan Telescope Organization

The project has been spearheaded by Wendy Freedman, the director of the Carnegie Observatories and chair of the board of the GMT Organization. A consortium of U.S. and foreign entities has joined together to pursue the effort.<sup>2</sup> The aim is to construct and operate a telescope that will combine seven 8.4-meter primary mirrors to produce the equivalent of a telescope with a 25-meter aperture. The project promises to facilitate the understanding of the dawn of the universe, its large-scale properties, and the nature of the distribution of its matter and energy. The telescope will even allow the imaging of extrasolar planets, possibly allowing the discovery of life elsewhere. The GMT promises to open the next chapter of our understanding of the universe.

## CHALLENGES

These large collaborations reflect the application of a 21st-century mechanism for the accomplishment of Carnegie's vision of supporting exceptional people in the pursuit of cutting-edge science. Of course, this vision requires the expenditure of resources. Carnegie's principal sources of funding are our endowment, federal grants, and awards from foundations and individuals. In light of the continuing economic turmoil, a discussion of our funding challenges has been an element of

<sup>2</sup>The GMT0 partners are Astronomy Australia Ltd., the Australian National University, Carnegie Institution for Science, Harvard-Smithsonian Center for Astrophysics, Korea Astronomy and Space Science Institute, the University of Texas at Austin, Texas A&M University, the University of Arizona, and the University of Chicago.

my commentaries for several years. Unfortunately, this year is not one in which I can depart from the trend.

The endowment achieved an all-time highest valuation of \$870 million in June 2008. It declined significantly in fiscal year 2009 to a low of \$609 million, but has climbed back to \$792 million at June 30, 2011. With guidance from our Finance Committee, we have achieved returns that exceed the State Street benchmark for endowments and foundations over the one-, two- and five-year periods, including a 22.7% return in the fiscal year encompassed by this Year Book. But, given the need to balance current and future needs, the endowment gains, although encouraging, cannot be the sole source of significant new funds.

We are fortunate that new support provided by federal and private grants and contracts has grown over fiscal year 2010-11 by \$2.3 million to \$44.2 million, providing a helpful inventory of funding over the next several years. This success is a testament to the skills of our scientists. Clearly, however, we should anticipate and prepare for the significant likelihood that federal support for science may decline in future years. The Budget Control Act enacted in connection with the increase in the federal debt ceiling requires additional budget cuts totaling \$1.2 trillion over the next decade, and science funding from the federal government will no doubt suffer.

Nonetheless, I remain confident that the Carnegie scientists will continue to increase the storehouse of scientific knowledge through these tough economic times. Although the Carnegie departments are small by most measures, they are large in terms of their cutting-edge scientific output (as reflected, for example, by the listing of scientific publications elsewhere in this Year Book). We will continue to fulfill Andrew Carnegie's admonition to "encourage investigation, research, and discovery." The mysteries that can be unraveled by science are many and we pledge to continue to solve them.

FISCAL YEAR END	MARKET VALUE IN MILLIONS
6/30/2002	502
6/30/2003	526
6/30/2004	581
6/30/2005	648
6/30/2006	726
6/30/2007	832
6/30/2008	870
6/30/2009	636
6/30/2010	692
6/30/2011	792



Richard A. Meserve

# Carnegie Friends

## Annual Giving

*Gifts were received between July 1, 2010, and June 30, 2011.*

### The Barbara McClintock Society

An icon of Carnegie science, Barbara McClintock was a Carnegie plant biologist from 1943 until her retirement. She was a giant in the field of maize genetics and received the 1983 Nobel Prize in Physiology/Medicine for her work on patterns of genetic inheritance. She was the first woman to win an unshared Nobel Prize in this category. To sustain researchers like McClintock, annual contributions to the Carnegie Institution are essential. The McClintock Society thus recognizes generous individuals who contribute \$10,000 or more in a fiscal year, making it possible to pursue the highly original research for which Carnegie is known.



#### \$1,000,000 or more

William and Cynthia Gayden  
Michael and Mary Gellert  
Michael Long  
George P. Mitchell  
Deborah Rose, Ph.D.

#### \$100,000 to \$999,999

Anonymous (2)  
Bradley F. Bennett\*  
Richard Buynitzky\*  
Bruce Ferguson and Heather Sandiford  
Stephen and Janelle Fodor  
Robert G. and Alexandra C. Goelet  
William R. Hearst III

#### \$10,000 to \$99,999

Anonymous  
Lee Ainslie  
Remi and Lindsay Barbier, Ph.D.  
Didier and Brigitte Berthelemot  
Samuel and Diane Bodman  
John and Jean Botts  
Gary P. and Suzann A. Brinson  
Martin and Jacqueline Gellert  
Sibyl R. Golden  
Gary K. Hart and Cary S. Hart  
Robert and Margaret Hazen  
Laure W. Kastanis  
Douglas Koshland  
Burton and Deedee McMurtry

Richard A. and Martha R. Meserve  
Al and Honey Nashman  
Yasumi Ohshima  
Cary Queen  
David Singer  
William and Nancy Turner  
Sidney J. Weinberg, Jr.\*  
Michael G. Wilson

*\* Deceased*



## Other Annual Giving

### Individuals

#### \$1,000 to \$9,999

Anonymous (3)  
 Paul A. Armond  
 Henry H. Arnhold  
 Mary B. Bailey  
 Giuseppe Bertani  
 Charles Bestor  
 Page Boteler  
 Peter Brennan  
 Anthony Cavaliere and Ellen Look  
 Joseph H. and Alice Coulombe  
 John and Anne Crawford  
 Eleanora K. Dalton  
 Igor Dawid and Keiko Ozato  
 John P. de Neufville  
 Wallace and Charlotte Ernst  
 Sandra and Andrew Faber  
 Christopher Field and Nona Chiariello  
 Charlotte S. Greenewalt  
 Claire M. Haldan  
 Russell Hemley and Amanda Davis  
 John and Dori Holaday  
 Rush D. Holt and Margaret Lancefield  
 Charles B. Hunter  
 Neil and Lorna Irvine  
 Kathleen E. Jolly  
 Mary-Claire King  
 Paul and Carolyn Kokulis  
 G. G. Kowalczyk  
 Paul Latimer  
 Gerald D. Laubach  
 Alan and Agnes Leshner  
 Gilbert and Karen Levin  
 Lawrence H. Linden  
 John and Jean Lively  
 John D. Macomber  
 Donald H. McClelland  
 Jaylee M. Mead  
 Amy Meserve  
 Lauren A. Meserve  
 Robert Metcalf

Alan and Melinda Naye  
 Peter M. Nicholas  
 Catherine A. Piez  
 Frederick H. Prince  
 Vera C. Rubin  
 Maxine and Daniel Singer  
 Joel Spira  
 Allan Spradling and  
 Constance Griffin  
 Tetsuo Takanami  
 John R. Thomas, Ph.D.  
 Ian Thompson  
 Scott B. Tollefsen  
 Thomas and Mary Urban  
 Frederick P. Woodson  
 Mary Lou Zoback

#### Under \$1,000

Anonymous (4)  
 John Abelson  
 Judith C. Adams  
 Jagannadham Akella  
 L. Thomas Aldrich  
 Lloyd and Emilie Allen  
 Christopher Allison  
 Ariel Altman  
 Sheldon Applegate  
 Joseph P. Ardizzi  
 Louis G. Arnold  
 Dr. George E. Assousa  
 John Avallone  
 Gaurav Bagwe  
 Lawrence C. Baldwin  
 Cheryl A. Bantz  
 John F. Barton  
 Manuel N. Bass  
 Harvey E. Belkin  
 Jack Bennett  
 James Bennett  
 Paul and Mildred Berg  
 Richard J. Bergemann  
 Angela Bertagna  
 Lloyd Biscomb  
 Tom I. Bonner  
 Frank Borchert  
 Kurt R. Borski

Todd Brethauer  
 Robin Brett  
 Winslow R. Briggs  
 Peter C. Brockett  
 Kenneth Brockman  
 Harold and Naomi Brodsky  
 Jeanette S. Brown  
 Lore E. Brown  
 Allan B. Burdick  
 Marjorie Burger  
 James E. Burke  
 Gordon Burley  
 Donald M. Burt  
 Christopher Cahill  
 John A. Caldwell  
 Scott Cameron  
 Allan Campbell  
 Finley A. Campbell  
 Carol L. Carpenter  
 Timothy J. Carr  
 Dana Carroll  
 Liang-Chen Chen  
 Wen P. Chen  
 Ida Chow  
 Paul S. Clark  
 Mary M. Coder  
 John R. Coleman  
 Rita R. Colwell  
 Jason Conratt  
 John D. Cooper  
 Jonathan Coopersmith  
 Professor José M. Correia-Neves  
 Ronald Croasdale  
 Daniel L. Crotty  
 Martin Czigler  
 Howard H. Dana  
 Nicholas F. Davis  
 John B. Denniston  
 Robert C. DeVries  
 John M. Dick  
 John F. Dilley  
 James F. Dinwiddie  
 John B. Doak  
 Bruce R. Doe  
 James A. Drummond  
 David Dyregrov

Constance B. Elliot  
 John Farhood  
 Raul Fernandez  
 Carolina Flores-Helizon  
 Frederick Forro  
 Christine E. Foster  
 Laurence W. Fredrick  
 David H. Freeman  
 Bevan French  
 Fred S. Fry  
 Gladys H. Fuller  
 Jill Gaddis  
 Joseph H. Gainer  
 Esra Galun  
 David Gambrel  
 Joan Gantz  
 Susanne E. Garvey  
 Lind S. Gee  
 Domenico Gellera  
 John H. Gibbons  
 M. C. Gilbert  
 James Golden  
 Mary Helen M. Goldsmith  
 David J. Goldston  
 Jeremy Gracik  
 Mark Grammer  
 Barbara Graves  
 Thomas and Josephine Greeley  
 Barbara T. Greenewalt  
 David L. Greenewalt  
 Donald Groelsema  
 Scott and Emma Gromacki  
 Marianne U. Gustafson  
 William and Dorothy Hagar  
 B. Fenton Hall  
 Paul A. Hanle  
 Walter A. Harrison  
 Stanley R. Hart  
 William K. Hart  
 Richard S. Hartman  
 Karl M. Hartmann  
 Gordon S. Hawkins  
 H. L. Helfer  
 J. J. and Helen V. Hemley  
 Phyllis H. Herman  
 Jo Ann Hersh

Vera Hewitt	Jonathan Loonin	David Proch	Todd R. Supple
Jutta Hicks	Thomas E. Lovejoy	Daniel W. Pugh	Nugroho H. Suwito
Margaret A. Higbee	Peter B. Lyons	James Rapp	Thomas H. Symons
Henry P. Hoffstot	Madhu Madhavan	Shirley Raps	Kathleen Taimi
Patricia Hohwiesner	Richard J. Mahler	Martin Ratliff	Gary R. Tanigawa
Lisa L. Holt	Steven R. Majewski	Patrick Reavey	Colin Taylor
Mary F. Horan	Michael E. Malone	Graham Redinger	Lawrence A. Taylor
Larry D. Huffman	W. R. Mancuso	Leonard Reed	Leslie C. Taylor
Sandra N. Humphrey	Donald Mansfield	Minocher Reporter	Mack Taylor
Renate Jaacks and Linda Ford	Steve P. Maran	Daniel W. Rice	Thomas M. Tekach
John H. Jacobs	Chester B. and Barbara C. Martin	Michael Rich	Diluan Terry
Morgan Jacobs	James M. Mattinson	Benjamin Richter	Peter A. Tinsley
Jack C. James	David Mauriello	Herman H. Rieke	Charles H. Townes
Phil James	Dennis McCormick	Garth A. Roark	Jonathan Tuerk
Bernard W. Janicki	Sheila McCormick	Paula Roediger	Andrew Tufano
Heather Johnson	Don H. McDowell	James Rowland	Michael S. Turner
Theodore J. Johnson	Christopher McEniry	Christopher Rubel	Thomas Valleau
Peter G. Katona	Kevin McGarry	Doug and Karen Rumble	Frits Van Beek
James P. Kelly and Beverlee Bickmore	David McMeans	Lawrence Sager	W. K. VanNewkirk
Charles Kengla	Jerry McMillan	Akira Sasaki	David Velinsky
Ed Kiessling	Rhonda McNulty	Anne K. Sawyer	Clayton Vickland
Marguerite J. Kingston	Carl R. Merrill	Maarten Schmidt	Daniel and Eloise Vitiello
M. B. Kirkham	Dennis F. Miller	Joyce R. Schwartz	Mallory Walker
Mark A. Kleinman	Susan P. Mitchell	François and Linda Schweizer	Richard J. Walker
Gundolf H. Kohlmaier	Mary Lee Morrison and William B. Upholt	Malcolm Scully	Parrish Walsh
William E. Kopka	John Morrow	Frederic T. Selleck	Wayne H. Warren
Olavi Kouvo	John W. Mothersole	Nobumichi Shimizu	Johannes Weertman
Audrey S. Krause	Gary G. Mrenak	Eli C. Siegel	Richard Weston
Arthur Krieger	Charles G. Myers	Barry Silver	Edward White
Robert Kulin	Ralph H. Nafziger	Michael Silverglat	William M. White
Gerald Lamboley	Jatinder N. Nanda	Randolph Sim	James E. Williams
Arlo U. Landolt	Norman and Georgine Neureiter	Mary E. Simon	Evelyn M. Witkin
John S. Langford	Richard L. Nielsen	Jeffrey R. Singer	James A. Wood
Samuel A. Lawrence	Robert A. Nilan	Virginia B. Sisson	Laquita Wood
Kurt Lawson	Peter J. Nind	Brett Smith	Julianne Worrell
Calvin D. Lee	Adrienne Noe	Brian G. Smith	Michael J. Worth
Harold H. Lee	Michael O'Connor	Christine D. Smith	Frank K. Wyatt
Ernest H. Lehmann	Michael E. Ollinger	Robert C. Smith	Robert Yamartino
Lavonne Lela	Gilbert Omenn and Martha Darling	David E. Snead	Charles Yanofsky
Howard M. and Sylvia G. Lenhoff	John G. Ormerod	Richard H. Solomon	Yoshio Yaoita
Frederick K. Lepple	John Overholt	Jordan Sorensen	Janet Young
Alan E. Levin	R. B. and Deborah Parry	Phillip K. Sotel	Robert A. Young
Kathleen D. Lewis	Niels M. Pedersen	Chad Steinback	Violet K. Young
Steven and Nancy L'Hernault	Anil Prakash	Erich W. Steiner	Anatoly Zak
Joseph Q. Livingston		Michelle Stokes	Timothy A. Zimmerlin
Felix J. Lockman		Nathan Strug	Wanna M. Zinsmaster

*Carnegie Institution for Science***Foundations and Corporations****\$1,000,000 or more**

The Gayden Family Foundation  
 Michael E. Gellert Trust  
 The Grantham Foundation for the Protection of the Environment  
 The Cynthia and George Mitchell Foundation  
 Gordon and Betty Moore Foundation  
 Alfred P. Sloan Foundation

**\$100,000 to \$999,999**

Anonymous  
 Air Liquide Foundation  
 The Chicago Community Trust, Searle Scholars Program  
 Howard Hughes Medical Institute  
 Andrew W. Mellon Foundation  
 Ambrose Monell Foundation  
 The San Simeon Fund, Inc.  
 The G. Unger Vetlesen Foundation

**\$10,000 to \$99,999**

The Abell Foundation  
 Baltimore Community Foundation  
 The Bodman Family Foundation  
 The Brinson Foundation  
 The Margaret A. Cargill Foundation  
 Carnegie Institution of Canada/Institution Carnegie du Canada  
 The Jane Coffin Childs Memorial Fund for Medical Research  
 Durland Co., Inc.  
 Golden Family Foundation  
 Gregor Mendel Institute of Molecular Plant Biology  
 Robert and Margaret Hazen Foundation  
 Richard W. Higgins Foundation  
 Laurel Foundation  
 Life Sciences Research Foundation  
 Maverick Capital Foundation  
 The McMurtry Family Foundation  
 MGW & CJW 2007 Trust  
 Monsanto Company  
 Pioneer Hi-Bred International, Inc.  
 The Rose Hills Foundation  
 Shippy Foundation  
 The Sidney J. Weinberg, Jr. Foundation

**\$500 to \$9,999**

American Academy of Arts and Sciences  
 Aquaneering  
 Arnhold Foundation, Inc.  
 Atlantis Research Foundation  
 Paul and Mildred Berg Charitable Fund  
 Cavalieri-Look Fund  
 Coulombe Family Trust  
 The Crystal Family Foundation  
 Damel Investors LLC  
 Ernst Charities  
 GrassRoots Biotechnology  
 Hicks Family Charitable Foundation  
 The Holaday Foundation  
 Laubach Family Fund  
 Linden Trust for Conservation  
 Lutron Foundation  
 McClelland Living Trust  
 Robert W. and Gladys S. Meserve Charitable Trust  
 Mulago Foundation  
 Northrop Grumman  
 Omenn-Darling Family Advised Fund  
 Pfizer Foundation Matching Gifts Program  
 Prince Charitable Trusts  
 Roxiticus Fund  
 Syntris Business Systems, Inc  
 T. Rowe Price Foundation  
 The Lee and Carol Tager Family Charitable Fund  
 VWR Charitable Foundation  
 The Wachovia Wells Fargo Foundation  
 The Weathertop Foundation  
 The Zoback Trust



★ William Ian Mackenzie Turner, Jr.

### *William Ian Mackenzie Turner, Jr.*

Canadian Bill Turner joined the Carnegie board in 1990 and has served on practically every board committee at one time or another. With his mechanical engineering degree from the University of Toronto, his M.B.A. from Harvard, and his leadership positions with power, natural resources, and investment holding companies, Turner was a natural fit for Carnegie. He possesses the unusual ability to understand both the technical and business sides of the institution. Turner was vice chairman of the board from 1993 through 2006. Over the years he served on or chaired the Finance Committee, the Budget and Operations Committee, The Magellan Campaign Committee, the Employee Affairs Committee, the Nominating Committee, and the Research Committee.

For 20 years Turner has been a pivotal figure in all aspects of Carnegie's operations. But what sets him apart are his contributions to individual scientific projects. In 1993, Turner founded the Institution Carnegie du Canada. Each year Carnegie staff members have the opportunity to propose their research for grant awards. The Carnegie Canada board then annually awards grants to support individual scientists and programs that involve both Canada and the U.S. The collaborative grants span the spectrum of Carnegie science. In the 1990s and early 2000s Carnegie Canada awarded grants to Plant Biology to determine whether Canadian forests were sinks for carbon dioxide. Researchers at the Observatories benefited from a visiting Canadian astronomer's collaboration on the study of the age, structure, and dynamics of the universe. Terrestrial Magnetism received grants to understand why some continents are more stable than others and to search for extrasolar planets. Researchers at the Geophysical Laboratory (GL) received support to learn if gas hydrates had the potential to be energy sources.

Some examples of more recent Carnegie Canada support include fieldwork at Plant Biology to study how microbes living in extreme environments process phosphorus, an essential plant nutrient; fieldwork at GL to collect samples of ancient sedimentary rock in the Hudson Bay region; and a grant to Embryology to develop new tools to detect hormone activity in fat metabolism.

Many researchers have benefited from Bill Turner's unique generosity. The Carnegie scientists who have received grants not only greatly appreciate the support, they also appreciate his direct interest in their work. Carnegie is grateful for Turner's insights, guidance, hard work, and support for Carnegie science for over two decades. Turner and his wife, Nancy, are members of the Vannevar Bush Society.

## Lifetime Giving Societies

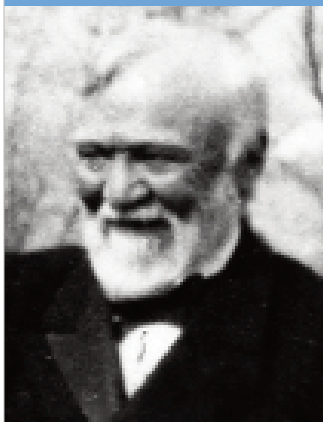
### The Carnegie Founders Society

Andrew Carnegie, the founder of the Carnegie Institution, established it with a gift of \$10 million. Although he ultimately gave a total of \$22 million to the institution, his initial \$10 million gift represents a special level of giving. In acknowledgment of the significance of this initial contribution, individuals who support Carnegie's scientific mission with lifetime contributions of \$10 million or more are recognized as members of the Carnegie Founders Society.

### The Edwin Hubble Society

The most famous astronomer of the 20th century, Edwin Hubble, joined the Carnegie Institution in 1919. Hubble's observations shattered our old concept of the universe. He proved that the universe is made of collections of galaxies and is not just limited to our own Milky Way—and that it is expanding. This work redefined the science of cosmology. Science typically requires years of work before major discoveries like these can be made. The Edwin Hubble Society honors those whose lifetime support has enabled the institution to continue fostering such long-term, paradigm-changing research by recognizing those who have contributed between \$1,000,000 and \$9,999,999.

#### ★ Andrew Carnegie



Caryl P. Haskins\*  
William R. Hewlett\*  
George P. Mitchell

#### ★ Edwin Hubble



D. Euan and Angelica Baird  
William and Cynthia Gayden  
Michael and Mary Gellert  
Robert G. and Alexandra C. Goelet  
William R. Hearst III  
Richard E. Heckert\*  
Kazuo and Asako Inamori  
Michael Long  
Burton and Deedee McMurtry  
Jaylee M. Mead  
Cary Queen  
Deborah Rose, Ph.D.  
William J. Rutter  
Thomas and Mary Urban  
Sidney J. Weinberg, Jr.\*

## The Vannevar Bush Society

Vannevar Bush, the renowned leader of American scientific research of his time, served as Carnegie's president from 1939 to 1955. Bush believed in the power of private organizations and wrote in 1950, "It was Andrew Carnegie's conviction that an institution which sought out the unusual scientist, and rendered it possible for him to create to the utmost, would be worthwhile . . ." He further said that "the scientists of the institution . . . seek to extend the horizons of man's knowledge of his environment and of himself, in the conviction that it is good for man to know." The Vannevar Bush Society recognizes individuals who have made lifetime contributions of between \$100,000 and \$999,999.

### ★ Vannevar Bush



Anonymous (3)  
 Bruce and Betty Alberts  
 Daniel Belin and Kate Ganz  
 Bradley F. Bennett\*  
 Didier and Brigitte Berthelemot  
 Gary P. and Suzann A. Brinson  
 Donald and Linda Brown  
 Richard Buynitzky\*  
 A. James Clark  
 Tom and Anne Cori  
 Jean and Leslie Douglas  
 Bruce Ferguson and Heather Sandiford  
 Stephen and Janelle Fodor  
 Robert and Margaret Hazen  
 Antonia Ax:son Johnson and Goran Ennerfelt  
 Paul A. Johnson\*  
 Paul and Carolyn Kokulis  
 Gerald D. Laubach  
 Lawrence H. Linden  
 John D. Macomber  
 Steven L. McKnight  
 Richard A. and Martha R. Meserve  
 Al and Honey Nashman  
 Vera C. Rubin  
 Leonard Searle\*  
 Christopher and Margaret Stone  
 William and Nancy Turner

## Second Century Society

The Carnegie Institution is now in its second century of supporting scientific research and discovery. The Second Century Society recognizes individuals who have remembered, or intend to remember, the Carnegie Institution in their estate plans and those who have supported the institution through other forms of planned giving.

Anonymous  
 Bradley F. Bennett\*  
 Louis and Lore E. Brown  
 Richard Buynitzky\*  
 Eleanora K. Dalton  
 Nina V. Fedoroff  
 Kirsten H. Gildersleeve  
 Robert and Margaret Hazen  
 Paul A. Johnson\*  
 Paul and Carolyn Kokulis  
 Gilbert and Karen Levin  
 Chester B. and Barbara C. Martin  
 Robert Metcalf  
 Leonard Searle\*  
 Maxine and Daniel Singer  
 John R. Thomas, Ph.D.  
 Hatim A. Tyabji

### \* Deceased

Members were qualified with records we believe to be accurate. If there are any questions, please call Irene Chen at 202.939.1122.

# Honors & Transitions

## Honors

### Trustees/Administration

Trustee and astronomer **Sandra Faber** is the 2011 recipient of the Henry Norris Russell Lectureship of the American Astronomical Society.

Carnegie president **Richard Meserve** was the first recipient of the Vannevar Bush Dean's Medal from Tufts University in April 2011. He was also elected councilor of the National Academy of Engineering in May 2011.

Carnegie president emerita **Maxine Singer** received the Viktor Hamburger Outstanding Educator Prize from the Society for Developmental Biology in August 2010.

### Embryology

Senior technician **Ona Martin** received the Carnegie Service to Science Award in May 2011.

### Plant Biology

Director Emeritus **Winslow Briggs** was elected an Einstein Professor by the Chinese Academy of Sciences in October 2010.

### Terrestrial Magnetism

Staff member **Paul Butler** was named a Fellow of the American Academy of Arts and Sciences in April 2011.

Business manager **Terry Stahl** received the Carnegie Service to Science Award in May 2011.

**Vera Rubin** received an honorary degree from American University in May 2010.

## Transitions

### Trustees/Administration

Senior trustee **Sidney J. Wienberg, Jr.**, died in October 2010.

The Carnegie board of trustees welcomed **Michael G. Wilson** to the board in May 2011.

**Rick Sherman** became Carnegie's chief advancement officer in February 2011.

### Embryology

**Nicholas Ingolia** became a staff member on October 1, 2010.

### Global Ecology

**Anna Michalak** was appointed a staff member June 1, 2011.

### Observatories

Staff member emeritus **Allan Sandage** died November 13, 2010, at his San Gabriel, California, home.

Director Emeritus **Leonard Searle** died July 2, 2010, at his home in California.

**Joshua Simon** became a staff member September 1, 2010.

**Jeffrey Crane** joined the department as a staff associate in April 2010.

### Plant Biology

New staff member **José Dinneny** arrived on June 15, 2011.

### Terrestrial Magnetism

**Matthew Fouch** and **Diana Roman** joined as new staff members on June 27, 2011.



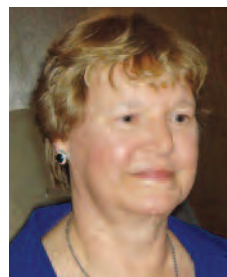
★ Sandra Faber



★ Richard Meserve



★ Maxine Singer



★ Ona Martin



★ Winslow Briggs



★ Paul Butler



★ Terry Stahl



★ Vera Rubin



★ Sidney J. Wienberg, Jr.



★ Michael G. Wilson



★ Rick Sherman



★ Nicholas Ingolia



★ Anna Michalak



★ Allan Sandage



★ Leonard Searle



★ Joshua Simon



★ Jeffrey Crane



★ José Dinneny



★ Matthew Fouch



★ Diana Roman



# Research Highlights



# Embryology

*Deciphering the Complexity of Cellular, Developmental, and Genetic Biology*

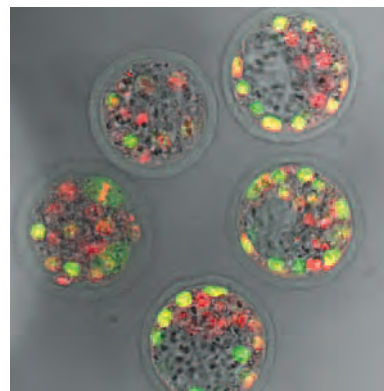


## Tracking Cell Destiny

Egg and sperm beget a single cell that will eventually turn into a multicellular organism with vastly different cells and tissues. This journey begins when the single cell produces two cell “lineages”: the outer cell lineage produces the placenta, and the inner cell lineage gives rise to all the body parts and derives embryonic stem cells (ESCs). How this “lineage specialization” happens has mystified scientists, but understanding this diversion will help to determine how the stem cells are able to turn into different types of tissues, which in turn could help determine how to reprogram adult cells back into stem cells for therapeutic purposes. Carnegie researchers Yixian Zheng and Katie McDole, in collaboration with Pablo Iglesias and Yuan Xiong at the Johns Hopkins Department of Electrical and Computer Engineering, and with the help of Carnegie’s microscopy specialist Mahmud Siddiqi, have developed a new way to track cells in living mouse embryos as they develop. Surprisingly, they found that cells on the outside of the developing, ball-like embryo do not necessarily just turn into the placental lineage, as was previously thought.

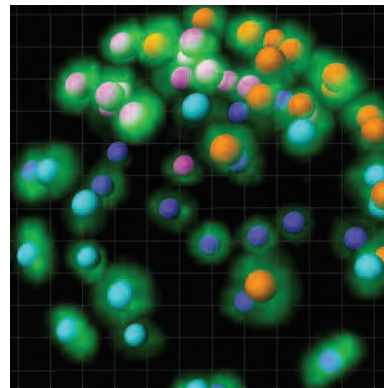
A stumbling block to investigating early developmental decisions arises from the fact that embryos die when

This image shows ball-like, 32-cell-stage blastocyte embryos expressing dual fluorescently tagged proteins. Cells labeled red (mCherry) mark the cells’ nuclei; green-fluorescing (GFP) cells mark cells destined for the outer cell layer.



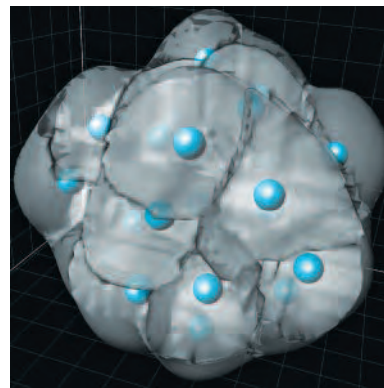
*Image courtesy Katie McDole*

This 3-D reconstruction shows a 64-cell-stage embryo expressing GFP in the cell’s nucleus. Each nucleus is marked with different-colored spots representing each cell “lineage,” starting from the 4-cell stage.



*Image courtesy Katie McDole*

This 3-D reconstruction of an embryo using the program IMARIS has blue spheres marking nuclear position and gray outlines representing the reconstructed surface of the embryo.



*Image courtesy Katie McDole*

## Embryology, *Continued*

exposed to light from a microscope for prolonged periods. Therefore, the team employed a different imaging technique that allows them to observe these lineage specialization events. They tag individual cells with fluorescent proteins to observe cell behavior and view them using two-photon microscopy coupled with sophisticated tracking algorithms.

With regular, one-photon, microscopy, the entire embryo is exposed to a high-energy beam of light. This light is toxic to the embryos and limits the time they can be imaged. In two-photon microscopy, the embryo is only exposed to high-energy light at the point of focus, leaving the rest of the embryo unharmed. In addition, the two-photon method has excellent depth of penetration, producing much better images. Among other surprises, the team discovered a unique population of embryonic cells that expose some of their surface to the outside but retain properties of inner cells and thus contribute to both the placental and embryonic lineages. They also found that the angle at which the cells divide, called cell cleavage, relates to cellular polarity, and described a previously unknown population of cells that change their cell fate through a unique migration event.

### 3-D Movies Advance Stem Cell Biology

To build and maintain a tissue, stem cells coordinate both the production of new cells on site and their migration to the location where they are needed. Understanding such active processes has been hampered by the need to fix, prepare, and stain cells for the microscope. Now Lucy Morris and Allan Spradling have developed a method for imaging stem cells in live tissue in the fruit fly *Drosophila*.

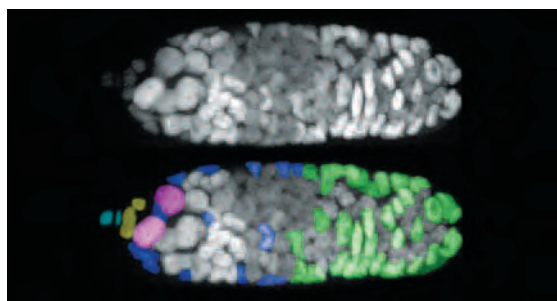
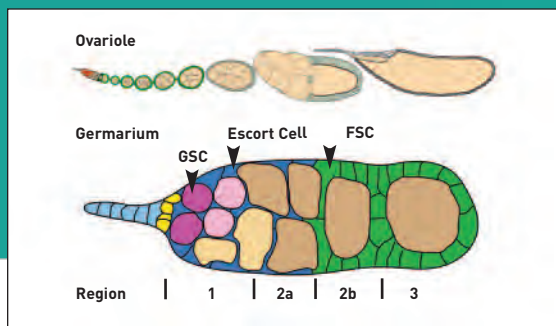


Lucy Morris in the lab

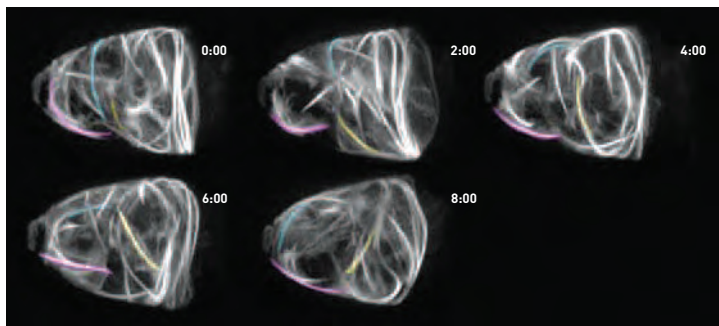
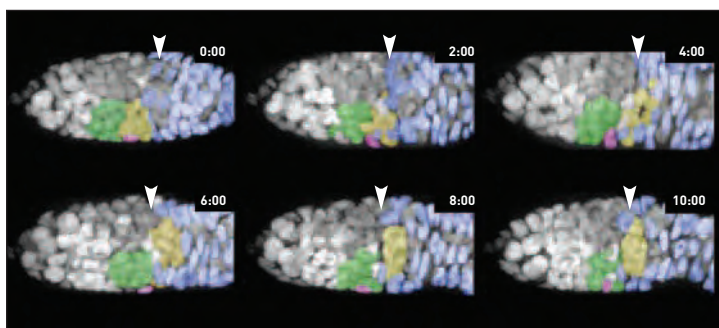
Human stem cells are harder to study than *Drosophila*'s. But studies of *Drosophila* can reveal how human stem cells can be used to treat injury, disease, and aging. This research is beginning to establish how both cell production and migration are regulated.

*Drosophila* ovarian stem cells generate egg precursors, known as follicles, within a small structure known as the germarium, which can be isolated and grown in culture. The germarium contains two types of stem cells: precursors to germ cells that will become the egg, and separate precursors that generate the epithelial cells of the follicle. How the germarium controls stem cells within special zones known as niches and how it orchestrates the movement of germ cell and follicle precursors remained unclear. Thin cells known as escort cells that are especially hard to study microscopically were likely involved. They wrap around early egg precursors from birth until they are packaged by a follicle cell layer.

Morris and Spradling were able to culture living germaria and record three-dimensional movie frames every



This diagram shows the four distinct subregions and the types of cells populating them in the *Drosophila* egg factory called the germarium. The photographs below show the actual cells. Immature egg cells are magenta in the lower one. Escort cells are dark blue and follicle cells are green.



10 minutes for 12 to 14 hours. The scientists used specific fruit fly strains genetically engineered to produce a fluorescent gene product that is observable in the living germarium. The scientists analyzed more than 120 cultures and recorded more than 1,300 hours of movies in all.

These studies helped characterize the follicle stem cell niche, whose origin has remained a major mystery. Previously, it was thought that escort cells are short lived, and move along with each developing egg cell. The movies showed that escort cells remain stationary while the egg assembly line passes by. Two stable escort cells contact follicle cell stem cells and likely serve as niche generators. Epithelial stem cell niches in humans remain poorly

known, but they maintain tissues throughout our bodies, and their dysfunction promotes cancer. Thus, the work provides both new techniques and insights into regulatory mechanisms that ultimately influence our health and life span. □

(Top) The images in this sequence show how a grouping of immature egg cells (yellow) is initially associated with an escort cell (magenta). After 10 hours, the egg cell group migrates to a new location surrounded by follicle cells (blue). Meanwhile, the escort cell stays put and becomes associated with a younger group of immature egg cells (green).

(Bottom) Three escort cells (magenta, yellow, and turquoise) move in an otherworldly swirl of activity. The cells extend a thin membrane of ropelike structures called microtubules that surround the egg cell group. The scientists found that the escort cells do not adhere to and accompany the immature egg cell as it travels to the other end of the germanium, as most researchers believed. Instead, the escorts undergo dramatic shape changes and hand off the developing egg to other escort cells.

# Geophysical Laboratory

*Probing Planetary Interiors, Origins, and Extreme States of Matter*



28

Geophysical Laboratory

## Minerals Love Life

It was not until recently that scientists even thought about how the mineral kingdom may have changed over time. Traditionally classified by composition, structure, and other features, the age of a mineral was usually ignored. That changed in the mid 2000s when Bob Hazen wondered why only 12 minerals existed in our corner of the cosmos before the Solar System formed 4.6 billion years ago and now there are more than 4,500. That sparked his pioneering research into mineral evolution. Surprisingly, he found out that the emergence of early life kindled some two-thirds of today's minerals. The work suggests that looking for specific minerals on other planets and moons could enhance the search for extraterrestrial life.

Hazen and colleagues have identified three eras of mineral evolution—early Solar System formation, when planets started to aggregate; the time when Earth's crust and mantle began to change; and the time when the Earth's surface interacted with biology. These three eras are further subdivided into 10 stages. But it was the Great Oxidation Event, about 2.4 to 2.1 billion years ago, that triggered an explosion of new minerals. That is when photosynthetic microorganisms began their rise, releasing oxygen, with the result that chemical reactions with oxygen

and water at the near surface went wild.

The Big Bang produced just hydrogen, helium, and a smattering of lithium. Other elements formed over millions of years as giant stars produced other elements in their cores. When they exploded as supernovae, the first dozen minerals (mostly diamond, graphite, silicates, and oxides) crystallized. More than 250 different minerals formed in the earliest Solar System as dust and gas accumulated into planetesimals. On Earth, volcanoes, plate tectonics, water-rock interactions, and other geological changes 4.5 to 2.5 billion years ago led to the first continents and some 1,500 new minerals. But the emergence of life almost tripled the mineral population to some 4,000.

Currently, Hazen is looking at the first appearances of minerals containing specific elements. The research shows a notable increase in mineral diversity between 2.8 to 2.5, 2.0 to 1.8, and 0.43 to 0.25 billion years ago—when supercontinents were assembling and mountain building led to mineralization. Hazen recently found that many mercury-related

Bob Hazen conducts fieldwork in Montana.



Image courtesy Margee Hazen



Image used with permission from Ron Miller

minerals first occur in formations dating from about 400 million years ago when the element interacted with organic matter introduced from the rise of the biosphere. These and other findings will be entered into a new Mineral Evolution Database under development, which no doubt will reveal other patterns.

## Bonding Surprise

Understanding earthquakes, volcanoes, plate tectonics, and the evolution of the deep Earth requires determining how the small amount of water in deep materials behaves under high pressures and temperatures. Previous studies have looked at the changes that hydrogen and deuterium (hydrogen with an added neutron) undergo in systems of molecular hydrogen gas and water vapor

(Top) The Great Oxidation Event, which took place 2.4 to 2.1 billion years ago, witnessed an explosion of new minerals as the near Earth surface interacted with oxygen produced by photosynthetic microorganisms and water. Ferrous iron, which is present in black basalt (cooled rock from lava), became oxidized and rusty.

(Bottom) The table at left itemizes the eras, stages, time and number of minerals that have evolved on Earth over the past 4.6 billion years.

**TABLE 1** THREE ERAS AND TEN STAGES OF EARTH'S MINERAL EVOLUTION

Era/Stage	Age [Ga]	Cumulative no. of species
Prenebular "Ur-Minerals"	>4.6	12
<b>Era of Planetary Accretion (&gt;4.55 Ga)</b>		
1. Primary chondrite minerals	>4.56 Ga	60
2. Achondrite and planetesimal alteration	>4.56 to 4.55 Ga	250
<b>Era of Crust and Mantle Reworking (4.55 to 2.5 Ga)</b>		
3. Igneous rock evolution	4.55 to 4.0 Ga	350 to 500*
4. Granite and pegmatite formation	4.0 to 3.5 Ga	1000
5. Plate tectonics	>3.0 Ga	1500
<b>Era of Biologically Mediated Mineralogy (&gt;2.5 Ga to Present)</b>		
6. Anoxic biological world	3.9 to 2.5 Ga	1500
7. Great Oxidation Event	2.5 to 1.9 Ga	>4000
8. Intermediate ocean	1.9 to 1.0 Ga	>4000
9. Snowball Earth events	1.0 to 0.542 Ga	>4000
10. Phanerozoic era of biomineralization	0.542 Ga to present	4400+

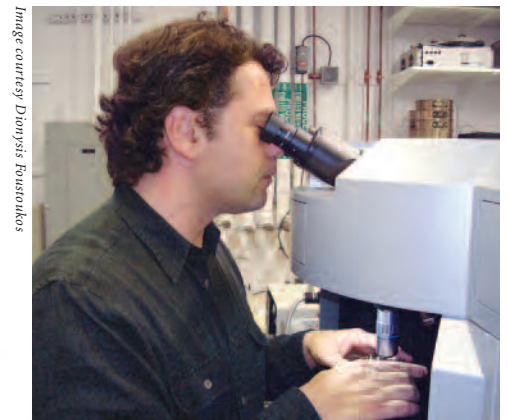
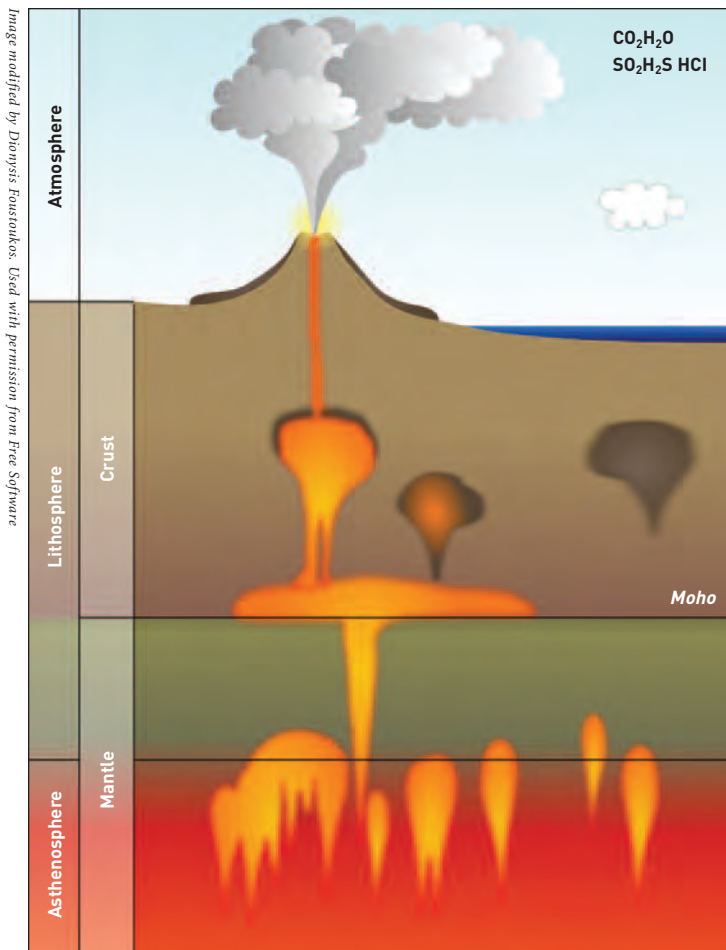
\*Depending on the volatile content of the planet or moon

Image used with permission from Elements

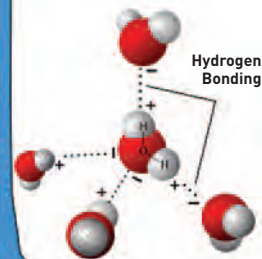
## Geophysical Laboratory, *Continued*

and hydrogen gas and liquid water, but not for molecules in a supercritical fluid—a state of matter in which distinct gas and liquid phases are not found, such as in the deep Earth. Scientists Dionysis Foustoukos and Bjørn Mysen took a new approach to this old question.

As conditions vary in the Earth's interior, water and hydrogen molecules are incorporated in minerals, which greatly affect the chemical and physical properties of rocks and fluids coexisting deep inside the Earth. In particular, losses and gains of water, carbon dioxide, and hydrogen




Dionysis Foustoukos in the lab



Water storage capacity in Earth's interior

The water in the interior affects melting and mantle differentiation processes, and it has a profound effect on the distribution of volatiles—molecules that evaporate easily. Experimental studies addressing the strength of hydrogen bonding between water molecules shed light on the separation of isotopes between solid minerals and hydrous phases.



have significant effects on the evolution of magma—a molten rock mixture high in silica (silicon and oxygen).

The investigators mimicked lower-crust and upper-mantle conditions in the lab and analyzed different molecules using novel vibrational analysis techniques called Raman spectroscopy. They unexpectedly found that the hydrogen and deuterium systems underwent very different changes at high temperatures, which defies theory.

The researchers reacted solutions of normal water ( $H_2O$ ) and so-called heavy water ( $D_2O$ ) with titanium oxide to form molecules of hydrogen  $H_2$ , deuterium  $D_2$ , hydrogen and deuterium HD, and hydrogen, deuterium, and oxygen HDO. These are components that control the evolution of some mantle materials, such as methane. The scientists subjected the molecules to temperatures ranging from 570°F to 1470°F (300°C-800°C) under pressures from about 3,000 to 13,000 times atmospheric pressure (3-13 kilobars). The unexpected happened within the 1100°F to 1400°F (600°C-800°C) range. Theory suggests that hydrogen and deuterium would have the same energy-exchange reactions and behave similarly at these conditions. But instead, the stable isotope distribution of hydrogen in the  $H_2O$ - $H_2$  and  $D_2O$ - $D_2$  systems differed greatly, meaning that hydrogen and deuterium would evolve differently in Earth's interior.

The researchers believe this result arises from surprising differences in hydrogen-bonding interactions of hydrogen versus deuterium in the fluid—information critical to mantle-water evolution models.

## Harnessing Time

At first glance, materials science, environmental and planetary science, and defense and energy technologies

seem to have little in common. But innovations in all these fields come from extreme temperature and pressure research. Now Alexander Goncharov and colleagues are taking their investigations of extreme states of matter to a higher level.

Traditionally, extreme pressure/temperature studies involve squeezing a small sample of matter between two diamond tips in a diamond anvil cell, then measuring the changes in structure, atomic behavior, electron movement, and other properties under different conditions. Over the decades, new materials have been created by this technique, and fundamental physical properties have been discovered. But until recently researchers have been unable to study material behavior over very short periods—billionths of a second and even shorter. These short snapshots are important for understanding materials as they transition from solids to liquids and gases, undergo fast chemical reactions, and engage in other activities.

These time limitations are now disappearing. Conventional so-called static compression methods involve a continuous heat source, often a laser, which bakes a sample in a traditional manner. Goncharov and team are exploring new dynamic methods, which use pulsed lasers to repeatedly heat and compress materials and examine them over very short intervals. Pulsed heating has several advantages: it can reach temperatures many times that of the old method, the short duration overcomes the problems of samples spreading out and inducing unwanted chemical reactions, and the dynamics of the processes can be investigated. It also happens to use much less power.

Carnegie leads new developments of ultrafast X-ray diffraction and imaging at the Advanced Photon Source in collaboration with the Carnegie-led High Pressure Collaborative Access Team (HPCAT) and the GeoSoil-



## Geophysical Laboratory, *Continued*

Enviro Center for Advanced Radiation Sources (GSE-CARS). Recently, the Carnegie and Lawrence Livermore National Laboratory team used the new techniques to cold-compress hydrogen on an ultrafast timescale. At Carnegie's Washington campus, a suite of new optical instruments has been developed for ultrafast optical spectroscopy, imaging,

and heat-flow measurements.

These advances will enhance understanding of unusual states, such as superconductivity. Studying electromagnetic and thermomechanical extremes will contribute to future fusion power, better steam turbines and jet engines, and fuel-efficient vehicles, among other applications. The short

sampling intervals will also allow researchers to mimic chemical changes that come from meteoritic impacts on planetary surfaces, and the more extreme temperatures will better approximate conditions of planetary interiors, thereby enabling the study of their evolution. □

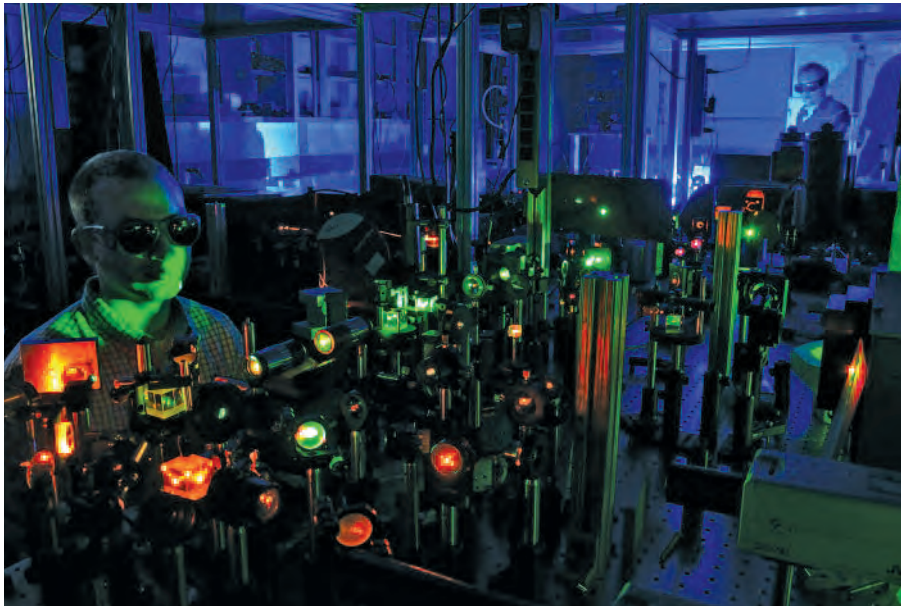


Image courtesy Alexander Goncharov

(Top) Members of the dynamic laser team include Goncharov postdoctoral associates D. Allen Dalton at left working with a supercontinuum laser beam. On the right in the back is R. Stewart McWilliams. He is working with a Raman system.

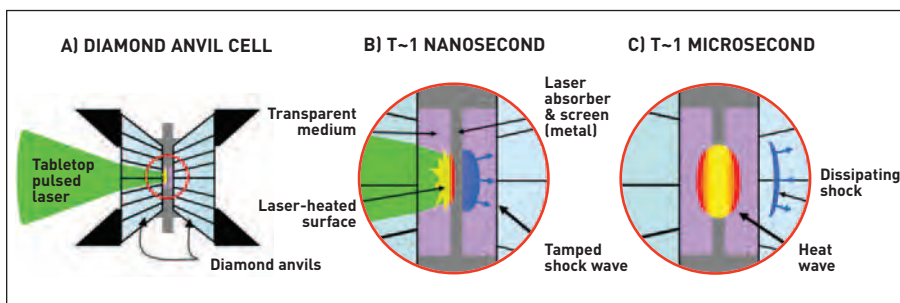


Image courtesy Alexander Goncharov

(Bottom) Diagrams show a schematic of the laser-driven dynamic experiments in a diamond anvil cell. At left is the diamond anvil cell and the laser source. The middle image shows how the initial heating produces a shock wave in about one nanosecond. The right image shows how the heat wave propagates in about one microsecond.

# Global Ecology

## *Linking Ecosystem Processes with Large-scale Impacts*

### Solving the Carbon Conundrum

There is a carbon conundrum. Plants take up carbon dioxide ( $\text{CO}_2$ ) in photosynthesis—the conversion of the gas and sunlight into food, water, and oxygen—while it is simultaneously being released as plants respire, or “exhale.” So researchers cannot easily tell the net effect.

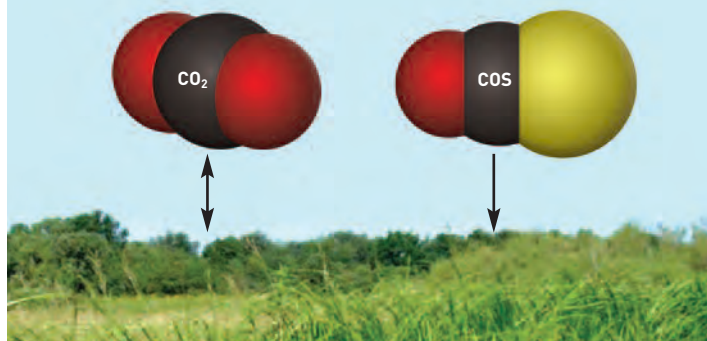
Without accurate measurements, it is not possible to determine how much carbon dioxide comes from different emitters. Joe Berry and colleagues found that they can solve this problem by analyzing the trace gas carbonyl sulfide (COS). They discovered that it is taken up by plants in tandem with  $\text{CO}_2$ , but it is not emitted by them. The dynamics of this gas uptake, therefore, reflect photosynthesis, not respiration, allowing the two processes to be separated.

Understanding the photosynthesis-climate feedback is key to deciphering how climate change may affect the natural processes that provide a sink for human-made carbon emissions. Carbonyl sulfide is made at the ocean surface by microbes and circulated to the atmosphere at levels roughly a million times lower than  $\text{CO}_2$ .

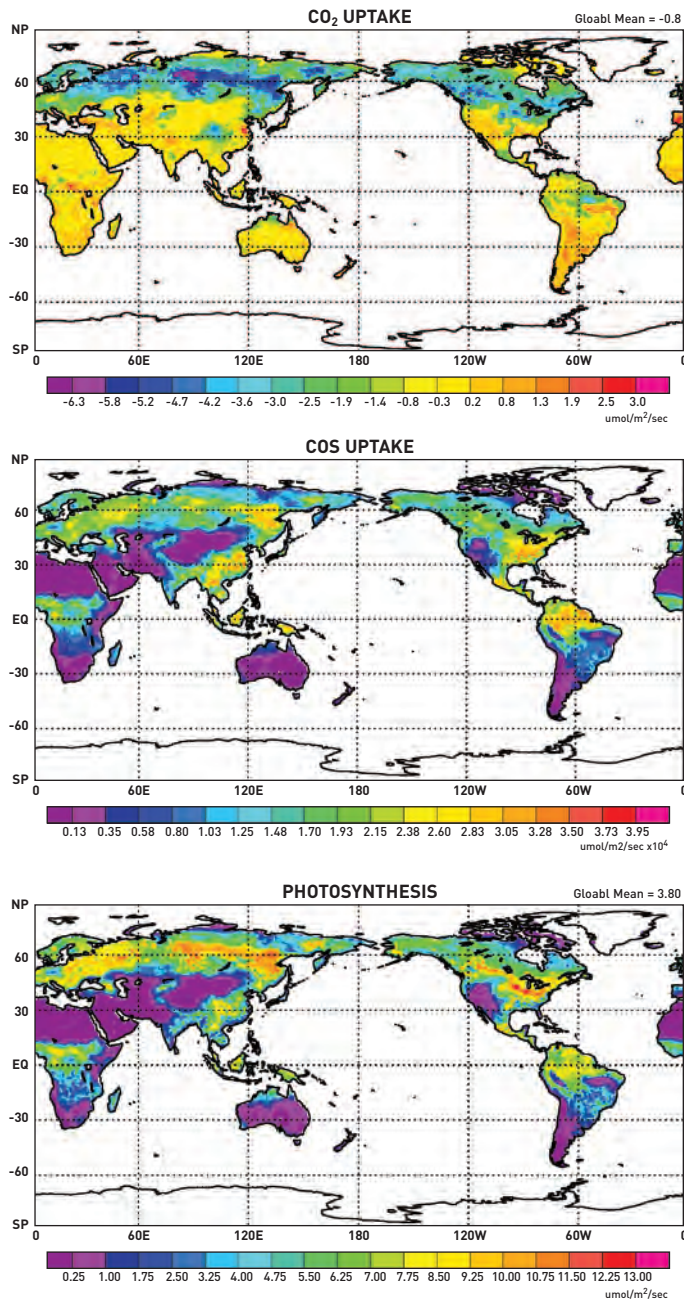
Berry and colleagues from the Weizmann Institute in Israel, U.C. Merced, and Colorado State University have been conducting studies of the kinetics of COS uptake by leaves and have used this information to include COS uptake in a global-scale carbon-cycle model. The team proposes that measurements of COS and net  $\text{CO}_2$  uptake, used together, can separate photosynthesis and respiration. To test the hypothesis, the researchers will use an archive of more than 25,000 atmospheric measurements of COS and  $\text{CO}_2$  concentration at various locations, collected by researchers at NOAA.

The outcome of this study—that a reverse analysis of the atmospheric carbonyl sulfide measurements may be used to quantify the carbon released during plant respiration—fills the essential piece that has been missing in carbon-cycle research for years.

Carbonyl sulfide (COS) in the atmosphere is taken up by terrestrial ecosystems in parallel with carbon dioxide ( $\text{CO}_2$ ) during photosynthesis. But, unlike  $\text{CO}_2$ , there is no release of COS associated with respiration, “exhaling.” Therefore, changes in the concentration of COS reflect photosynthesis, whereas changes in  $\text{CO}_2$  reflect both respiration and photosynthesis.



## Global Ecology, Continued



(Top) Image shows simulated net CO<sub>2</sub> uptake by the terrestrial biosphere for the month of July. The modeled net CO<sub>2</sub> shows highly productive areas in the tropics (yellow through orange) with near zero net CO<sub>2</sub> exchange similar to deserts. We get this result because we can only see the difference between photosynthesis and respiration. Strong uptake of CO<sub>2</sub> occurs in temperate ecosystems (yellow through orange) because photosynthesis exceeds respiration in this month.

(Center and bottom) Images show that COS uptake has a very similar pattern to photosynthesis. Note that the pattern of COS uptake, which can be measured, is similar to that of photosynthetic uptake of CO<sub>2</sub>, which cannot be measured because of interference from respiration. Purple is the lowest level and orange is the highest.

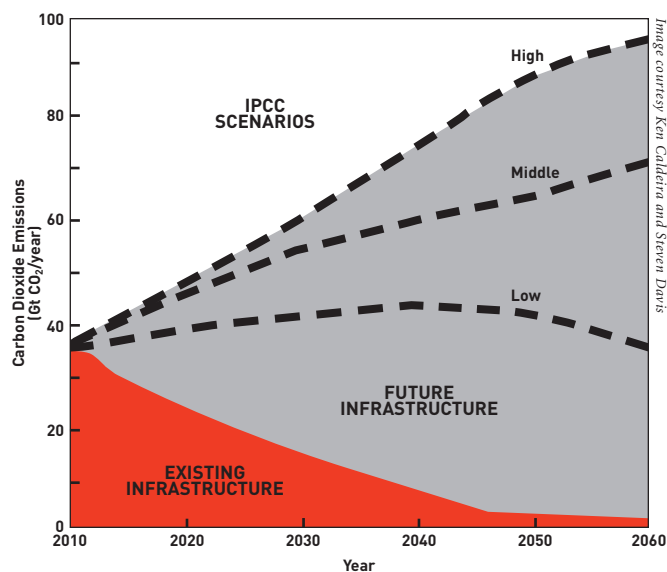
## Shifting to Low-Carbon Energy

Global Ecology's Ken Caldeira believes we need to get started on building the next generation of clean energy technologies now if we want to avoid the worst potential effects of climate change caused by greenhouse gases in the atmosphere. Caldeira and Steven Davis, along with former Carnegie postdoc Damon Matthews, asked, what if we never built another CO<sub>2</sub>-emitting device, but let the existing technology live out its life span?

They calculated the amount of carbon dioxide expected to be released from existing energy and transportation infrastructure around the world. They used this information to create a model that projects the impact of this infrastructure, if it is unchanged—including power plants, cars, trucks, manufacturing, and waste management—on the Earth's atmosphere going forward to 2060.

Energy infrastructure—such as this power station—as well as cars, trucks, manufacturing, waste management, and other sources of pollution, would release about 500 billion tons of carbon dioxide into the atmosphere between 2010 and 2060.

The photograph was taken by Petr Kratochvíl and provided by PublicDomainPictures.net.



This graph compares the projected decline of carbon dioxide emissions in gigatons (billions of tons) from existing energy and transportation infrastructure (red wedge) over the next 50 years in three different emissions scenarios (dotted lines) from the Special Report on Emissions Scenarios (SRES) Intergovernmental Panel on Climate Change (IPCC). The high, middle, and low emissions projections correspond to the SRES A1G-FI, A2, and B1 scenarios, respectively.

They found that between 2010 and 2060 this infrastructure would release about 500 billion tons of carbon dioxide into the atmosphere. The resulting increase in global mean temperature would be less than 1.3 degrees Celsius (2.34°F). Their work was published in *Science* in September 2010.

If we don't change direction, we will build many more energy and transportation devices in the future. This would lead to an increased impact on Earth's climate. Therefore, to avoid even worse projections for the future of our atmosphere, the research team emphasizes the importance

of constructing energy infrastructure and transportation methods that have low carbon emissions now. The greatest risks can be avoided if we start now, according to Caldeira.

The infrastructure overhaul needs to take into account structures that don't directly emit carbon dioxide but do contribute to the inertia of the existing system. For example, the existing network of gas stations around the country makes gasoline-powered vehicles more attractive to consumers than electric vehicles, which have a comparative paucity of recharging infrastructure. □

# Observatories

*Investigating the Birth, Structure, and Fate of the Universe*



36

Observatories

## Three Cheers for FourStar!

A new, wide-field near-infrared (IR) camera named FourStar saw “first light,” in December of 2010, on the Magellan Baade 6.5-meter telescope. Near IR radiation, with wavelengths longer than those of visible light, can be detected from some of the most distant objects in the universe. To see distant galaxies, astronomers often use space-based IR instruments because space is above the moisture, emission, and turbulence of Earth’s atmosphere. Now, Eric Persson and his team have designed and built the ground-based FourStar—a highly accurate, unique infrared camera that can see as far back as 2 billion years after the Big Bang. It will address questions about galaxy and cluster evolution for galaxies at intermediate and great distances, and much more. FourStar’s unique design is the brainchild of a team of astronomers and engineers. Persson is the principal investigator and Steve Shectman is the architect of the optics, as they were for a

prototype IR camera called PANIC. FourStar’s field of view is 10.9 x 10.9 arc minutes—about 25 times larger than PANIC’s. (For comparison, the Moon’s diameter is about 30 arc minutes.) The wavelength range of IR cameras are designated by letters. FourStar covers 1 to 2.5 microns in the *J*, *H*, and *K* bands.

Persson is particularly interested in using FourStar to understand the era from 2 billion to 5 billion years after the Big Bang. During this time, the first galaxies had stopped forming stars, there is ample evidence of galaxy evolution, and galaxy clusters started to form. It is difficult to study the very faint objects of this era using ordinary techniques. So the team split the *J* and *H* bands into subsets—the *J* band into three and the *H* band into two. By increasing the bands from 2 to 5, the researchers obtain more samples, which refines the data for better spectral resolution.



*Image courtesy Frank Perze*

(Far left) Andy Monson (left), principal investigator Eric Persson (middle), and Randy Hammond (right) stand with the FourStar camera mounted on the Magellan Baade telescope.

(Top right) Eric Persson sits in front of the monitor that shows the first galaxy imaged by FourStar in December 2010.



Image courtesy: Alan Uomoto

(Bottom right) The two circles on this image of the sky encompass two galaxy groupings in a probable cluster forming 3 billion years after the Big Bang. The display colors were adjusted to pick out intrinsically redder galaxies using the band-splitting technique that the team developed. The red colors and tendency to appear in tight groupings are the telltale signs of a distant cluster.

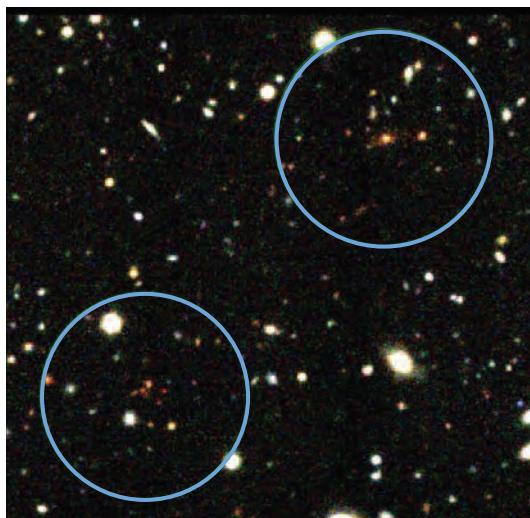


Image courtesy: Ivo Labbé

Accurate measurements, obtained over exposures of several hours in each band, are analyzed to yield the distances to very distant galaxies and clusters as well as the type and age of galaxies. Instead of measuring one or a few galaxies at a time, FourStar can measure 10,000 at a time.

Over the next two years the FourStar Galaxy Evolution Survey (Z-FOURGE), a collaboration of astronomers from five institutions led by former postdoctoral associate Ivo Labbé, now at the University of Leiden, with Hubble Fellow Janice Lee and her team, will establish a benchmark of galaxy characteristics by measuring some 30,000 galaxies from that era.

## Scrutinizing Supernovae

Certain two-star systems end their lives as gigantic thermonuclear explosions called supernovae, which remain exceedingly bright for some weeks. The extreme brightness of Type Ia supernovae makes them attractive for astronomers to determine distances in the universe, making them so-called standard candles. By measuring a number of these objects over a decade ago, Mark Phillips and the High-z Supernova Search Team discovered that the

universe is expanding at an accelerating rate—a fact that is the foundation for the notion of dark energy, which makes up some 70% of the energy density of the universe. Although the brightness of these objects is very similar, there are some differences. Phillips and collabora-

Observatories, *Continued**Image courtesy Mark Phillips**Image courtesy Mark Phillips*

These are composite optical images. The left image shows a supernova above and to the left of the nucleus. The right image was taken a year later when the supernova had faded from sight.

tors are calibrating the differences to ensure there are no distortions to the dark energy measurements in a project that expands on the Carnegie Supernova Project, which sampled some 200 supernovae.

One of the biggest difficulties in observing Type Ia supernovae is correcting for obscuring dust. Near-infrared light is able to penetrate the dust. Using the modern near-infrared instrumentation available at the Las Campanas Observatory, including the new FourStar near-infrared camera that came online in December 2010, Phillips and team are scrutinizing supernovae at a new level of detail.

Previous work showed that Type Ia supernovae come from at least two different populations. Those whose light slowly declines are more likely to occur in spiral and irregular galaxies, whereas faster-declining objects tend to occur in older elliptical and so-called SO galaxies. The team is addressing whether all Type Ia supernovae explode in the same way, how differences in the age and chemical composition of the progenitor stars affect their brightness, and how much of the color differences are intrinsic or due to dust. All of these can affect the luminosity—the underpinning of distance measurements.

The new project will obtain both near-infrared and optical light measurements of 100 to 200 Type Ia supernovae at distances of 0.4 to 1.0 billion light-years—near enough to study the supernovae in detail, but far enough to give an independent estimate of their relative distances. This will allow Phillips and his team to quantify the nature of such effects on the luminosities of Type Ia supernovae, an important next step in understanding the nature of dark energy. □



*Image courtesy Mark Phillips*



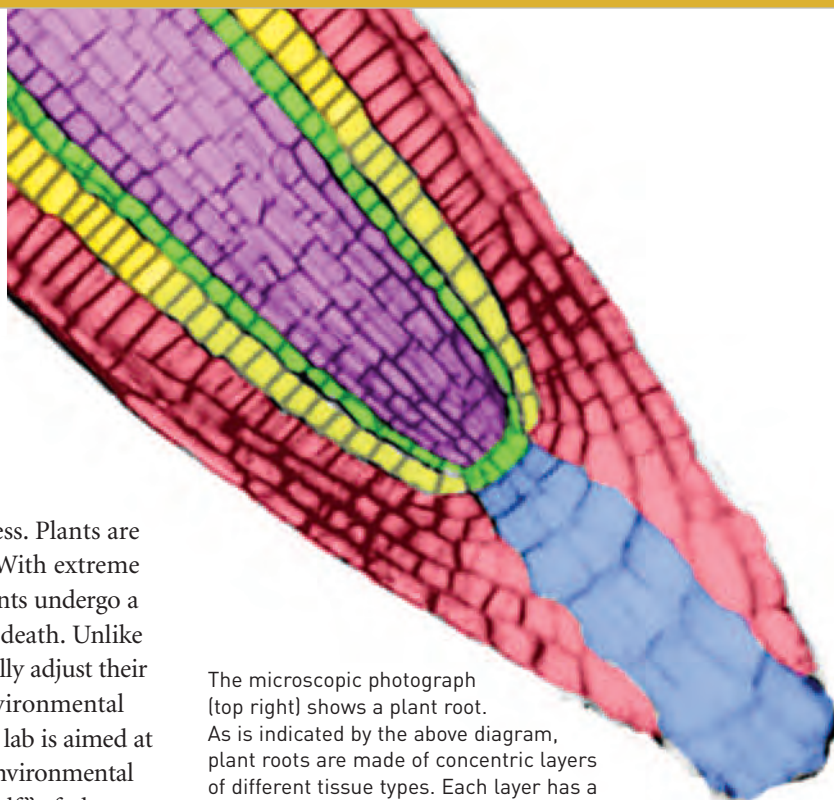
(Top) The yellow bar indicates Supernova 2006X, one of the Type Ia supernova measured in the Carnegie Supernova Project.

(Bottom) Mark Phillips is the associate director of Carnegie's Las Campanas Observatory.



# Plant Biology

*Characterizing the Genes of Plant Growth and Development*



## Stressed-Out Plants

People are not the only ones who suffer stress. Plants are highly sensitive to environmental changes. With extreme changes, such as drought or high salinity, plants undergo a stress response to prevent further injury or death. Unlike animals that can move, plants must continually adjust their growth and development to adapt to an environmental change. Research in the new José R. Dinneny lab is aimed at understanding the developmental basis for environmental responses of the root system—the “hidden half” of plants. Most recently, the researchers have identified a gene involved in sensing water availability, which could be a key step toward engineering plants to withstand drought.

Plant roots are composed of concentric layers of different tissue types. Each layer has a different function in absorbing the water and nutrients necessary to support the growth of the aboveground shoot. During his postdoctoral fellowship at Duke University, Dinneny discovered that each tissue layer plays a distinct role in response to stresses, such as high salinity and iron-nutrient deprivation. One key question the Dinneny lab is currently addressing is how each tissue layer of the root generates unique responses to the same stimulus. They are trying to understand how genes, which control acclimation,

The microscopic photograph (top right) shows a plant root. As is indicated by the above diagram, plant roots are made of concentric layers of different tissue types. Each layer has a different function in absorbing the water and nutrients necessary to support the growth of the aboveground shoot. For example, the endodermis (green) acts as a selective barrier limiting the types of materials that can enter the vasculature system (purple)—the tissues that circulate water. The root tip senses gravity in guiding the root downward.

are activated differently in different tissues.

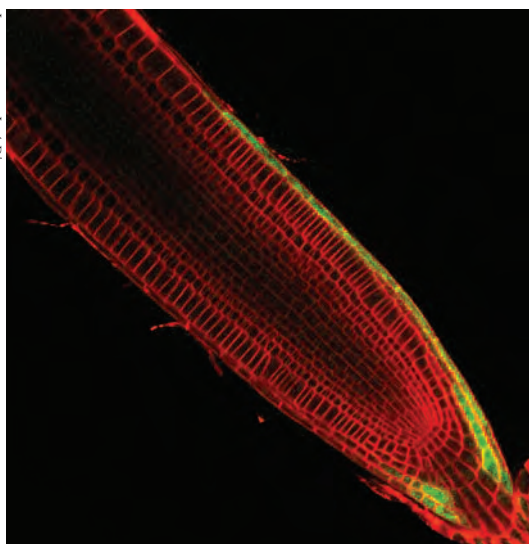
A new area of research in the lab is focused on understanding how plants are able to sense the presence of water in the soil. The ability of plants to grow toward soil with higher relative moisture has been known since the time of Darwin, yet the mechanism involved in guiding the root has remained a mystery.

The Dinneny lab recently identified a gene, *NCED2*, involved in the biosynthesis of the stress hormone abscisic acid. This gene has the unique property of being activated in cells of the root directly contacting liquid and suppressed in cells contacting air. Current studies are investigating the role of hormone-signaling gradients in regulating the growth and tissue patterning of the root. This work will lead to an understanding of how cells are able to perceive differences in moisture content and how these pathways differ in plants adapted to arid environments.

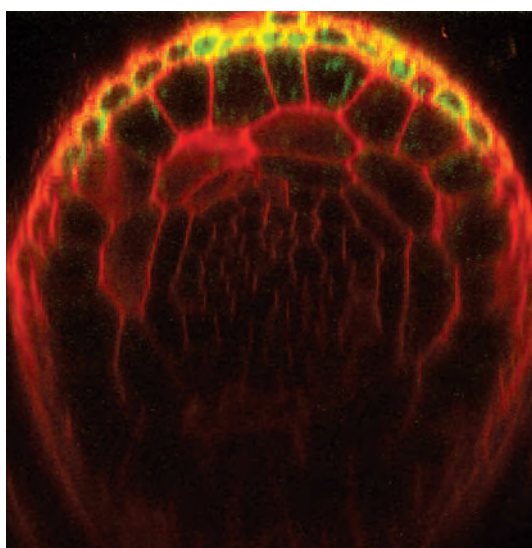
## Improving Plants, Increasing Food

When photosynthesis first evolved, the atmosphere contained much more carbon dioxide and much less oxygen than it does today. As a result, the photosynthetic machinery of many organisms may not be completely optimized for today's environment. Plant Biology's Martin Jonikas is working to understand, and eventually increase, photosynthetic efficiency.

The protein responsible for fixing carbon dioxide—called Rubisco—worked very well in the Earth's early atmosphere. 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



Images courtesy José Dinneny



Images courtesy José Dinneny

(Top) The green fluorescence tag on this root structure shows where the gene *NCED2* has been turned on. The lab discovered that the gene marks which side is drier and thereby indicates the ability of the root to perceive local differences in the environment. More green marks the driest side (top).

(Bottom) This cross section of a root shows where the gene *NCED2* has been turned on to indicate the driest side (green at top).

## Plant Biology, *Continued*

low concentrations of carbon present in today's atmosphere, Rubisco functions extremely slowly and often costs plants metabolic energy when it mistakenly fixes oxygen instead of carbon dioxide. However, Rubisco is such a central component of the photosynthetic metabolism that it cannot be removed or replaced, in spite of its inefficiency.

In March 2011, Martin Jonikas and three U.K. collaborators received one of four grants from the U.S. National Science Foundation and the U.K. Biotechnology and Biological Sciences Research Council to fund research on increasing photosynthetic efficiency.

Jonikas and his colleagues are studying a special mechanism by which the unicellular green alga *Chlamydomonas* is able to increase the concentration of carbon dioxide in proximity to Rubisco, thus dramatically improving its performance and improving the overall efficiency of photosynthesis.

The growth rate of several major crop plants, including wheat and rice, is often limited by their slowness in assimilating carbon from the atmosphere. If Jonikas and his colleagues can transfer the green algal carbon dioxide-concentrating ability to these crops, then they might improve food production around the world. □

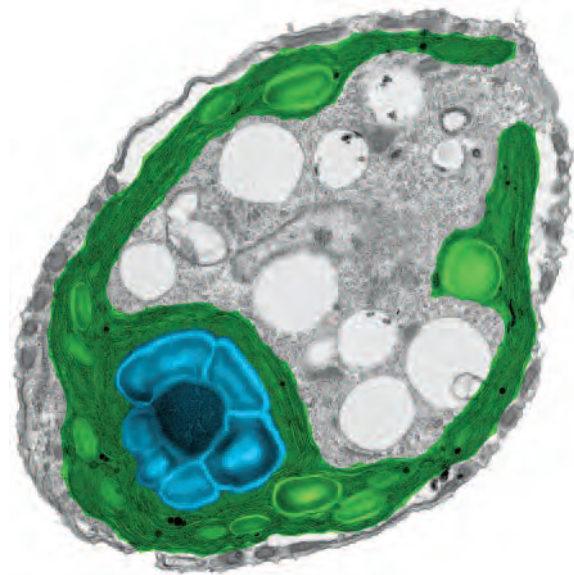


Image courtesy Moritz Meyer

This electron microscopy of the green alga *Chlamydomonas* reveals a ball-shaped structure within the cell, called the pyrenoid (shaded in blue), which helps these algae assimilate carbon to improve their photosynthetic efficiency. The pyrenoid sits in the middle of the chloroplast (shaded in green). Jonikas and his collaborators will characterize the pyrenoid and associated components, and aim to transfer them to higher plants in an effort to improve their photosynthetic efficiency.



Members of the Jonikas lab are (left to right) Weronika Patena, Spencer Gang, Ute Armbruster, Ru Zhang, Mia Terashima, and Martin Jonikas. Not pictured are Leif Pallesen and Sean Blum.

# Terrestrial Magnetism

*Understanding Earth, Other Planets, and Their Place in the Cosmos*

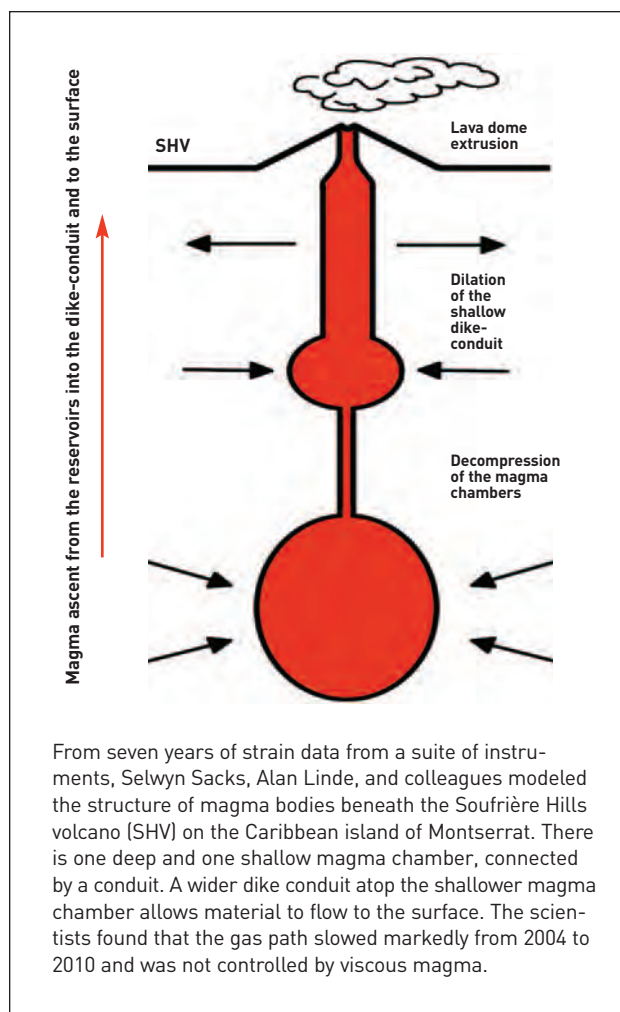
## What Sparks Volcanoes?

Understanding the chain of events that lead to volcanic eruptions will help scientists understand volcanic structure and perhaps lead to eruption prediction. For some years, Selwyn Sacks and Alan Linde have been studying volcanic activity. Recently, Diana Roman joined the staff to boost these investigations. She studies relationships among magma flow, seismicity, local stresses, and more.

Linde, Sacks, and colleagues have been studying changes in the Soufrière Hills volcano on the Caribbean island of Montserrat since 2003. The team uses Sacks-Evertson strainmeters, codeveloped by Sacks, to measure tiny levels of deformation within the Earth. The instruments are buried in four 670-foot-deep boreholes 3.3 to 5.7 miles (5.3 to 9.2 kilometers) from the volcanic crater.

In 2003 there was a major dome collapse with subsequent explosions affecting the conduit—the pipe through which magma ascends over the uppermost mile to the surface. Strainmeter data showed that a shallow reservoir (about 3 miles, or 5 kilometers deep) had experienced increased pressure. An explosion in March 2004 required an additional pressure source, associated with gas entering a shallow dike from the magma chamber before breaking out at the surface. Later data also revealed the existence of a deeper (about 7 miles, or 11 kilometers)

reservoir. The researchers determined that the upper chamber and dike had been active since 2004, and that a connection between the deep and shallower magma chambers had developed by 2008.



From seven years of strain data from a suite of instruments, Selwyn Sacks, Alan Linde, and colleagues modeled the structure of magma bodies beneath the Soufrière Hills volcano (SHV) on the Caribbean island of Montserrat. There is one deep and one shallow magma chamber, connected by a conduit. A wider dike conduit atop the shallower magma chamber allows material to flow to the surface. The scientists found that the gas path slowed markedly from 2004 to 2010 and was not controlled by viscous magma.

*Image courtesy Selwyn Sacks*

## Terrestrial Magnetism, *Continued*



Image courtesy: Diana Roman

Diana Roman deploys a broadband seismometer at Crater Lake volcano, Oregon, in June 2008.

Diana Roman also seeks to understand volcanic systems by analyzing minute amounts of deformation deep in the Earth. By examining the pattern of rock breakage encoded in microearthquakes beneath restless volcanoes, she looks for pressurizing batches of magma weeks to months before they reach the surface. Currently, she and her team are analyzing data from approximately a dozen active volcanoes in the United States, Nicaragua, New Zealand, and Iceland.

### What Makes the High Lava Plains So Hot?

Volcanoes tend to concentrate along the boundaries of tectonic plates and in oceanic regions with particularly high rates of volcanic outflows, or “hotspots,” such as Hawaii. But in some instances notable volcanic activity occurs within a stable continental plate. Scientists have



Image courtesy John West, Arizona State University

(Top right) Matt Fouch (standing on right), Steven Golden (DTM's field seismologist, kneeling), and David James (with vest), along with Arizona State University students Shaji Nair (left) and Jeff Roth, confer in a strategy session in the midst of a station installation on the High Lava Plains of eastern Oregon.

(Bottom right) This shaded topographic map of the northwestern U.S. shows locations of broadband seismic stations used for this study. Small squares indicate High Lava Plains stations, white triangles denote EarthScope Transportable Array stations, and circles denote other regional broadband stations.

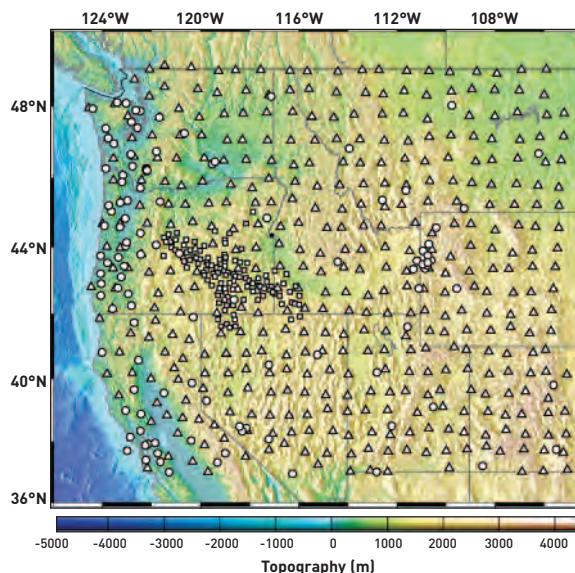


Image courtesy Matt Fouch and David James

been puzzled by the processes governing this “intraplate” volcanism. Rarely, these intraplate volcanoes involve huge outpourings of lava to form rocks called flood basalts, which are commonly attributed to a plume of magma upwelling from the deep mantle. It is thus not surprising that geologists have favored a mantle-plume model to explain the great volumes of flood basalts and later volcanic eruptions that have blanketed the U.S. Pacific Northwest east of the Cascades over the past 17 million years. New research from the multidisciplinary High Lava Plains (HLP) Project led by DTM scientists, however, suggests an alternative interpretation based on a complex history of the oceanic Juan de Fuca plate as it “subducted,” or descended beneath, the Pacific margin of the North American plate.

The research area includes the High Lava Plains of central and eastern Oregon and the Snake River Plain/Yellowstone region. The HLP seismological team, led by coprincipal investigators David James and newly arrived staff member Matthew Fouch, with a team of colleagues and students from the department and other institutions,

deployed broadband seismic instruments at 118 stations in the region over three years in one of the largest seismic experiments ever of its kind. Rick Carlson leads the overall multidisciplinary effort.

With the HLP data, augmented by data from EarthScope USArray stations, the team obtained high-resolution seis-

## Terrestrial Magnetism, *Continued*

mic images of the mantle beneath the region. Surprisingly, these images do not show a deep mantle plume, but reveal that the Juan de Fuca slab has been extensively broken or fragmented, with a far-eastward fragment of oceanic slab adrift in the mantle 250 to 370 miles (400 to 600 kilometers) under the Snake River Plain/Yellowstone hotspot. These structures suggest that slab-generated magma upwelling could produce the plumelike hotspot without involving a deep mantle plume.

The team also took a closer look at the Steens Mountain and Columbia River flood basalts, which erupted 17 million years ago, and suggest that these eruptions may have been caused by slab disruption about 20 million years ago with a subsequent reinitiation of a new subduction cycle when the Juan de Fuca plate began anew its descent beneath North America. □

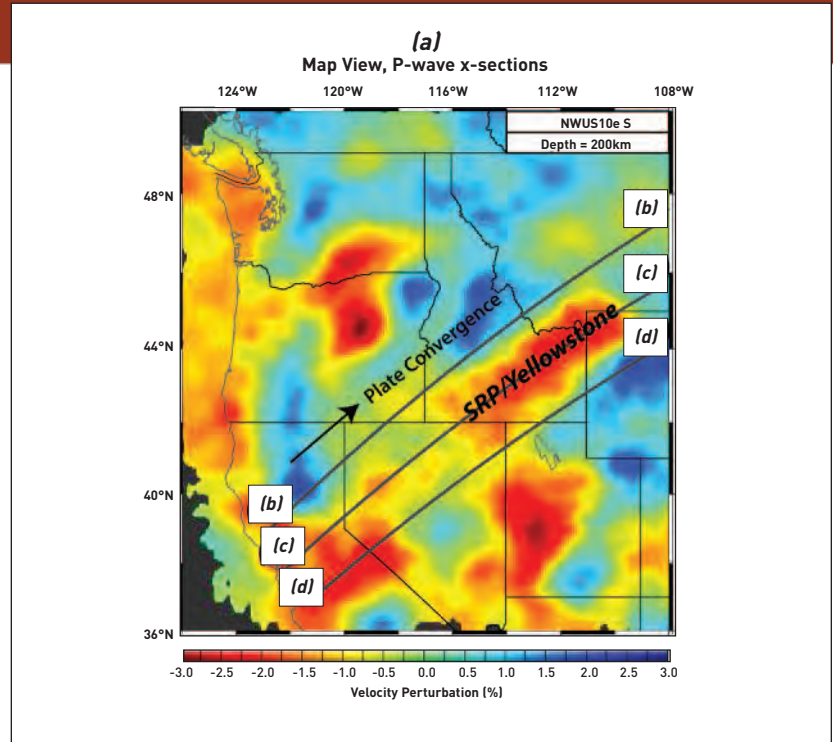


Image courtesy David James and Matt Fouch

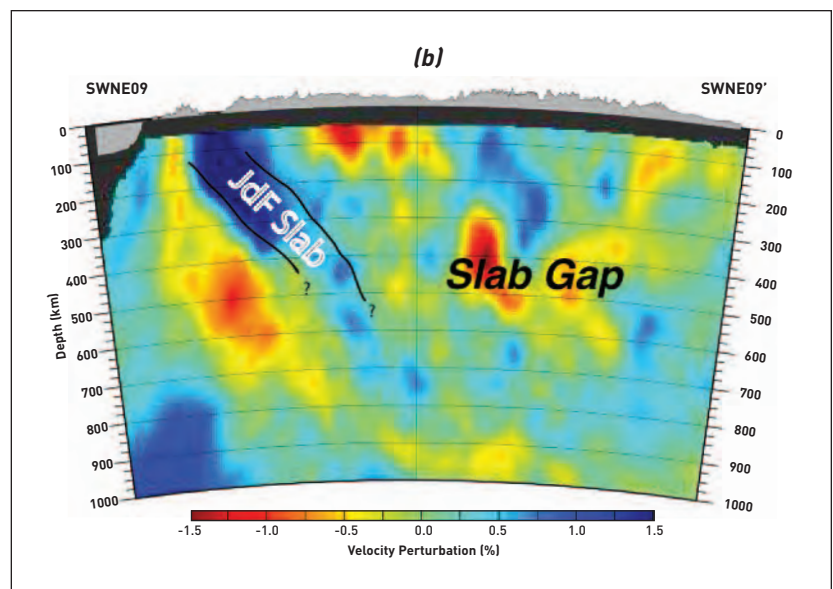
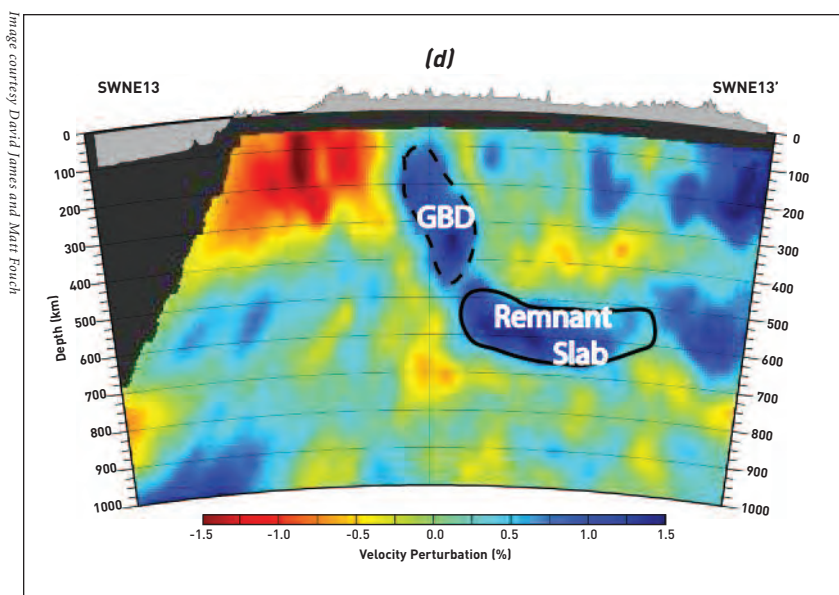
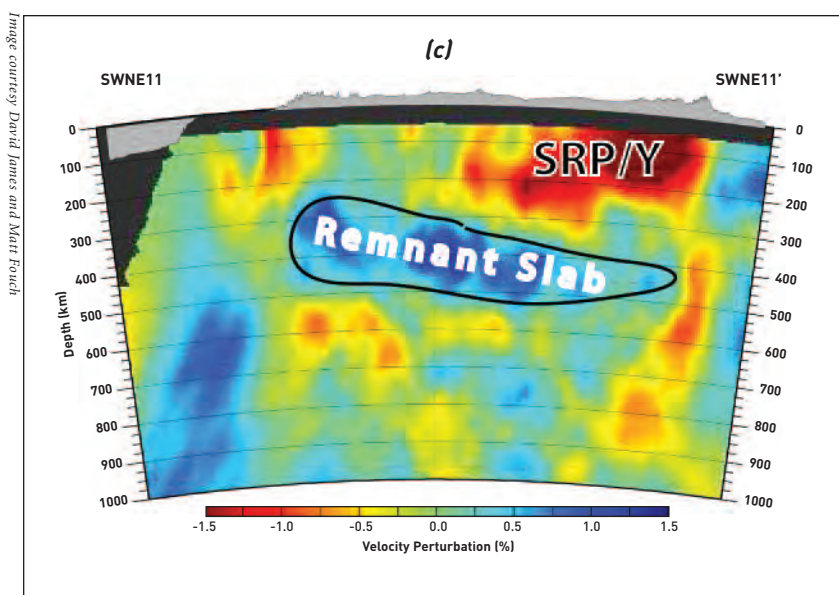


Image courtesy David James and Matt Fouch



This series of cross sections of tomographic seismic images begins with a top-down view of the study area at about 125 miles (200 kilometers) in depth (panel a). This map view provides a key to the surface traces of the vertical cross sections shown in the other three images (b, c, and d), which are aligned with the direction of convergence of the North American and Juan de Fuca plates. Red areas in all of these images indicate low seismic velocities indicative of high temperatures, and blue indicates higher velocities and lower temperatures. Image (b) shows the normal descent (subduction) of the cold Juan de Fuca (JdF) slab, with a slab gap to the east. The key image is that shown in panel (c), a vertical cross section oriented directly along the axis of the Snake River Plain/Yellowstone hotspot track. Panel (c) reveals a very gently northeast-dipping (subhorizontal) remnant of a slab of the now-subducted Farallon plate adrift in the mantle transition zone. Its leading edge is just beneath Yellowstone. Panel (d) shows the southern continuation of the remnant slab as well as part of the Great Basin Drip (labeled GBD) — a column of cold lithospheric material descending into the mantle like dripping honey.



# First Light & The Carnegie Academy

*Teaching the Art of Teaching Science and Math*



48

*First Light & The Carnegie Academy for Science Education*

## From Local Teachers to Other Planets

It was a big year for the MESSENGER Mission to Mercury, and likewise it was a big year for the MESSENGER Education and Public Outreach team. Their hallmark program, MESSENGER Education Fellows, had six participants attend the probe's orbit insertion event in March and five attend the mission's Science Team meeting in May. The program provides educational materials and background for educators to lead workshops back in their communities to help local teachers improve their curriculum about space in general and the mission itself. The team leader, Carnegie's Julie Edmonds, estimates that by the end of the MESSENGER mission, the program will have trained 20,000 teachers and reached over a million students.

The team also conducted a multisite workshop for 140 educators in May, allowing teachers to get face-to-face time with scientists, including Carnegie's Sean Solomon, who is MESSENGER's principal investigator, at four different locations as well as via NASA's Digital Learning Network. Public events included a table of MESSENGER scientists at the annual meeting of AAAS,

which reached approximately 600 people, and an entire event devoted to MESSENGER at the Hands-On science museum in Ann Arbor, Michigan, where children were able to participate in activities that taught them about Mercury and about the mission.

## It All Adds Up

The Math for America (MfA) DC Fellowship Program, initiated by Carnegie, already has three cohorts and is recruiting another. The fellows spend 15 months getting a master's degree in math education at MfA's expense—coursework includes math pedagogy and graduate-level mathematics—in return for four years teaching math at District of Columbia public and public charter secondary schools. There are currently six fellows in the master's program. The group of 14 current teaching fellows are reaching around 1,100 students in the District of Columbia.

The program is one of seven nationwide. Each works with one or more academic partners, including American University for the Washington-based program. The program recruits recent graduates and career changers with strong math, physics, or engineering backgrounds who are interested in teaching. It focuses on high-need schools, predominately in urban areas. The goal is to use the participant's math skills as a lens to focus on secondary school students who are behind the learning curve, and bring them up to speed quickly and efficiently.

During the required four years of teaching, the fellows meet once a month for professional development programs, receive continual one-on-one mentoring, and attend occasional social events. □

# for Science Education



MESSENGER Principal Investigator Sean Solomon talks to children about the mission during an event at the Ann Arbor Hands-On Museum August 16, 2011. The event was hosted by the museum with participation by the MESSENGER Education and Public Outreach team and several members of the MESSENGER science and engineering teams.



CASE's Guy Brandenburg (in profile) leads third-cohort fellows in the popular Math on the Mall development project, which included real-world spatial math projects on the National Mall in June 2011. Left to right are Lawrence Chien, Rebecca Dunn, Ariel Kramer, Conor Kenney [obstructed], Joe Herbert, and Jessica Ogle.



Shown here are MESSENGER Educator Fellows and members of the Education and Public Outreach and science teams at the orbit insertion event March 17, 2011. Left to right: Robert Farquha (science team), Cathy Williamson (fellow), Christina Dorr (fellow), Lollie Garay (fellow), Julie Edmonds (E&PO team), Susie Miller (fellow), Carol Fraser (fellow), Heather Weir (E&PO team), Robert Petro (fellow), Sean Solomon (science team), and Harri Vanhala (E&PO team).



Participants at the Hands-On Museum event, shown right, use the Education and Public Outreach team's MESSENGER Mosaic Postcards to learn about the mission and the planet.

# Financial Profile

*for the year ending June 30, 2011 (unaudited)*



**Reader's Note:** *In this section, we present summary financial information that is unaudited. Each year the Carnegie Institution, through the Audit committee of its Board of Trustees, engages an independent auditor to express an opinion about the financial statements and the financial position of the institution. The complete audited financial statements are made available on the institution's website at [www.carnegieScience.edu](http://www.carnegieScience.edu).*

The Carnegie Institution of Washington completed fiscal year 2011 in sound financial condition due to the positive returns (+22.7%) of the diversified investments within its endowment; a disciplined spending policy that balances today's needs with the long-term requirements of the institution and the interests of future scientists; and the continued support of organizations and individuals who recognize the value of nurturing basic science.

The single primary source of support for the institution's activities continues to be its endowment. This reliance on institutional funding provides an important degree of independence in the research activities of the institution's scientists.

As of June 30, 2011, the endowment was valued at \$796 million. Over the period 2001-2011, average annual increases in endowment contributions to the budget were 5.5%. In this era of continuing market volatility, Carnegie closely controls expenses in order to ensure the continuation of a healthy scientific enterprise.

For a number of years, under the direction of the Finance committee of the board, Carnegie's endowment has been allocated among a broad spectrum of asset classes including: fixed-income instruments (bonds), equities (stocks), absolute return investments, real estate partnerships, private equity, and natural resources partnerships. The goal of this diversified approach is to generate attractive overall performance and minimize the volatility that would exist in a less diversified portfolio.

The Finance committee of the board regularly examines the asset allocation of the endowment and readjusts the allocation, as appropriate. The institution relies upon external managers and partnerships to conduct the investment activities, and it employs a commercial bank to maintain custody. The following chart shows the allocation of the institution's endowment among asset classes as of June 30, 2011.

Asset Class	Target	Actual
Common Stock	37.5%	39.0%
Alternative Assets	55.0%	54.0%
Fixed Income and Cash	7.5%	7.0%

Carnegie's investment goals are to provide high levels of current support to the institution and to maintain the long-term spending power of its endowment. The success of Carnegie's investment strategy is illustrated in the first figure that compares, for a hypothetical investment of \$100 million, Carnegie's investment returns with the average returns for all educational institutions for the last twelve years.

Carnegie has pursued a long-term policy of controlling its spending rate, bringing the budgeted rate down in a gradual fashion from 6+ % in 1992 to 5.00% today. Carnegie employs what is known as a 70/30 hybrid spending rule. That is, the amounts available from the endowment in any year is made up of 70% of the previous year's budget, adjusted for inflation, and 30% of the most recently completed year-end endowment value, multiplied by the spending rate of 5.0% and adjusted for inflation and for debt. This method reduces volatility from year-to-year. The second figure depicts actual spending as a percentage of ending market value for the last 20 years.

In fiscal year 2011, Carnegie benefitted from continuing federal support. Carnegie's federal support has grown from \$24.5 million in 2006 to more than \$34 million in new grants in 2011. This is a testament to the high quality of Carnegie scientists and their ability to compete successfully for federal funds in this period of fiscal restraint.

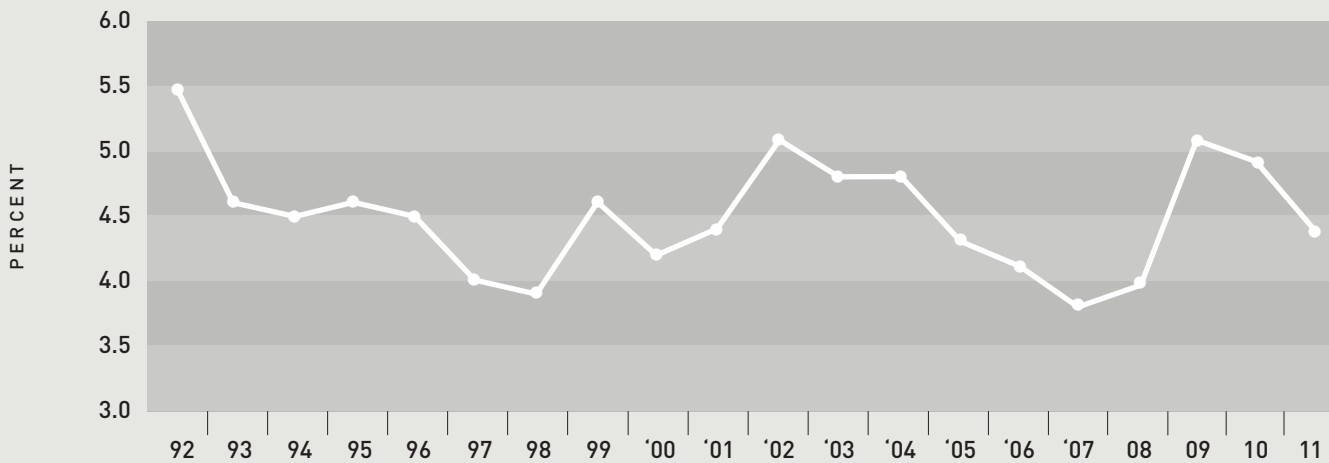
Carnegie also benefits from generous support from foundations and individuals. Funding from foundations has grown from an average of about \$3 million/year in the period from 2000 to 2004 to a record \$9 million in 2011. Within Carnegie's endowment, there are a number of "funds" that provide support either in a general way or targeted to a specific purpose. The largest of these is the Andrew Carnegie Fund, begun with the original gift of \$10 million. Mr. Carnegie later made additional gifts totaling another \$12 million during his lifetime. This tradition of generous support for Carnegie's scientific mission has continued throughout our history, and a list of donors in fiscal year 2011 appears in an earlier section of this year book. In addition, Carnegie receives important federal and private grants for specific research purposes, including support from the Howard Hughes Medical Institute for researchers at the Department of Embryology.

### Illustration of \$100 Million Investment - Carnegie Returns vs. Average Returns for All Educational Institutions (2000-2011)



Average returns for educational institutions are taken from Commonfund reports on endowment performance.

### Endowment Spending as a Percent of Ending Endowment Value\*



\*Includes debt financing.

## Statements of Financial Position (unaudited)

June 30, 2011, and 2010

	2011	2010
<b>Assets</b>		
Current assets:		
Cash and cash equivalents	\$ 1,518,067	\$ 32,359,327
Accrued investment income	0	46,301
Contributions receivable	7,298,027	6,342,270
Accounts receivable and other assets	17,279,764	20,411,836
Bond proceeds held by Trustee	17,694	26,728
<b>Total current assets</b>	<b>\$ 26,113,552</b>	<b>\$ 59,186,462</b>
Noncurrent assets:		
Investments	795,672,507	688,251,697
Property and equipment, net	154,768,137	156,738,554
<b>Total noncurrent assets</b>	<b>\$950,440,644</b>	<b>\$844,990,251</b>
<b>Total assets</b>	<b>\$976,554,196</b>	<b>\$904,176,713</b>
<b>Liabilities and Net Assets</b>		
Accounts payable and accrued expenses	\$ 10,918,845	\$ 18,579,451
Amount held for others	0	33,186,239
Deferred revenues	31,307,772	33,916,916
Bonds payable	65,728,416	65,800,315
Accrued postretirement benefits	17,206,079	15,246,053
<b>Total liabilities</b>	<b>\$125,161,112</b>	<b>\$166,728,974</b>
<b>Net assets</b>		
Unrestricted	\$244,949,855	\$217,326,563
Temporarily restricted	551,513,903	465,231,580
Permanently restricted	54,929,326	54,889,596
<b>Total net assets</b>	<b>\$851,393,084</b>	<b>\$737,447,739</b>
<b>Total liabilities and net assets</b>	<b>\$976,554,196</b>	<b>\$904,176,713</b>

**Statements of Activities<sup>1</sup> (unaudited)**

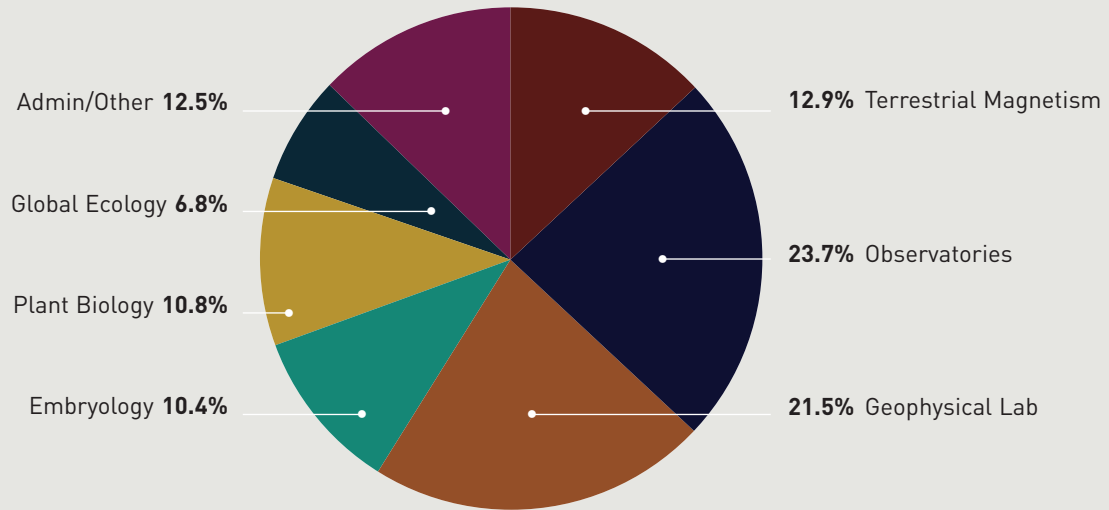
Periods ended June 30, 2011 and 2010

	2011	2010
Revenue and support:		
Grants and contracts	\$ 40,480,694	\$ 42,707,752
Contributions, gifts	13,081,598	14,255,572
Other income	18,583	898,225
Net external revenue	\$ 53,580,875	\$ 57,861,549
Investment income and unrealized gains (losses)	\$153,142,080	\$ 85,323,573
Total revenues, gains, other support	\$206,722,955	\$143,185,122
Program and supporting services:		
Terrestrial Magnetism	\$ 11,957,202	\$ 11,210,212
Observatories	21,920,605	26,961,521
Geophysical Laboratory	19,962,665	16,464,866
Embryology	9,670,782	8,959,492
Plant Biology	10,032,715	10,284,361
Global Ecology	6,267,032	7,378,555
Other programs	1,050,387	915,319
Administration and general expenses	10,556,630	10,495,497
Total expenses	\$ 41,418,018	\$ 92,669,823
Change in net assets before pension related changes	\$115,304,937	\$ 50,515,299
Pension Related Changes	(1,359,592)	(53,052)
Net assets at the beginning of the period	\$737,447,739	\$686,985,492
Net assets at the end of the period	\$851,393,084	\$737,447,739

<sup>1</sup>Includes restricted, temporarily restricted, and permanently restricted revenues, gains, and other support.



### 2011 Expenses by Department (\$91.4 Million)





# Personnel

*July 1, 2010-June 30, 2011*

## Carnegie Administration

Benjamin Barbin, *Manager of Advancement Activities*  
 Shaun Beavan, *Systems Administrator*  
 Gloria Brienza, *Budget and Management Analyst Manager*  
 Donald Brooks, *Building Maintenance Specialist*  
 Marjorie Burger, *Financial Manager*  
 Cady Canapp, *Manager of Human Resources and Insurance*  
 Alan Cutler, *Science Writer*<sup>1</sup>  
 Robert Ellis, *Web Developer*  
 Kristen Fisher, *Special Events and Facility Coordinator*<sup>2</sup>  
 Alexis Fleming, *Special Events and Facility Coordinator*  
 Shawn Frazier, *Accounting Assistant*  
 Dina Freydin, *Senior Grants Accountant*  
 Susanne Garvey, *Director of External Affairs*  
 Darla Keefer, *Special Assistant for Administration and Building Operations*  
 Mulyono Kertajaya, *Business Data Analyst*  
 Ann Keyes, *Payroll Coordinator*  
 Yang Kim, *Deputy Financial Manager*  
 Lisa Klow, *Executive Assistant to the President*<sup>3</sup>  
 G. Gary Kowalczyk, *Director of Administration and Finance*  
 Tina McDowell, *Editor and Publications Officer*  
 Richard A. Meserve, *President*

Natasha Metzler, *Science Writer*<sup>4</sup>  
 Christina Naguiat, *Executive Assistant to the President*<sup>5</sup>  
 June Napoco-Soriente, *Financial Accountant*  
 Mikhail Pimenov, *Endowment Manager*  
 Gotthard Sághi-Szabó, *Chief Information Officer*  
 C. Rick Sherman, *Chief Advancement Officer*<sup>6</sup>  
 Harminder Singh, *Financial Accountant*  
 John Strom, *Multimedia Designer/Producer*  
 Mira, Thompson, *Manager of Advancement Operations*<sup>7</sup>  
 Laura Unterholzner, *Special Events/Building Assistant*<sup>8</sup>  
 Yulonda R. White, *Human Resources and Records Coordinator*  
 Jacqueline Williams, *Assistant to Human Resources and Insurance Manager*

<sup>1</sup>To August 20, 2010

<sup>2</sup>To December 3, 2010

<sup>3</sup>To January 31, 2011

<sup>4</sup>From November 8, 2010

<sup>5</sup>From January 20, 2011

<sup>6</sup>From February 21, 2011

<sup>7</sup>To May 13, 2011

<sup>8</sup>From December 7, 2010

## Carnegie Academy for Science Education

Bianca Abrams, *Director, Math for America (MfA)*  
 Brianna Anderson, *STARS Program Intern*<sup>2</sup>  
 Joel Battle, *First Light Volunteer*  
 Sarah Bax, *CASE Mentor*<sup>1</sup>  
 Guy Brandenburg, *First Light Instructor, CASE and MfA Mentor*  
 Anne Brooks-Hemphill, *CASE Mentor*<sup>1</sup>  
 Khalid Bullock, *STARS Program Intern*<sup>1</sup>  
 Laurence Chien, *Math for America Fellow*  
 Katherine Collins, *Math for America Fellow*  
 Kenney Conor, *Math for America Fellow*  
 Amy Danks, *Math for America Fellow*  
 Asonja Dorsey, *CASE Mentor*<sup>1</sup>  
 Lauren Dorsey, *CASE Intern*<sup>1</sup>  
 Stephen Dorsey, *CASE Intern*<sup>1</sup>  
 Juwana Douglas, *STARS Program Intern*<sup>1</sup>  
 VanNessa Duckett, *CASE Mentor*<sup>1</sup>  
 Rebecca Dunn, *Math for America Fellow*  
 Julie Edmonds, *Codirector, CASE*  
 Anne Farrell, *Math for America Fellow*  
 Maya Garcia, *CASE Mentor*<sup>1</sup>  
 Ricky Garibay, *Intern and First Light Assistant*<sup>1</sup>  
 Darcy Hampton, *CASE Mentor*<sup>1</sup>  
 Tashima Hawkins, *CASE Mentor*<sup>1</sup>  
 Joseph Herbert, *Math for America Fellow*  
 Krystn Hodge, *Math for America Fellow*  
 Courtney Holmes, *STARS Program Intern*<sup>1</sup>  
 Alexandra Horenstein, *CASE Fellow*<sup>2</sup>  
 Toby Horn, *Codirector, CASE*  
 Dasia Jacob, *STARS Program Intern*<sup>2</sup>  
 Linda Jamison, *STARS Program Intern*<sup>1</sup>  
 Marlena Jones, *CASE Coordinator*  
 Molley Kaiyoorowongs, *Math for America Fellow*  
 Brian Kim, *Research Assistant*<sup>1</sup>  
 Sarah Kennedy, *CASE Intern*<sup>2</sup>

Ariel Kramer, *Math for America Fellow*  
 Sophia Lallinger, *Math for America Fellow*  
 Shameka Lyles, *STARS Program Intern*<sup>1</sup>  
 Lindsay Mann, *Math for America Fellow*  
 Emily Marks, *Administrative Assistant, MfA*<sup>3</sup>  
 Mirielle Mbepeh, *STARS Program Intern*<sup>2</sup>  
 Dakari McAdoo, *First Light Volunteer*  
 Jeanah McCall, *CASE Intern*<sup>1</sup>  
 Max Mikulec, *Math for America Fellow*  
 Devonte Miles, *STARS Program Intern*<sup>1</sup>  
 Thomas Nassif, *CASE Mentor*<sup>1</sup>  
 Jessica Ogle, *Math for America Fellow*  
 Maximilian Olivier, *Math for America Fellow*  
 Julia Penn, *Math for America Fellow*  
 Jessica Reynolds, *Math for America Fellow*  
 Debron Rodney, *CASE Intern*<sup>1</sup>  
 John Solano, *CASE Fellow*<sup>1</sup>  
 Lauren Soriente, *CASE Volunteer*  
 Grier Starling, *STARS Program Intern*<sup>2</sup>  
 Dashawn Taylor, *STARS Program Intern*<sup>1</sup>  
 Jasmine Thomas, *STARS Program Intern*<sup>1</sup>  
 Tierra Thornton, *STARS Program Intern*<sup>1</sup>  
 Samuel Trichtinger, *Math for America Fellow*  
 Meredith Wachs, *Math for America Fellow*  
 Christina Warner, *Administrative Assistant, MfA*<sup>4</sup>  
 Brittany Warren, *STARS Program Intern*<sup>1</sup>  
 Maya Washington, *STARS Program Intern*<sup>2</sup>  
 DeVaughn Wilson, *STARS Program Intern*<sup>1</sup>  
 Heather Zelinsky, *Math for America Fellow*

<sup>1</sup>Summer 2010

<sup>2</sup>Summer 2011

<sup>3</sup>From February 7, 2011, to May 31, 2011

<sup>4</sup>From August 30, 2011, to January 28, 2011

# Embryology

## Research Staff Members

Alexsky Bortvin  
Donald D. Brown, *Director Emeritus*  
Chen-Ming Fan  
Steven Farber  
Joseph G. Gall  
Marnie Halpern  
Nicholas T. Ingolia<sup>1</sup>  
Allan C. Spradling, *Director*  
Yixian Zheng

## Staff Associates

Jeffrey Han  
David MacPherson

## Postdoctoral Fellows and Associates

Sang Jung Ahn, *Research Associate, NIH Grant (Halpern)*  
Joshua Bembenek, *Research Associate, Howard Hughes Medical Institute (Zheng)*<sup>2</sup>  
Haiyang Chen, *Research Associate, NIH Grant (Zheng)*<sup>3</sup>  
Sung Gook Cho, *Research Associate, NIH Grant (MacPherson)*<sup>4</sup>  
Tagide deCarvalho, *Research Associate, NIH Grant (Halpern)*  
Svetlana Deryusheva, *Visiting Scientist, Carnegie*  
Lucilla Facchin, *Carnegie Fellow*  
Caroline Flournoy, *Research Associate, NIH Grant (Fan)*<sup>5</sup>  
Donald Fox, *Research Associate, Howard Hughes Medical Institute (Spradling)*<sup>6</sup>  
Rebecca Frederick, *Research Fellow, American Cancer Society Fellowship*  
Megha Ghildiyal, *Research Associate, Howard Hughes Medical Institute (Spradling)*<sup>7</sup>  
Mary Goll, *Research Associate, NIH Grant (Halpern)*<sup>8</sup>  
Ben Goodman, *Carnegie Fellow*<sup>9</sup>  
Daniel Gorelick, *Research Associate, (NRSA Postdoctoral Fellowship)*  
Axel Horn, *Research Associate, NIH Grant (Han)*<sup>10</sup>  
Mario Izaguirre-Sierra, *Carnegie Fellow*  
Shreyas Jadhav, *Carnegie Fellow*<sup>11</sup>  
Junling Jia, *Research Associate, Howard Hughes Medical Institute (Zheng)*  
Youngjo Kim, *Research Associate, Howard Hughes Medical Institute (Zheng)*  
Ming-Chia Lee, *Research Associate, Howard Hughes Medical Institute (Spradling)*  
Lei Lei, *Research Associate, Howard Hughes Medical Institute (Spradling)*  
Christoph Lepper, *Research Associate, NIH Grant (Fan)*<sup>12</sup>  
Robert Levis, *Special Investigator, NIH Grant (Spradling with Baylor College of Medicine, subcontract)*  
Zhonghua Liu, *Research Associate, Howard Hughes Medical Institute (Zheng)*  
Vicki Losick, *Research Fellow, Jane Coffin Childs Fellowship*  
Siew Hui Low, *Research Associate, NIH Grant (Fan)*<sup>13</sup>  
Safia Malki, *Research Fellow, McClintock Fellowship*  
One Mapp, *Research Associate, Mathers Grant (Farber)*<sup>14</sup>  
Irena Martirosyan, *Research Associate, NIH Grant (Han)*<sup>15</sup>  
Lucy Morris, *Research Associate, Howard Hughes Medical Institute (Spradling)*  
Itay Onn, *Research Associate, Howard Hughes Medical Institute (Spradling)*<sup>16</sup>  
Jianjun Sun, *Research Associate, Howard Hughes Medical Institute (Spradling)*  
James Walters, *Research Fellow, (NRSA Postdoctoral Fellowship)*  
Shusheng Wang, *Research Associate, NIH Grant (Zheng)*  
Zheng-an Wu, *Special Investigator, NIH Grant (Gall) and Carnegie Fellow*  
Helan Xiao, *Carnegie Fellow*<sup>17</sup>  
Erin Zeituni, *Carnegie Collaborative Fellow*<sup>18</sup>  
Xiaobin Zheng, *Research Associate, NIH Grant (Zheng)*<sup>19</sup>

## Predocctoral Fellows and Associates

Courtney Akitake, *The Johns Hopkins University*<sup>20</sup>  
Dean Calahan, *The Johns Hopkins University*<sup>21</sup>  
Juliana Carten, *The Johns Hopkins University*  
Julio Castaneda, *The Johns Hopkins University*  
Valeriya Gaysinskaya, *The Johns Hopkins University*  
Pavol Genzor, *The Johns Hopkins University*  
Ben Goodman, *The Johns Hopkins University*<sup>22</sup>

Michael Harris, *The Johns Hopkins University*<sup>23</sup>  
Margaret Hoang, *The Johns Hopkins University*<sup>24</sup>  
Christoph Lepper, *The Johns Hopkins University*<sup>25</sup>  
Lydia Li, *The Johns Hopkins University*  
Peter Lopez, *The Johns Hopkins University*  
Alexis Marianes, *The Johns Hopkins University*  
Vanessa Matos-Cruz, *The Johns Hopkins University*  
Katie McDole, *The Johns Hopkins University*  
Anna McGeachy, *The Johns Hopkins University*<sup>26</sup>  
Eric Mills, *The Johns Hopkins University*<sup>27</sup>  
Katherine Mitchell, *The Johns Hopkins University*<sup>28</sup>  
Rosa Miyares, *The Johns Hopkins University, (NRSA Predocctoral Fellowship and Hollaender Fellowship)*  
Tim Mulligan, *The Johns Hopkins University*<sup>29</sup>  
Zehra Nizami, *The Johns Hopkins University*  
Michelle Roza, *The Johns Hopkins University*  
Andrew Skora, *The Johns Hopkins University*<sup>30</sup>  
Abhignya Subedi, *The Johns Hopkins University*  
Aaron Welch, *The Johns Hopkins University*<sup>31</sup>  
William Yarosh, *The Johns Hopkins University*

## Supporting Staff

Arash Adeli, *Animal Technician*  
Jen Anderson, *Research Technician*  
Susan Artes, *Carnegie Science Outreach Coordinator*  
Jordon Boston, *Intern*<sup>32</sup>  
Keisha Breland, *Animal Technician*  
Molly Broache, *Research Undergraduate*<sup>33</sup>  
Valerie Butler, *Carnegie Science Outreach Coordinator*  
Bianca Cabri, *Research Undergraduate*<sup>34</sup>  
Ellen Cammon, *Howard Hughes Medical Institute Research Technician I*<sup>35</sup>  
Patricia Cammon, *Howard Hughes Medical Institute Laboratory Helper*  
Eric Chen, *Research Undergraduate*<sup>36</sup>  
Dolly Chin, *Administrative Assistant*  
Karina Conkrite, *Research Technician*  
Min Cui, *Research Specialist*<sup>37</sup>  
Carol Davenport, *Howard Hughes Medical Institute Research Technician III*  
Eugenia Dikovskaia, *Animal Facility Manager*  
Chun Dong, *Research Scientist*  
Andrew Eifert, *Assistant Facility Manager*  
Daniel Escobar, *Research Technician*<sup>38</sup>  
Caroline Haislip, *Student Assistant*<sup>39</sup>  
Roger Henry, *Student Assistant*  
Amy Herbert, *Student Volunteer*  
Alice Hung, *Summer Student*<sup>40</sup>  
Ella Jackson, *Howard Hughes Medical Institute Laboratory Helper*  
Fred Jackson, *P/T Animal Care Technician*  
Connie Jewell, *Microcomputer Support Specialist*  
Glenese Johnson, *Laboratory Helper*  
Rejeanne Juste, *Research Technician*  
Susan Kern, *Business Manager*  
Gennadiy Klimachev, *Animal Technician*  
Lindsey Knapp, *Student Volunteer*<sup>41</sup>  
Amy Kowalski, *Research Technician*  
Bill Kupiec, *Information Systems Manager*  
Megan Kutzer, *Research Technician*<sup>42</sup>  
Warner Lai, *Student Assistant, Ingenuity*<sup>43</sup>  
Michelle Macurak, *Research Technician*  
Ona Martin, *Howard Hughes Medical Institute Research Technician III*  
Tom McDonough, *Facilities Manager*  
Neda Muzaffar, *Research Technician*<sup>44</sup>  
Pedram Nozari, *Animal Technician*  
Allison Pinder, *Howard Hughes Medical Institute Research Technician III*  
Earl Potts, *Animal Technician*  
Christine Pratt, *Howard Hughes Medical Institute Administrative Assistant II*

Joan Pulupa, *Howard Hughes Medical Institute Laboratory Assistant*  
 Megan Reid, *Laboratory Assistant*  
 Samantha Satchell, *Research Technician*  
 Michael Sepanski, *Electron Microscopy Technician*  
 Mahmud Siddiqi, *Microscope Specialist*  
 C. Evan Siple, *Research Technician*  
 Lakishia Smith, *Administrative Secretary*<sup>45</sup>  
 Loretta Steffy, *Accounting Assistant*  
 Sarah Stockman, *Predoctoral Research Associate*<sup>46</sup>  
 Allen Strause, *Machinist*  
 Maggie Sundby, *Research Technician*  
 Robert Vary, *Carnegie Science Outreach Educator*  
 Rafael Villagaray, *Macintosh Support Specialist*  
 Neil Vranis, *Student Assistant*<sup>47</sup>  
 Dianne Williams, *Howard Hughes Medical Institute Research Technician III*  
 Alex Yeh, *Student Assistant*<sup>48</sup>  
 Geoffrey Zearfoss, *P/T Animal Technician*

#### Visiting Investigators and Collaborators

Hugo Bellen, *Baylor College of Medicine*  
 Robert Bittman, *Department of Chemistry and Biochemistry, Queens College of CUNY*  
 Ian Blair, *Department of Chemistry, University of Pennsylvania*  
 Vitor Bortolo de Rezende, *Universidade Federal de Minas Gerais, Brazil*  
 Steven Ekker, *Department of Genetics, Cell Biology, and Development, University of Minnesota Medical School*  
 Matthias Hammerschmidt, *Max Planck Institute for Immunobiology, Germany*

Samer Hattar, *Department of Biology, The Johns Hopkins University*  
 Marko Horb, *Institut de Recherches Cliniques de Montréal (IRCM)*  
 Roger Hoskins, *Lawrence Berkeley National Laboratory*  
 Hao Jiang, *Laboratory of Molecular Cell Biology and Center of Cell Signaling, Shanghai Institutes for Biological Sciences, Chinese Academy of Sciences*  
 Henry Krause, *Donnelly Centre for Cellular and Biomolecular Research, University of Toronto, Canada*  
 Steven Leach, *Department of Surgery, Division of Surgical Oncology, The Johns Hopkins University School of Medicine*  
 Li Ma, *Laboratory of Molecular Cell Biology and Center of Cell Signaling, Shanghai Institutes for Biological Sciences, Chinese Academy of Sciences*  
 Cecilia Moens, *Fred Hutchinson Cancer Research Center*  
 Karen Oogema, *European Molecular Biology Laboratory, Germany*  
 Michael Pack, *Department of Medicine, University of Pennsylvania*  
 Michael Parsons, *Departments of Surgery and Oncology, The Johns Hopkins University School of Medicine*  
 John Rawls, *Department of Cell and Molecular Physiology, University of North Carolina*  
 Karen Reue, *Human Genetics and Medicine, David Geffen School of Medicine at the University of California, Los Angeles*  
 Gerald M. Rubin, *Howard Hughes Medical Institute, Janelia Farm Research Campus*  
 Didier Stainier, *University of California, San Francisco*  
 Bernard Thisse, *Department of Cell Biology and the Morphogenesis and Regenerative Medicine Institute, University of Virginia*  
 Christine Thisse, *Department of Cell Biology and the Morphogenesis and Regenerative Medicine Institute, University of Virginia*  
 Junqi Zhang, *Microbiology Department, Shanghai Medical College Fudan University*

<sup>1</sup>From October 1, 2010

<sup>2</sup>To July 31, 2010

<sup>3</sup>From April 5, 2011

<sup>4</sup>From April 12, 2011

<sup>5</sup>From January 10, 2011

<sup>6</sup>To June 30, 2011

<sup>7</sup>From November 1, 2010

<sup>8</sup>To August 15, 2010

<sup>9</sup>From April 20, 2011

<sup>10</sup>From August 30, 2010

<sup>11</sup>To July 12, 2010

<sup>12</sup>From July 1, 2010

<sup>13</sup>From June 15, 2011

<sup>14</sup>From March 1, 2011

<sup>15</sup>From September 29, 2010

<sup>16</sup>To June 30, 2011

<sup>17</sup>From October 1, 2010

<sup>18</sup>From September 15, 2010

<sup>19</sup>From May 2, 2011

<sup>20</sup>To June 30, 2011

<sup>21</sup>To May 1, 2011

<sup>22</sup>To April 20, 2011

<sup>23</sup>From May 23, 2011

<sup>24</sup>To November 30, 2010

<sup>25</sup>To July 1, 2010

<sup>26</sup>From May 23, 2011

<sup>27</sup>From October 15, 2010

<sup>28</sup>To September 23, 2010

<sup>29</sup>To September 30, 2010

<sup>30</sup>To August 19, 2010

<sup>31</sup>To July 31, 2010

<sup>32</sup>To July 31, 2010

<sup>33</sup>To August 31, 2010

<sup>34</sup>From September 8, 2010

<sup>35</sup>To August 31, 2010

<sup>36</sup>To November 15, 2010

<sup>37</sup>From January 19, 2011

<sup>38</sup>To August 31, 2010

<sup>39</sup>To August 31, 2010

<sup>40</sup>From August 11, 2010

<sup>41</sup>From May 31, 2011

<sup>42</sup>To August 13, 2010

<sup>43</sup>To August 31, 2010

<sup>44</sup>To January 15, 2011

<sup>45</sup>From July 1, 2010

<sup>46</sup>To August 31, 2010

<sup>47</sup>To August 31, 2010

<sup>48</sup>To July 31, 2010

## Geophysical Laboratory

### Staff Scientists

George D. Cody  
 Ronald E. Cohen  
 Yingwei Fei  
 Marilyn L. Fogel  
 Alexander F. Goncharov  
 Robert M. Hazen  
 Russell J. Hemley, *Director*  
 Wesley T. Huntress, Jr., *Director Emeritus*  
 T. Neil Irvine, *Emeritus*  
 Ho-kwang Mao  
 Bjørn O. Mysen  
 Douglas Rumble III  
 Anat Shahar  
 Andrew Steele  
 Viktor V. Struzhkin

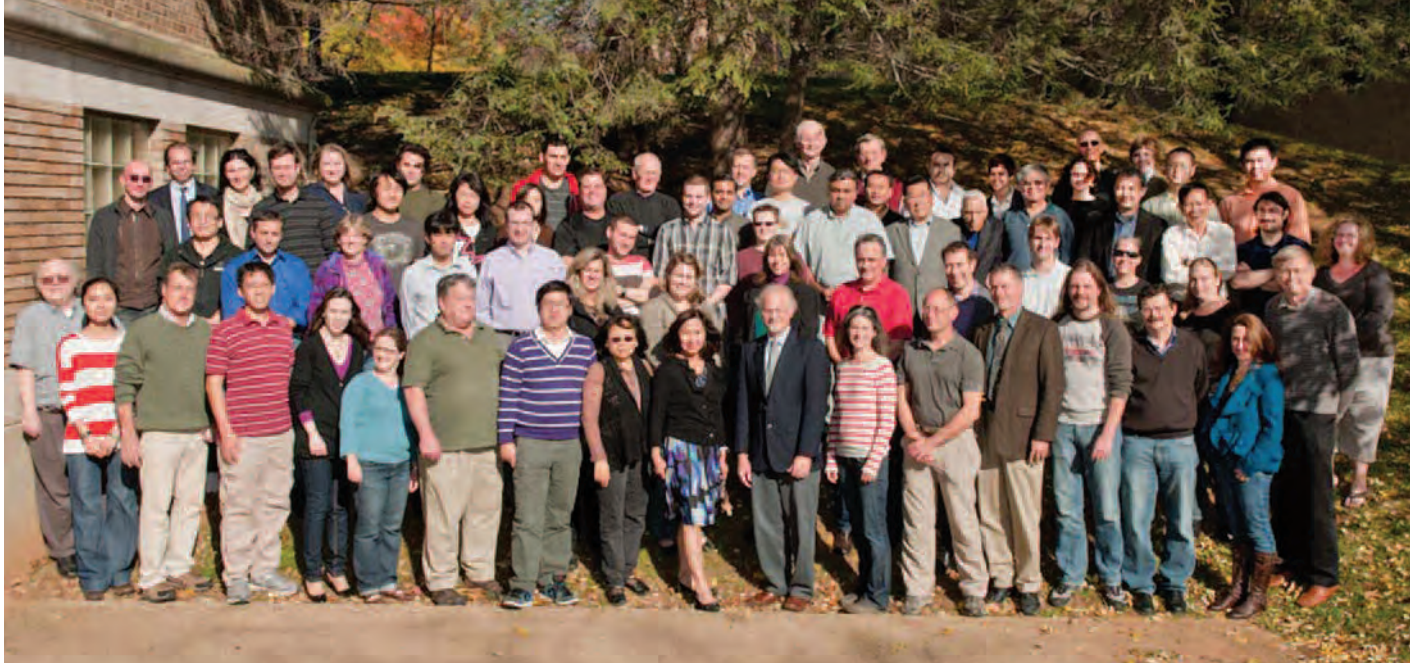
### Senior Scientists and Visiting Investigators

Reinhard Boehler, *Max Planck Institute for Chemistry, Germany, EFree*  
 Dudley R. Herschbach, *Harvard University*

Charles T. Prewitt, *University of Arizona*  
 Dimitri A. Sverjensky, *The Johns Hopkins University*  
 Takamitsu Yamanaka, *Osaka University, Japan*

### Research Scientists

Muhetaer Aihaiti, *ONR, CDAC*  
 Constance M. Bertka, *Program Director, DCO*<sup>1</sup>  
 Nabil Z. Boctor, *NASA, NASA Astrobiology Institute (NAI)*  
 Xiao-Jia Chen, *DOE*  
 Dionysis I. Foustoukos, *NSF*  
 Mihaela Glamoclija, *AMASE*  
 Malcolm Guthrie, *Chief Scientist, EFree*  
 Valerie Hillgren, *NASA*  
 Qi Liang, *CVD Diamond*  
 Jinfu Shu, *HPCAT, Carnegie*<sup>2</sup>  
 Maddury Somayazulu, *CDAC*  
 Timothy Strobel, *NSF*<sup>3</sup>  
 Chih-Shiue Yan, *CVD Diamond, NSF, Carnegie*  
 Chang-Sheng Zha, *CDAC*



**GEOPHYSICAL LABORATORY** Front row (left to right): John Armstrong, Yufei Meng, Reinhard Boehler, Joe Lai, Danielle Appleby, Morgan Phillips, Paul Goldey, Renbiao Tao, Susana Mysen, Marilyn (Helen) Venzon, Russell Hemley, Anat Shahar, George Cody, Robert Hazen, Andrew Steele, Alexander Goncharov, Verena Starke. Second row: Liuxiang Yang, Elissaios Stavrou, Valerie Hillgren, Takaki Muramatsu, Douglas Allen Dalton, Dyanne Furtado, Sami Mikhail, Lauren Cryan, Andrea Mangum, Stephen Gramsch, Ronald Cohen, Timothy Strobel, Dina Bower, Karyn Rogers, Bjørn Mysen. Third row: Daniel Hummer, Shohei Ohara, Ying Wang, Yoko Kebukawa, Stephen Hodge, Derek Smith, Amol Karandikar, Katherine Crispin, Victor Lugo, Takamitsu Yamanaka, Nabil Boctor, Jinfu Shu, Muhetaer Aihaiti, Trong Nguyen, Vincenzo Stagno, Roxane Bowden. Back row: Oleksandr Kurakevych, Craig Schiffries, Mihaela Glamoclija, Kateryna Klochko, Dionysis Foustoukos, Codi Lazar, Douglas Rumble, Shaun Hardy, Duck Young Kim, Neil Irvine, Felix Krasnicki, Adrian Villegas-Jimenez, Ileana Perez-Rodriguez, Celia Dalou, Stephen Coley, Merri Wolf, Gefei Qian, Chi Zhang.

#### NSF REU Program Director and CDAC Laboratory Manager

Stephen A. Gramsch<sup>4</sup>

#### High Pressure Collaborative Access Team (HPCAT), High Pressure Synergetic Center (HPSynC) at the Advanced Photon Source (APS), Argonne National Laboratory, Chicago, IL; National Synchrotron Light Source (NSLS) at Brookhaven National Laboratory, Upton, NY; Joint Institute for Neutron Sciences (JINS) Spallation Neutron Source (SNS) at Oak Ridge National Laboratory, Oak Ridge, TN; and Lujan Neutron Scattering Center (LANSCE) at Los Alamos National Laboratory, Los Alamos, NM

Wing-Shing Au, *Beamline Associate*, HPCAT<sup>5</sup>

Maria Baldini, *Research Scientist*, HPSynC<sup>6</sup>

Alaina Beres, *Summer Intern*, HPCAT<sup>7</sup>

Arunkumar S. Bommannavar, *Beamline Control Scientist*, HPCAT

Paul Chow, *Beamline Scientist*, HPCAT

Yang Ding, *Beamline Scientist*, HPSynC

Cindy Doran, *Administrative Assistant*, HPSynC

Richard Ferry, *Technician*, HPSynC

Rong Huang, *Research Scientist*, HPCAT<sup>8</sup>

Xiaojing Huang, *Postdoctoral Associate*, HPSynC<sup>9</sup>

Daijo Ikuta, *Beamline Associate*, HPCAT

Georgios Karotsis, *Postdoctoral Associate*, SNS<sup>10</sup>

Curtis Kenney-Benson, *Beamline Associate*, HPCAT

Svetlana Kharlamova, *Postdoctoral Associate*, HPSynC<sup>11</sup>

Lingping Kong, *Predocctoral Associate*, HPSynC<sup>12</sup>

Yoshio Kono, *Research Scientist*, HPCAT<sup>13</sup>

Katherine Lazarz, *Summer Intern*, HPCAT<sup>14</sup>

Bing Li, *Predocctoral Associate*, HPSynC

Fangfei Li, *Postdoctoral Associate*, HPSynC<sup>15</sup>

Zhijun Lin, *Research Scientist*, LANSCE<sup>16</sup>

Zhenxian Liu, *Beamline Scientist*, NSLS

Ho-kwang Mao, *Executive Director*, HPCAT<sup>17</sup>

Qiang Mei, *Postdoctoral Associate*, HPCAT<sup>18</sup>

Yue Meng, *Beamline Scientist*, HPCAT

Veronica O'Connor, *Office Manager*, HPCAT

Changyong Park, *Beamline Scientist*, HPCAT

Dmitry Popov, *Beamline Scientist*, HPCAT

Eric Rod, *Beamline Technician*, HPCAT

Olga Shebanova, *Postdoctoral Associate*, HPCAT<sup>19</sup>

Guoyin Shen, *Director*, HPCAT<sup>20</sup>

Stanislav Sinogeikin, *Beamline Scientist*, HPCAT

Jesse Smith, *Postdoctoral Associate*, HPCAT<sup>21</sup>

Erik Wang, *Summer Intern*, HPCAT<sup>22</sup>

Junyue Wang, *Postdoctoral Associate*, HPSynC and ANL

Lin Wang, *Research Scientist*, HPSynC

Yuming Xiao, *Beamline Scientist*, HPCAT<sup>23</sup>

Wenge Yang, *Director*, HPSynC<sup>24</sup>

Kirill Zhuravlev, *Postdoctoral Associate*, GSECARS, APS<sup>25</sup>

#### Postdoctoral Fellows and Postdoctoral Associates

David M. Baker, *Postdoctoral Associate*, NSF<sup>26</sup>

Dina Bower, *NAI Fellow*

Henderson James Cleaves II, *Visiting Investigator*, NASA and NAI

D. Allen Dalton, *Postdoctoral Associate*, CDAC and NSF

Liwei Deng, *Carnegie Fellow*<sup>27</sup>

Floyd Fayton, Jr., *Postdoctoral Associate*, NSF CMG, ONR<sup>28</sup>

Weifu Guo, *Carnegie Fellow*<sup>29</sup>

Sanchayan Neal Gupta, *NAI Fellow*<sup>30</sup>

Kadek Hemawan, *Postdoctoral Associate, CDAC, WDLP*<sup>31</sup>  
 Daniel Hummer, *Carnegie Fellow*  
 Yoko Kebukawa, *Carnegie Fellow, NAI*<sup>32</sup>  
 Svetlana Kharlamova, *Postdoctoral Associate*<sup>33</sup>  
 Kateryna Klochko, *Postdoctoral Associate, NAI and NSF*  
 George Lazar, *Carnegie Fellow*<sup>34</sup>  
 Yufei Meng, *Postdoctoral Associate*  
 Lane Nixon, *Postdoctoral Associate, ONR*<sup>35</sup>  
 Shohei Ohara, *Postdoctoral Associate, NSF*  
 Julius Ojwang, *Carnegie Fellow*<sup>36</sup>  
 Dominic Papineau, *Postdoctoral Associate, NSF*<sup>37</sup>  
 Robert Potter, *Postdoctoral Associate, DOE*<sup>38</sup>  
 Christopher Seagle, *Carnegie Fellow*  
 Timothy Strobel, *Carnegie Fellow, NSF*<sup>39</sup>  
 Ying Wang, *Carnegie Fellow*  
 Liuxiang Yang, *Postdoctoral Associate, EFree, Carnegie*<sup>40</sup>  
 Chi Zhang, *Carnegie Fellow*<sup>41</sup>  
 Li Zhang, *Postdoctoral Associate, NASA*

#### **Predoctoral Fellows and Predoctoral Associates**

Charlene Estrada, *Predoctoral Fellow, NSF*  
 Patrick L. Griffin, *Research Assistant, Predoctoral Associate, Keck Foundation, DCO*<sup>42</sup>  
 Amol Karandikar, *Predoctoral Associate, EFree*  
 Namhey Lee, *Predoctoral Fellow, The Johns Hopkins University*  
 Joseph Rodriguez, *Predoctoral Associate, NAI*<sup>43</sup>  
 Derek Smith, *Predoctoral Fellow, Dartmouth College*<sup>44</sup>  
 Verena Starke, *NASA Marshall Space Flight Center*  
 Renbiao Tao, *Predoctoral Associate, NSF*<sup>45</sup>

#### **College Interns**

Kelare Aihaiti, *Old Dominion University*<sup>46</sup>  
 Alaina Beres, *Elmhurst College*<sup>47</sup>  
 Collin Black, *University of Connecticut*<sup>48</sup>  
 Alyssa Frederick, *Lab Assistant, Research Assistant, American University*<sup>49</sup>  
 Thomas Hittinger, *Howard University*<sup>50</sup>  
 Yasmin Kadry, *Howard University*<sup>51</sup>  
 Stevia Morawski, *Lab Assistant, American University*<sup>52</sup>  
 Olaoluwa Omotosho, *Howard University*<sup>53</sup>

#### **Summer Scholar Interns (Summer 2011)**

Katherine Ames, *University of Delaware*  
 Ari Benjamin, *Williams College*  
 Kevin Hernandez, *California State University-Sacramento*  
 Tau Liu, *Howard Community College*  
 Julia Vidonish, *University of Chicago*

#### **High School Interns**

Justin Chang, *Montgomery Blair High School*<sup>54</sup>  
 Jessica Garland, *Sidwell Friends School*<sup>55</sup>  
 Thomas Gramsch, *Lake Braddock High School*<sup>56</sup>  
 Katherine Jin, *Montgomery Blair High School*<sup>57</sup>  
 Lori Kaufman, *Montgomery Blair High School*<sup>58</sup>  
 Winston Liu, *Montgomery Blair High School*<sup>59</sup>  
 Paola Sofia Palacios, *Montgomery Blair High School*<sup>60</sup>  
 William Qian, *Thomas Jefferson High School for Science and Technology*<sup>61</sup>  
 Maimon Rose, *Melvin J. Berman Hebrew Academy*<sup>62</sup>

#### **Supporting Staff**

Danielle J.-H. Appleby, *Assistant to the Director, Departmental and Institutional Affairs*  
 John Armstrong, *Microbeam Specialist*  
 Maceo T. Bacote, *Building Engineer*<sup>63</sup>  
 Gary A. Bors, *Building Engineer*<sup>64</sup>  
 Roxane Bowden, *Lab Manager, Stable Isotope Facility*  
 Stephen D. Coley, Sr., *Instrument Shop Supervisor*  
 Lauren Cryan, *DCO Program Assistant*<sup>65</sup>  
 Roy R. Dingus, *Facility Manager*<sup>66</sup>

Pablo D. Esparza, *Maintenance Technician*<sup>67</sup>  
 Dyanne Furtado, *Staff Accountant*  
 Christos G. Hadidiacos, *Electronics Engineer*  
 Shaun J. Hardy, *Librarian*<sup>68</sup>  
 Stephen Hodge, *Instrument Maker*  
 Garret W. Huntress, *Systems Administrator, Systems Developer*  
 William E. Key, *Building Engineer*<sup>69</sup>  
 Szczesny (Felix) Krasnicki, *CVD Diamond Senior Engineer*  
 Joseph Lai, *CVD Diamond Lab Manager*  
 Jeff Lightfield, *Controller*  
 Victor Lugo, *Instrument Maker*<sup>70</sup>  
 Andrea Mangum, *DCO Program Associate*<sup>71</sup>  
 Quintin Miller, *Building Engineer Apprentice*<sup>72</sup>  
 Fabian Moscoso, *Building Engineer Apprentice*<sup>73</sup>  
 Susana Mysen, *EFree Project Administrator*  
 Trong T. Nguyen, *Assistant Controller*  
 Morgan D. Phillips, *Assistant to the Director, Science and CDAC*  
 Scott Price, *Electronics Specialist*  
 Gefei Qian, *Systems Administrator*  
 Pedro J. Roa, *Maintenance Technician*<sup>74</sup>  
 Haiyun (Kevin) Shu, *CVD Diamond Technician*  
 Helen Venzon, *Accounts Payable Specialist*  
 Merri Wolf, *Library Technical Assistant*<sup>75</sup>  
 Pamela L. Woodard, *Web/Departmental Assistant*  
 Thomas Yu, *CVD Diamond Technician*

#### **Visiting Investigators (Washington, DC)**

David Baker, *Smithsonian Institution*  
 Richard Becker, *Army Research Laboratory*  
 Laura Burkemper, *University of New Mexico*  
 Andrew J. Campbell, *University of Maryland*  
 Razvan Caracas, *Université de Lyon, École Normale Supérieure de Lyon, France*  
 Laura Carmody, *University College London, U.K.*  
 Paul Carpenter, *Washington University*  
 Jennifer Ciezak, *U.S. Army Research Laboratory, Aberdeen Proving Grounds*  
 Henderson James Cleaves II, *NASA*  
 Nicole DeBond, *Memorial University, Newfoundland, Canada*  
 Mariana Derzi, *University of Warsaw, Poland*  
 Joseph Feldman, *U.S. Naval Research Laboratory*  
 Thomas Fitzgibbons, *Pennsylvania State University*  
 Christopher Florian, *University of Colorado at Boulder*  
 Christopher Freeman, *University of Alabama at Birmingham*  
 Marc Fries, *NASA JPL*  
 Alexander Gavriiliuk, *Institute for High Pressure Physics, Russia*  
 Jennifer Girard, *Florida International University*  
 Wojciech Grochala, *University of Warsaw, Poland*  
 Brent Grocholski, *Massachusetts Institute of Technology*  
 Neal Sanchayan Gupta, *Indian Institute of Science Education and Research, Mohali*  
 Xinguo Hong, *NSLS, Brookhaven National Laboratory*  
 Wen-Pin Hsieh, *University of Illinois at Urbana-Champaign*  
 Pierre-Eymeric Janolin, *École Centrale Paris, France*  
 Xiulan Jiang, *Jilin University, PR China*  
 Seiji Kamada, *Tohoku University, Japan*  
 Chi-Chang Kao, *NSLS, Brookhaven National Laboratory*  
 Kiho Kim, *American University*  
 Anton Kolesnikov, *Moscow State Academy of Fine Chemical Technology, Russia*  
 Atsushi Kyono, *University of Tsukuba, Japan*  
 Kai Landskron, *Lehigh University*  
 Chad Lane, *Memorial University, Newfoundland, Canada*  
 Peter Lazor, *Uppsala University, Sweden*  
 Jung-Fu Lin, *University of Texas at Austin*  
 Qiong Liu, *Peking University, PR China*  
 Konstantin Lokshin, *University of Tennessee*  
 Xuan Luo, *Unaffiliated*  
 Mohammad Mahmood, *Howard University*  
 Murli Manghni, *University of Hawaii*  
 Matteo Masotta, *University of Rome, Sapienza, Italy*  
 Charles Meade, *RAND Corporation*

Francis McCubbin, *University of New Mexico*  
 Stewart McWilliams, *Howard University*  
 Sami Mikhail, *University College London, UK*  
 Lisa Monaco, *Marshall Space Flight Center*  
 Amy Morrow, *Stanford University*  
 Motohiko Murakami, *Tohoku University, Japan*  
 Yuki Nakamoto, *Osaka University, Japan*  
 Nora Noffke, *Old Dominion University*  
 Charlotte Oskam, *Murdoch University, Australia*  
 Dominic Papineau, *Boston College*  
 Qing Peng, *California State University, Northridge*  
 Kate Pinkerton, *American University*  
 Laurie Raymundo, *University of Guam*  
 Jamey Redding, *American University*  
 K.V. Shanavas, *Bhabha Atomic Research Centre, Mumbai, India*  
 Chip Shearer, *University of New Mexico*  
 Balazs Sipos, *Oak Ridge National Laboratory*  
 Mahmooda Sultana, *NASA Goddard Space Flight Center*  
 Michelle Thompson, *Royal Ontario Museum, Toronto, Canada*  
 Jack Tossell, *University of Maryland*  
 Chris Tulk, *Oak Ridge National Laboratory*  
 Douwe van Hinsbergen, *University of Oslo, Norway*  
 Willem van Westrenen, *Vrije University, The Netherlands*  
 Udaya Vempati, *The Johns Hopkins University*  
 Norman Wainwright, *Charles River Laboratories*  
 Wilson Wanene, *University of Nevada, Reno*  
 Yanbin Wang, *University of Chicago*  
 Manuel Weinberger, *Lehigh University*  
 Nathan Wolf, *University of Wyoming*  
 Hikaru Yabuta, *Osaka University, Japan*  
 Jiang Zhang, *South China University of Technology*

**Visiting Investigators (Geophysical  
 Laboratory Synchrotron Facilities)**

Makram Abd El Qader, *University of Nevada, Las Vegas, HPCAT*  
 Tayro Acosta, *University of Hawaii, HPCAT*  
 Christopher Adams, *Los Alamos National Laboratory, HPCAT*  
 Kimberly Adams, *Northwestern University, NSLS*  
 G. Amulele, *Yale University, NSLS*  
 Daniel Antonio, *University of Nevada, Las Vegas, HPCAT*  
 Chantel Aracne, *Lawrence Livermore National Laboratory, HPCAT*  
 Matthew Armentrout, *University of California, Los Angeles, HPCAT*  
 Bruce Baer, *Lawrence Livermore National Laboratory, HPCAT*  
 Ligang Bai, *University of Nevada, Las Vegas, HPCAT*  
 Jason Baker, *University of Nevada, Las Vegas, HPCAT*  
 Maria Baldini, *Stanford University, HPCAT*  
 Arnab Banerjee, *The University of Chicago, HPCAT*  
 Eric Bauer, *Los Alamos National Laboratory, HPCAT*  
 Mai Huong Bausch, *University of Nevada, Las Vegas, HPCAT*  
 Bruce Bennett, *Princeton University, HPCAT*  
 Neelanjan Bhattacharaya, *University of Nevada, Las Vegas, HPCAT*  
 Matthew Bishop, *University of West Georgia, HPCAT*  
 Kerri Blobaum, *Lawrence Livermore National Laboratory, HPCAT*  
 Corwin Booth, *Lawrence Berkeley National Laboratory, HPCAT*  
 Eric Borkholder, *Indiana University South Bend, HPCAT*  
 Joseph Bradley, *Lawrence Livermore National Laboratory, HPCAT*  
 Jack Brangham, *University of Nevada, Las Vegas, HPCAT*  
 Pamela Burnley, *University of Nevada, Las Vegas, HPCAT*  
 Nicholas Butch, *University of Maryland, HPCAT*  
 Connor Callahan, *University of Nevada, Las Vegas, HPCAT*  
 Kristie Canaday, *University of Nevada, Las Vegas, HPCAT*  
 Luana Caron, *Delft University of Technology, HPCAT*  
 Justine Carryer, *University of Nevada, Las Vegas, HPCAT*  
 Yun-yuan Chang, *Northwestern University, HPCAT*  
 Raja Chellappa, *Los Alamos National Laboratory, HPCAT*  
 Jing-Yin Chen, *Washington State University, HPCAT*  
 Jinguang Cheng, *University of Texas at Austin, HPCAT*  
 Jennifer Ciezak-Jenkins, *Army Research Laboratory, NSLS*

Andrew Cornelius, *University of Nevada, Las Vegas, HPCAT*  
 Erica Cotter, *Indiana University South Bend, HPCAT*  
 Céline Crépisson, *Université Pierre et Marie Curie*  
 Hyunchoe Cynn, *Lawrence Livermore National Laboratory, HPCAT*  
 Dana Dattelbaum, *Los Alamos National Laboratory, HPCAT*  
 Christopher DeVreugd, *Virginia Polytechnic Institute & State University, HPCAT*  
 Przemyslaw Dera, *University of Chicago*  
 Liyanagamage Dias, *Washington State University, HPCAT*  
 Vincent Doczy, *Indiana University South Bend, HPCAT*  
 Daniel Dolan, *Sandia National Laboratory, HPCAT*  
 Haini Dong, *Princeton University, HPCAT*  
 Zhaohui Dong, *University of Western Ontario, HPCAT*  
 Susannah Dorfman, *Princeton University, HPCAT*  
 Vadym Drozd, *Florida International University, HPCAT*  
 Zhixue Du, *Yale University, HPCAT*  
 Thomas Duffy, *Princeton University, HPCAT*  
 William Evans, *Lawrence Livermore National Laboratory, HPCAT*  
 H. Feng, *Montclair State University, NSLS*  
 Gregory Finkelstein, *Princeton University, HPCAT*  
 Maggie Frank, *Northern Illinois University, HPCAT*  
 Mark Frank, *Northern Illinois University, HPCAT*  
 Martin Galley, *University of Nevada, Las Vegas, HPCAT*  
 P. Gao, *New Jersey Institute of Technology, NSLS*  
 Ariana Gleason, *Stanford University, HPCAT*  
 Chen Gu, *Massachusetts Institute of Technology, HPCAT*  
 W. Han, *Brookhaven National Laboratory, NSLS*  
 Sara Haravifard, *Argonne National Laboratory, HPCAT*  
 Daniel Haskel, *Argonne National Laboratory, HPCAT*  
 E. Hausrath, *University of Nevada, Las Vegas, HPCAT*  
 Shigeto Hirai, *Stanford University, HPCAT*  
 Christopher Holl, *Northwestern University, HPCAT*  
 Daniel Hooks, *Los Alamos National Laboratory, HPCAT*  
 John Howard, *University of Nevada, Las Vegas, HPCAT*  
 Dongbin Hou, *Texas Tech University, HPCAT*  
 Rostislav Hrubik, *Florida International University, HPCAT*  
 Shu Huang, *Florida International University, HPCAT*  
 Valentin Iota, *University of Alabama at Birmingham, HPCAT*  
 Matthew Jacobsen, *University of Nevada, Las Vegas, HPCAT*  
 Steven Jacobsen, *Northwestern University, HPCAT*  
 Jason Jeffries, *Lawrence Livermore National Laboratory, HPCAT*  
 Zsolt Jenei, *Lawrence Livermore National Laboratory, HPCAT*  
 Brian Jensen, *Los Alamos National Laboratory, HPCAT*  
 Ru Jia, *University of Hawaii, HPCAT*  
 Yu Jiang, *University of Nevada, Las Vegas, HPCAT*  
 Changqing Jin, *Chinese Academy of Sciences, HPCAT*  
 Zhicheng Jing, *University of Chicago, HPCAT*  
 Patricia Kalita, *University of Nevada, Las Vegas, HPCAT*  
 Abby Kavner, *University of California, Los Angeles, HPCAT*  
 Minseob Kim, *Washington State University, HPCAT*  
 T. Kim, *Yonsei University, NSLS*  
 Jae-Hyun Klepeis, *Lawrence Livermore National Laboratory, HPCAT*  
 Lingping Kong, *Harbin Institute of Technology, HPCAT*  
 Ravhi Kumar, *University of Nevada, Las Vegas, HPCAT*  
 Maik Lang, *University of Michigan, NSLS*  
 Barbara Lavina, *University of Nevada, Las Vegas, HPCAT*  
 Kanani Lee, *Yale University, HPCAT*  
 Yongjae Lee, *Yonsei University, NSLS*  
 Yongmoon Lee, *Yonsei University, NSLS*  
 Zachary Levine, *National Institute of Standards and Technologies, HPCAT*  
 Bing Li, *Jilin University, HPCAT*  
 Chunyu Li, *Harbin Institute of Technology, HPCAT*  
 Fangfei Li, *Jilin University, HPCAT*  
 Q. Li, *Jilin University, NSLS*  
 Jung-Fu Lin, *University of Texas at Austin, HPCAT*  
 Yu Lin, *Stanford University, HPCAT*  
 Kristina Lipinska-Kalita, *University of Nevada, Las Vegas, HPCAT*  
 Magnus Lipp, *Lawrence Livermore National Laboratory, HPCAT*  
 Ang Liu, *University of Western Ontario, HPCAT*



Baochang Liu, *Jilin University, HPCAT, NSLS*  
 D. Liu, *Jilin University, NSLS*  
 D. Liu, *Yonsei University, NSLS*  
 Haozhe Liu, *Harbin Institute of Technology, HPCAT*  
 Jin Liu, *University of Texas at Austin, HPCAT*  
 Yu Liu, *University of Nevada, Las Vegas, HPCAT*  
 Chang Lu, *University of Texas at Austin, HPCAT*  
 Matthew Lucas, *Air Force Research Laboratory, HPCAT*  
 Hongwei Ma, *Stanford University, HPCAT*  
 M. Ma, *Chinese Academy of Sciences, NSLS*  
 Nathan Mack, *Los Alamos National Laboratory, HPCAT*  
 Simon MacLeod, *Atomic Weapons Establishment, HPCAT*  
 Wendy Mao, *Stanford University, HPCAT*  
 Zhu Mao, *University of Texas at Austin, HPCAT*  
 Brian Mattern, *Washington State University, HPCAT*  
 Lisa Mauger, *California Institute of Technology, HPCAT*  
 Rana Mohtadi, *Toyota, HPCAT*  
 Jeffrey Montgomery, *University of Alabama at Birmingham, HPCAT*  
 Jorge Munoz, *California Institute of Technology, HPCAT*  
 J. Mustfeldt, *University of Tennessee, NSLS*  
 Hu Dung Nguyen, *Delft University of Technology, HPCAT*  
 Zhihua Nie, *Northern Illinois University, HPCAT*  
 H. Okamura, *Kobe University, NSLS*  
 K. Otsuka, *Yale University, NSLS*  
 Jonpierre Paglione, *University of Maryland, HPCAT*  
 Wendy Panero, *Ohio State University, NSLS*  
 Jeffrey Pigott, *Ohio State University, HPCAT, NSLS*  
 Gopal Pradhan, *University of Texas at Austin, HPCAT*  
 Michael Pravica, *University of Nevada, Las Vegas, HPCAT, NSLS*  
 Daniel Preston, *Los Alamos National Laboratory, HPCAT*  
 Daniel Raeman, *Ohio State University, HPCAT, NSLS*  
 Emma Rainey, *University of California, Los Angeles, HPCAT*  
 Yang Ren, *Argonne National Laboratory, HPCAT*  
 Hahnbidt Rhee, *Lawrence Livermore National Laboratory, HPCAT*  
 John Robinson, *University of Nevada, Las Vegas, HPCAT*  
 Harrison Ruiz, *University of Nevada, Las Vegas, HPCAT*  
 Tatsuya Sakamaki, *University of Chicago, HPCAT*  
 Gopi Samudrala, *University of Alabama at Birmingham, HPCAT*  
 Chrysteale Sanloup, *Université Paris*  
 Adam Schwartz, *Lawrence Livermore National Laboratory, HPCAT*  
 Henry Scott, *Indiana University South Bend, HPCAT*  
 D. Seoung, *Yonsei University, NSLS*  
 Yingxia Shi, *Stanford University, HPCAT*  
 Dan Shim, *Massachusetts Institute of Technology, HPCAT*  
 Adam Simon, *University of Nevada, Las Vegas, HPCAT*  
 Hillary Smith, *California Institute of Technology, HPCAT*  
 Emmanuel Soignard, *Arizona State University, HPCAT*  
 Yang Song, *University of Western Ontario, HPCAT*  
 Gerald Stevens, *National Security Technologies, HPCAT*  
 Brandon Stewart, *University of Nevada, Las Vegas, HPCAT*  
 Hongjin Tan, *California Institute of Technology, HPCAT*  
 Elizabeth Tanis, *University of Nevada, Las Vegas, HPCAT*  
 Sarah Thomas, *University of Alabama at Birmingham, HPCAT*  
 Sarah Tolbert, *University of California, Los Angeles, HPCAT*  
 Dane Tomasino, *Washington State University, HPCAT*  
 Raffaella Torchio, *European Synchrotron Radiation Facility, HPCAT*  
 Sally Tracy, *California Institute of Technology, HPCAT*  
 Oliver Tschauner, *University of Nevada, Las Vegas, HPCAT*  
 J. Tse, *University of Saskatchewan, NSLS*  
 Georgiy Tsoy, *University of Alabama at Birmingham, HPCAT*  
 T. Tyson, *New Jersey Institute of Technology, NSLS*  
 Cayman Unterborn, *Ohio State University, HPCAT*  
 Nenad Velisavljevic, *Los Alamos National Laboratory, HPCAT, NSLS*  
 José Vieira Leitao, *Delft University of Technology, HPCAT*  
 Yogesh Vohra, *University of Alabama at Birmingham, HPCAT*  
 Kai Wang, *Jilin University, HPCAT*  
 L. Wang, *State University of New York at Stony Brook, NSLS*  
 Luhong Wang, *Harbin Institute of Technology, HPCAT*  
 Shanmin Wang, *Los Alamos National Laboratory, HPCAT*  
 Yanbin Wang, *University of Chicago, HPCAT*  
 Yuejian Wang, *Yale University, HPCAT*  
 X. Wang, *Brookhaven National Laboratory, NSLS*  
 Haoyan Wei, *Washington State University, HPCAT*  
 Samuel Weir, *Lawrence Livermore National Laboratory, HPCAT*  
 Jennifer Wojno, *University of Nevada, Las Vegas, HPCAT*  
 Dylan Wood, *University of Nevada, Las Vegas, HPCAT*  
 Junjie Wu, *Chinese Academy of Sciences, HPCAT*  
 Yang Wu, *Stanford University, HPCAT*  
 Miao Xie, *University of California, Los Angeles, HPCAT*  
 G. Yang, *Brookhaven National Laboratory, NSLS*  
 Choong-Shik Yoo, *Washington State University, HPCAT*  
 Tony Yu, *University of Chicago, HPCAT*  
 Xiaohui Yu, *Los Alamos National Laboratory, HPCAT*  
 Zhenhai Yu, *Harbin Institute of Technology, HPCAT*  
 Fuming Zhang, *University of Michigan, NSLS*  
 Jinggeng Zhao, *Harbin Institute of Technology, HPCAT*  
 Yusheng Zhao, *University of Nevada – Las Vegas, HPCAT*  
 Jianshi Zhou, *University of Texas at Austin, HPCAT*  
 Hongyang Zhu, *Texas Tech University, HPCAT*  
 Jinlong Zhu, *Los Alamos National Laboratory, HPCAT*  
 Pavel Zinin, *University of Hawaii, HPCAT*  
 Bo Zou, *Jilin University, HPCAT*

<sup>1</sup> To January 28, 2011<sup>2</sup> Incorrectly represented last year<sup>3</sup> From October 1, 2010<sup>4</sup> To August 31, 2010; DOE Program/  
Departmental Outreach Coordinator  
from September 1, 2010<sup>5</sup> To January 17, 2011<sup>6</sup> From January 10, 2011<sup>7</sup> From June 8, 2010<sup>8</sup> From January 10, 2011, to April 8, 2011<sup>9</sup> From February 9, 2011<sup>10</sup> From February 1, 2011<sup>11</sup> From July 1, 2010, to February 28, 2011<sup>12</sup> From October 19, 2010<sup>13</sup> From April 1, 2011<sup>14</sup> From May 2, 2011<sup>15</sup> From September 15, 2010<sup>16</sup> From August 1, 2010, to March 11, 2011<sup>17</sup> From July 1, 2010<sup>18</sup> To January 4, 2011<sup>19</sup> To August 31, 2010; Visiting

Investigator from September 1, 2010

<sup>20</sup> From July 1, 2010<sup>21</sup> From April 1, 2011<sup>22</sup> From June 20, 2011<sup>23</sup> Incorrectly represented last year<sup>24</sup> From July 1, 2010<sup>25</sup> To April 15, 2011<sup>26</sup> To January 14, 2011; Visiting

Investigator from January 17, 2011

<sup>27</sup> From October 4, 2010<sup>28</sup> From January 3, 2011<sup>29</sup> To April 30, 2011<sup>30</sup> To August 31, 2010<sup>31</sup> From July 1, 2010<sup>32</sup> To June 7, 2011; JSPS Fellow from  
June 8, 2011<sup>33</sup> From March 1, 2011<sup>34</sup> From January 4, 2011<sup>35</sup> From January 3, 2011<sup>36</sup> To June 30, 2011<sup>37</sup> To December 31, 2010<sup>38</sup> From July 1, 2010<sup>39</sup> To September 30, 2010; Research

Scientist from October 1, 2010

<sup>40</sup> From October 12, 2010<sup>41</sup> From September 7, 2010<sup>42</sup> To May 31, 2011; from June 1, 2011<sup>43</sup> From June 23, 2011<sup>44</sup> From September 1, 2010<sup>45</sup> From February 22, 2011<sup>46</sup> To August 13, 2010<sup>47</sup> To August 6, 2010<sup>48</sup> From May 16, 2011<sup>49</sup> From September 29, 2010, toFebruary 27, 2011; from February  
28, 2011<sup>50</sup> To August 31, 2010<sup>51</sup> To August 31, 2010<sup>52</sup> From September 29, 2010, to

December 31, 2010

<sup>53</sup> To August 31, 2010<sup>54</sup> From June 1, 2011<sup>55</sup> From June 2011<sup>56</sup> To August 31, 2010<sup>57</sup> From July 15, 2010, to August 14, 2010<sup>58</sup> From June 20, 2011<sup>59</sup> To April 1, 2011<sup>60</sup> From May 3, 2011, to May 31, 2011<sup>61</sup> To August 31, 2010<sup>62</sup> From May 2, 2011<sup>63</sup> Joint appointment with DTM<sup>64</sup> Joint appointment with DTM<sup>65</sup> To February 28, 2011; DCO Program

Associate from March 1, 2011

<sup>66</sup> Joint appointment with DTM<sup>67</sup> Joint appointment with DTM<sup>68</sup> Joint appointment with DTM<sup>69</sup> Joint appointment with DTM<sup>70</sup> From August 16, 2010<sup>71</sup> To February 28, 2011; DCO Program

Manager from March 1, 2011

<sup>72</sup> Joint appointment with DTM;

From April 1, 2011

<sup>73</sup> Joint appointment with DTM;

To February 3, 2011

<sup>74</sup> Joint appointment with DTM<sup>75</sup> Joint appointment with DTM



**GLOBAL ECOLOGY** Front row (left to right): David Knapp, Kelly McManus, Dana Chadwick, Monalisa Chatterjee, Yuntao Zhou, Naoia Williams, Jan Brown, Tuai Williams, Evana Lee, Dahlia Quist, Kyla Dahlin, Yoichi Shiga. Second row: John Griffin, Chris Anderson, Kris Ebi, Robin Martin, Loreli Carranza-Jimenez, Julia Pongratz, Katharine Ricke, Lee Love-Anderegg, Hulya Aksoy, Linda Longoria, Rumi Asano, Susan Cortinas, Ismael Villa, Kathi Bump, Ken Caldeira. Third row: Joe Mascaro, Joe Berry, Anna Michalak, Greg Asner, Aravindh Balaji, Mark Higgins, John Clark, Rebecca Hernandez, Jean Baptiste Feret, Matt Colgan, Marion O'Leary, Katherine Marvel, Long Cao, Shane Easter, Kenny Schneider, Vineet Yadav, Ben Kravitz, Michael Mastrandrea, Larry Giles, Eric Kissel, Katharine Mach, Abhishek Chatterjee, Aaron Strong, Bill Anderegg, Jennifer Johnson, Todd Tobeck, Michael Dini, Chris Field, Ty Kennedy-Bowdoin.

## Global Ecology

### Research Staff Members

Gregory Asner  
Joseph A. Berry  
Kenneth Caldeira  
Christopher B. Field, *Director*  
Anna Michalak<sup>1</sup>

### Postdoctoral Fellows and Associates

George Ban-Weiss, *Stanford University*<sup>2</sup>  
Long Cao, *University of Illinois*  
Steven Davis, *Stanford University*  
Jean-Baptiste Feret, *Université Paris-Diderot, Paris*  
James Kellner, *University of Georgia*<sup>3</sup>  
Ben Kravitz, *Rutgers University*<sup>4</sup>  
Shaun Leveck, *University of Witwatersrand, Johannesburg, South Africa*<sup>5</sup>  
Scott Loarie, *Duke University*  
Katharine Mach, *Stanford University*<sup>6</sup>  
Robin Martin, *University of Colorado*  
Joseph Mascaro, *University of Wisconsin*<sup>7</sup>  
Julia Pongratz, *Max Planck Institute of Meteorolog, Germany*  
Kenneth Schneider, *Hebrew University of Jerusalem*  
Ho-Jeong Shin, *Yonsei University, Seoul, South Korea*<sup>8</sup>

### Predocctoral Fellows and Associates

Bill Anderegg, *Stanford University*  
Eben Broadbent, *Stanford University*  
Matthew Colgan, *Stanford University*

Kyla Dahlin, *Stanford University*  
Luis Fernandez, *Stanford University*  
Rebecca Hernandez, *Stanford University*<sup>9</sup>  
Jennifer Johnson, *Stanford University*  
Kelly McManus, *Stanford University*<sup>10</sup>  
Alex Nees, *Stanford University*  
Adam Wolf, *Stanford University*<sup>11</sup>

### Supporting Staff

Christopher Anderson, *Laboratory Technician*  
Aravindh Balaji, *Computer Technician*  
Loreli Carranza-Jimenez, *Research Technician*  
Dana Chadwick, *Intern*<sup>12</sup>  
Nona Chiariello, *Senior Research Associate*<sup>13</sup>  
John Clark, *Laboratory Technician*  
Benjamin Cohen-Stead, *Laboratory Technician*<sup>14</sup>  
Michael Dini, *Laboratory Technician*<sup>15</sup>  
Shane Easter, *Laboratory Technician*<sup>16</sup>  
Yuka Estrada, *Laboratory Technician*  
Ijah Garfield, *Laboratory Technician*<sup>17</sup>  
Robert Genova, *Researcher and Systems Administrator*  
Lawrence Giles, *Senior Laboratory Technician*  
Mona Houcheime, *Laboratory Technician*<sup>18</sup>  
James Jacobson, *Laboratory Technician*  
Ty Kennedy-Bowdoin, *Senior Laboratory Technician*  
David Knapp, *Senior Laboratory Technician*  
Linda Longoria, *Administrative Assistant*

Lena Maatoug, *Intern*<sup>19</sup>  
 Stephanie May, *Intern*<sup>20</sup>  
 Frank Merry, *Senior Research Associate*<sup>21</sup>  
 Julia Morrison, *Laboratory Technician*<sup>22</sup>  
 Marion O'Leary, *Senior Advancement Consultant*  
 Guayana Paez-Acosta, *Program Coordinator*<sup>23</sup>  
 Alexandra Santiago, *Laboratory Technician*<sup>24</sup>  
 Kevin Smith, *Laboratory Technician*<sup>25</sup>  
 Todd Tobeck, *Laboratory Manager*  
 C. Parker Weiss, *Laboratory Technician*

<sup>1</sup> From June 1, 2011  
<sup>2</sup> To October 30, 2010  
<sup>3</sup> To January 7, 2011  
<sup>4</sup> From June 1, 2011  
<sup>5</sup> To September 29, 2010  
<sup>6</sup> From July 1, 2010, to April 30, 2011  
<sup>7</sup> From July 1, 2010  
<sup>8</sup> To October 30, 2010  
<sup>9</sup> From September 1, 2010  
<sup>10</sup> From September 1, 2010  
<sup>11</sup> To October 15, 2010  
<sup>12</sup> From February 28, 2011  
<sup>13</sup> From July 1, 2010

<sup>14</sup> From May 24, 2011  
<sup>15</sup> From November 1, 2011  
<sup>16</sup> From July 6, 2010  
<sup>17</sup> From September 27, 2010, to March 1, 2011  
<sup>18</sup> To April 15, 2011  
<sup>19</sup> From February 28, 2011  
<sup>20</sup> From March 4, 2010  
<sup>21</sup> From November 1, 2010  
<sup>22</sup> From May 3, 2010, to August 31, 2010  
<sup>23</sup> To June 17, 2011  
<sup>24</sup> From August 16, 2010, to March 15, 2011  
<sup>25</sup> To May 31, 2011

## The Observatories

### Research Staff Members

Alan Dressler  
 Wendy Freedman, *Director*  
 Luis Ho  
 Juna Kollmeier  
 Patrick McCarthy  
 Andrew McWilliam  
 John Mulchaey  
 Augustus Oemler, Jr., *Director Emeritus*  
 Eric Persson  
 George Preston, *Director Emeritus*  
 Michael Rauch  
 Allan Sandage, *Staff Member Emeritus*<sup>1</sup>  
 François Schweizer  
 Leonard Searle, *Director Emeritus*<sup>2</sup>  
 Stephen Sheckman  
 Joshua Simon<sup>3</sup>  
 Ian Thompson  
 Ray Weymann, *Director Emeritus*

### Research Associates

Dan Kelson, *Staff Associate*  
 Barry Madore, *Senior Research Associate*

### Technical Staff Members

Matt Johns, *Chief Systems Engineer, GMT0*<sup>4</sup>  
 Alan Uomoto, *Magellan Technical Manager*

### Postdoctoral Fellows and Associates

Lei Bai, *Postdoctoral Associate*<sup>5</sup>  
 Christopher Burns, *Research Associate*  
 Thomas J. Cox, *Carnegie Fellow*  
 Jeffrey Crane, *Staff Associate*  
 Xiaobo Dong, *Research Assistant*<sup>6</sup>  
 Nimish Hathi, *Postdoctoral Associate*<sup>3</sup>  
 Song Huang, *Research Assistant*<sup>7</sup>  
 Ivo Labbé, *Hubble Fellow*<sup>8</sup>  
 Janice Lee, *Carnegie Fellow*  
 Zhao-Yu Li, *Research Assistant*<sup>9</sup>  
 Karín Menéndez-Delmestre, *NSF Fellow*  
 Ivelina Momcheva, *Postdoctoral Associate*  
 Andy Monson, *Postdoctoral Associate*  
 Eric Murphy, *Postdoctoral Associate*<sup>10</sup>  
 Masami Ouchi, *Carnegie Fellow*<sup>11</sup>  
 José Prieto, *Carnegie-Princeton-Hubble Fellow*  
 Ryan Quadri, *Hubble Fellow*<sup>7</sup>  
 Iván Ramírez, *Sagan Fellow*<sup>7</sup>  
 Jesper Rasmussen, *Chandra Fellow*<sup>12</sup>

Jane Rigby, *Carnegie Fellow*<sup>13</sup>  
 Ian Roederer, *Carnegie Fellow*  
 Victoria Scowcroft, *Postdoctoral Associate*  
 Mark Seibert, *Postdoctoral Associate*  
 Joshua Simon, *Carnegie-Vera Rubin Fellow*<sup>14</sup>  
 Rik Williams, *Postdoctoral Associate*

### Las Campanas Research Staff

Mark Phillips, *Associate Director, Las Campanas Observatory and Magellan Telescope*  
 Miguel Roth, *Director, Las Campanas Observatory*

### Las Campanas Fellows and Associates

Francisco Di Mille, *AAO Magellan Fellow*  
 Gaston Folatelli, *Postdoctoral Fellow*  
 Shane Walsh, *AAO Magellan Fellow*

### Las Campanas Visiting Investigator

Nidia Morrell, *Visiting Scientist*

### Support Scientist

David Murphy, *Instrument Scientist*

### External Affairs, Pasadena

Reed Haynie, *Campaign Manager, Giant Magellan Telescope*<sup>15</sup>

### Giant Magellan Telescope Organization (GMT0)

John Apoian, *Facilities Lead*<sup>16</sup>  
 Antonin Bouchez, *Adaptive Optics Scientist*  
 Steven Dolmseth, *Chief Financial Officer*  
 Arash Farahani, *Enclosure Engineer*<sup>17</sup>  
 José Filgueira, *System Software Controls Lead*<sup>18</sup>  
 Richard Haley, *Contracts Officer*  
 Charlie Hull, *Project Mechanical Engineer*  
 George Jacoby, *Instrumentation Scientist*  
 Matthew Johns, *Chief Systems Engineer*<sup>4</sup>  
 Jonathan Kern, *Telescope Engineering Manager*  
 Carolynn LaRocca, *Administrative Assistant to the Director*<sup>19</sup>  
 Jessica Maiten, *Senior Systems Engineer*<sup>20</sup>  
 Leni Malherbe, *Document Control Specialist*  
 Patrick McCarthy, *Director*  
 Keith Raybould, *Project Manager*<sup>21</sup>  
 Michael Sheehan, *Telescope Lead*<sup>22</sup>  
 Stephen Sheckman, *Project Scientist*  
 Eli Slawson, *Administrative Assistant*<sup>4</sup>  
 Carey Smith, *Optomechanical Engineer*  
 Amnon Talmor, *Project Engineer*  
 Michael Ward, *Senior Systems Engineer*<sup>23</sup>  
 Charmeen Wing, *Joint Development Officer*



**THE OBSERVATORIES** Front row (left to right): Juna Kollmeier, Silvia Hutchison, Jorge Estrada, Wendy Freedman, Eric Persson, Ken Clardy, Leni Malherbe, Lei Bai, Karín Menéndez-Delmestre, Victoria Scowcroft, Jane Rigby. Second row: Gillian Tong, Janice Lee, Ayako Jinno-Kanayama, Jon Kern, Luis Ochoa, Vgee Ramiah, Luis Ho, Sharon Kelly, Christoph Birk, François Schweizer, Robert Storts, Matt Johns, Carey Smith, Richard Haley, Alan Uomoto, Steven Dolmseth, José Filgueira, Antonin Bouchez, Tyson Hare, Michael Ward, Amnon Talmor, Ivelina Momcheva, Alan Bagish, Greg Ortiz, Eli Slawson, Jerson Castillo. Third row: José Prieto, Charmeen Wing, Edward Villanueva, John Mulchaey, Rik Williams, Dan Kelson, Pat McCarthy, George Preston, Andrew McWilliam, David Murphy, Steve Wilson, Earl Harris, Scott Rubel, T.J. Cox, Barry Madore, Paul Collison, Charlie Hull, Mark Seibert, Andy Monson, Robert Pitts, John Grula. Absent: Greg Burley, Chris Burns, Jeffrey Crane, Alan Dressler, Vincent Kowal, Becky Lynn, Zhaoyu Li, Michael Rauch, Steve Sheckman, Joshua Simon, Ian Thompson.

#### Supporting Staff, Pasadena

Alan Bagish, *Las Campanas Observatory Engineer*  
 Christoph Birk, *Data Acquisition Programmer*  
 Jerson Castillo, *Instrument Maker*  
 Ken Clardy, *Programmer*  
 Paul Collison, *Computer Systems Manager*  
 Jorge Estrada, *Electronics Technician*  
 John Grula, *Head Librarian, Information Services/Publications Manager*  
 Tyson Hare, *Mechanical Engineer*  
 Earl Harris, *Shipping and Receiving Specialist*  
 Silvia Hutchison, *Assistant to the Director*  
 Ayako Jinno-Kanayama, *Financial Accountant*<sup>24</sup>  
 Sharon Kelly, *Senior Buyer*<sup>25</sup>  
 Vincent Kowal, *Machine Shop Foreperson/ Instrument Maker*  
 Anthony Lee, *Assistant Business Manager*<sup>26</sup>  
 Becky Lynn, *Secretary*  
 Sonia Ochoa, *Purchasing Manager*<sup>27</sup>  
 Luis Ochoa Ramirez, *Accounts Payable Specialist*  
 Greg Ortiz, *Assistant, Buildings and Grounds*  
 Robert Pitts, *Assistant, Buildings and Grounds*  
 Vgee Ramiah, *Business Manager*  
 Scott Rubel, *Associate Facilities Manager*  
 Robert Storts, *Instrument Maker*  
 Irina Strelnik, *Assistant Business Manager*<sup>28</sup>  
 Edward Villanueva, *Data Analyst and Programmer*  
 Valerie Vlahovic, *Financial Accountant*<sup>29</sup>  
 Gregory Walth, *Data Analyst*  
 Steven K. Wilson, *Facilities Manager*

#### Supporting Staff, Las Campanas

Miriela Abarca, *Janitor*  
 Carolina Alcayaga, *Purchasing Officer*  
 Ricardo Alcayaga, *Mechanic*  
 Juan Alfaro, *Magellan Site Maintenance Support*  
 Hernán Ángel, *Driver/Purchaser*  
 Jorge Araya, *Magellan Telescope Operator*  
 Hector Balbontín, *Chef*  
 Andres Borquez, *Chef*<sup>50</sup>  
 Jorge Bravo, *Magellan Instrument Specialist*  
 Juan-Carlos Carrasco, *Driver/Purchaser*  
 Pedro Carrizo, *Plumber*  
 Jilberto Carvajal, *El Pino Guard*  
 Jorge Castillo, *Paramedic*<sup>51</sup>  
 Pablo Castro, *Telescope Controls Programmer*  
 Emilio Cerda, *Magellan Electronics Engineer*  
 Angel Cortés, *Accountant*  
 Henry Cortés, *Electrician*  
 José Cortés, *Janitor*  
 Oscar Duhalde, *Mechanical Technician*  
 Julio Egaña, *Painter*  
 Juan Espoz, *Mechanic*  
 Glenn Eychaner, *Telescope Systems Programmer*  
 Francisco Figueroa, *Supervisor of Mountain Maintenance*  
 Carlos Flanega, *Janitor*  
 Javier Fuentes, *Night Assistant*<sup>52</sup>  
 Juan Gallardo, *Mechanical Engineer*<sup>3</sup>  
 Manuel Gamboa, *Assistant Construction*<sup>53</sup>

Jaime Gómez, *Accounting Assistant*  
 Danilo González, *El Pino Guard*  
 Luis González, *Janitor*  
 Sergio González, *Night Assistant*<sup>34</sup>  
 Javier Gutiérrez, *Mechanical Technician Assistant*  
 Nelson Ibacache, *Mechanical Assistant*  
 Patricio Jones, *Magellan Electronics Engineer*  
 Oscar Juica, *Plumber*  
 Marc Leroy, *Assistant Telescope Engineer*  
 Alejandro Leyton, *Electrician*<sup>35</sup>  
 Leonel Lillo, *Carpenter*<sup>36</sup>  
 Gabriel Martin, *Magellan Instrument Specialist*  
 Mauricio Martinez, *Magellan Telescope Operator*  
 Miguel Méndez, *Mechanical Technician*  
 Victor Meriño, *Magellan Instrument Specialist*  
 Emma Molina, *Administrative Assistant*<sup>37</sup>  
 Mario Mondaca, *P/T El Pino Guard*  
 Eric Muñoz, *Accountant*  
 Pascual Muñoz, *Chef*<sup>38</sup>  
 Silvia Muñoz, *Business Manager*  
 Mauricio Navarrete, *Magellan Instrument Specialist*  
 Hernán Nuñez, *Magellan Telescope Operator*  
 Miguel Ocaranza, *Administrative Assistant*  
 Herman Olivares, *Night Assistant*  
 Jorge Olivares, *Mechanic*<sup>39</sup>  
 David Osip, *Magellan Instrumentation Scientist*  
 Povilas Palunas, *Telescope Scientist*  
 Frank Perez, *Site Manager/Telescope Engineer*  
 Patricio Pinto, *Electronics Engineer*  
 Gabriel Prieto, *GMT Site Testing Support*  
 Félix Quiroz, *Mechanical Technician*  
 Andres Rivera, *Electronics Engineer*  
 Hugo Rivera, *Magellan Telescope Operator Controls Programmer*  
 Javier Rivera, *Paramedic*  
 Agustín Sarmiento, *Chef*<sup>41</sup>  
 Joanna Thomas-Osip, *Site Test Scientist*  
 Gabriel Tolmo, *El Pino Guard*  
 Manuel Traslaviña, *Heavy Equipment Operator*  
 Gerardo Vallardes, *Magellan Telescope Operator*  
 Sergio Vera, *Magellan Telescope Operator*  
 David Verdugo, *Chef*  
 Jose Zambra, *Chef*<sup>42</sup>

#### Visiting Investigators

Alicia Aarnio, *University of Michigan*  
 Louis Abramson, *The University of Chicago*  
 Simon Albrecht, *Massachusetts Institute of Technology*  
 Javier Alonso Garcia, *Pontificia Universidad Católica de Chile*  
 Alan Alves, *Pontificia Universidad Católica de Chile*  
 Mark Ammons, *The University of Arizona*  
 Joseph Anderson, *Universidad de Chile*  
 Angeloni Angeloni, *Pontificia Universidad Católica de Chile*  
 Guillem Anglada, *Department of Terrestrial Magnetism*  
 Timo Anguita, *Pontificia Universidad Católica de Chile*  
 John Apoian, *Giant Magellan Telescope Organization*  
 Catalina Arcos, *Universidad de Valparaíso, Chile*  
 Pamela Arriagada, *Pontificia Universidad Católica de Chile*  
 Matthew Ashby, *Harvard-Smithsonian, CFA*  
 Jose Astudillo, *Universidad de La Serena, Chile*  
 Daniela Barria, *Universidad de Concepción, Chile*  
 Felipe Barrientos, *Pontificia Universidad Católica de Chile*  
 Mary Barsony, *Science Space Institute*  
 Tadeusz Batsch, *The Andrzej Soltan Institute for Nuclear Studies, Poland*  
 Franz Bauer, *Pontificia Universidad Católica de Chile*  
 Patrick Baumann, *Max-Planck-Institut Für Astronomie, Germany*  
 Matthew Bayliss, *The University of Chicago*  
 Jacob Bean, *Harvard-Smithsonian, CFA*  
 Susan Benecchi, *Department of Terrestrial Magnetism*  
 Amokrane Berdja, *NOAO, Chile*  
 Edo Berger, *Harvard-Smithsonian, CFA*  
 Michael Berry, *Rutgers, The State University of New Jersey*  
 John Bochanski, *Pennsylvania State University*  
 Jura Borissova, *Universidad de Valparaíso, Chile*  
 Alan Boss, *Department of Terrestrial Magnetism*  
 Emily Bowsler, *University of California, San Diego*  
 Rafael Brahm, *Pontificia Universidad Católica de Chile*  
 Greg Bredthauer, *Semiconductor Technology Associates Inc.*  
 Christopher Britt, *Louisiana State University*  
 Mark Brodwin, *Harvard-Smithsonian, CFA*  
 Adam Burgasser, *University of California, San Diego*  
 Ben Burningham, *University of Hertfordshire, UK*  
 Paul Butler, *Department of Terrestrial Magnetism*  
 Paula Calderon, *Universidad de Concepción, Chile*  
 Abdo Campillay, *National Science Foundation*  
 Julio Carballo, *Instituto de Astrofísica de Canarias, Spain*  
 Don Carona, *The Johns Hopkins University*  
 Guivanni Carraro, *European Southern Observatory*  
 Daniela Carrasco, *Pontificia Universidad Católica de Chile*  
 Bradley Carter, *University of Southern Queensland, Australia*  
 Luca Casagrande, *Max-Planck-Institut Für Astronomie, Germany*  
 Andrew Casey, *The Australian National University*  
 Julio Chaname, *Department of Terrestrial Magnetism*  
 David Charbonneau, *Harvard-Smithsonian, CFA*  
 Joy Chavez, *The Johns Hopkins University*  
 Ryan Chornock, *Harvard-Smithsonian, CFA*  
 Alejandro Clocchiatti, *Pontificia Universidad Católica de Chile*  
 Laird Close, *The University of Arizona*  
 Maureen Conroy, *Harvard-Smithsonian, CFA*  
 Kyle Cook, *The Johns Hopkins University*  
 Michael Cooper, *The University of Arizona*  
 Michiel Cottaar, *ETH Zürich, Switzerland*  
 Feffrey Coughlin, *Department of Terrestrial Magnetism*  
 Michael Cushing, *NASA, Jet Propulsion Laboratory*  
 Ian Czekala, *Harvard-Smithsonian, CFA*  
 Gary Da Costa, *The Australian National University*  
 Avril Day Jones, *Universidad de Chile*  
 John Debes, *NASA, Goddard Space Flight Center*  
 Istvan Dekany, *Pontificia Universidad Católica de Chile*  
 Darren DePoy, *Texas A&M University*  
 Curtis Dewitt, *University of Florida*  
 Andrea Dupree, *Harvard-Smithsonian, CFA*  
 Maria Duran, *University of California, San Diego*  
 Eiichi Egami, *The University of Arizona*  
 Josh Emery, *University of Tennessee*  
 Kristen Erickson, *University of Missouri*  
 Pablo Espinoza, *The University of Arizona*  
 Juan Espoz, *Universidad de Valparaíso, Chile*  
 Emilio Falco, *Harvard-Smithsonian, CFA*  
 Xiaohui Fan, *The University of Arizona*  
 Gabriel Ferrero, *Universidad Nacional de La Plata, Argentina*  
 Robert Fesen, *Dartmouth College*  
 Veronica Firpo, *Universidad Nacional de La Plata, Argentina*  
 Ryan Foley, *Harvard-Smithsonian, CFA*  
 Stuart Folkes, *Universidad de Valparaíso, Chile*  
 Wen-fai Fong, *Harvard-Smithsonian, CFA*  
 Harold Francke, *Pontificia Universidad Católica de Chile*  
 Anna Frebel, *Harvard-Smithsonian, CFA*  
 Cesar Fuentes, *Northern Arizona University*  
 Maricruz Galvez, *Universidad Complutense de Madrid, Spain*  
 Roberto Gamen, *Universidad Nacional de La Plata, Argentina*  
 Cristina Garcia, *Pontificia Universidad Católica de Chile*  
 Victor Gasho, *The University of Arizona*  
 Jean Rene Gauthier, *The University of Chicago*  
 Marla Geha, *Yale University*

Doug Geisler, *Universidad de Concepción, Chile*  
 Chris Gelino, *California Institute of Technology*  
 David Gerdes, *University of Michigan*  
 Daniel Gifford, *University of Michigan*  
 Marek Gorski, *Universidad de Concepción, Chile*  
 Dariusz Graczyk, *Universidad de Concepción, Chile*  
 Jenny Greene, *University of Texas at Austin*  
 Caitlin Griffith, *The University of Arizona*  
 Lucia Guaita, *Pontificia Universidad Católica de Chile*  
 Guillermo Gunthard, *Universidad de La Serena, Chile*  
 Kevin Hainline, *University of California, Los Angeles*  
 Randy Hammond, *The Johns Hopkins University*  
 Sang-Il Han, *Yonsei University, Korea*  
 Daniel Handlin, *Harvard-Smithsonian, CfA*  
 Craig Harrison, *University of Michigan*  
 Takuya Hashimoto, *University of Tokyo, Japan*  
 Marianne Heida, *Space Research Organization Netherlands*  
 Pascale Hibon, *Gemini Observatory*  
 Fredrick High, *The University of Chicago*  
 Mathew Holman, *Harvard-Smithsonian, CfA*  
 Laurens Homs, *Utrecht University, Netherlands*  
 Young Hoon Joe, *Yonsei University, Korea*  
 Joseph Hora, *Harvard-Smithsonian, CfA*  
 Wen-Hsin Hsu, *University of Michigan*  
 Sang Il Han, *Yonsei University, Korea*  
 Catalina Infante, *Pontificia Universidad Católica de Chile*  
 Jimmy Irwin, *University of Michigan*  
 Marcelo Jaque, *Universidad de La Serena, Chile*  
 Matt Johns, *Giant Magellan Telescope Organization*  
 Sean Johnson, *The University of Chicago*  
 Andres Jordan, *Pontificia Universidad Católica de Chile*  
 Stella Kafka, *Department of Terrestrial Magnetism*  
 Janusz Kaluzny, *Nicolaus Copernicus Astronomical Centre, Poland*  
 Yijung Kang, *Yonsei University, Korea*  
 Jjohn Kavelaars, *National Research Council-HIA, Canada*  
 Stefan Keller, *The Australian National University*  
 Harish Khandrika, *University of California, San Diego*  
 Taehyun Kim, *National Radio Astronomy Observatory*  
 Larry Knowles, *Harvard-Smithsonian, CfA*  
 Evgenia Koumpia, *National Observatory of Athens, IAA, Greece*  
 Stefan Kraus, *University of Michigan*  
 Kory Kreimeyer, *University of Maryland*  
 Mariska Kriek, *Harvard-Smithsonian, CfA*  
 Peter Kurczynski, *Rutgers, The State University of New Jersey*  
 Tanmoy Laskar, *Harvard-Smithsonian, CfA*  
 Susan Lederer, *National Aeronautics and Space Administration*  
 Emily Levesque, *University of Colorado*  
 Paulina Lira, *Universidad de Chile*  
 Xin Liu, *Harvard-Smithsonian, CfA*  
 Matthew Lockhart, *Department of Terrestrial Magnetism*  
 Sarah Logsdon, *University of California, San Diego*  
 Mercedes Lopez, *Department of Terrestrial Magnetism*  
 Ragnhild Lunnan, *Harvard-Smithsonian, CfA*  
 Lucas Macri, *The Johns Hopkins University*  
 Jesus Maiz, *Instituto de Astrofísica de Andalucía, Spain*  
 Sangeeta Malhotra, *Arizona State University*  
 Danilo Marchesini, *Tufts University*  
 Jennifer Marshall, *The Johns Hopkins University*  
 Phillip Massey, *Lowell Observatory*  
 Renne Mateluna, *Universidad de Concepción, Chile*  
 Mario Mateo, *University of Michigan*  
 Anne Matthews, *Harvard-Smithsonian, CfA*  
 Maria Jose Maureira, *Universidad de Chile*  
 Jeff McClintock, *Harvard-Smithsonian, CfA*  
 Kenneth McCracken, *Harvard-Smithsonian, CfA*  
 Michael McDonald, *University of Maryland*  
 Ian McGreer, *The University of Arizona*  
 Brian McLeod, *Harvard-Smithsonian, CfA*  
 Jorge Melendez, *Universidade de São Paulo, Brazil*  
 Steffen Mieske, *European Southern Observatory*  
 Valerie Mikles, *Louisiana State University*  
 Dan Milisavljevic, *Dartmouth College*  
 Brek Miller, *University of Birmingham, UK*  
 Christian Moni Bidin, *Universidad de Concepción, Chile*  
 Marcelo Mora, *Universidad de los Andes, Columbia*  
 Nicholas Moskowitz, *Department of Terrestrial Magnetism*  
 John Moustakas, *University of California, San Diego*  
 Ricardo Muñoz, *Yale University*  
 Kathryn Neugent, *Lowell Observatory*  
 Elizabeth Newton, *Harvard-Smithsonian, CfA*  
 John Norris, *The Australian National University*  
 Tim Norton, *Harvard-Smithsonian, CfA*  
 Pasquier Noterdaeme, *Universidad de Chile*  
 George Nystrom, *Harvard-Smithsonian, CfA*  
 John O'Meara, *Saint Michael's College*  
 Edward Olszewski, *The University of Arizona*  
 Yoshiaki Ono, *University of Tokyo, Japan*  
 Mark Ordway, *Harvard-Smithsonian, CfA*  
 Masami Ouchi, *University of Tokyo, Japan*  
 Stephen Parker, *University of New South Wales, Australia*  
 Daniel Patnaude, *Harvard-Smithsonian, CfA*  
 Grzegorz Pietrzynski, *Universidad de Concepción, Chile*  
 Giuliano Pignata, *Universidad Andrés Bello, Chile*  
 Bogumil Pilecki, *Universidad de Concepción, Chile*  
 Pavlos Protopapas, *Harvard-Smithsonian, CfA*  
 Wojtek Pych, *Nicolaus Copernicus Astronomical Centre, Poland*  
 Markus Rabus, *Pontificia Universidad Católica de Chile*  
 Timothy Rawle, *The University of Arizona*  
 Jean Philippe Reault, *The Johns Hopkins University*  
 Alberto Rebas, *Universidad de Valparaíso, Chile*  
 Jean Philippe Rheault, *The Johns Hopkins University*  
 Douglas Richstone, *University of Michigan*  
 Jane Rigby, *NASA, Goddard Space Flight Center*  
 John Roll, *Harvard-Smithsonian, CfA*  
 Alexandre Roman, *Universidad de La Serena, Chile*  
 Alessio Romeo, *Universidad Andrés Bello, Chile*  
 Gisela Romero, *Universidad de Valparaíso, Chile*  
 Nathaniel Ross, *University of California, Los Angeles*  
 Jonathan Ruel, *Harvard-Smithsonian, CfA*  
 Maria Teresa Ruiz, *Universidad de Chile*  
 Pedro Salas, *Pontificia Universidad Católica de Chile*  
 David Sand, *Harvard-Smithsonian, CfA*  
 Wallace Sargent, *California Institute of Technology*  
 Margarita Schultz, *Universidad de Chile*  
 Patrick Seitzer, *University of Michigan*  
 Mathieu Servillat, *Harvard-Smithsonian, CfA*  
 Anil Seth, *Harvard-Smithsonian, CfA*  
 James Shaw, *Harvard-Smithsonian, CfA*  
 Yue Shen, *Harvard-Smithsonian, CfA*  
 Scott Sheppard, *Department of Terrestrial Magnetism*  
 Andrew Shevchuk, *The University of Arizona*  
 Jiri Silha, *National Aeronautics and Space Administration*  
 Robert Simcoe, *Massachusetts Institute of Technology*  
 Mirko Simunovic, *Pontificia Universidad Católica de Chile*  
 Ragini Singh, *The Australian National University*  
 Stephen Smee, *The Johns Hopkins University*  
 Nathan Smith, *The University of Arizona*  
 Jennifer Sobek, *The University of Chicago*  
 Rebeca Sobel, *Massachusetts Institute of Technology*  
 Marcin Sokolowski, *The Andrzej Soltan Institute for Nuclear Studies, Poland*  
 Mario Soto, *Universidad de La Serena, Chile*  
 Lee Spitler, *Swinburne University of Technology, Australia*  
 Brian Stalder, *Harvard-Smithsonian, CfA*  
 Anthony Stark, *Harvard-Smithsonian, CfA*

Daniel Steeghs, *University of Warwick, UK*  
 James Steiner, *Harvard-Smithsonian, CFA*  
 Jay Strader, *Harvard-Smithsonian, CFA*  
 Christopher Stubbs, *Harvard-Smithsonian, CFA*  
 Vincent Suc, *Pontificia Universidad Católica de Chile*  
 Dorota Szczygiel, *Ohio State University*  
 Andrew Szentgyorgyi, *Harvard-Smithsonian, CFA*  
 Sumin Tang, *Harvard-Smithsonian, CFA*  
 Mauricio Tapia, *Universidad Nacional Autónoma, Mexico*  
 Johanna Teske, *The University of Arizona*  
 Cristina Thomas, *Northern Arizona University*  
 Vithal Tilvi, *Arizona State University*  
 Chris Tinney, *University of New South Wales, Australia*  
 Adam Tomczak, *The Johns Hopkins University*  
 Manuel Torres, *Harvard-Smithsonian, CFA*  
 Simon Torres, *Universidad de La Serena, Chile*  
 Chad Trujillo, *Gemini Observatory*  
 Leonardo Vanzi, *Pontificia Universidad Católica de Chile*

Sergio Vasquez, *Pontificia Universidad Católica de Chile*  
 Luis Vega, *Universidad de Valparaíso, Chile*  
 Sandro Villanova, *Universidad de Concepción, Chile*  
 Steven Vogt, *University of California, Santa Cruz*  
 Saeqa Vrtilik, *Harvard-Smithsonian, CFA*  
 Matthew Walker, *Harvard-Smithsonian, CFA*  
 Gregory Walth, *The University of Arizona*  
 Alycia Weinberger, *Department of Terrestrial Magnetism*  
 Benjamin Weiner, *The University of Arizona*  
 Hsiao Wen Chen, *The University of Chicago*  
 Christopher Willmer, *The University of Arizona*  
 Kenneth Wong, *The University of Arizona*  
 Dong Wook Lim, *Yonsei University, Korea*  
 Eva Wuyts, *University of Chicago*  
 Stijin Wuyts, *Harvard-Smithsonian, CFA*  
 Yujin Yang, *Max-Planck-Institut Für Astronomie, Germany*  
 Dennis Zaritsky, *The University of Arizona*

<sup>1</sup> To November 13, 2010

<sup>2</sup> To July 2, 2010

<sup>3</sup> From September 1, 2010

<sup>4</sup> No date provided, title change

<sup>5</sup> To September 30, 2010

<sup>6</sup> From April 1, 2011

<sup>7</sup> From October 1, 2010

<sup>8</sup> To February 28, 2011

<sup>9</sup> To October 18, 2010

<sup>10</sup> From March 17, 2011

<sup>11</sup> To July 19, 2010

<sup>12</sup> To July 31, 2010

<sup>13</sup> To August 20, 2010

<sup>14</sup> To August 31, 2010, now Research Staff Member

<sup>15</sup> From October 5, 2010

<sup>16</sup> To April 29, 2011

<sup>17</sup> From June 18, 2011

<sup>18</sup> From August 11, 2011

<sup>19</sup> From February 24, 2011

<sup>20</sup> From April 11, 2011

<sup>21</sup> From December 6, 2010

<sup>22</sup> From March 21, 2011

<sup>23</sup> To February 15, 2011

<sup>24</sup> To September 15, 2010

<sup>25</sup> From February 15, 2011, formerly Buyer

<sup>26</sup> From October 18, 2010, to April 27, 2011

<sup>27</sup> From August 23, 2010

<sup>28</sup> From June 20, 2011

<sup>29</sup> From August 30, 2010

<sup>30</sup> From October 26, 2010

<sup>31</sup> To June 20, 2011

<sup>32</sup> To May 2, 2011

<sup>33</sup> From January 4, 2011

<sup>34</sup> From April 19, 2011

<sup>35</sup> To April 4, 2011

<sup>36</sup> To May 24, 2011

<sup>37</sup> To June 26, 2011

<sup>38</sup> To July 5, 2011

<sup>39</sup> From January 5, 2011

<sup>40</sup> To June 14, 2011

<sup>41</sup> To November 11, 2010

<sup>42</sup> From February 23, 2011

## Plant Biology

### Research Staff Members

M. Kathryn Barton  
 Winslow R. Briggs, *Director Emeritus*  
 José Dinneny<sup>1</sup>  
 David Ehrhardt  
 Wolf B. Frommer, *Director*  
 Arthur R. Grossman  
 Seung Y. Rhee  
 Zhi-Yong Wang

### Adjunct Staff

Devaki Bhaya  
 Matthew Evans  
 Eva Huala

### Young Investigator

Martin Jonikas

### Visiting Investigators

Cindy Ast, *University of Potsdam, Germany*<sup>2</sup>  
 Sonia Bhattacharya, *Harker High School, San Jose, CA*<sup>3</sup>  
 Niek de Klein, *HAN University of Applied Sciences, Netherlands*<sup>4</sup>  
 Sheila Jensen, *University of Copenhagen, Denmark*<sup>5</sup>  
 Ulrich Kutschera, *University of Kassel, Germany*  
 Catherine Lu, *Stanford University*<sup>6</sup>  
 Eva Nowack, *University of Cologne, Germany*  
 Theodore Raab, *Stanford University*  
 Arun Sampathkumar, *Bharathiar University, India*<sup>7</sup>  
 Paol Rosas Santiago, *Instituto de Biología UNAM, Mexico*<sup>8</sup>

### Postdoctoral Fellows and Associates

Nabila Aboulaich, *Carnegie Fellow*<sup>5</sup>  
 Manever Aksoy, *NSF Research Associate*<sup>9</sup>  
 Ute Armbruster, *Carnegie Fellow*<sup>10</sup>  
 Mingyi Bai, *NIH Research Associate*  
 Clara Bermejo-Herrero, *NIH Research Associate*,  
 Flavia Bossi, *Carnegie Fellow*  
 Shuolei Bu, *Hebei Normal University*<sup>11</sup>  
 Claudia Catalanotti, *Carnegie Fellow*  
 Lee Chae, *NSF Research Associate*  
 Li-Qing Chen, *DOE Research Associate*  
 Antony Chettoor, *Carnegie Fellow, NSF Research Associate*  
 Roberto DeMichele, *NSF Research Associate*<sup>12</sup>  
 David Dewez, *NSF Research Associate*<sup>13</sup>  
 María Rosario Gómez-García, *NSF Research Associate*<sup>14</sup>  
 Guido Grossmann, *Carnegie Fellow*  
 Woei-Jiun Guo, *DOE Research Associate*<sup>15</sup>  
 Fanglian He, *Carnegie Fellow*<sup>12</sup>  
 Mark Heinnickel, *Carnegie Fellow*  
 Alexander Jones, *Carnegie Fellow*  
 Taehyong Kim, *NSF Research Associate*<sup>16</sup>  
 Tae-Wuk Kim, *NIH Research Associate*  
 Sylvie LaLonde, *NIH Research Associate*<sup>17</sup>  
 Viviane Lanquar, *CNRS-Marie Curie Fellow*  
 Tie Liu, *NSF Research Associate*  
 Yongxian Lu, *NSF Research Associate*<sup>12</sup>  
 Enrico Magnani, *LSRF Fellow*  
 Leonardo Magneschi, *Scuola Sant'Anna Fellow*<sup>18</sup>  
 Masayoshi Nakamura, *Carnegie Fellow*<sup>19</sup>



**DEPARTMENT OF PLANT BIOLOGY** First row (left to right): Yongxian Lu, Robert (Bob) Muller, Sue Rhee, Hulya Aksoy, Fanglian He, Xueliang Wei, Yun Bao, Geng Yu, Mia Terashima, Por Se Seaw. Second row: Martin Jonikas, Spencer Gang, Devaki Bhaya, Ute Armbruster, Claudia Catalanotti, Eva Nowack, Shouling Xu, Lina Duan, Ru Zhang, José Dinneny, Mark Heinnickel, Lee Chae, John Griffin, Wolf Frommer, Zhiyong Wang. Third row: Shruti Kumar, Bi-Huei Hou, Evana Lee, Maria Sardi, Saman Parsa, Dahlia Wist, Susan Cortinas, Xiaoqing Qu, Jiaying Zhu, Arthur Grossman, Rick Kim, Larry Ploetz. Fourth row: Peifen Zhang, Erika Valle, Li-qing Chen, Diane Chermak, Naoia Williams, Rumi Asano, I Lin, Franklin Talavera-Rauh. Fifth row: Tyler Wittkopp, Yang Bai, Rafael Arenhart, Mingyi Bai, Munvver Aksoy, Ting Ting Xiang, Shoulei Bu, Sunita Patil, Jianxiu Shang, Flavia Bossi, Phillipe Lamesch, Weronika Patena, Donghui Li, Hye In Nam, Kathy Barton. Sixth row: Wenqiang Yang, Alexandra Grote, Michelle Davison, Masayoshi Nakamura, Ismael Villa, Eunkyoo Oh, Chan Ho Park. Seventh row: Tie Liu, David Ehrhardt, Winslow Briggs, Taehyong Kim, Tanya Beradini, Eva Huala, Shanker Singh, William (Bill) Nelson. Eighth row: Dimitri Tolleter, Enrico Magnani, Philipp Dennyng, Roberto DeMichele, Guido Grossman, Davide Sosso, Alexander Jones, Leif Pallensen, Adam Longhurst, Heather Cartwright, Matt Evans, Tam Tran, Tuai Williams, Antony Chettoor.

David Nelson *Carnegie Fellow*<sup>20</sup>  
 Eunkyoo Oh, *Carnegie Fellow*  
 Chan-Ho Park, *Carnegie Fellow*  
 Allison Phillips, *USDA Fellow, Carnegie Fellow*<sup>21</sup>  
 Brenda Reinhart, *Carnegie Fellow*  
 Davide Sosso, *DOE Research Associate*<sup>22</sup>  
 Dimitri Tolleter, *Moore Research Associate*<sup>19</sup>  
 Tong-Seung Tseng, *NSF Research Associate*  
 Chao-Jung Tu, *Carnegie Fellow*<sup>23</sup>  
 Ankit Walia, *NSF Research Associate*  
 Susanne Wisen, *NSF Postdoctoral Associate*  
 TingTing Xiang, *Moore Research Associate*<sup>24</sup>  
 Shouling Xu, *DOE Research Associate*  
 Wenqiang Yang, *DOE Research Associate*  
 Chang-Hun You, *NSF Research Associate*<sup>25</sup>  
 Ru Zhang, *USAF Research Associate*  
 Shuqing Zhao, *NIH Research Associate*<sup>18</sup>

#### **Predocctoral Fellows and Associates**

Rafael Arenhart, *Federal University of Rio Grande do Sul, Brazil*<sup>26</sup>  
 Michele Davison, *Stanford University*  
 Ryan Gutierrez, *Stanford University*  
 Blaise Hamel, *Stanford University*<sup>27</sup>  
 Yaqi Hao, *Northwest A&F University, China*<sup>27</sup>  
 Zubin Huang, *Stanford University*  
 Ju-Won Kim, *Yonsei University, China*<sup>28</sup>

Tian Li, *Lanzhou University, China*<sup>29</sup>  
 Jiangshu Liu, *Chinese Academy of Sciences, China*  
 Katherine Mackey, *Stanford University*<sup>18</sup>  
 Wirulda Pootakham, *Stanford University*<sup>29</sup>  
 Xiao Qing Qu, *China Agricultural University, China*  
 Jianxiu Shang, *Hebei Normal University, China*  
 Lee Hak Soo, *Yonsei University, Korea*<sup>30</sup>  
 Peng Xu, *Hebei Normal University, China*<sup>31</sup>  
 Min Yuan, *Hebei Normal University, China*<sup>18</sup>  
 Jiaying Zhu, *The Capital Normal University, China*<sup>19</sup>

#### **Supporting Staff**

Hulya Aksoy, *AP Specialist*  
 Debbie Alexander, *Curator*  
 Brandon Araki, *Intern*<sup>32</sup>  
 Rumi Asano, *H&S/IT Manager*  
 Tanya Berardini, *Curator*  
 Sonia Bhattacharya, *Intern*<sup>18</sup>  
 Kathryn Bump, *Business Manager*  
 Lance Cabalona, *Laboratory Assistant*<sup>33</sup>  
 Avelino Carbajal, *Facilities Assistant*  
 Tara Chandran, *Intern*<sup>34</sup>  
 Diane Chermak, *Senior Laboratory Technician*  
 Raymond Chetty, *Software Engineer*<sup>35</sup>  
 Clayton Coker, *Laboratory Technician*  
 Susan Cortinas, *Grants Administrator*



Kate Dreher, *Curator*  
 Min Fan, *Laboratory Technician*<sup>4</sup>  
 Hartmut Foerster, *Curator*<sup>36</sup>  
 Spencer Gang, *Laboratory Technician*<sup>33</sup>  
 Jordan Haarsma, *Intern*<sup>34</sup>  
 Paul Hichwa, *Intern*<sup>18</sup>  
 Bi-Huei Hou, *Laboratory Technician*  
 Daniel Hsiung, *Intern*<sup>34</sup>  
 Julian Huang, *Intern*<sup>37</sup>  
 Danielle Ikoma, *Intern*<sup>38</sup>  
 Caryn Johansen, *Intern*<sup>22</sup>  
 Purva Karia, *Intern*<sup>39</sup>  
 Athikkatuvalasu Karthikeyan, *Curator*  
 Jay Kim, *Intern*<sup>40</sup>  
 Rick Kim, *Intern*<sup>22</sup>  
 Philippe Lamesch, *Curator*  
 Cherise Lau, *Intern*<sup>41</sup>  
 Cynthia Lee, Jr., *Software Engineer*  
 Evana Lee, *Financial Analyst*  
 Donghui Li, *Curator*  
 Andrew Ma, *Intern*<sup>42</sup>  
 Shruti Manoj Kumar, *Laboratory Technician*<sup>43</sup>  
 Dorianne Moss, *Laboratory Technician*  
 Steven Muenzen, *Intern*<sup>18</sup>  
 Robert Muller, *Technical Lead Curator*  
 Hye In Nam, *Laboratory Technician*  
 William Nelson, *Programmer*<sup>44</sup>  
 Graham Newell, *Laboratory Assistant*<sup>13</sup>  
 Nicole Newell, *Laboratory Technician*  
 Jarrod Nixon, *Intern*  
 Duncan Oja, *Intern*  
 Sairupa Paduchuri, *Laboratory Assistant*

Saman Asgharzadeh Parsa, *Laboratory Technician*  
 Sejal Patekh, *Intern*<sup>31</sup>  
 Weronika Patena, *Laboratory Technician*<sup>22</sup>  
 Sunita Patil, *Laboratory Technician*<sup>1</sup>  
 Chloe Peters, *Intern*<sup>41</sup>  
 Kimberly Pham, *Intern*<sup>45</sup>  
 Larry Ploetz, *Systems Administrator*  
 Andrew Prior, *Intern*<sup>1</sup>  
 Leanna Racine, *Intern*<sup>46</sup>  
 Leonore Reiser, *Curator*  
 Mayuri Sadoine, *Intern*<sup>47</sup>  
 Maria Sardi, *Laboratory Technician*  
 Rajkumar Sasidharan, *Curator*<sup>29</sup>  
 Dasha Savage, *Intern*<sup>48</sup>  
 Emma Sedivy, *Intern*  
 David Simmons, *Laboratory Assistant*  
 Shanker Singh, *Database Administrator*  
 Eric Slessarev, *Intern*  
 Paul Sterbentz, *Facilities Manager*  
 David Swarbreck, *Curator*<sup>49</sup>  
 Franklin Talavera-Rauh, *Laboratory Technician*<sup>50,51</sup>  
 Jennifer Teleschow, *Intern*<sup>31</sup>  
 Erika Valle, *Laboratory Technician*  
 Angelica Vazquez, *Dishwasher*  
 Ismael Villa, *Facilities Assistant*  
 Raymond Von Itter, *Greenhouse Assistant*  
 April Wensel, Christopher Wilks, *Intern*  
 Faatuai Williams, *Receptionist/AP Clerk*<sup>52</sup>  
 Naoia Williams, *Receptionist/AP Clerk*,<sup>53</sup> *Accounts Payable Specialist*<sup>52</sup>  
 Dahlia Wist, *Greenhouse Manager*  
 Peifen Zhang, *Curator*

<sup>1</sup>From June 16, 2011<sup>2</sup>From October 16, 2010, to May 13, 2011<sup>3</sup>From June 22, 2010, to September 30, 2011<sup>4</sup>From September 1, 2010, to January 15, 2011<sup>5</sup>To May 31, 2011<sup>6</sup>From January 3, 2011, to May 31, 2011<sup>7</sup>From February 28, 2011, to March 18, 2011<sup>8</sup>From August 4, 2010, to October 28, 2010<sup>9</sup>From September 1, 2010<sup>10</sup>From March 1, 2011<sup>11</sup>From September 1, 2010, to January 31, 2011<sup>12</sup>From July 1, 2010<sup>13</sup>To March 31, 2011<sup>14</sup>To October 15, 2010<sup>15</sup>To January 26, 2011<sup>16</sup>From February 1, 2011<sup>17</sup>To June 1, 2011<sup>18</sup>To August 31, 2010<sup>19</sup>From April 1, 2011<sup>20</sup>From October 1, 2010, to June 30, 2011<sup>21</sup>To June 3, 2011<sup>22</sup>From May 16, 2011<sup>23</sup>To December 31, 2010<sup>24</sup>From January 3, 2011<sup>25</sup>To May 6, 2011<sup>26</sup>From December 16, 2010<sup>27</sup>To June 30, 2010<sup>28</sup>From January 14, 2011, to February 18, 2011<sup>29</sup>To July 15, 2010<sup>30</sup>To April 6, 2011<sup>31</sup>To September 6, 2010<sup>32</sup>From June 1, 2011<sup>33</sup>From September 20, 2010<sup>34</sup>From June 13, 2011<sup>35</sup>To October 29, 2010<sup>36</sup>To June 1, 2010<sup>37</sup>From July 23, 2010, to May 31, 2011<sup>38</sup>From July 6, 2010, to May 31, 2011<sup>39</sup>From January 3, 2011, to June 30, 2011<sup>40</sup>From June 6, 2011<sup>41</sup>From July 6, 2010, to September 20, 2010<sup>42</sup>From January 1, 2011, to February 28, 2011<sup>43</sup>From June 14, 2011<sup>44</sup>From April 18, 2011<sup>45</sup>From July 12, 2010, to December 31, 2010<sup>46</sup>From November 22, 2010, to June 30, 2011<sup>47</sup>From April 1, 2011, to June 15, 2011<sup>48</sup>From October 12, 2010<sup>49</sup>To September 10, 2010<sup>50</sup>From September 20, 2010, to January 23, 2011<sup>51</sup>From January 24, 2011<sup>52</sup>From October 4, 2010<sup>53</sup>To October 1, 2010



**DEPARTMENT OF TERRESTRIAL MAGNETISM** First row (left to right): Joleen Carlberg, Christopher Starke, Shoshana Weider, Wan Kim, Stella Kafka, Linda Elkins-Tanton, Kasey Cunningham, Christian Klimczak, Stacey Santiago Matusko, Sandy Keiser, Alycia Weinberger, Mary Horan, Shaun Hardy, Susan Webb (former predoctoral fellow visiting from the University of Witwatersrand), Vera Rubin, Guillem Anglada-Escudé, Conel Alexander. Second row: Nick Moscovitz, Paul Byrne, Deborah Smith, Merri Wolf, Christian Miller, Matthew Fouch, David James, Daoyuan Sun, Mike Crawford, Zan Peeters, John Chambers, Larry Nittler, Alan Boss, Bill Key, Alan Linde, Selwyn Sacks, Ray Aylor, Tim Mock. Third row: Chin-Wu Chen, Steven Golden, Ben Pandit, Jianhua Wang, Sean Solomon, Brian Schleigh, Janice Dunlap, Tyler Bartholomew, Pablo Esparza, Liyan Tian, Eloïse Gaillou, Frances Jenner, Paul Rydelek, Diana Roman, Adelio Contreras, Roy Dingus, Maceo Bacote, Quintin Miller, Maria Carrillo, Yeny Alejandro, Brian Jackson, Manuel Schilling.

## Terrestrial Magnetism

### Research Staff Members

L. Thomas Aldrich, *Emeritus*  
 Conel M. O'D. Alexander  
 Alan P. Boss  
 R. Paul Butler  
 Richard W. Carlson  
 John E. Chambers  
 Matthew J. Fouch<sup>1</sup>  
 John A. Graham, *Emeritus*  
 Erik H. Hauri  
 David E. James  
 Alan T. Linde  
 Larry R. Nittler  
 Diana C. Roman<sup>2</sup>  
 Scott S. Sheppard  
 Steven B. Shirey  
 Sean C. Solomon, *Director*  
 Fouad Tera, *Emeritus*  
 Alycia J. Weinberger

### Senior Fellows

Vera C. Rubin  
 I. Selwyn Sacks

### Postdoctoral Fellows and Associates

Guillem Anglada-Escudé, *Carnegie Fellow and NASA Associate*  
 Susan D. Benecchi, *Carnegie Fellow*<sup>3</sup>  
 Lydie F. S. Bonal, *NAI Research Associate*<sup>4</sup>  
 Paul K. Byrne, *MESSENGER Fellow*<sup>5</sup>  
 Julio Chanamé, *Hubble Fellow*<sup>6</sup>  
 Chin-Wu Chen, *Harry Oscar Wood Fellow*  
 Eloïse Gaillou, *Carnegie Fellow and Smithsonian Institution, National Museum of Natural History*<sup>7</sup>  
 Natalia Gómez Pérez, *MESSENGER Fellow*<sup>8</sup>  
 Frank Gyngard, *Carnegie Fellow and NASA Astrobiology Institute Associate*<sup>9</sup>  
 Stella Kafka, *NASA Astrobiology Institute Fellow*  
 Christian Klimczak, *MESSENGER Fellow*<sup>10</sup>  
 Ming-Chang Liu, *NASA Associate*<sup>11</sup>  
 Mercedes López-Morales, *Hubble Fellow*<sup>12</sup>  
 Christian A. Miller, *NASA Associate*<sup>13</sup>  
 Nicholas A. Moskovitz, *Richard B. Roberts Fellow, Carnegie Fellow, and NASA Astrobiology Institute Associate*<sup>14</sup>  
 Wendy R. Nelson, *Barbara McClintock Fellow*<sup>15</sup>  
 Jonathan O'Neil, *NSF Associate*<sup>16</sup>  
 Alexander P. A. Peeters, *NASA Astrobiology Institute Associate*<sup>17</sup>  
 Nicholas Schmerr, *Harry Oscar Wood Fellow*<sup>18</sup>  
 Evgenya Shkolnik, *NASA Astrobiology Institute Associate*  
 Deborah E. Smith, *Carnegie Fellow*<sup>19</sup>  
 Christopher C. Stark, *Carnegie Fellow*<sup>20</sup>  
 Daoyuan Sun, *Scott Forbush Fellow, Carnegie Fellow*  
 Jessica M. Warren, *NASA Astrobiology Institute Associate*<sup>21</sup>  
 Shoshana Z. Weider, *MESSENGER Fellow*<sup>22</sup>

**Predoctoral Fellows and Associates**

Grant M. Bybee, *University of the Witwatersrand*  
 Sergio D. Hoyer Miranda, *Universidad de Chile*  
 Justin C. Rogers, *Johns Hopkins University*

**Research Interns**

Katherine Ames, *University of Delaware*  
 Zachary Kaden

**Supporting Staff**

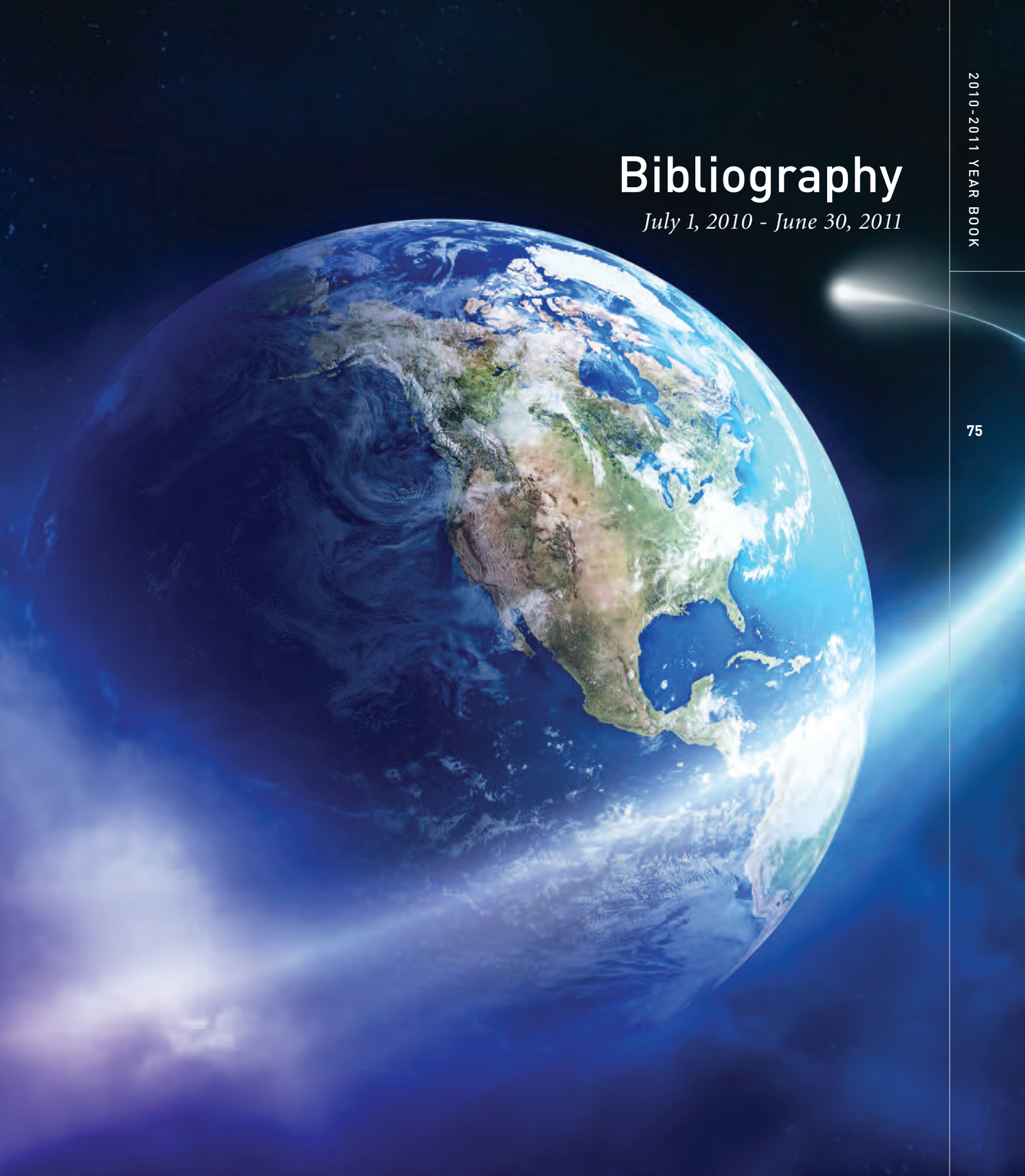
Michael J. Acierno, *IT/IS Manager/Systems Engineer*  
 Raymond Aylor, *Machinist/Instrument Maker*  
 Maceo T. Bacote, *Building Engineer*<sup>23</sup>  
 Tyler Bartholomew, *Machinist Apprentice*  
 Gary A. Bors, *Building Engineer*<sup>23</sup>  
 Alicia R. Case, *Administrative Assistant*<sup>24</sup>  
 Michael J. Crawford, *Machinist, Instrument Maker*  
 Roy R. Dingus, *Facility Manager*<sup>23</sup>  
 Janice S. Dunlap, *Assistant to the Director*  
 Pablo D. Esparza, *Maintenance Technician*<sup>23</sup>  
 Steven Golden, *Field Seismologist*  
 Shaun J. Hardy, *Librarian*<sup>23</sup>  
 Mary F. Horan, *Geochemistry Laboratory Manager*  
 Sandra A. Keiser, *Scientific Computer Programmer/Systems Manager*  
 William E. Key, *Building Engineer*<sup>23</sup>  
 Wan K. Kim, *Staff Accountant*  
 Stacey S. Matusko, *Administrative Assistant*<sup>25</sup>  
 Quintin Miller, *Engineer Apprentice*<sup>23,26</sup>  
 Timothy D. Mock, *Mass Spectrometry Laboratory Manager*  
 Fabian E. Moscoso, *Building Engineer Apprentice*<sup>27</sup>  
 Ben K. Pandit, *Electronics Laboratory Manager*  
 Daniela D. Power, *Geophysical Research Assistant*  
 Pedro J. Roa, *Maintenance Technician*<sup>23</sup>  
 Brian P. Schleigh, *Electronic Design Engineer*  
 Terry L. Stahl, *Fiscal Officer*  
 Jianhua Wang, *Ion Microprobe Research Specialist*  
 Merri Wolf, *Library Technical Assistant*<sup>23</sup>

**Visiting Investigators**

Mark D. Behn, *Woods Hole Oceanographic Institution*  
 Craig R. Bina, *Northwestern University*  
 Ingi Th. Bjarnason, *Science Institute, University of Iceland*  
 Maud Boyet, *Laboratoire Magmas et Volcans, Clermont-Ferrand*  
 Jay A. Brandes, *Skidaway Institute of Oceanography*  
 Kevin C. Burke, *University of Houston*  
 Lindsey Chambers, *University of California, Santa Cruz*  
 James Y.-K. Cho, *University of London*  
 Inés L. Cifuentes, *American Geophysical Union*

Roy S. Clarke, Jr., *Smithsonian Institution, National Museum of Natural History*  
 Clinton P. Conrad, *University of Hawaii*  
 Catherine M. Cooper, *Washington State University*  
 Lucy M. Flesch, *Purdue University*  
 Stephen S. Gao, *Kansas State University*  
 Harry W. Green II, *University of California, Riverside*  
 William E. Holt, *State University of New York, Stony Brook*  
 Emilie E. E. Hooft Toomey, *University of Oregon*  
 Ya-Ju Hsu, *Academia Sinica*  
 Neng Jiang, *Chinese Academy of Sciences*  
 Catherine L. Johnson, *University of British Columbia*  
 Karl Kehm, *Washington College*  
 Katherine A. Kelley, *University of Rhode Island*  
 Christopher R. Kincaid, *University of Rhode Island*  
 Carolina Lithgow-Bertelloni, *University College London*  
 Maureen D. Long, *Yale University*  
 Mercedes López-Morales, *Institut de Ciències de L'Espai (CSIC-ICE)*  
 Patrick J. McGovern, *Lunar and Planetary Institute*  
 Fukashi Maeno, *The University of Tokyo*  
 Fenglin Niu, *Rice University*  
 Stephen H. Richardson, *University of Cape Town*  
 Joseph Rodriguez, *George Mason University*  
 Thomas G. Ruedas  
 Paul A. Rydelek  
 Alberto Saal, *Brown University*  
 Brian Savage, *University of Rhode Island*  
 Martha K. Savage, *Victoria University, New Zealand*  
 Nicholas Schmerr, *Goddard Space Flight Center*  
 Maria Schönbächler, *University of Manchester*  
 Alison M. Shaw, *Woods Hole Oceanographic Institution*  
 Yang Shen, *University of Rhode Island*  
 David W. Simpson, *Incorporated Research Institutions for Seismology*  
 J. Arthur Snoke, *Virginia Polytechnic Institute and State University*  
 Teh-Ru Alex Song, *Yokohama Institute for Earth Science*  
 Erik O. Sturkell, *University of Iceland*  
 Kiyoshi Suyehiro, *Japan Agency for Marine-Earth Science and Technology*  
 Taka'aki Taira, *University of California, Berkeley*  
 Tetsuo Takanami, *Hokkaido University*  
 Henry B. Throop, *Southwest Research Institute*  
 Douglas R. Toomey, *University of Oregon*  
 Nathalie J. Valette-Silver, *National Oceanic and Atmospheric Administration*  
 Suzan van der Lee, *Northwestern University*  
 John C. VanDecar, *Nature Magazine, London*  
 Lara S. Wagner, *University of North Carolina, Chapel Hill*  
 Linda M. Warren, *University of Arizona*  
 Andrew A. West, *Boston University*  
 Elisabeth Widom, *Miami University, Ohio*  
 Cecily J. Wolfe, *University of Hawaii*

<sup>1</sup>From June 27, 2011<sup>2</sup>From June 20, 2011<sup>3</sup>From September 1, 2010<sup>4</sup>To December 18, 2010<sup>5</sup>From June 16, 2011<sup>6</sup>To September 1, 2011<sup>7</sup>From January 1, 2011<sup>8</sup>To September 30, 2010<sup>9</sup>To May 31, 2011<sup>10</sup>From May 23, 2011<sup>11</sup>To August 26, 2010<sup>12</sup>To September 7, 2010<sup>13</sup>From September 1, 2010<sup>14</sup>From April 1, 2010<sup>15</sup>To September 22, 2011<sup>16</sup>To September 9, 2011<sup>17</sup>From November 1, 2010<sup>18</sup>To August 31, 2010<sup>19</sup>From November 15, 2010<sup>20</sup>From August 16, 2010<sup>21</sup>To July 31, 2010<sup>22</sup>From February 2, 2011<sup>23</sup>Joint appointment with Geophysical Laboratory<sup>24</sup>To September 30, 2010<sup>25</sup>From September 13, 2010<sup>26</sup>From April 1, 2010<sup>27</sup>To February 3, 2011



# Bibliography

*July 1, 2010 - June 30, 2011*

## Carnegie Institution of Washington

## EMBRYOLOGY

- Akitake, C. M., M. L. Macurak, M. E. Halpern, and M. G. Goll, Transgenerational analysis of transcriptional silencing in zebrafish, *Dev. Biol.* 352, 191-201, 2011.
- Anderson, J. L., J. D. Carten, and S. A. Farber, Zebrafish lipid metabolism: from mediating early patterning to the metabolism of dietary fat and cholesterol, *Methods Cell Biol.* 101, 111-141, 2011.
- Anderson, J. L., M. L. Macurak, M. E. Halpern, and S. A. Farber, A versatile aquatics facility inventory system with real-time barcode scan entry, *Zebrafish* 7, 281-287, 2010.
- Bellen, H. J., R. W. Levis, Y. He, J. W. Carlson, M. Evans-Holm, E. Bae, J. Kim, A. Metaxakis, C. Savakis, K. L. Schulze, R. A. Hoskins, and A.C. Spradling, The *Drosophila* gene disruption project: progress using transposons with distinctive site specificities, *Genetics* 188, 731-743, 2011.
- Castañeda, J., P. Genzor, and A. Bortvin, piRNAs, transposon silencing, and germline genome integrity, *Mutat. Res.* 714, 95-104, 2011.
- Clifton, J. D., E. Lucumi, M. C. Myers, A. Napper, K. Hama, S. A. Farber, A. B. Smith 3rd, D. M. Huryn, S. L. Diamond, and M. Pack, Identification of novel inhibitors of dietary lipid absorption using zebrafish, *PLoS ONE* 5, e12386, 2010.
- Conkrite, K., M. Sundby, S. Mukai, J. M. Thomson, D. Mu, S. Hammond, and D. MacPherson, *miR-17-92* cooperates with *RB* pathway mutations to promote retinoblastoma, *Genes Dev.* 25, 1734-1745, 2011.
- Feng, S., S. J. Cokus, X. Zhang, P. Y. Chen, M. Bostick, M. G. Goll, J. Hetzel, J. Jain, S. H. Strauss, M. E. Halpern, C. Ukomadu, K. C. Sadler, S. Pradhan, M. Pellegrini, and S. E. Jacobsen, Conservation and divergence of methylation patterning in plants and animals, *Proc. Natl. Acad. Sci. USA* 107, 8689-8694, 2010.
- Fox, D. T., J. G. Gall, and A. C. Spradling, Error-prone polyloid mitosis during normal *Drosophila* development, *Genes Dev.* 24, 2294-2302, 2010.
- Goll, M. G., and M. E. Halpern, DNA methylation in zebrafish, *Prog. Mol. Biol. Transl. Sci.* 101, 193-218, 2011.
- Goodman, B., W. Channels, M. Qiu, P. A. Iglesias, G. Yang, and Y. Zheng, Lamin-B counteracts the kinesin Eg5 to restrain spindle pole separation during spindle assembly, *J. Biol. Chem.* 285, 35238-35244, 2010.
- Gorelick, D. A., and M. E. Halpern, Visualization of estrogen receptor transcriptional activation in zebrafish, *Endocrinology* 152, 2690-2703, 2011.
- Gracheva, E. O., J. F. Cordero-Morales, J. A. González-Carcacia, N. T. Ingolia, C. Manno, C. I. Aranguren, J. S. Weissman, and D. Julius, Ganglion-specific splicing of TRPV1 underlies infrared sensation in vampire bats, *Nature* 476, 88-91, 2011.
- Guan, L., G. W. van der Heijden, A. Bortvin, and M. M. Greenberg, Intracellular detection of Cytosine incorporation in genomic DNA by using 5-ethynyl-2'-deoxycytidine, *ChemBioChem* 12, 2184-2190, 2011.
- Han, J. S., Non-long terminal repeat (non-LTR) retrotransposons: mechanisms, a decade of developments, and unanswered questions, *Mob. DNA* 12, 15, 2010.
- Lepper, C., T. A. Partridge, and C. M. Fan, An absolute requirement for Pax7-positive satellite cells in acute injury-induced skeletal muscle regeneration, *Development* 138, 3639-3646, 2011.
- Losick, V. P., L. X. Morris, D. T. Fox, and A. C. Spradling, *Drosophila* stem cell niches: a decade of discovery suggests a unified view of stem cell regulation, *Dev. Cell* 21, 159-171, 2011.
- MacPherson, D., Small cell lung cancer: insights into origins, *Cell Cycle*, in press.
- McDole, K., Y. Xiong, P. A. Iglesias, and Y. Zheng, Lineage mapping the pre-implantation mouse embryo by two-photon microscopy, new insights into the segregation of cell fates, *Dev. Biol.* 355, 239-249, 2011.
- Morris, L. X., and A. C. Spradling, Long-term live imaging provides new insight into stem cell regulation and germline-soma coordination in the *Drosophila* ovary, *Development* 138, 2207-2215, 2011.
- Mukhi, S., and D. D. Brown, Transdifferentiation of tadpole pancreatic acinar cells to duct cells mediated by Notch and stromelysin-3, *Dev. Biol.* 351, 311-317, 2011.
- Mulligan, T., and S. A. Farber, Central and C-terminal domains of heterotrimeric G protein gamma subunits differentially influence the signaling necessary for primordial germ cell migration, *Cell. Signal.* 23, 1617-1624, 2011.
- Nizami, Z. F., S. Deryusheva, and J. G. Gall, Cajal bodies and histone locus bodies in *Drosophila* and *Xenopus*, *Cold Spring Harb. Symp. Quant. Biol.* 75, 313-320, 2010.
- Osterberg, N., M. Wiehle, O. Oehike, S. Heidrich, C. Xu, C. M. Fan, K. Kriegstein, and E. Roussa, Sim1 is a novel regulator in the differentiation of mouse dorsal raphe serotonergic neurons, *PLoS ONE* 6, e19239, 2011.
- Pineda-Álvarez, D. E., E. Roessler, P. Hu, K. Srivastava, B. D. Solomon, C. E. Siple, C. M. Fan, and M. Muenke, Missense substitutions in the GAS1 protein present in holoprosencephaly patients reduce the affinity for its ligand, SHH, *Hum. Genet.*, in press.
- Poirier, C. C., Y. Zheng, and P. A. Iglesias, Mitotic membrane helps to focus and stabilize the mitotic spindle, *Biophys. J.* 99, 3182-3190, 2010.
- Spradling, A. C., *Drosophila* P elements preferentially transpose to replication origins, *Proc. Natl. Acad. Sci. USA* 108, 15948-15953, 2011.
- Spradling, A. C., The living-tissue microscope: the importance of studying stem cells in their natural, undisturbed microenvironment, *J. Path.* 255, 161-152, 2011.
- Spradling, A. C., M. T. Fuller, R. E. Braun, and S. Yoshida, Germline stem cells, *Cold Spring Harbor Perspectives in Biology*, in press, 2011.
- Takacs, J. E., T. B. Neary, N. T. Ingolia, A. K. Saini, P. Martin-Marcos, J. Pelletier, A. G. Hinnebusch, and J. R. Lorsch, Identification of compounds that decrease the fidelity of start codon recognition by the eukaryotic translational machinery, *RNA* 17, 439-452, 2011.
- Tootle, T. L., D. Williams, A. Hubb, R. Frederick, and A. Spradling, *Drosophila* eggshell production: identification of new genes and coordination by Pxt, *PLoS ONE* 6, e19943, 2011.
- van der Heijden, G. W., J. Castañeda, and A. Bortvin, Bodies of evidence-compartmentalization of the piRNA pathway in mouse fetal prospermatogonia, *Curr. Opin. Cell Biol.* 6, 752-757, 2010.
- Vranis, N. M., G. W. van der Heijden, S. Malki, and A. Bortvin, Synaptonemal complex length variation in wild-type male mice, *Genes* 1, 505-520, 2010.
- Wang, S., and Y. Zheng, Identification of a novel dynein binding domain in nucleolar essential for spindle pole organization in *Xenopus* egg extract, *J. Biol. Chem.* 286, 587-593, 2011.

## GEOPHYSICAL LABORATORY

Here updated through September 1, 2011. The list is regularly updated on the Geophysical Laboratory Web site (<http://www.gli.cwi.edu>).

- 4253 Ahart, M., M. Somayazulu, S. A. Gramsch, R. Boehler, H. K. Mao, and R. J. Hemley, Brillouin scattering of H<sub>2</sub>O ice to megabar pressures, *J. Chem. Phys.* 134, 124517, 2011.
- 4269 Andrade, M., D. Dzivenko, G. Miede, R. Boehler, H. T. Hintzen, and R. Riedel, High-pressure high-temperature synthesis and structure of β-MgSiN<sub>2</sub>, *Phys. Status Solidi RRL* 5, 196-198, 2011.
- 4213 Angel, R. J., and L. W. Finger, *SINGLE*: a program to control single-crystal diffractometers, *J. Appl. Crystallogr.* 44, 247-251, 2011.
- 4279 Bahri, S., C. M. Jonsson, C. L. Jonsson, D. Azzolini, D. A. Sverjensky, and R. M. Hazen, Adsorption and surface complexation study of L-DOPA on rutile (α-TiO<sub>2</sub>) in NaCl solutions, *Environ. Sci. Technol.* 45, 3959-3966, 2011.
- 4222 Baldini, M., V. V. Struzhkin, A. F. Goncharov, P. Postorino, and W. L. Mao, Persistence of Jahn-Teller distortion up to the insulator to metal transition in LaMnO<sub>3</sub>, *Phys. Rev. Lett.* 106, 066402, 2011.

- 4298 Baldini, M., W. Yang, G. Aquilanti, L. Zhang, Y. Ding, S. Pascarelli, and W. L. Mao, High-pressure EXAFS measurements of crystalline Ge using nanocrystalline diamond anvils, *Phys. Rev. B* **84**, 014111, 2011.
- 4301 Bertka, C., D. K. Blackman, B. Ildefonse, P. B. Kelemen, A. J. Mangum, C. Myers, J. Phipps-Morgan, M. Schrenk, K. Suehiro, Y. Tatsumi, and J. Warren, Executive summary: "Mantle Frontier" workshop, *Sci. Drill.* **11**, 51-55, 2011.
- 4229 Bi, W., Y. Meng, R. S. Kumar, A. L. Cornelius, W. W. Tipton, R. G. Hennig, Y. Zhang, C. Chen, and J. S. Schilling, Pressure-induced structure transitions in europium metal to 92 GPa, *Phys. Rev. B* **83**, 104106, 2011.
- 4284 Blobaum, K. J. M., J. R. Jeffries, A. J. Schwartz, H. Cynn, W. Yang, M. A. Wall, and W. J. Evans, *In situ* X-ray diffraction study of the  $\delta$  to  $\alpha'$  isothermal martensitic transformation kinetics in a Pu-Ga alloy, *J. Nucl. Mater.* **412**, 327-333, 2011.
- \_\_\_\_ Callahan, M. P., K. E. Smith, H. J. Cleaves II, J. Ruzicka, J. C. Stern, D. P. Glavin, C. H. House, and J. P. Dworkin, Carbonaceous meteorites contain a wide range of extraterrestrial nucleobases, *Proc. Natl. Acad. Sci. USA*, in press.
- 4252 Chen, X.-J., C. Zhang, Y. Meng, R.-Q. Zhang, H.-Q. Lin, V. V. Struzhkin, and H. K. Mao,  $\beta$ -tin  $\rightarrow$  Imma  $\rightarrow$  sh phase transitions of germanium, *Phys. Rev. Lett.* **106**, 135502, 2011.
- \_\_\_\_ Chidester, B. A., and T. A. Strobel, The ammonia-hydrogen system under pressure, *J. Phys. Chem. A*, in press.
- 4243 Christensen, H., and M. L. Fogel, Feeding ecology and evidence for amino acid synthesis in the periodical cicada (*Magicicada*), *J. Insect Physiol.* **57**, 211-219, 2011.
- 4227 Ciezak, J. A., T. A. Jenkins, and R. J. Hemley, Optical and Raman microspectroscopy of nitrogen and hydrogen mixtures at high pressures, in *Shock Compression of Condensed Matter - 2009*, M. L. Elert et al., eds., pp. 1291-1294, AIP Conference Proceedings 1195, American Institute of Physics, Melville, N.Y., 2009.
- 4316 Cleaves, H. J., II, Catalyst, in *Encyclopedia of Astrobiology*, M. Gargaud et al., eds., p. 262, Springer, New York, 2011.
- 4317 Cleaves, H. J., II, Dinitrogen, in *Encyclopedia of Astrobiology*, M. Gargaud et al., eds., pp. 437-438, Springer, New York, 2011.
- 4318 Cleaves, H. J., II, Formaldehyde, in *Encyclopedia of Astrobiology*, M. Gargaud et al., eds., pp. 595-599, Springer, New York, 2011.
- 4319 Cleaves, H. J., II, Formose reaction, in *Encyclopedia of Astrobiology*, M. Gargaud et al., eds., pp. 600-605, Springer, New York, 2011.
- 4320 Cleaves, H. J., II, Hydrogen, in *Encyclopedia of Astrobiology*, M. Gargaud et al., eds., p. 781, Springer, New York, 2011.
- 4323 Cleaves, H. J., II, Nitrogen, in *Encyclopedia of Astrobiology*, M. Gargaud et al., eds., pp. 1119-1120, Springer, New York, 2011.
- 4324 Cleaves, H. J., II, Organic molecule, in *Encyclopedia of Astrobiology*, M. Gargaud et al., eds., pp. 1182-1183, Springer, New York, 2011.
- 4326 Cleaves, H. J., II, Sulfur, in *Encyclopedia of Astrobiology*, M. Gargaud et al., eds., pp. 1617-1618, Springer, New York, 2011.
- 4327 Cleaves, H. J., II, Thiol, in *Encyclopedia of Astrobiology*, M. Gargaud et al., eds., p. 1668, Springer, New York, 2011.
- \_\_\_\_ Cleaves, H. J., and J. L. Bada, The prebiotic chemistry of alternative nucleic acids, in *Genesis: Origin of Life on Earth and Planets*, J. Seckbach and R. Gordon, eds., Springer, Berlin, in press.
- 4293 Cleaves, H. J., II, E. Crapster-Pregont, C. M. Jonsson, C. L. Jonsson, D. A. Sverjensky, and R. M. Hazen, The adsorption of short single-stranded DNA oligomers to mineral surfaces, *Chemosphere* **83**, 1560-1567, 2011.
- \_\_\_\_ Cleaves, H. J., II, C. M. Jonsson, C. L. Jonsson, D. A. Sverjensky, and R. M. Hazen, Interactions of single-stranded DNA with mineral surfaces, *Environ. Sci. Technol.*, in press.
- 4245 Cody, G. D., N. S. Gupta, D. E. G. Briggs, A. L. D. Kilcoyne, R. E. Summons, F. Kenig, R. E. Plotnick, and A. C. Scott, Molecular signature of chitin-protein complex in Paleozoic arthropods, *Geology* **39**, 255-258, 2011.
- \_\_\_\_ Cody, G. D., E. Heying, C. M. O'D. Alexander, L. R. Nittler, A. L. D. Kilcoyne, S. A. Sandford, and R. M. Stroud, Establishing a molecular relationship between chondritic and cometary organic solids, *Proc. Natl. Acad. Sci. USA*, in press.
- 4285 Cohen, R., P. Gehring, and B. Noheda, eds., *Fundamental Physics of Ferroelectrics and Related Materials 2011: Extended Abstracts*, 185 pp., 2011. (Available online at <http://www.gi.ciw.edu/workshops/2011/ferro>)
- 4299 Daëron, M., W. Guo, J. Eiler, D. Genty, D. Blamart, R. Boch, R. Drysdale, R. Maire, K. Wainer, and G. Zanchetta,  $^{13}\text{C}^{18}\text{O}$  clumping in speleothems: observations from natural caves and precipitation experiments, *Geochim. Cosmochim. Acta* **75**, 3303-3317, 2011.
- \_\_\_\_ De Gregorio, B. T., R. M. Stroud, G. D. Cody, L. R. Nittler, A. L. D. Kilcoyne, and S. Wirick, Correlated microanalysis of cometary organic grains returned by Stardust, *Meteorit. Planet. Sci.*, in press.
- \_\_\_\_ Dohm, J. M., H. Miyamoto, G. G. Ori, A. G. Fairen, A. F. Davila, G. Komatsu, W. C. Mahaney, J.-P. Williams, S. B. Joye, G. Di Achille, D. Oehler, G. Marzo, D. Schulze-Makuch, V. Acocella, M. Glamoclija, M. Pondrelli, P. Boston, C. R. Allen, R. C. Anderson, V. R. Baker, W. Fink, A. R. Frazer, R. Furfaro, C. H. Gross, T. M. Hare, K. M. Hart, F. Ip, B. P. Kelleher, K. J. Kim, S. Maruyama, P. C. McGuire, D. Netoff, J. Parnell, L. Wendt, S. Wheelock, and A. Steele, An inventory of potentially habitable environments on Mars: geological and biological perspectives, in *Analogues for Planetary Exploration*, B. Gerry and J. Bleacher, eds., Special Paper, Geological Society of America, Boulder, Colorado, in press.
- 4312 Errandonea, D., L. Gracia, A. Beltrán, A. Vegas, and Y. Meng, Pressure-induced phase transitions in  $\text{AgClO}_4$ , *Phys. Rev. B* **84**, 064103, 2011.
- 4223 Foustoukos, D. I., J. L. Houghton, W. E. Seyfried, Jr., S. M. Sievert, and G. D. Cody, Kinetics of  $\text{H}_2\text{-O}_2\text{-H}_2\text{O}$  redox equilibria and formation of metastable  $\text{H}_2\text{O}_2$  under low temperature hydrothermal conditions, *Geochim. Cosmochim. Acta* **75**, 1594-1607, 2011.
- 4234 Friedrich, J. M., S. F. Wolf, D. Rumble III, J. Troiano, C. J. L. Gagnon, P. Jenniskens, and M. H. Shaddad, The elemental composition of Almahata Sitta, *Meteorit. Planet. Sci.* **45**, 1718-1727, 2010.
- 4328 Fries, M., and A. Steele, Raman spectroscopy and confocal Raman imaging in mineralogy and petrography, in *Confocal Raman Microscopy*, T. Dieing, O. Hollricher, and J. Toporski, eds., pp. 111-135, Springer, New York, 2010.
- 4193 Gaillou, E., J. E. Post, N. D. Bassim, A. M. Zaitsev, T. Rose, M. D. Fries, R. M. Stroud, A. Steele, and J. E. Butler, Spectroscopic and microscopic characterizations of color lamellae in natural pink diamonds, *Diamond Rel. Mater.* **19**, 1207-1220, 2010.
- 4280 Ganesh, P., and R. E. Cohen, Orbital ordering, ferroelasticity, and the large pressure-induced volume collapse in  $\text{PbCrO}_3$ , *Phys. Rev. B* **83**, 172102, 2011.
- 4244 Ganesh, P., and M. Widom, First-principles coexistence simulations of supercooled liquid silicon, *J. Non-Cryst. Solids* **357**, 442-445, 2011.
- 4211 Gao, P., H. Y. Chen, T. A. Tyson, Z. X. Liu, J. M. Bai, L. P. Wang, Y. J. Choi, and S.-W. Cheong, Observation of anomalous phonons in orthorhombic rare-earth manganites, *Appl. Phys. Lett.* **97**, 262905, 2010.
- 4288 Gao, P., Z. Zhen, T. A. Tyson, T. Wu, K. H. Ahn, Z. Liu, R. Tappero, S. B. Kim, and S.-W. Cheong, High-pressure structural stability of multiferroic hexagonal  $\text{RMnO}_3$  ( $R=\text{Y, Ho, Lu}$ ), *Phys. Rev. B* **83**, 224113, 2011.
- 4315 Gargaud, M., R. Amils, J. Cernicharo, H. J. Cleaves II, W. M. Irvine, D. L. Pinti, and M. Viso, eds., *Encyclopedia of Astrobiology*, Springer, New York, 1853 pp., 2011.
- \_\_\_\_ Glamoclija, M., M. L. Fogel, A. Steele, and A. Kish, Microbial nitrogen and sulfur cycles at the gypsum dunes of White Sands National Monument, New Mexico, *Geomicrobiol. J.*, in press.
- 4305 Glamoclija, M., L. Marinangeli, and G. Komatsu, Harmakis Vallis source region, Mars: insights into the recent geothermal history based on geological mapping, *Planet. Space Sci.* **59**, 1179-1194, 2011.
- 4259 Goncharov, A. F., R. J. Hemley, and H. K. Mao, Vibron frequencies of solid  $\text{H}_2$  and  $\text{D}_2$  to 200 GPa and implications for the  $P$ - $T$  phase diagram, *J. Chem. Phys.* **134**, 174501, 2011.
- 4203 Goncharov, A. F., V. B. Prakapenka, V. V. Struzhkin, I. Kantor, M. L. Rivers, and D. A. Dalton, X-ray diffraction in the pulsed laser heated diamond anvil cell, *Rev. Sci. Instrum.* **81**, 113902, 2010.

- 4314 Goncharov, A. F., N. Subramanian, T. R. Ravindran, M. Somayazulu, V. B. Prakapenka, and R. J. Hemley, Polymorphism of dense, hot oxygen, *J. Chem. Phys.* 135, 084512, 2011.
- 4307 Grew, E. S., J. L. Bada, and R. M. Hazen, Borate minerals and origin of the RNA world, *Origins Life Evol. Biospheres* 41, 307-316, 2011.
- 4282 Griffin, P. L., A. Kish, A. Steele, and R. J. Hemley, Differential high pressure survival in stationary-phase *Escherichia coli* MG1655, *High Pressure Res.* 31, 325-333, 2011.
- 4249 Guillaume, C. L., E. Gregoryanz, O. Degtyareva, M. I. McMahon, M. Hanfland, S. Evans, M. Guthrie, S. Sinogeikin, and H. K. Mao, Cold melting and solid structures of dense lithium, *Nature Phys.* 7, 211-214, 2011.
- 4286 Gupta, N. S., and G. D. Cody, Identification and characterization of chitin in organisms, in *Chitin: Formation and Diagenesis*, N. S. Gupta, ed., pp. 117-132, Springer, Dordrecht, 2011.
- 4270 Han, W.-Q., H.-G. Yu, and Z. Liu, Convert graphene sheets to boron nitride and boron nitride-carbon sheets via a carbon-substitution reaction, *Appl. Phys. Lett.* 98, 203112, 2011.
- 4308 Hazen, R. M., Exciting frontiers await at scientific boundaries: an example from the Deep Carbon Observatory, *Earth* 56 (no. 7), 71, 2011.
- \_\_\_\_ Hazen, R. M., Geochemical origins of life, in *A Geobiology Reader*, A. H. Knoll, K. O. Konhauser, and D. E. Canfield, eds., Wiley-Blackwell, in press.
- \_\_\_\_ Hazen, R. M., *The Story of Earth*, Viking, New York, in press.
- 4287 Hazen, R. M., A. Bekker, D. L. Bish, W. Bleeker, R. T. Downs, J. Farquhar, J. M. Ferry, E. S. Grew, A. H. Knoll, D. Papineau, J. P. Ralph, D. A. Sverjensky, and J. R. Valley, Needs and opportunities in mineral evolution research, *Am. Mineral.* 96, 953-963, 2011.
- \_\_\_\_ Hazen, R. M., and D. Papineau, Mineralogical co-evolution of the geo- and biospheres, in *A Geobiology Reader*, A. H. Knoll, K. O. Konhauser, and D. E. Canfield, eds., Wiley-Blackwell, in press.
- \_\_\_\_ Hemawan, K. W., C. S. Yan, Q. Lian, J. Lai, Y. Meng, S. Krasnicki, H. K. Mao, and R. J. Hemley, Hot spot formation in microwave plasma CVD diamond synthesis, *IEEE Trans. Plasma Sci.*, in press.
- 4207 Hemley, R. J., Percy W. Bridgman's second century, *High Pressure Res.* 30, 581-619, 2010.
- 4271 Herd, C. D. K., A. Blinova, D. N. Simkus, Y. Huang, R. Tarozo, C. M. O'D. Alexander, F. Gyngard, L. R. Nittler, G. D. Cody, M. L. Fogel, Y. Kebukawa, A. L. D. Kilcoyne, R. W. Hiltz, G. F. Slater, D. P. Glavin, J. P. Dworkin, M. P. Callahan, J. E. Elsilá, B. T. De Gregorio, and R. M. Stroud, Origin and evolution of prebiotic organic matter as inferred from the Tagish Lake meteorite, *Science* 332, 1304-1307, 2011.
- 4303 Huntress, W. T., Jr., and M. Ya. Marov, *Soviet Robots in the Solar System: Mission Technologies and Discoveries*, Springer-Praxis, New York, 453 pp., 2011.
- 4206 Jacobsen, S. D., Z. Liu, T. Boffa Ballaran, E. F. Littlefield, L. Ehm, and R. J. Hemley, Effect of H<sub>2</sub>O on upper mantle phase transitions in MgSiO<sub>3</sub>: Is the depth of the seismic X-discontinuity an indicator of mantle water content? *Phys. Earth Planet. Inter.* 183, 234-244, 2010.
- 4228 Jenei, Zs., H. Liermann, H. Cynn, J. H. Klepeis, B. Baer, and W. Evans, Structural phase transition in vanadium at high pressure and high temperature: influence of nonhydrostatic conditions, *Phys. Rev. B* 83, 054101, 2011.
- 4321 Kebukawa, Y., Infrared spectroscopy, in *Encyclopedia of Astrobiology*, M. Gargaud et al., eds., pp. 813-814, Springer, New York, 2011.
- 4254 Kebukawa, Y., C. M. O'D. Alexander, and G. D. Cody, Compositional diversity in insoluble organic matter in type 1, 2, and 3 chondrites as detected by infrared spectroscopy, *Geochim. Cosmochim. Acta* 75, 3530-3541, 2011.
- 4224 Konôpková, Z., P. Lazor, A. F. Goncharov, and V. V. Struzhkin, Thermal conductivity of hcp iron at high pressure and temperature, *High Pressure Res.* 31, 228-236, 2011.
- 4274 Kumar, R. S., D. Antonio, M. Kanagaraj, S. Arumugam, A. L. Cornelius, S. Sinogeikin, J. Prakash, G. S. Thakur, A. K. Ganguli, T. Hartmann, and Y. Zhao, Pressure effect on crystal structure and superconductivity of La<sub>0.8</sub>Th<sub>0.2</sub>FeAsO, *Phys. Status Solidi RRL* 5, 208-210, 2011.
- 4210 Kumar, R. S., D. Antonio, M. Kanagaraj, S. Arumugam, J. Prakash, S. Sinogeikin, G. S. Thakur, A. K. Ganguli, A. Cornelius, and Y. Zhao, Pressure induced structural transition and enhancement of superconductivity in Co doped CeFeAsO, *Appl. Phys. Lett.* 98, 012511, 2011.
- 4191 Kumar, R. S., Y. Zhang, S. Sinogeikin, Y. Xiao, S. Kumar, P. Chow, A. L. Cornelius, and C. Chen, Crystal and electronic structure of FeSe at high pressure and low temperature, *J. Phys. Chem. B* 114, 12597-12606, 2010.
- 4313 Kumar, R. S., Y. Zhang, Y. Xiao, J. Baker, A. Cornelius, S. Veeramalai, P. Chow, C. Chen, and Y. Zhao, Pressure induced high spin-low spin transition in FeSe superconductor studied by x-ray emission spectroscopy and ab initio calculations, *Appl. Phys. Lett.* 99, 061913, 2011.
- 4272 Kung, A., A. F. Goncharov, C. S. Zha, P. Eng, and W. L. Mao, Compressional, temporal, and compositional behavior of H<sub>2</sub>-O<sub>2</sub> compound formed by high pressure x-ray irradiation, *J. Chem. Phys.* 134, 234502, 2011.
- 4296 Kyono, A., M. Ahart, T. Yamanaka, S. Gramsch, H. K. Mao, and R. J. Hemley, High-pressure Raman spectroscopic studies of ulvöspinel Fe<sub>2</sub>TiO<sub>4</sub>, *Am. Mineral.* 96, 1193-1198, 2011.
- 4197 Lazicki, A., R. J. Hemley, W. E. Pickett, and C.-S. Yoo, Structural study of LiB to 70 GPa, *Phys. Rev. B* 82, 180102, 2010.
- 4265 Lee, Y., D. Liu, D. Seoung, Z. Liu, C.-C. Kao, and T. Vogt, Pressure- and heat-induced insertion of CO<sub>2</sub> into an auxetic small-pore zeolite, *J. Am. Chem. Soc.* 133, 1674-1677, 2011.
- 4239 Li, Z., B. Liu, S. Yu, J. Wang, Q. Li, B. Zou, T. Cui, Z. Liu, Z. Chen, and J. Liu, The study of structural transition of ZnS nanorods under high pressure, *J. Phys. Chem. C* 115, 357-361, 2011.
- 4267 Li, Z., L. Wang, B. Liu, J. Wang, B. Liu, Q. Li, B. Zou, T. Cui, Y. Meng, H. K. Mao, Z. Liu, and J. Liu, The structural transition behavior of CdSe/ZnS core/shell quantum dots under high pressure, *Phys. Status Solidi B* 248, 1149-1153, 2011.
- 4200 Liang, Z., P. Mohanty, Y. Fei, and K. Landskron, Synthesis of coesite nanocrystals from ethane bridged periodic mesoporous organosilica at low temperature and extreme pressure, *Chem. Commun.* 46, 8815-8817, 2010.
- 4309 Lin, J.-F., J. S. Tse, E. E. Alp, J. Zhao, M. Lerche, W. Sturhahn, Y. Xiao, and P. Chow, Phonon density of states of Fe<sub>2</sub>O<sub>3</sub> across high-pressure structural and electronic transitions, *Phys. Rev. B* 84, 064424, 2011.
- 4232 Lin, Z. J., J. Z. Zhang, B. S. Li, L. P. Wang, H. K. Mao, R. J. Hemley, and Y. Zhao, Superhard diamond/tungsten carbide nanocomposites, *Appl. Phys. Lett.* 98, 121914, 2011.
- \_\_\_\_ Litasov, K. D., A. F. Goncharov, and R. J. Hemley, Crossover from melting to dissociation of CO<sub>2</sub> under pressure: implications for the lower mantle, *Earth Planet. Sci. Lett.*, in press.
- 4199 Liu, D., W. Lei, Z. Liu, and Y. Lee, Spectroscopic study of the effects of pressure media on high-pressure phase transitions in natrolite, *J. Phys. Chem. C* 114, 18819-18824, 2010.
- 4292 Liu, Q., X. Yu, X. Wang, Z. Deng, Y. Lv, J. Zhu, S. Zhang, H. Liu, W. Yang, L. Wang, H. K. Mao, G. Shen, Z.-Y. Lu, Y. Ren, Z. Chen, Z. Lin, Y. Zhao, and C. Jin, Pressure-induced isostructural phase transition and correlation of FeAs coordination with the superconducting properties of 111-type Na<sub>1-x</sub>FeAs, *J. Am. Chem. Soc.* 133, 7892-7896, 2011.
- 4311 Liu, W., Q. Zeng, Q. Jiang, L. Wang, and B. Li, Density and elasticity of Zr<sub>18</sub>Cu<sub>37.6</sub>Ag<sub>8.4</sub>Al<sub>6</sub> bulk metallic glass at high pressure, *Scr. Mater.* 65, 497-500, 2011.
- 4230 Lucas, M. S., L. Mauger, J. A. Muñoz, Y. Xiao, A. O. Sheets, S. L. Semiatin, J. Horwath, and Z. Turgut, Magnetic and vibrational properties of high-entropy alloys, *J. Appl. Phys.* 109, 07E307, 2011.
- 4202 Lucas, M. S., J. A. Muñoz, O. Delaire, N. D. Markovskiy, M. B. Stone, D. L. Abernathy, I. Halevy, L. Mauger, J. B. Keith, M. L. Winterrose, Y. Xiao, M. Lerche, and B. Fultz, Effects of composition, temperature, and magnetism on phonons in bcc Fe-V alloys, *Phys. Rev. B* 82, 144306, 2010.
- 4196 Mao, H. K., E. L. Shirley, Y. Ding, P. Eng, Y. Q. Cai, P. Chow, Y. Xiao, J. Shu, R. J. Hemley, C. Kao, and W. L. Mao, Electronic structure of crystalline <sup>4</sup>He at high pressures, *Phys. Rev. Lett.* 105, 186404, 2010.
- 4248 Mao, Z., S. M. Dorfman, S. R. Shieh, J. F. Lin, V. Prakapenka, Y. Meng, and T. S. Duffy, Equation of state of a high-pressure phase of Gd<sub>3</sub>Ga<sub>5</sub>O<sub>12</sub>, *Phys. Rev. B* 83, 054114, 2011.

- 4205 Mao, Z., J. F. Lin, C. Jacobs, H. C. Watson, Y. Xiao, P. Chow, E. E. Alp, and V. B. Prakapenka, Electronic spin and valence states of Fe in  $\text{CaIrO}_3$ -type silicate post-perovskite in the Earth's lowermost mantle, *Geophys. Res. Lett.* 37, L22304, doi: 10.1029/2010GL045021, 2010.
- 4268 Marqués, M., M. Santoro, C. L. Guillaume, F. A. Gorelli, J. Contreras-García, R. T. Howie, A. F. Goncharov, and E. Gregoryanz, Optical and electronic properties of dense sodium, *Phys. Rev. B* 83, 184106, 2011.
- 4190 Marshall-Bowman, K., S. Ohara, D. A. Sverjensky, R. M. Hazen, and H. J. Cleaves, Catalytic peptide hydrolysis by mineral surface: implications for prebiotic chemistry, *Geochim. Cosmochim. Acta* 74, 5852-5861, 2010.
- 4306 McCubbin, F. M., B. L. Jolliff, H. Nekvasil, P. K. Carpenter, R. A. Zeigler, A. Steele, S. M. Elardo, and D. H. Lindsley, Fluorine and chlorine abundances in lunar apatite: implications for heterogeneous distributions of magmatic volatiles in the lunar interior, *Geochim. Cosmochim. Acta* 75, 5073-5093, 2011.
- 4278 Mibe, K., T. Kawamoto, K. N. Matsukage, Y. Fei, and S. Ono, Slab melting versus slab dehydration in subduction-zone magmatism, *Proc. Natl. Acad. Sci. USA* 108, 8177-8182, 2011.
- 4219 Morris, H. C., L. A. Monaco, A. Steele, and N. Wainwright, Setting a standard: the *Limulus* Amebocyte Lysate assay and the assessment of microbial contamination on spacecraft surfaces, *Astrobiology* 10, 845-852, 2010.
- 4325 Mulikjanian, A. Y., and H. J. Cleaves II, Substrate, in *Encyclopedia of Astrobiology*, M. Gargaud et al., eds., p. 1614, Springer, New York, 2011.
- 4291 Musfeldt, J. L., Z. Liu, S. Li, J. Kang, C. Lee, P. Jena, J. L. Manson, J. A. Schlueter, G. L. Carr, and M.-H. Whangbo, Pressure-induced local structure distortions in  $\text{Cu}(\text{pyz})\text{F}_2(\text{H}_2\text{O})_2$ , *Inorg. Chem.* 50, 6347-6352, 2011.
- 4201 Mysen, B. O., Speciation and mixing behavior of silica-saturated aqueous fluid at high temperature and pressure, *Am. Mineral.* 95, 1807-1816, 2010.
- \_\_\_\_ Mysen, B. O., An *in-situ* experimental study of phosphorous and aluminosilicate speciation in and partitioning between aqueous fluids and silicate melts at high temperature and pressure, *Am. Mineral.*, in press.
- \_\_\_\_ Mysen, B. O., K. Kumamoto, G. D. Cody, and M. L. Fogel, Solubility and solution mechanisms of C-O-H volatiles in silicate melt with variable redox conditions and melt composition at upper mantle temperatures and pressures, *Geochim. Cosmochim. Acta*, in press.
- 4247 Newsome, S. D., P. W. Collins, T. C. Rick, D. A. Guthrie, J. M. Ertlandson, and M. L. Fogel, Reply to Hudgens et al.: Bald eagles, no-analog ecological scenarios, and conservation strategies on the Channel Islands, *Proc. Natl. Acad. Sci. USA* 108, E26, 2011.
- \_\_\_\_ Newsome, S. D., M. L. Fogel, L. Kelly, and C. Martinez del Rio, Contributions of direct incorporation from diet and microbial amino acids to protein synthesis in Nile tilapia, *Funct. Ecol.*, in press.
- \_\_\_\_ Newsome, S. D., G. H. Miller, J. W. Magee, and M. L. Fogel, Quaternary record of aridity and mean annual precipitation based on  $\delta^{15}\text{N}$  in ratite and dromornithid eggshells from Lake Eyre, Australia, *Oecologia*, in press.
- 4238 Newsome, S. D., K. Ralls, C. V. H. Job, M. L. Fogel, and B. L. Cypher, Stable isotopes evaluate exploitation of anthropogenic foods by the endangered San Joaquin kit fox (*Vulpes macrotis mutica*), *J. Mammal.* 91, 1313-1321, 2010.
- 4310 Nuevo, M., S. N. Milam, S. A. Sandford, B. T. De Gregorio, G. D. Cody, and A. L. D. Kilcoyne, XANES analysis of organic residues produced from the UV irradiation of astrophysical ice analogs, *Adv. Space Res.* 48, 1126-1135, 2011.
- 4277 Oduro, H., A. Kamyshny, Jr., W. Guo, and J. Farquhar, Multiple sulfur isotope analysis of volatile organic sulfur compounds and their sulfonium precursors in coastal marine environments, *Mar. Chem.* 124, 78-89, 2011.
- 4322 Ohara, S., Liquid chromatography-mass spectrometry, in *Encyclopedia of Astrobiology*, M. Gargaud et al., eds., pp. 929-930, Springer, New York, 2011.
- 4188 Papineau, D., B. T. De Gregorio, G. D. Cody, M. D. Fries, S. J. Mojzsis, A. Steele, R. M. Stroud, and M. L. Fogel, Ancient graphite in the Eoarchean quartz-pyroxene rock from Akilia in southern West Greenland I: petrographic and spectroscopic characterization, *Geochim. Cosmochim. Acta* 74, 5862-5883, 2010.
- 4283 Papineau, D., B. T. De Gregorio, G. D. Cody, J. O'Neil, A. Steele, R. M. Stroud, and M. L. Fogel, Young poorly crystalline graphite in the >3.8-Gyr-old Nuvvuagittuq banded iron formation, *Nature Geosci.* 4, 376-379, 2011.
- 4189 Papineau, D., B. T. De Gregorio, R. M. Stroud, A. Steele, E. Pecoits, K. Konhauser, J. Wang, and M. L. Fogel, Ancient graphite in the Eoarchean quartz-pyroxene rock from Akilia in southern West Greenland II: isotopic and chemical compositions and comparison with Paleoproterozoic banded iron formations, *Geochim. Cosmochim. Acta* 74, 5884-5905, 2010.
- 4225 Parikh, S. J., J. D. Kubicki, C. M. Jonsson, C. L. Jonsson, R. M. Hazen, D. A. Sverjensky, and D. L. Sparks, Evaluating glutamate and aspartate binding mechanisms to rutile ( $\alpha\text{-TiO}_2$ ) via ATR-FTIR spectroscopy and quantum chemical calculations, *Langmuir* 27, 1778-1787, 2011.
- 4281 Parker, E. T., H. J. Cleaves, M. P. Callahan, J. P. Dworkin, D. P. Glavin, A. Lazzano, and J. L. Bada, Prebiotic synthesis of methionine and other sulfur-containing organic compounds on the primitive Earth: a contemporary reassessment based on an unpublished 1958 Stanley Miller experiment, *Origins Life Evol. Biospheres* 41, 201-212, 2011.
- 4256 Parker, E. T., H. J. Cleaves, J. P. Dworkin, D. P. Glavin, M. Callahan, A. Aubrey, A. Lazzano, and J. L. Bada, Primordial synthesis of amines and amino acids in a 1958 Miller  $\text{H}_2\text{S}$ -rich spark discharge experiment, *Proc. Natl. Acad. Sci. USA* 108, 5526-5531, 2011.
- 4295 Peng, Q., and R. E. Cohen, Origin of pyroelectricity in  $\text{LiNbO}_3$ , *Phys. Rev. B* 83, 220103, 2011.
- 4195 Pravica, M., M. Galley, E. Kim, P. Weck, and Z. Liu, A far- and mid-infrared study of HMX (octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine) under high pressure, *Chem. Phys. Lett.* 500, 28-34, 2010.
- 4263 Pravica, M., M. Galley, C. Park, H. Ruiz, and J. Wojno, A high pressure, high temperature study of 1,1-diamino-2,2-dinitro ethylene, *High Pressure Res.* 31, 80-85, 2011.
- 4297 Pravica, M., M. Galley, C. Park, H. Ruiz, and J. Wojno, In-situ synchrotron x-ray study of phase transitions in melamine under high pressures and high temperatures, *Diamond Rel. Mater.* 20, 1090-1092, 2011.
- 4236 Qin, L., D. Rumble, C. M. O'D. Alexander, R. W. Carlson, P. Jenniskens, and M. H. Shaddad, The chromium isotopic composition of Almahata Sitta, *Meteorit. Planet. Sci.* 45, 1771-1777, 2010.
- 4218 Riccialdelli, L., S. D. Newsome, M. L. Fogel, and R. N. P. Goodall, Isotopic assessment of prey and habitat preferences of a cetacean community in the southwestern South Atlantic Ocean, *Mar. Ecol. Prog. Ser.* 418, 235-248, 2010.
- 4300 Riches, A. J. V., Y. Liu, J. M. D. Day, I. S. Puchtel, D. Rumble III, H. Y. McSweeney, Jr., R. J. Walker, and L. A. Taylor, Petrology and geochemistry of Yamato 984028: a cumulate lherzolitic shergottite with affinities to Y 000027, Y 000047, and Y 000097, *Polar Sci.* 4, 497-514, 2011.
- 4192 Riner, M. A., F. M. McCubbin, P. G. Lucey, G. J. Taylor, and J. J. Gillis-Davis, Mercury surface composition: integrating petrologic modeling and remote sensing data to place constraints on FeO abundance, *Icarus* 209, 301-313, 2010.
- \_\_\_\_ Romero, I. C., M. Jacobson, J. A. Fuhrman, M. Fogel, and D. G. Capone, Long-term nitrogen and phosphorus fertilization effects on  $\text{N}_2$  fixation rates and *nifH* gene community patterns in mangrove sediments, *Mar. Ecol.*, in press.
- 4226 Ross, A. J., A. Steele, M. D. Fries, L. Kater, H. Downes, A. P. Jones, C. L. Smith, P. M. Jenniskens, M. E. Zolensky, and M. H. Shaddad, MicroRaman spectroscopy of diamond and graphite in Almahata Sitta and comparison with other ureilites, *Meteorit. Planet. Sci.* 46, 364-378, 2011.
- 4251 Rumble, D., III, E. D. Young, A. Shahar, and W. Guo, Stable isotope cosmochemistry and the evolution of planetary systems, *Elements* 7, 23-28, 2011.
- 4235 Rumble, D., M. E. Zolensky, J. M. Friedrich, P. Jenniskens, and M. H. Shaddad, The oxygen isotope composition of Almahata Sitta, *Meteorit. Planet. Sci.* 45, 1765-1770, 2010.
- 4246 Sang, L., C. B. Vanpeteghem, S. V. Sinogeikin, and J. D. Bass, The elastic properties of diopside,  $\text{CaMgSi}_2\text{O}_6$ , *Am. Mineral.* 96, 224-227, 2011.
- 4240 Scott, C. T., A. Bekker, C. T. Reinhard, B. Schnetger, B. Krapež, D. Rumble III, and T. W. Lyons, Late Archean euxinic conditions before the rise of atmospheric oxygen, *Geology* 39, 119-122, 2011.
- 4217 Sha, X., and R. E. Cohen, First-principles studies of electrical resistivity of iron under pressure, *J. Phys.: Cond. Matter* 23, 075401, 2011.



- 4255 Shen, G., Q. Mei, V. B. Prakapenka, P. Lazor, S. Sinogeikin, Y. Meng, and C. Park, Effect of helium on structure and compression behavior of SiO<sub>2</sub> glass, *Proc. Natl. Acad. Sci. USA* 108, 6004-6007, 2011.
- 4215 Shu, J., X. Chen, I.-M. Chou, W. Yang, J. Hu, R. J. Hemley, and H. K. Mao, Structural stability of methane hydrate at high pressures, *Geosci. Front.* 2, 93-100, 2011.
- Stevens, L. L., D. M. Dattelbaum, M. Ahart, and R. J. Hemley, High-pressure elastic properties of a fluorinated copolymer: poly(chlorotrifluoroethylene-co-vinylidene fluoride) (Kel-F 800), *J. Polym. Sci. B*, in press.
- 4198 Strobel, T. A., X.-J. Chen, M. Somayazulu, and R. J. Hemley, Vibrational dynamics, intermolecular interactions, and compound formation in GeH<sub>4</sub>-H<sub>2</sub> under pressure, *J. Chem. Phys.* 133, 164512, 2010.
- 4264 Strobel, T. A., A. F. Goncharov, C. T. Seagle, Z. Liu, M. Somayazulu, V. V. Struzhkin, and R. J. Hemley, High-pressure study of silane to 150 GPa, *Phys. Rev. B* 83, 144102, 2011.
- 4260 Strobel, T. A., M. Somayazulu, and R. J. Hemley, Phase behavior of H<sub>2</sub> + H<sub>2</sub>O at high pressures and low temperatures, *J. Phys. Chem. C* 115, 4898-4903, 2011.
- 4257 Subramanian, N., A. F. Goncharov, V. V. Struzhkin, M. Somayazulu, and R. J. Hemley, Bonding changes in hot fluid hydrogen at megabar pressures, *Proc. Natl. Acad. Sci. USA* 108, 6014-6019, 2011.
- 4289 Subramanian, N., A. F. Goncharov, V. V. Struzhkin, M. Somayazulu, and R. J. Hemley, Probing hydrogen at extreme conditions by Raman spectroscopy, in *Solid State Physics: Proceedings of the 55th DAE Solid State Physics Symposium 2010*, A. B. Garg, R. Mittal, and R. Mukhopadhyay, eds., pp. 7-10, AIP Conference Proceedings 1349, American Institute of Physics, Melville, N.Y., 2011.
- 4262 Summons, R. E., J. P. Amend, D. L. Bish, R. Buick, G. D. Cody, D. J. Des Marais, G. Dromart, J. L. Eigenbrode, A. H. Knoll, and D. Y. Sumner, Preservation of Martian organic and environmental records: final report of the Mars Biosignature Working Group, *Astrobiology* 11, 157-181, 2011.
- 4250 Sun, Y., W. Yang, Y. Ren, L. Wang, and C. Lei, Multiple-step phase transformation in silver nanoplates under high pressure, *Small* 7, 606-611, 2011.
- 4294 Sun, Z., J. Zhou, Y. Pan, Z. Song, H. K. Mao, and R. Ahuja, Pressure-induced reversible amorphization and an amorphous-amorphous transition in Ge<sub>2</sub>Sb<sub>2</sub>Te<sub>5</sub> phase-change memory material, *Proc. Natl. Acad. Sci. USA* 108, 10410-10414, 2011.
- 4214 Trefil, J., and R. M. Hazen, Scientific literacy: a modest proposal, in *Science and the Educated American: A Core Component of Liberal Education*, J. Meinwald and J. G. Hildebrand, eds., pp. 57-69, American Academy of Arts and Sciences, Cambridge, Mass., 2010.
- 4216 Tschauner, O., B. Kiefer, M. Nicol, S. Sinogeikin, R. Kumar, and A. Cornelius, Lithium hydroxide dihydrate: a new type of icy material at elevated pressure, *J. Chem. Phys.* 134, 044526, 2011.
- 4304 Vailionis, A., E. G. Gamaly, V. Mizeikis, W. Yang, A. V. Rode, and S. Juodkazis, Evidence of superdense aluminium synthesized by ultrafast microexplosion, *Nature Commun.* 2, 445, 2011.
- Walter, M. J., S. C. Kohn, D. Araujo, G. P. Bulanova, C. B. Smith, E. Gaillou, J. Wang, A. Steele, and S. B. Shirey, Deep mantle cycling of oceanic crust: evidence from diamonds and their mineral inclusions, *Science*, in press.
- 4276 Wang, L., Y. Ding, U. Patel, W. Yang, Z. Xiao, Z. Cai, W. L. Mao, and H. K. Mao, Studying single nanocrystals under high pressure using an x-ray nanoprobe, *Rev. Sci. Instrum.* 82, 043903, 2011.
- 4290 Wang, L., W. Yang, Y. Xiao, B. Liu, P. Chow, G. Shen, W. L. Mao, and H. K. Mao, Application of a new composite cubic-boron nitride gasket assembly for high pressure inelastic x-ray scattering studies of carbon related materials, *Rev. Sci. Instrum.* 82, 073902, 2011.
- 4194 Wang, S., W. L. Mao, A. P. Sorini, C.-C. Chen, T. P. Devereaux, Y. Ding, Y. Xiao, P. Chow, N. Hiraoka, H. Ishii, Y. Q. Cai, and C.-C. Kao, High-pressure evolution of Fe<sub>2</sub>O<sub>3</sub> electronic structure revealed by x-ray absorption, *Phys. Rev. B* 82, 144428, 2010.
- 4212 Wang, Y., Z. Zhang, V. Jain, J. Yi, S. Mueller, J. Sokolov, Z. Liu, K. Levon, B. Rigas, and M. H. Rafailovich, Potentiometric sensors based on surface molecular imprinting: detection of cancer biomarkers and viruses, *Sens. Actuators B* 146, 381-387, 2010.
- 4237 Weirich, J. R., A. Wittmann, C. E. Isachsen, D. Rumble, T. D. Swindle, and D. A. Kring, The Ar-Ar age and petrology of Miller Range 05029: evidence for a large impact in the very early solar system, *Meteorit. Planet. Sci.* 45, 1868-1888, 2010.
- 4258 Winterroose, M. L., L. Mauger, I. Halevy, A. F. Yue, M. S. Lucas, J. A. Muñoz, H. Tan, Y. Xiao, P. Chow, W. Sturhahn, T. S. Toellner, E. E. Alp, and B. Fultz, Dynamics of iron atoms across the pressure-induced Invar transition in Pd<sub>3</sub>Fe, *Phys. Rev. B* 83, 134304, 2011.
- 4204 Xu, M., Y. Meng, Y. Q. Cheng, H. W. Sheng, X. D. Han, and E. Ma, Pressure-induced crystallization of amorphous Ge<sub>2</sub>Sb<sub>2</sub>Te<sub>5</sub>, *J. Appl. Phys.* 108, 083519, 2010.
- 4220 Yabuta, H., C. M. O'D. Alexander, M. L. Fogel, A. L. D. Kilcoyne, and G. D. Cody, A molecular and isotopic study of the macromolecular organic matter of the ungrouped C2 WIS 91600 and its relationship to Tagish Lake and PCA 91008, *Meteorit. Planet. Sci.* 45, 1446-1460, 2010.
- 4302 Yabuta, H., G. D. Cody, C. M. O'D. Alexander, A. L. D. Kilcoyne, E. Araki, and S. A. Sandford, New development of the study on the early solar system history through  $\mu$ -XANES analyses of cometary and meteoritic organic matter using scanning transmission X-ray microscope [in Japanese], *Chikyukagaku [Geochemistry]* 43, 155-168, 2009.
- 4208 Yamada, A., Y. Wang, T. Inoue, W. Yang, C. Park, T. Yu, and G. Shen, High-pressure x-ray diffraction studies on the structure of liquid silicate using a Paris-Edinburgh type large volume press, *Rev. Sci. Instrum.* 82, 015103, 2011.
- 4266 Yoshimura, Y., S. T. Stewart, M. Somayazulu, H. K. Mao, and R. J. Hemley, Convergent Raman features in high density amorphous ice, ice VII, and ice VIII under pressure, *J. Phys. Chem. B* 115, 3756-3760, 2011.
- 4273 Zeng, Q. S., C. R. Rotundu, W. L. Mao, J. H. Dai, Y. M. Xiao, P. Chow, X. J. Chen, C. L. Qin, H. K. Mao, and J. Z. Jiang, Low temperature transport properties of Ce-Al metallic glasses, *J. Appl. Phys.* 109, 113716, 2011.
- 4275 Zeng, Q. S., H. Sheng, Y. Ding, L. Wang, W. Yang, J.-Z. Jiang, W. L. Mao, and H. K. Mao, Long-range topological order in metallic glass, *Science* 332, 1404-1406, 2011.
- 4261 Zeng, Z., L. Wang, X. Ma, S. Qu, J. Chen, Y. Liu, and D. Yang, Improvement in the mechanical performance of Czochralski silicon under indentation by germanium doping, *Scr. Mater.* 64, 832-835, 2011.
- 4209 Zhang, J. L., S. J. Zhang, H. M. Weng, W. Zhang, L. X. Yang, Q. Q. Liu, S. M. Feng, X. C. Wang, R. C. Yu, L. Z. Cao, L. Wang, W. G. Yang, H. Z. Liu, W. Y. Zhao, S. C. Zhang, X. Dai, Z. Fang, and C. Q. Jin, Pressure-induced superconductivity in topological parent compound Bi<sub>2</sub>Te<sub>3</sub>, *Proc. Natl. Acad. Sci. USA* 108, 24-28, 2011.
- 4231 Zhang, J. S., J. D. Bass, T. Taniguchi, A. F. Goncharov, Y.-Y. Chang, and S. D. Jacobsen, Elasticity of cubic boron nitride under ambient condition, *J. Appl. Phys.* 109, 063521, 2011.
- 4221 Zhang, R. F., Z. J. Lin, H. K. Mao, and Y. Zhao, Thermodynamic stability and unusual strength of ultra-incompressible rhenium nitrides, *Phys. Rev. B* 83, 060101, 2011.
- 4242 Zhao, Q., G. Wen, Z. Liu, Y. Fan, G. Zou, L. Li, R. Zheng, S. P. Ringer, and H. K. Mao, Synthesis of dense, single-crystalline CrO<sub>2</sub> nanowire arrays using AAO template-assisted chemical vapor deposition, *Nanotechnology* 22, 125603, 2011.
- 4233 Zolensky, M., J. Herrin, T. Mikouchi, K. Ohsumi, J. Friedrich, A. Steele, D. Rumble, M. Fries, S. Sandford, S. Milam, K. Hagiya, H. Takeda, W. Satake, T. Kurihara, M. Colbert, R. Hanna, J. Maisano, R. Ketcham, C. Goodrich, L. Le, G. Robinson, J. Martinez, K. Ross, P. Jenniskens, and M. H. Shaddad, Mineralogy and petrology of the Almahata Sitta ureilite, *Meteorit. Planet. Sci.* 45, 1618-1637, 2010.
- 4241 Zou, X., B. Liu, Q. Li, Z. Li, B. Liu, W. Wu, Q. Zhao, Y. Sui, D. Li, B. Zou, T. Cui, G. Zou, and H. K. Mao, One-step synthesis, growth mechanism, and photoluminescence properties of hollow GeO<sub>2</sub> walnuts, *CrystEngComm* 13, 979-984, 2011.

## GLOBAL ECOLOGY

- Almeyda Zambrano, A. M., E. N. Broadbent, M. Schmink, S. G. Perz, and G. P. Asner, Deforestation drives in southwest Amazonia: comparing smallholder farmers in Iñapari, Peru, and Assis Brasil, Brazil, *Conservat. Soc.* 8, 157-170, 2010.

- Anderson, R. G., J. G. Canadell, J. T. Randerson, R. B. Jackson, B. A. Hungate, D. D. Baldocchi, G. A. Ban-Weiss, G. B. Bonan, K. Caldeira, L. Cao, N. S. Diffenbaugh, K. R. Gurney, L. M. Kueppers, B. E. Law, S. Luysaert, and T.L. O'Halloran, Biophysical considerations in forestry for climate protection, *Front. Ecol. Environ.* 9, 174-182, 2011.
- Asner, G. P., Painting the world REDD: addressing scientific barriers to monitoring emissions from tropical forests, *Environ. Res. Lett.* 6, 021002, doi:10.1088/1748-9326/6/2/021002, 2011.
- Asner, G. P., R. F. Hughes, J. Mascaro, A. L. Uowolo, D. E. Knapp, J. Jacobson, T. Kennedy-Bowdoin, and J. K. Clark, High-resolution carbon mapping on the million-hectare island of Hawaii, *Front. Ecol. Environ.*, doi:10.1890/100179, 2011.
- Asner, G. P., S. R. Loarie, and U. Heyder, Combined effects of climate and land-use change on the future of humid tropical forests, *Conserv. Lett.* 00, 1-9, 2010.
- Asner, G. P., and R. E. Martin, Canopy phylogenetic, chemical, and spectral assembly in a lowland Amazonian forest, *New Phytol.*, doi:10.1111/j.1469-8137.2010.03549.x, 2010.
- Asner, G. P., R. E. Martin, D. E. Knapp, R. Tupayachi, C. Anderson, L. Carranza, P. Martinez, M. Houcheime, F. Sinca, and C. P. Weiss, Spectroscopy of canopy chemicals in humid tropical forests, *Remote Sens. Environ.*, doi:10.1016/j.rse.2011.08.020, 2011.
- Asner, G. P., R. E. Martin, R. Tupayachi, R. Emerson, P. Martinez, F. Sinca, G. V. N. Powell, S. J. Wright, and A. E. Lugo, Taxonomy and remote sensing of leaf mass per area (LMA) in humid tropical forests, *Ecol. Appl.* 21, 85-98, 2011.
- Ban-Weiss, G. A., L. Cao, G. Bala, and K. Caldeira, Dependence of climate forcing and response on the altitude of black carbon aerosols, *Clim. Dynam.*, doi:10.1007/s00382-011-1052-y, 2011.
- Caldeira, K., and S. J. Davis, Commentary: accounting for carbon dioxide emissions: a matter of time, *Proc. Natl. Acad. Sci. USA* 108, doi:10.1073/pnas.1106517108, 2011.
- Cao, L., G. Bala, and K. Caldeira, Why is there a short-term increase in global precipitation in response to diminished CO<sub>2</sub> forcing? *Geophys. Res. Lett.* 38, L06703, doi:10.1029/2011GL046713, 2011.
- Davis, M. A., M. K. Chew, R. J. Hobbs, A. E. Lugo, J. J. Ewel, G. J. Vermeij, J. H. Brown, M. L. Rosenzweig, M. R. Gardener, S. P. Carroll, K. Thompson, S. T. A. Pickett, J. C. Stromberg, P. Del Tredici, K. N. Suding, J. G. Ehrenfeld, J. P. Grime, J. Mascaro, and J. C. Briggs, Don't judge species on their origins, *Nature* 474, 153-154, 2011.
- Davis, S. J., and K. Caldeira, Consumption-based accounting of CO<sub>2</sub> emissions, *Proc. Natl. Acad. Sci. USA*, doi:10.1073/pnas.0906974107, 2010.
- Doughty, C. E., G. P. Asner, and R. E. Martin, Predicting tropical plant physiology from leaf and canopy spectroscopy, *Oecologia* 165, 289-299, doi:10.1007/s00442-010-1800-4, 2010.
- Doughty, C. E., and C. B. Field, Agricultural net primary production in relation to that liberated by the extinction of Pleistocene mega-herbivores: an estimate of agricultural carrying capacity? *Environ. Res. Lett.* 5, doi:10.1088/1748-9326/5/4/044001, 2010.
- Doughty, C. E., C. B. Field, and A. M. S. McMillan, Can crop albedo be increased through the modification of leaf trichomes, and could this cool regional climate? *Climatic Change* 104, 379-387, doi:10.1007/s10584-010-9936-0, 2010.
- Doughty, C. E., and A. Wolf, Detecting tree-like multicellular life on extrasolar planets, *Astrobiology Magazine* 10, 869-979, 2010.
- Dukes, J. S., N. R. Chiariello, S. R. Loarie, and C. B. Field, Strong response of an invasive plant species (*Centaurea solstitialis* L.) to global environmental changes, *Ecol. Appl.* 21, 1887-1894, 2011.
- Feret, J.-B., and G. P. Asner, Spectroscopic classification of tropical forest species using radiative transfer modeling, *Remote Sens. Environ.* 115, 2415-2422, 2011.
- Feret, J.-B., C. François, A. Gitelson, G. P. Asner, K. M. Barry, C. Panigada, A. D. Richardson, and S. Jacquemoud, Optimizing spectral indices and chemometric analysis of leaf chemical properties using radiative transfer modeling, *Remote Sens. Environ.* 115, 2742-2750, 2011.
- Georgescu, M., D. B. Lobell, and C. B. Field, Direct climate effects of perennial bioenergy crops in the United States, *Proc. Natl. Acad. Sci. USA*, doi:10.1073/pnas.1008779108, 2011.
- Gonzalez, P., G. P. Asner, J. J. Battles, M. A. Lefsky, K. M. Waring, and M. Palace, Forest carbon densities and uncertainties from Lidar, QuickBird, and field measurements in California, *Remote Sens. Environ.* 114, 1561-1575, 2010.
- Hernandez, R. R., and D. R. Sandquist, Disturbance of biological soil crust increases emergence of exotic vascular plants in California sage scrub, *Plant Ecol.* 212, 1709-1721, doi:10.1007/s11258-011-9943-x, 2011.
- Huang, M., and G. P. Asner, Long-term carbon loss and recovery following selective logging in Amazon forests, *Glob. Biogeochem. Cycl.* 24, GB 3028, doi:10.1029/2009GB003727, 2010.
- Huang, C., G. P. Asner, N. N. Barger, J. C. Neff, and M. L. Floyd, Regional aboveground live carbon losses due to drought-induced tree dieback in piñon-juniper ecosystems, *Remote Sens. Environ.* 114, 1471-1479, 2010.
- Kellner, J. R., G. P. Asner, K. M. Kinney, S. R. Loarie, D. E. Knapp, T. Kennedy-Bowdoin, E. J. Questad, S. Cordell, and J. M. Thaxton, Remote analysis of biological invasion and the impact of enemy release, *Ecol. Appl.* 21, 2094-2104, 2011.
- Kellner, J. R., G. P. Asner, P. M. Vitousek, M. A. Tweiten, S. Hotchkiss, and O. A. Chadwick, Dependence of forest structure and dynamics on substrate age and ecosystem development, *Ecosystems*, doi:10.1007/s10021-011-9472-4, 2011.
- Knox, N. M., A. K. Skidmore, H. H. T. Prins, G. P. Asner, H. M. A. van der Werff, W. F. de Boer, C. van der Waal, H. J. de Knegt, E. M. Kohi, R. Slotow, and R. C. Grant, Dry season mapping of savanna forage quality, using the hyperspectral Carnegie Airborne Observatory sensor, *Remote Sens. Environ.* 115, 1478-1488, 2011.
- Kutschera, U., R. Pieruschka, and J. A. Berry, Leaf development, gas exchange characteristics, and photorespiratory activity in maize seedlings, *Photosynthesis* 48, 617-622, 2010.
- Levick, S. R., G. P. Asner, T. Kennedy-Bowdoin, and D. E. Knapp, The spatial extent of termite influences on herbivore browsing in an African savanna, *Biol. Conserv.* 143, 2462-2467, 2010.
- Litton, C. M., C. P. Giardina, J. K. Albano, M. S. Long, and G. P. Asner, The magnitude and variability of soil-surface CO<sub>2</sub> efflux increase with mean annual temperature in Hawaiian tropical montane wet forests, *Soil Biol. Biochem.* 43, 2315-2323, 2011.
- Loarie, S. R., D. B. Lobell, G. P. Asner, Q. Mu, and C. B. Field, Direct impacts on local climate of sugarcane expansion in Brazil, *Nature Clim. Chng.*, doi:10.1038/nclimate1067, 2011.
- MacMynowski, D. G., H.-J. Shin, and K. Caldeira, The frequency response of temperature and precipitation in a climate model, *Geophys. Res. Lett.* 38, L16711, doi:10.1029/2011GL048623, 2011.
- Mascaro, J., G. P. Asner, H. C. Muller-Landau, M. Van Breugel, J. Hall, and K. Dahlin, Controls over aboveground forest carbon density on Barro Colorado Island, Panama, *Biogeosciences* 8, 1615-1629, 2011.
- Mastrandrea, M. D., and K. J. Mach, Treatment of uncertainties in IPCC assessment reports: past approaches and considerations for the Fifth Assessment Report, *Climatic Change* 108, 659-673, doi:10.1007/s10584-011-0177-7, 2011.
- Mastrandrea, M. D., K. J. Mach, G.-K. Plattner, O. Edenhofer, T. F. Stocker, C. B. Field, K. L. Ebi, and P. K. Matschoss, The IPCC AR5 guidance note on consistent treatment of uncertainties: a common approach across the working groups, *Climatic Change* 108, 675-691, doi:10.1007/s10584-011-0178-6, 2011.
- McCoy, M. D., G. P. Asner, and M. W. Graves, Airborne lidar survey of irrigated agricultural landscapes: an application of the slope contrast method, *J. Archaeol. Sci.* 38, 2141-2154, 2011.
- Meilillo, J. M., S. Butler, J. Johnson, J. Mohan, P. Steudler, H. Lux, E. Burrows, F. Bowles, R. Smith, L. Scott, C. Vario, T. Hill, A. Burton, Y. Zhou, and J. Tang, Soil warming, carbon-nitrogen interactions, and forest carbon budgets, *Proc. Natl. Acad. Sci. USA* 108, 9508-9512, 2011.
- Niboyet, A., J. R. Brown, P. Dijkstra, J. C. Blankinship, P. W. Leadley, X. LeRoux, L. Barthes, R. L. Barnard, C. B. Field, and B. A. Hungate, Global change could amplify fire effects on soil greenhouse gas emissions, *PLoS ONE* 6, e20105, doi:10.1371/journal.pone.0020105, 2011.
- Niboyet, A., X. Le Roux, P. Dijkstra, B. A. Hungate, L. Barthes, J. C. Blankinship, J. R. Brown, C. B. Field, and P. W. Leadley, Testing interactive effects of global environmental changes on soil nitrogen cycling, *Ecosphere* 2, art56, doi:10.1890/ES10-00148.1, 2011.
- Ochoa-Hueso, R., R. R. Hernandez, J. J. Pueyo, and E. Manrique, Spatial distribution and physiology of biological soil crusts from semi-arid central Spain are related to soil chemistry and shrub cover, *Soil Biol. Biochem.* 43, 1894-1901, 2011.
- Perz, S. G., and A. M. Almeyda, A tri-partite framework of forest dynamics: hierarchy, panarchy, and heterarchy in the study of secondary growth, chap. 4 of *Reforesting Landscapes: Linking Pattern and Process*, H. Nagendra and J. Southworth, eds., Landscape Series 10, pp. 59-84, SpringerLink, New York, doi:10.1007/978-1-4020-9656-3\_4, 2010.

Pongratz, J., C. H. Reick, T. Raddatz, K. Caldeira, and M. Claussen, Past land use decisions have increased mitigation potential of reforestation, *Geophys. Res. Lett.* 38, L15701, doi:10.1029/2011GL047848, 2011.

Smit, I. P. J., G. P. Asner, N. Govender, T. Kennedy-Bowdoin, D. E. Knapp, and J. Jacobson, Effects of fire on woody vegetation structure in African savanna, *Ecol. Appl.* 20, 1865-1875, 2010.

Somers, B., G. P. Asner, L. Tits, and P. Coppin, Endmember variability in spectral mixture analysis: a review, *Remote Sens. Environ.* 115, 1603-1616, 2011.

Takahashi, M., T. W. Giambelluca, R. C. Mudd, J. K. DeLay, M. A. Nullet, and G. P. Asner, Rainfall partitioning and cloud water interception in native forest and invaded forest in Hawai'i Volcanoes National Park, *Hydrol. Proc.* 25, 448-464, 2011.

Wessels, K. J., R. Mathieu, B. F. N. Erasmus, G. P. Asner, I. P. J. Smit, J. A. N. van Aardt, R. Main, J. Fisher, W. Marais, T. Kennedy-Bowdoin, D. E. Knapp, R. Emerson, and J. Jacobson, Impact of communal land use and conservation on woody vegetation structure in the Lowveld savannas of South Africa, *For. Ecol. Manage.* 261, 19-29, 2011.

Wolf, A., P. Ciais, V. Bellassen, N. Delbart, C. B. Field, and J. A. Berry, Forest biomass allometry in global land surface models, *Glob. Biogeochem. Cycl.* 25, GB3015, doi:10.1029/2010GB003917, 2011.

Wolf, A., C. B. Field, and J. A. Berry, Allometric growth and allocation in forests: a perspective from FLUXNET, *Ecol. Appl.* 21, 1546-1556, 2011.

## OBSERVATORIES

Adams, E. R., M. López-Morales, J. L. Elliot, S. Seager, and D. J. Osip, Six high-precision transits of OGLE-TR-113b, *Astrophys. J.* 721, 1829, 2010.

Adams, E. R., M. López-Morales, J. L. Elliot, S. Seager, and D. J. Osip, Transit timing variation analysis of OGLE-TR-132b with seven new transits, *Astrophys. J.* 728, 125, 2011.

Aihara, H., C. Allende Prieto, D. An, S. F. Anderson, . . . J. Kolmeier, et al., The eighth data release of the Sloan Digital Sky Survey: first data from SDSS-III, *Astrophys. J. Suppl. Ser.* 193, 29, 2011.

Atek, H., M. Malkan, P. McCarthy, H. I. Teplitz, . . . A. Dressler, et al., The WFC3 Infrared Spectroscopic Parallel (WISP) Survey, *Astrophys. J.* 723, 104, 2010.

Atlee, D. W., P. Martini, R. J. Assef, D. D. Kelson, and J. S. Mulchaey, A multi-wavelength study of low-redshift clusters of galaxies. I. Comparison of X-ray and mid-infrared selected active galactic nuclei, *Astrophys. J.* 729, 22, 2011.

Balogh, M. L., S. L. McGee, D. J. Wilman, A. Finoguenov, L. C. Parker, J. L. Connelly, J. S. Mulchaey, et al., Direct observational evidence for a large transient galaxy population in groups at  $0.85 < z < 1$ , *Mon. Not. Roy. Astron. Soc.* 412, 2303, 2011.

Bate, N. F., D. J. E. Floyd, R. L. Webster, and J. S. B. Wyithe, A microlensing measurement of dark matter fractions in three lensing galaxies, *Astrophys. J.* 731, 71, 2011.

Beccari, G., L. Spezzi, G. De Marchi, F. Paresce, . . . P. J. McCarthy, et al., Progressive star formation in the young galactic super star cluster NGC 3603, *Astrophys. J.* 720, 1108, 2010.

Besla, G., N. Kallivayalil, L. Hernquist, R. P. van der Marel, T. J. Cox, and D. Kereš, Simulations of the Magellanic Stream in a first infall scenario, *Astrophys. J. Lett.* 721, L97, 2010.

Biasi, R., D. Veronese, M. Andrighettoni, G. Angerer, . . . M. W. Johns, P. M. Hinz, and J. Kern, GMT adaptive secondary design, in *Adaptive Optics Systems II*, SPIE Proceedings 7736, B. L. Ellerbroek et al., eds., p. 77363O, American Institute of Physics, Melville, N.Y., 2010.

Bigiel, F., A. Leroy, F. Walter, L. Blitz, E. Brinks, W. J. G. de Blok, and B. Madore, Extremely inefficient star formation in the outer disks of nearby galaxies, *Astron. J.* 140, 1194, 2010.

Bigiel, F., A. Leroy, M. Seibert, F. Walter, L. Blitz, D. Thilker, and B. Madore, Tightly correlated H I and FUV emission in the outskirts of M83, *Astrophys. J. Lett.* 720, L31, 2010.

Blake, C., S. Brough, M. Colless, W. Couch, . . . B. Madore, et al., The WiggleZ Dark Energy Survey: the selection function and  $z = 0.6$  galaxy power spectrum, *Mon. Not. Roy. Astron. Soc.* 406, 803, 2010.

Blecha, L., T. J. Cox, et al., Recoiling black holes in merging galaxies: relationship to active galactic nucleus lifetimes, starbursts and the  $M_{\text{BH-}\sigma}$  relation, *Mon. Not. Roy. Astron. Soc.* 412, 2154, 2011.

Bouwens, R. J., G. D. Illingworth, V. González, I. Labbé, et al.,  $z \sim 7$  galaxy candidates from NICMOS observations over the HDF-South and the CDF-South and HDF-North GOODS fields, *Astrophys. J.* 725, 1587, 2010.

Bouwens, R. J., G. D. Illingworth, I. Labbé, et al., A candidate redshift  $z \sim 10$  galaxy and rapid changes in that population at an age of 500 Myr, *Nature* 469, 504, 2011.

Brown, P. J., P. W. A. Roming, P. Milne, F. Bufano, . . . M. M. Phillips, et al., The absolute magnitudes of type Ia supernovae in the ultraviolet, *Astrophys. J.* 721, 1608, 2010.

Brunner, S., A. Burton, J. Crane, et al., APOGEE fiber development and FRD testing, in *Ground-based and Airborne Instrumentation for Astronomy III*, SPIE Proceedings 7735, I. S. McLean, S. K. Ramsay, and H. Takami, eds., p. 77356A, American Institute of Physics, Melville, N.Y., 2010.

Bullock, E., P. Szkody, A. S. Mukadam, B. W. Borges, . . . M. Seibert, et al., GALEX and optical observations of GW Librae during the long decline from superoutburst, *Astron. J.* 141, 84, 2011.

Burns, C. R., M. Stritzinger, M. M. Phillips, S. Kattner, S. E. Persson, B. F. Madore, W. L. Freedman, L. Boldt, A. Campillay, C. Contreras, G. Folatelli, S. Gonzalez, W. Krzeminski, N. Morrell, F. Salgado, and N. B. Suntzeff, The Carnegie Supernova Project: light-curve fitting with SNooPy, *Astron. J.* 141, 19, 2011.

Buta, R. J., K. Sheth, M. Regan, J. L. Hinz, A. Gil de Paz, K. Menéndez-Delmestre, J.-C. Muñoz-Mateos, M. Seibert, . . . L. C. Ho, B. F. Madore, et al., Mid-infrared galaxy morphology from the Spitzer Survey of Stellar Structure in Galaxies (S<sup>4</sup>G): the imprint of the De Vaucouleurs Revised Hubble-Sandage Classification System at 3.6  $\mu\text{m}$ , *Astrophys. J. Suppl. Ser.* 190, 147, 2010.

Calzetti, D., R. Chandar, J. C. Lee, et al., A method for measuring variations in the stellar initial mass function, *Astrophys. J. Lett.* 719, L158, 2010.

Calzetti, D., R. Chandar, J. C. Lee, et al., A new method for measuring the upper end of the IMF, in *UP2010: Have Observations Revealed a Variable Upper End of the Initial Mass Function?* ASP Conf. Series 440, M. Treyer et al., eds., p. 125, Astronomical Society of the Pacific, San Francisco, 2011.

Cano, Z., D. Bersier, C. Guidorzi, R. Margutti, . . . V. Scowcroft, et al., A tale of two GRB-SNe at a common redshift of  $z = 0.54$ , *Mon. Not. Roy. Astron. Soc.* 413, 669, 2011.

Capak, P., B. Mobasher, N. Z. Scoville, H. McCracken, O. Ilbert, M. Salvato, K. Menéndez-Delmestre, et al., Spectroscopy of luminous  $z > 7$  galaxy candidates and sources of contamination in  $z > 7$  galaxy searches, *Astrophys. J.* 730, 68, 2011.

Casagrande, L., R. Schönrich, M. Asplund, S. Cassisi, I. Ramírez, et al., New constraints on the chemical evolution of the solar neighborhood and Galactic disc(s). Improved astrophysical parameters for the Geneva-Copenhagen Survey, *Astron. Astrophys.* 530, 138, 2011.

Chandar, R., B. C. Whitmore, H. Kim, C. Kaleida, . . . P. McCarthy, et al., The luminosity, mass, and age distributions of compact star clusters in M83 based on Hubble Space Telescope/Wide Field Camera 3 observations, *Astrophys. J.* 719, 966, 2010.

Chen, H.-W., V. Wild, J. L. Tinker, J.-R. Gauthier, J. E. Helsby, S. A. Sheckman, and I. B. Thompson, What determines the incidence and extent of Mg II absorbing gas around galaxies? *Astrophys. J. Lett.* 724, L176, 2010.

Close, L. M., V. Gasho, D. Kopon, J. Males, K. B. Follette, K. Brulag, A. Uomoto, and T. Hare, The Magellan Telescope adaptive secondary AO system: a visible and mid-IR AO facility, in *Adaptive Optics Systems II*, SPIE Proceedings 7736, B. L. Ellerbroek et al., eds., p. 773605, American Institute of Physics, Melville, N.Y., 2010.

Cohen, J. G., E. N. Kirby, J. D. Simon, and M. Geha, NGC 2419 – another remnant of accretion by the Milky Way, *Astrophys. J.* 725, 288, 2010.

Colbert, J. W., C. Scarlata, H. Teplitz, P. Francis, P. Palunas, G. M. Williger, and B. Woodgate, Polycyclic aromatic hydrocarbon emission within Ly $\alpha$  blobs, *Astrophys. J.* 728, 59, 2011.

Comerón, S., J. H. Knapen, K. Sheth, M. W. Regan, J. L. Hinz, A. Gil de Paz, K. Menéndez-Delmestre, J.-C. Muñoz-Mateos, M. Seibert, . . . L. C. Ho, et al., The thick disk in the galaxy NGC 4244 from S<sup>4</sup> imaging, *Astrophys. J.* 729, 18, 2011.

Cowan, J., I. Roederer, C. Sneden, and J. E. Lawler, New n-capture element abundance determinations in an r-process enriched star, in *Proceedings of the 11th Symposium on Nuclei in the Cosmos*, published online at [http://pos.sissa.it/archive/conferences/100/076/NIC%20X1\\_076.pdf](http://pos.sissa.it/archive/conferences/100/076/NIC%20X1_076.pdf), 2010.

Crane, J. D., S. A. Sheckman, R. P. Butler, I. B. Thompson, C. Birk, P. Jones, and G. S. Burley, The Carnegie Planet Finder Spectrograph: integration and commissioning, in *Ground-based and Airborne Instrumentation for Astronomy III*, SPIE Proceedings 7735, I. S. McLean, S. K. Ramsay, and H. Takami, eds., p. 773553, American Institute of Physics, Melville, N.Y., 2010.

- Crockett, R. M., S. Kaviraj, J. I. Silk, B. C. Whitmore, . . . P. J. McCarthy, et al., Anatomy of a post-starburst minor merger: a multi-wavelength WFC3 study of NGC 4150, *Astrophys. J.* 727, 115, 2011.
- Damen, M., I. Labbé, et al., The SIMPLE Survey: observations, reduction, and catalog, *Astrophys. J.* 727, 1, 2011.
- Damjanov, I., R. G. Abraham, K. Glazebrook, P. McGregor, F. Rigaut, P. J. McCarthy, et al., Extragalactic fields optimized for adaptive optics, *Publ. Astron. Soc. Pac.* 123, 348, 2011.
- Davé, R., B. D. Oppenheimer, N. Katz, J. A. Kollmeier, and D. H. Weinberg, The intergalactic medium over the last 10 billion years – I. Ly $\alpha$  absorption and physical conditions, *Mon. Not. Roy. Astron. Soc.* 408, 2051, 2010.
- Dong, X.-B., L. C. Ho, et al., The prevalence of narrow optical Fe II emission lines in type 1 active galactic nuclei, *Astrophys. J. Lett.* 721, L143, 2010.
- D’Onofrio, M., T. Valentiniuzzi, G. Fasano, A. Moretti, . . . A. Dressler, et al., On the connection between shape and stellar population in early-type galaxies, *Astrophys. J. Lett.* 727, L6, 2011.
- Dopita, M. A., D. Calzetti, J. Maiz Apellániz, W. P. Blair, . . . P. McCarthy, et al., Supernova remnants, planetary nebulae, and the distance to NGC 4214, *Astrophys. Space Sci.* 330, 123, 2010.
- Drake, A. J., S. G. Djorgovski, J. L. Prieto, et al., Discovery of the extremely energetic supernova 2008fz, *Astrophys. J. Lett.* 718, L127, 2010.
- Dressler, A., B. Bigelow, T. Hare, B. Sutin, I. Thompson, G. Burley, H. Epps, A. Oemler, A. Bagish, C. Birk, K. Clardy, S. Gunnels, D. Kelson, S. Shectman, and D. Osip, IMACS: the Inamori-Magellan Areal Camera and Spectrograph on Magellan-Baade, *Publ. Astron. Soc. Pac.* 123, 288, 2011.
- Driver, S. P., D. T. Hill, L. S. Kelvin, A. S. G. Robotham, . . . B. F. Madore, M. J. Meyer, M. Seibert, et al., Galaxy and Mass Assembly (GAMA): survey diagnostics and core data release, *Mon. Not. Roy. Astron. Soc.* 413, 971, 2011.
- Efremova, B. V., L. Bianchi, D. A. Thilker, J. D. Neill, D. Burgarella, T. K. Wyder, B. F. Madore, . . . M. Seibert, et al., The recent star formation in NGC 6822: an ultraviolet study, *Astrophys. J.* 730, 88, 2011.
- Eskridge, P. B., R. A. Windhorst, V. A. Mager, and R. A. Jansen, The young stellar population of the nearby late-type galaxy NGC 1311, *Astron. J.* 140, 1137, 2010.
- Essig, R., N. Sehgal, L. E. Strigari, M. Geha, and J. D. Simon, Indirect dark matter detection limits from the ultrafaint Milky Way satellite Segue 1, *Phys. Rev. D* 82, 123503, 2010.
- Fernández, X., J. H. van Gorkom, and F. Schweizer, A radio perspective on the wet merger remnant NGC 34, *Astron. J.* 140, 1965, 2010.
- Firpo, V., G. Bosch, G. F. Hägele, and N. Morrell, Giant HII regions in NGC 7479 and NGC 6070, *Mon. Not. Roy. Astron. Soc.* 406, 1094, 2010.
- Foley, R. J., A. Rest, M. Stritzinger, G. Pignata, J. P. Anderson, M. Hamuy, N. I. Morrell, M. M. Phillips, and F. Salgado, On the progenitor and supernova of the SN 2002cx-like supernova 2008ge, *Astron. J.* 140, 1321, 2010.
- Follette, K. B., L. M. Close, D. Kopon, J. R. Males, V. Gasho, K. M. Bruntlag, and A. Uomoto, The first VisAO-fed integral field spectrograph: VisAO IFS, in *Ground-based and Airborne Instrumentation for Astronomy III*, SPIE Proceedings 7735, I. S. McLean, S. K. Ramsay, and H. Takami, eds., p. 77351P, American Institute of Physics, Melville, N.Y., 2010.
- For, B.-Q., G. W. Preston, and C. Sneden, Radial velocities and pulsation ephemerides of 11 field RR Lyrae stars, *Astrophys. J. Suppl. Ser.* 194, 38, 2011.
- Freedman, W. L., R. C. Kennicutt, and J. R. Mould, Measuring the Hubble Constant with the Hubble Space Telescope, in *Highlights of Astronomy as Presented at the XXVII General Assembly, 2009*, 15, I. Corbett, ed., p. 1, Cambridge University Press, Cambridge, 2010.
- Freedman, W. L., and B. F. Madore, The Hubble Constant, *Annu. Rev. Astron. Astrophys.* 48, 673, 2010.
- Freedman, W. L., and B. F. Madore, A physically based method for scaling Cepheid light curves for future distance determinations, *Astrophys. J.* 719, 335, 2010.
- Freedman, W. L., and B. F. Madore, Two new tests of the metallicity sensitivity of the Cepheid period-luminosity relation (the Leavitt Law), *Astrophys. J.* 734, 46, 2011.
- Fritz, J., B. M. Poggianti, A. Cava, T. Valentiniuzzi, . . . A. Dressler, et al., WINGS-SPE II: a catalog of stellar ages and star formation histories, stellar masses, and dust extinction values for local cluster galaxies, *Astron. Astrophys.* 526, A45, 2001.
- Gallagher, J. S., III, H. Ferguson, D. Calzetti, and J. C. Lee, Summing up-2010, in *UP2010: Have Observations Revealed a Variable Upper End of the Initial Mass Function?* ASP Conf. Series 440, M. Treyer et al., eds., p. 407, Astronomical Society of the Pacific, San Francisco, 2011.
- Gilbank, D. G., M. L. Balogh, K. Glazebrook, R. G. Bower, I. K. Baldry, G. T. Davies, G. K. T. Hau, I. H. Li, and P. McCarthy, The Redshift One LDSS-3 Emission Line Survey, *Mon. Not. Roy. Astron. Soc.* 405, 2419, 2010.
- Gilbank, D. G., R. G. Bower, K. Glazebrook, M. L. Balogh, . . . P. McCarthy, et al., A spectroscopic measurement of galaxy formation time-scales with the Redshift One LDSS3 Emission Line Survey, *Mon. Not. Roy. Astron. Soc.* 414, 304, 2011.
- González, J. F., M. E. Veramendi, P. Ostrov, N. Morrell, and D. Minniti, Absolute parameters of five eclipsing binaries in the Large Magellanic Cloud, in *Binaries – Key to Comprehension of the Universe*, ASP Conf. Series 435, A. Prša and M. Zejda, eds., p. 401, Astronomical Society of the Pacific, San Francisco, 2010.
- Green, A. W., K. Glazebrook, P. J. McGregor, R. G. Abraham, G. B. Poole, I. Damjanov, P. J. McCarthy, et al., High star formation rates as the origin of turbulence in early and modern disk galaxies, *Nature* 467, 684, 2010.
- Greene, J. E., N. L. Zakamska, L. C. Ho, and A. J. Barth, Feedback in luminous obscured quasars, *Astrophys. J.* 732, 9, 2011.
- Hanish, D. J., M. S. Oey, J. R. Rigby, D. F. de Mello, and J. C. Lee, A multiwavelength study on the fate of ionizing radiation in local starbursts, *Astrophys. J.* 725, 2029, 2010.
- Hathi, N. P., R. E. Ryan, Jr., S. H. Cohen, H. Yan, R. A. Windhorst, P. J. McCarthy, et al., UV-dropout galaxies in the GOODS-South Field from WFC3 early release science observations, *Astrophys. J.* 720, 1708, 2010.
- Hayward, C. C., D. Narayanan, P. Jonsson, T. J. Cox, et al., Do sub-millimeter galaxy number counts provide evidence for a top-heavy IMF? in *UP2010: Have Observations Revealed a Variable Upper End of the Initial Mass Function?* ASP Conf. Series 440, M. Treyer et al., eds., p. 369, Astronomical Society of the Pacific, San Francisco, 2011.
- Heckman, T. M., S. Borthakur, R. Overzier, G. Kauffmann, . . . M. Seibert, et al., Extreme feedback and the epoch of reionization: clues in the local universe, *Astrophys. J.* 730, 5, 2011.
- Henderson, C. B., K. Z. Stanek, O. Pejcha, and J. L. Prieto, An R- and I-band photometric variability survey of the Cygnus OB2 association, *Astrophys. J. Suppl. Ser.* 194, 27, 2011.
- Henry, A. L., C. L. Martin, A. Dressler, P. McCarthy, and M. Sawicki, New results from the Magellan IMACS Spectroscopic Ly $\alpha$  Survey: NICMOS observations of Ly $\alpha$  emitters at  $z = 5.7$ , *Astrophys. J.* 719, 685, 2010.
- Hill, D. T., L. S. Kelvin, S. P. Driver, A. S. G. Robotham, . . . B. F. Madore, . . . M. Seibert, et al., Galaxy and Mass Assembly: FUV, NUV, *ugrizYJHK* Petrosian, Kron, and Sérsic photometry, *Mon. Not. Roy. Astron. Soc.* 412, 765, 2011.
- Hinz, P. M., A. Bouchez, M. Johns, S. Shectman, et al., The GMT adaptive optics system, in *Adaptive Optics Systems II*, SPIE Proceedings 7736, B. L. Ellerbroek et al., eds., p. 77360C, American Institute of Physics, Melville, N.Y., 2010.
- Hoffman, L., T. J. Cox, S. Dutta, and L. Hernquist, Orbital structure of merger remnants. I. Effect of gas fraction in pure disk mergers, *Astrophys. J.* 723, 818, 2010.
- Holden, B. P., A. van der Wel, D. D. Kelson, et al., M/L<sub>B</sub> and color evolution for a deep sample of M<sup>starf</sup> cluster galaxies at  $z \sim 1$ : the formation epoch and the tilt of the fundamental plane, *Astrophys. J.* 724, 714, 2010.
- Hong, S., D. Calzetti, M. A. Dopita, W. P. Blair, . . . P. J. McCarthy, et al., Large-scale shock-ionized and photoionized gas in M83: the impact of star formation, *Astrophys. J.* 731, 45, 2011.
- Howard, J., D. Ashby, and J. Kern, Performance of the Large Binocular Telescope’s hydrostatic bearing system, in *Ground-based and Airborne Telescopes III*, SPIE Proceedings 7733, L. M. Stepp, R. Gilmozzi, and H. J. Hall, eds., p. 773358, American Institute of Physics, Melville, N.Y., 2010.
- Hull, C., S. Gunnels, M. Johns, J. Kern, A. Talmor, M. Ward, and S. Shectman, Giant Magellan Telescope primary mirror cells, in *Ground-based and Airborne Telescopes III*, SPIE Proceedings 7733, L. M. Stepp, R. Gilmozzi, and H. J. Hall, eds., p. 773327, American Institute of Physics, Melville, N.Y., 2010.
- Humphreys, R. M., J. L. Prieto, et al., SN 2010U: a luminous nova in NGC 4214, *Astrophys. J. Lett.* 718, L43, 2010.
- Inami, H., L. Armus, J. M. Mazzarella, A. S. Evans, . . . B. F. Madore, et al., The buried starburst in the interacting galaxy II Zw 096 as revealed by the Spitzer Space Telescope, *Astron. J.* 140, 63, 2010.

- Jaffe, D. T., D. L. Depoy, D. G. Fabricant, P. M. Hinz, G. Jacoby, M. Johns, P. McCarthy, P. J. McGregor, S. Shectman, and A. Szentgyorgyi, Science instrument development for the Giant Magellan Telescope, in *Ground-based and Airborne Instrumentation for Astronomy III*, SPIE Proceedings 7735, I. S. McLean, S. K. Ramsay, and H. Takami, eds., p. 773525, American Institute of Physics, Melville, N.Y., 2010.
- Johnson, C. I., R. M. Rich, J. P. Fulbright, E. Valenti, and A. McWilliam, Alpha enhancement and the metallicity distribution function of Plaut's Window, *Astrophys. J.* 732, 108, 2011.
- Kajisawa, M., K. Shimasaku, Y. Matsude, E. Egami, M. Ouchi, et al., MOIRCS Deep Survey. IX. Deep near-infrared imaging data and source catalog, *Publ. Astron. Soc. Japan* 63, S379, 2011.
- Kaluzny, J., I. B. Thompson, W. Krzeminski, and K. Zloczewski, The Cluster AgeS Experiment (CASE). Variable stars in the globular cluster M55, *Acta Astron.* 60, 245, 2010.
- Kessler, R., B. Bassett, P. Belov, V. Bhatnagar, . . . M. Stritzinger, et al., Results from the Supernova Photometric Classification Challenge, *Publ. Astron. Soc. Pac.* 122, 1415, 2010.
- Kessler, R., D. Cinabro, B. Bassett, B. Dilday, . . . M. Stritzinger, et al., Photometric estimates of redshifts and distance moduli for type Ia supernovae, *Astrophys. J.* 717, 40, 2010.
- Khan, R., J. L. Prieto, et al., Pre-discovery and follow-up observations of the nearby SN 2009nr: implications for prompt type Ia supernovae, *Astrophys. J.* 726, 106, 2011.
- Kirby, E. N., P. Guhathakurta, J. D. Simon, et al., Multi-element abundance measurements from medium-resolution spectra. II. Catalog of stars in Milky Way dwarf satellite galaxies, *Astrophys. J. Suppl. Ser.* 191, 352, 2010.
- Kirby, E. N., G. A. Lanfranchi, J. D. Simon, et al., Multi-element abundance measurements from medium-resolution spectra. III. Metallicity distributions of Milky Way dwarf satellite galaxies, *Astrophys. J.* 727, 78, 2011.
- Koester, B. P., M. D. Gladders, J. F. Hennawi, K. Sharon, E. Wuyts, J. R. Rigby, M. B. Bayliss, and H. Dahle, Two lensed  $z \sim 3$  Lyman break galaxies discovered in the SDSS Giant Arcs Survey, *Astrophys. J. Lett.* 723, L73, 2010.
- Kollmeier, J. A., et al., SEGUE-2 limits on metal-rich old-population hypervelocity stars in the Galactic halo, *Astrophys. J.* 723, 812, 2010.
- Konishi, M., M. Akiyama, M. Kajisawa, T. Ichikawa, . . . M. Ouchi, et al., MOIRCS Deep Survey. VII. NIR morphologies of star-forming galaxies at redshift  $z \sim 1$ , *Publ. Astron. Soc. Japan* 63, S363, 2011.
- Konstantopoulos, I. S., S. C. Gallagher, K. Fedotov, P. R. Durrell, . . . J. S. Mulchaey, et al., Galaxy evolution in a complex environment: a multi-wavelength study of HCG 7, *Astrophys. J.* 723, 197, 2010.
- Kovacevic, A. V., Q. A. Parker, G. H. Jacoby, and B. Miszalski, A new [OIII]  $\lambda 5007$  Å Galactic planetary luminosity function, in *Asymmetric Planetary Nebulae V*, A. A. Zijlstra et al., eds., p. 44, Jodrell Bank Centre for Astrophysics, Manchester, U.K., 2010.
- Kozłowski, S., C. S. Kochanek, D. Stern, J. L. Prieto, et al., SDWFS-MT-1: a self-obscured luminous supernova at  $z \sim 0.2$ , *Astrophys. J.* 722, 1624, 2010.
- Kriek, M., I. Labbé, et al., The spectral energy distribution of post-starburst galaxies in the NEWFIRM Medium-band Survey: a low contribution from TP-AGB stars, *Astrophys. J. Lett.* 722, L64, 2010.
- Lampeitl, H., M. Smith, R. C. Nichol, B. Bassett, . . . M. Stritzinger, et al., The effect of host galaxies on type Ia supernovae in the SDSS-II Supernova Survey, *Astrophys. J.* 722, 566, 2010.
- Lee, J. C., et al., A GALEX ultraviolet imaging survey of galaxies in the local volume, *Astrophys. J. Suppl. Ser.* 192, 6, 2011.
- Lee, J. C., et al., UV/H $\alpha$  turmoil, in *UP2010: Have Observations Revealed a Variable Upper End of the Initial Mass Function?* ASP Conf. Series 440, M. Treyer et al., eds., p. 179, Astronomical Society of the Pacific, San Francisco, 2011.
- Lemonias, J. J., D. Schiminovich, D. Thilker, T. K. Wyder, D. C. Martin, M. Seibert, . . . B. F. Madore, et al., The space density of extended ultraviolet (XUV) disks in the local universe and implications for gas accretion onto galaxies, *Astrophys. J.* 733, 74, 2011.
- Li, I. H., K. Glazebrook, M. Balogh, R. Bower, I. Baldry, G. Davies, G. Hau, and P. McCarthy, Dependence of star formation activity on stellar mass and environment from the Redshift One LDSS3 Emission Line Survey, *Mon. Not. Roy. Astron. Soc.* 411, 1869, 2011.
- Loh, Y.-S., R. M. Rich, S. Heinis, R. Scranton, . . . M. Seibert, . . . B. F. Madore, et al., The UV-optical colour dependence of galaxy clustering in the local universe, *Mon. Not. Roy. Astron. Soc.* 407, 55, 2010.
- Ly, C., J. C. Lee, D. A. Dale, I. Momcheva, et al., The H $\alpha$  luminosity function and star formation rate volume density at  $z = 0.8$  from the NEWFIRM H $\alpha$  Survey, *Astrophys. J.* 726, 109, 2011.
- Madore, B. F., What is this thing called the Schmidt's Law? in *UP2010: Have Observations Revealed a Variable Upper End of the Initial Mass Function?* ASP Conf. Series 440, M. Treyer et al., eds., p. 289, Astronomical Society of the Pacific, San Francisco, 2011.
- Maeda, K., S. Benetti, M. Stritzinger, et al., An asymmetric explosion as the origin of spectral evolution diversity in type Ia supernovae, *Nature* 466, 82, 2010.
- Maeda, K., G. Leloudas, S. Taubenberger, M. Stritzinger, et al., Effects of the explosion asymmetry and viewing angle on the type Ia supernova colour and luminosity calibration, *Mon. Not. Roy. Astron. Soc.* 413, 3075, 2011.
- Mandelbaum, R., C. Blake, S. Bridle, F. B. Abdalla, . . . B. Madore, et al., The WiggleZ Dark Energy Survey: direct constraints on blue galaxy intrinsic alignments at intermediate redshifts, *Mon. Not. Roy. Astron. Soc.* 410, 844, 2011.
- Marchesini, D., K. E. Whitaker, G. Brammer, P. G. van Dokkum, I. Labbé, et al., The most massive galaxies at  $3.0 \leq z < 4.0$  in the NEWFIRM Medium-band Survey: properties and improved constraints on the stellar mass function, *Astrophys. J.* 725, 1277, 2010.
- Martínez-Delgado, D., R. J. Gabany, K. Crawford, S. Zibetti, . . . B. Madore, et al., Stellar tidal streams in spiral galaxies of the Local Volume: a pilot survey with modest aperture telescopes, *Astron. J.* 140, 962, 2010.
- Matsuda, Y., T. Yamada, T. Hayashino, R. Yamauchi, Y. Nakamura, N. Morimoto, M. Ouchi, et al., The Subaru Ly $\alpha$  Blob Survey: a sample of 100-kpc Ly $\alpha$  blobs at  $z = 3$ , *Mon. Not. Roy. Astron. Soc. Lett.* 410, L13, 2011.
- McCarthy, P. J., Scientific potential of ground layer adaptive optics on large telescopes, in *Adaptive Optics Systems II*, SPIE Proceedings 7736, B. L. Ellerbroek et al., eds., p. 77360A, American Institute of Physics, Melville, N.Y., 2010.
- McGee, S. L., M. L. Balogh, D. J. Wilman, R. G. Bower, J. S. Mulchaey, L. C. Parker, and A. Oemler, The Dawn of the Red: star formation histories of group galaxies over the past 5 billion years, *Mon. Not. Roy. Astron. Soc.* 413, 996, 2011.
- McWilliam, A., Galactic chemical evolution: the observational side, in *Proceedings of the 11th Symposium on Nuclei in the Cosmos*, published online at [http://pos.sissa.it/archive/conferences/100/008/NIC%20XI\\_008.pdf](http://pos.sissa.it/archive/conferences/100/008/NIC%20XI_008.pdf), 2010.
- McWilliam, A., and M. Zoccali, Two red clumps and the X-shaped Milky Way bulge, *Astrophys. J.* 724, 1491, 2010.
- Meeks, R. L., D. Ashby, C. Biddick, J. Devries, M. Gusick, and J. Kern, Super hardpoints for the Large Binocular Telescope, in *Ground-based and Airborne Telescopes III*, SPIE Proceedings 7733, L. M. Stepp, R. Gilmozzi, and H. J. Hall, eds., p. 77335H, American Institute of Physics, Melville, N.Y., 2010.
- Meixner, M., F. Galliano, S. Hony, J. Roman-Duval, . . . J. D. Simon, et al., HERSCHEL Inventory of The Agents of Galaxy Evolution (HERITAGE): the Large Magellanic Cloud dust, *Astron. Astrophys. Lett.* 518, L71, 2010.
- Menéndez-Delmestre, K., et al., Mid-IR spectroscopy of submm galaxies: extended star formation in high- $z$  galaxies, in *Highlights of Astronomy as Presented at the XXVII General Assembly, 2009, 15*, I. Corbett, ed., p. 423, Cambridge University Press, Cambridge, 2010.
- Milne, P. A., P. J. Brown, P. W. A. Roming, S. T. Holland, . . . M. Stritzinger, M. M. Phillips, et al., Near-ultraviolet properties of a large sample of type Ia supernovae as observed with the Swift UVOT, *Astrophys. J.* 721, 1627, 2010.
- Monachesi, A., S. C. Trager, T. R. Lauer, W. Freedman, A. Dressler, et al., The deepest Hubble Space Telescope color-magnitude diagram of M32. Evidence for intermediate-age populations, *Astrophys. J.* 727, 55, 2011.
- Moore, C. A., D. A. Dale, R. J. Barlow, S. A. Cohen, D. O. Cook, L. C. Johnson, S. M. Kattner, J. C. Lee, and S. M. Staudaer, The Wyoming Survey for H $\alpha$ . III. A multiwavelength look at attenuation by dust in galaxies out to  $z \sim 0.4$ , *Astron. J.* 140, 253, 2010.
- Monson, A. J., and M. J. Pierce, Near-infrared (JHK) photometry of 131 Northern Galactic classical Cepheids, *Astrophys. J. Suppl. Ser.* 193, 12, 2011.
- Mosleh, M., R. J. Williams, M. Franx, and M. Kriek, The evolution of the mass-sized relation to  $z = 3.5$  for UV-bright galaxies and submillimeter galaxies in the GOODS-North field, *Astrophys. J.* 727, 5, 2011.

- Muzzin, A., P. van Dokkum, M. Kriek, I. Labbé, et al., Well-sampled far-infrared spectral energy distributions of  $z \sim 2$  galaxies: evidence for scaled up cool galaxies, *Astrophys. J.* 725, 742, 2010.
- Nagamine, K., M. Ouchi, V. Springel, and L. Hernquist, Lyman- $\alpha$  emitters and Lyman-break galaxies at  $z = 3-6$  in cosmological SPH simulations, *Publ. Astron. Soc. Japan* 62, 1455, 2010.
- Narayanan, D., T. J. Cox, C. C. Hayward, and L. Hernquist, The Kennicutt-Schmidt star formation relation at  $z \sim 2$ , *Mon. Not. Roy. Astron. Soc.* 412, 287, 2011.
- Narayanan, D., A. Dey, C. C. Hayward, T. J. Cox, et al., A physical model for  $z \sim 2$  dust-obscured galaxies, *Mon. Not. Roy. Astron. Soc.* 407, 1701, 2010.
- Negrello, M., R. Hopwood, G. De Zotti, A. Cooray, . . . B. F. Madore, . . . M. Seibert, et al., The detection of a population of submillimeter-bright, strongly lensed galaxies, *Science* 330, 800, 2010.
- Neill, J. D., M. Sullivan, A. Gal-Yam, R. Quimby, E. Ofek, T. K. Wyder, D. A. Howell, P. Nugent, M. Seibert, . . . B. F. Madore, et al., The extreme hosts of extreme supernovae, *Astrophys. J.* 727, 15, 2011.
- Nidever, D. L., S. R. Majewski, R. R. Muñoz, R. L. Beaton, R. J. Patterson, and W. E. Kunkel, Discovery of a large stellar periphery around the Small Magellanic Cloud, *Astrophys. J. Lett.* 733, L10, 2011.
- Oesch, P. A., R. J. Bouwens, C. M. Carollo, G. D. Illingworth, D. Magee, M. Trenti, M. Stiavelli, M. Franx, I. Labbé, and P. G. van Dokkum, The evolution of the ultraviolet luminosity function from  $z \sim 0.75$  to  $z \sim 2.5$  using HST ERS WFC3/UVIS observations, *Astrophys. J. Lett.* 725, L150, 2010.
- Oliveira, J. M., J. Th. van Loon, G. C. Sloan, R. Indebetouw, F. Kemper, A. G. G. M. Tielens, J. D. Simon, et al., Ice chemistry in massive young stellar objects: the role of metallicity, *Mon. Not. Roy. Astron. Soc. Lett.* 411, L36, 2011.
- Ono, Y., M. Ouchi, et al., Stellar populations of Ly $\alpha$  emitters at  $z \sim 6-7$ : constraints on the escape fraction of ionizing photons from galaxy building blocks, *Astrophys. J.* 724, 1524, 2010.
- Oppenheimer, B. D., R. Davé, D. Kereš, M. Farday, N. Katz, J. A. Kollmeier, and D. H. Weinberg, Feedback and recycled wind accretion: assembling the  $z = 0$  galaxy mass function, *Mon. Not. Roy. Astron. Soc.* 406, 2325, 2010.
- Östman, L., J. Nordin, A. Goobar, R. Amanullah, M. Smith, J. Sollerman, V. Stanishev, M. D. Stritzinger, et al., NTT and NOT spectroscopy of SDSSII supernovae, *Astron. Astrophys.* 526, 28, 2011.
- Ouchi, M., et al., Statistics of 207 Ly $\alpha$  emitters at a redshift near 7: constraints on reionization and galaxy formation models, *Astrophys. J.* 723, 869, 2010.
- Overzier, R. A., T. M. Heckman, J. Wang, L. Armus, V. Buat, J. Howell, G. Meurer, M. Seibert, et al., Dust attenuation in UV-selected starbursts at high redshift and their local counterparts: implications for the cosmic star formation rate density, *Astrophys. J. Lett.* 726, L7, 2011.
- Palunas, P., D. Floyd, G. Eychaner, D. J. Osip, and P. Schechter, The Magellan Telescopes: a performance update, in *Ground-based and Airborne Telescopes III*, SPIE Proceedings 7733, L. M. Stepp, R. Gilmozzi, and H. J. Hall, eds., p. 773311, American Institute of Physics, Melville, N.Y., 2010.
- Parimucha, Š., T. Tribulla, S. Rucinski, J. Kaluzny, I. Thompson, M. Vaňko, and L. Hambálek, Preliminary analysis of DV Psc: a spotted, short-period eclipsing binary, in *Binaries – Key to Comprehension of the Universe*, ASP Conf. Series 435, A. Prša and M. Zejda, eds., p. 99, Astronomical Society of the Pacific, San Francisco, 2010.
- Perets, H. B., C. Badenes, I. Arcavi, J. D. Simon, and A. Gal-yam, An emerging class of bright, fast-evolving supernovae with low-mass ejecta, *Astrophys. J.* 730, 89, 2011.
- Petric, A. O., L. Armus, J. Howell, B. Chan, . . . B. Madore, et al., Mid-infrared spectral diagnostics of luminous infrared galaxies, *Astrophys. J.* 730, 28, 2011.
- Pietrzyński, G., I. Thompson, et al., The dynamical mass of a classical Cepheid variable star in an eclipsing binary system, *Nature* 468, 542, 2010.
- Pietrzyński, G., I. Thompson, et al., Precise distances to the Magellanic Clouds from unique late-type I long-period eclipsing binaries, in *Binaries – Key to Comprehension of the Universe*, ASP Conf. Series 435, A. Prša and M. Zejda, eds., p. 13, Astronomical Society of the Pacific, San Francisco, 2010.
- Pignata, G., M. Stritzinger, A. Soderberg, P. Mazzali, M. M. Phillips, N. Morrell, J. P. Anderson, L. Boldt, A. Campillay, C. Contreras, G. Folatelli, F. Förster, S. González, M. Hamuy, W. Krzeminski, J. Maza, M. Roth, F. Salgado, et al., SN 2009bb: a peculiar broad-lined type Ic supernova, *Astrophys. J.* 728, 14, 2011.
- Popescu, C. C., R. J. Tuffs, M. A. Dopita, J. Fischera, N. D. Kylafis, and B. F. Madore, Modelling the spectral energy distribution of galaxies. V. The dust and PAH emission SEDs of disk galaxies, *Astron. Astrophys.* 527, 109, 2011.
- Preston, G. W., RR Lyrae atmospherics: wrinkles old and new. A preview, *Astron. J.* 141, 6, 2011.
- Prieto, G., J. E. Thomas-Osip, M. M. Phillips, P. McCarthy, and M. Johns, Giant Magellan Telescope site testing, seeing and turbulence statistics, in *Ground-based and Airborne Telescopes III*, SPIE Proceedings 7733, L. M. Stepp, R. Gilmozzi, and H. J. Hall, eds., p. 773340, American Institute of Physics, Melville, N.Y., 2010.
- Prochaska, J. X., B. Weiner, H.-W. Chen, K. L. Cooksey, and J. S. Mulchaey, Probing the IGM/Galaxy connection. IV. The LCO/WFCCD Galaxy Survey of 20 fields surrounding UV-bright quasars, *Astrophys. J. Suppl. Ser.* 193, 28, 2011.
- Quadri, R. F., and R. J. Williams, Quantifying photometric redshift errors in the absence of spectroscopic redshifts, *Astrophys. J.* 725, 794, 2010.
- Querel, R. R., F. Kerber, G. Lo Curto, J. E. Thomas-Osip, G. Prieto, et al., Support for site testing of the European Extremely Large Telescope: precipitable water vapor over La Silla, in *Ground-based and Airborne Telescopes III*, SPIE Proceedings 7733, L. M. Stepp, R. Gilmozzi, and H. J. Hall, eds., p. 773349, American Institute of Physics, Melville, N.Y., 2010.
- Ramírez, I., et al., Granulation signatures in the spectrum of the very metal-poor red giant HD 122563, *Astrophys. J. Lett.* 725, L223, 2010.
- Rasmussen, J., J. S. Mulchaey, L. Bai, et al., Witnessing the formation of a brightest cluster galaxy in a nearby X-ray cluster, *Astrophys. J.* 717, 958, 2010.
- Rauch, M., and M. G. Haehnelt, Faint resonantly scattered Ly $\alpha$  emission from the absorption troughs of damped Ly $\alpha$  systems at  $z \sim 3$ , *Mon. Not. Roy. Astron. Soc. Lett.* 412, L55, 2011.
- Rest, A., R. J. Foley, S. Gezari, G. Narayan, . . . J. L. Prieto, et al., Pushing the boundaries of conventional core-collapse supernovae: the extremely energetic supernova SN 2003ma, *Astrophys. J.* 729, 88, 2011.
- Roederer, I., Musings on the ubiquitous nature of the r-process, in *Proceedings of the 11th Symposium on Nuclei in the Cosmos*, published online at [http://pos.sissa.it/archive/conferences/100/281/NIC%20XI\\_281.pdf](http://pos.sissa.it/archive/conferences/100/281/NIC%20XI_281.pdf), 2010.
- Roederer, I. U., C. Sneden, I. B. Thompson, G. W. Preston, and S. A. Shectman, Detailed abundances in a metal-poor stellar system, in *New Horizons in Astronomy: Frank N. Bash Symposium 2009*, ASP Conf. Series 432, L. M. Stanford et al., eds., p. 239, Astronomical Society of the Pacific, San Francisco, 2010.
- Rozycka, M., J. Kaluzny, P. Pietrukowicz, W. Pych, M. Catelan, C. Contreras, and I. B. Thompson, A search for dormant binaries with degenerate components in  $\omega$  Centauri and NGC 6397, *Astron. Astrophys.* 524, 78, 2010.
- Sanchis-Ojeda, R., J. N. Winn, M. J. Holman, J. A. Carter, D. J. Osip, and C. I. Fuentes, Starspots and spin-orbit alignment in the WASP-4 exoplanetary system, *Astrophys. J.* 733, 127, 2011.
- Schiminovich, D., B. Catinella, G. Kauffmann, S. Fabello, B. F. Madore, et al., The GALEX Arcibo SDSS Survey – II. The star formation efficiency of massive galaxies, *Mon. Not. Roy. Astron. Soc.* 408, 919, 2010.
- Sewilo, M., R. Indebetouw, L. R. Carlson, B. A. Whitney, . . . J. D. Simon, et al., The youngest massive protostars in the Large Magellanic Cloud, *Astron. Astrophys. Lett.* 518, L73, 2010.
- Sharon, K., A. Gam-Yal, D. Maoz, A. V. Filippenko, . . . W. L. Freedman, R. P. Kirshner, J. S. Mulchaey, et al., The type Ia supernova rate in redshift 0.5-0.9 galaxy clusters, *Astrophys. J.* 718, 876, 2010.
- Shectman, S., and M. Johns, GMT overview, in *Ground-based and Airborne Telescopes III*, SPIE Proceedings 7733, L. M. Stepp, R. Gilmozzi, and H. J. Hall, eds., p. 77331Y, American Institute of Physics, Melville, N.Y., 2010.
- Sheth, K., M. Regan, J. L. Hinz, A. Gil de Paz, K. Menéndez-Delmestre, J.-C. Muñoz-Mateos, M. Seibert, . . . L. C. Ho, B. F. Madore, et al., The Spitzer Survey of Stellar Structure in Galaxies (S<sup>2</sup>G), *Publ. Astron. Soc. Pac.* 122, 1397, 2010.
- Simon, J. D., et al., A complete spectroscopic survey of the Milky Way satellite Segue 1: the darkest galaxy, *Astrophys. J.* 733, 46, 2011.
- Sneden, C., I. Roederer, J. Cowan, and J. E. Lawler, r-process enhanced metal-poor stars, in *Proceedings of the 11th Symposium on Nuclei in the Cosmos*, published online at [http://pos.sissa.it/archive/conferences/100/074/NIC%20XI\\_074.pdf](http://pos.sissa.it/archive/conferences/100/074/NIC%20XI_074.pdf), 2010.
- Sobeck, J. S., R. P. Kraft, C. Sneden, G. W. Preston, J. J. Cowan, G. H. Smith, I. B. Thompson, S. A. Shectman, and G. S. Burley, The abundances of neutron-capture species in the very metal-poor globular cluster M15: a uniform analysis of red giant branch and red horizontal branch stars, *Astron. J.* 141, 175, 2011.

- Sota, A., J. Maíz Apellániz, R. H. Barbá, N. R. Walborn, E. J. Alfaro, R. C. Gamén, N. I. Morrell, et al., The Galactic O-Star Spectroscopic Survey (GOSSS) project status and first results, *Bull. Soc. Roy. Sci. Liège* 80, 519, 2011.
- Sota, A., J. Maíz Apellániz, N. R. Walborn, E. J. Alfaro, R. H. Barbá, N. I. Morrell, et al., The Galactic O-Star Spectroscopic Survey. I. Classification system and bright northern stars in the blue-violet at  $R \sim 2500$ , *Astrophys. J. Suppl. Ser.* 193, 24, 2011.
- Spezzli, L., G. Beccari, G. De Marchi, E. T. Young, . . . P. J. McCarthy, et al., Detection of brown dwarf like objects in the core of NGC 3603, *Astrophys. J.* 731, 1, 2011.
- Stark, D. P., R. S. Ellis, K. Chiu, M. Ouchi, and A. Bunker, Keck spectroscopy of faint  $3 < z < 7$  Lyman break galaxies – I. New constraints on cosmic reionization from the luminosity and redshift-dependent fraction of Lyman  $\alpha$  emission, *Mon. Not. Roy. Astron. Soc.* 408, 1628, 2010.
- Stark, D. P., R. S. Ellis, and M. Ouchi, Keck spectroscopy of faint  $3 > z > 7$  Lyman break galaxies: high fraction of line emitters at redshift six, *Astrophys. J. Lett.* 728, L2, 2011.
- Stoll, R., J. L. Prieto, et al., SN 2010jl in UGC 5189: yet another luminous type II supernova in a metal-poor galaxy, *Astrophys. J.* 730, 34, 2011.
- Straughn, A. N., H. Kuntschner, M. Kümmel, J. R. Walsh, . . . P. J. McCarthy, et al., Hubble Space Telescope WFC3 early release science: emission-line galaxies from infrared grism observations, *Astron. J.* 141, 14, 2011.
- Stritzinger, M., C. R. Burns, M. M. Phillips, G. Folatelli, K. Krisciunas, S. Kattner, S. E. Persson, L. Boldt, A. Campillary, C. Contreras, W. Krzeminski, N. Morrell, F. Salgado, W. L. Freedman, M. Hamuy, B. F. Madore, M. Roth, and N. B. Suntzeff, The distance to NGC 1316 (Fornax A) from observations of four type Ia supernovae, *Astron. J.* 140, 2036, 2010.
- Szczygiel, D. M., K. Z. Stanek, A. Z. Bonanos, G. Pojmański, B. Pilecki, and J. L. Prieto, Variability of luminous stars in the Large Magellanic Cloud using 10 years of ASAS data, *Astron. J.* 140, 14, 2010.
- Taubenberger, S., S. Benetti, M. Childress, R. Pakmor, . . . F. Salgado, J. Sollerman, M. Stritzinger, et al., High luminosity, slow ejecta, and persistent carbon lines: SN 2009dc challenges thermonuclear explosion scenarios, *Mon. Not. Roy. Astron. Soc.* 412, 2735, 2011.
- Taylor, W. D., C. J. Evans, H. Sana, N. R. Walborn, . . . N. Morrell, et al., The VLT-FLAMES Tarantula Survey. II. R139 revealed as a massive binary system, *Astron. Astrophys. Lett.* 530, L10, 2011.
- Thomas-Osip, J. E., P. McCarthy, G. Prieto, M. M. Phillips, and M. Johns, Giant Magellan Telescope site testing: summary, in *Ground-based and Airborne Telescopes III*, SPIE Proceedings 7733, L. M. Stepp, R. Gilmozzi, and H. J. Hall, eds., p. 77331L, American Institute of Physics, Melville, N.Y., 2010.
- Thomas-Osip, J. E., G. Prieto, A. McWilliam, M. M. Phillips, P. McCarthy, M. Johns, R. Querer, and D. Naylor, Giant Magellan Telescope site testing: PWW statistics and calibration, in *Ground-based and Airborne Telescopes III*, SPIE Proceedings 7733, L. M. Stepp, R. Gilmozzi, and H. J. Hall, eds., p. 77334N, American Institute of Physics, Melville, N.Y., 2010.
- Tran, K.-V. H., C. Papovich, A. Saintonge, M. Brodwin, . . . I. Momcheva, et al., Reversal of fortune: confirmation of an increasing star formation-density relation in a cluster at  $z = 1.62$ , *Astrophys. J. Lett.* 719, L126, 2010.
- Traub, W. A., P. R. Lawson, S. C. Unwin, M. W. Mutterspaugh, . . . A. Dressler, et al., Exoplanets Forum 2008, in *Pathways towards Habitable Planets*, ASP Conf. Series 430, V. Coudé du Foresto, D. M. Gelino, and I. Ribas, eds., p. 21, Astronomical Society of the Pacific, San Francisco, 2010.
- Treyer, M., D. Schiminovich, B. D. Johnson, M. O'Dowd, . . . M. Seibert, et al., Mid-infrared spectral indications of star formation and active galactic nucleus activity in normal galaxies, *Astrophys. J.* 719, 1191, 2010.
- Treyer, M., T. Wyder, J. Neill, M. Seibert, and J. C. Lee, eds., *UP2010: Have Observations Revealed a Variable Upper End of the Initial Mass Function?* ASP Conf. Series 440, Astronomical Society of the Pacific, San Francisco, 2011.
- van Dam, M. A., P. M. Hinz, J. L. Codona, M. Hart, A. García-Rissmann, M. W. Johns, S. A. Shectman, A. H. Bouchez, et al., Modeling the adaptive optics systems on the Giant Magellan Telescope, in *Adaptive Optics Systems II*, SPIE Proceedings 7736, B. L. Ellerbroek et al., eds., p. 773642, American Institute of Physics, Melville, N.Y., 2010.
- Villanueva, S., Jr., D. L. Depoy, J. Marshall, A. Berdja, J. P. Rheault, G. Prieto, et al., MooSci: a lunar scintillometer, in *Ground-based and Airborne Instrumentation for Astronomy III*, SPIE Proceedings 7735, I. S. McLean, S. K. Ramsay, and H. Takami, eds., p. 773547, American Institute of Physics, Melville, N.Y., 2010.
- Vulcani, B., B. M. Poggianti, A. Aragón-Salamanca, G. Fasano, G. Rudnick, T. Valentiniuzzi, A. Dressler, et al., Galaxy stellar mass functions of different morphological types in clusters, and their evolution between  $z = 0.8$  and 0, *Mon. Not. Roy. Astron. Soc.* 412, 246, 2011.
- Vulcani, B., B. M. Poggianti, A. Dressler, et al., The evolution of early-type galaxies in clusters from  $z \sim 0.8$  to  $z = 0$ : the ellipticity distribution and the morphological mix, *Mon. Not. Roy. Astron. Soc.* 413, 921, 2011.
- Wake, D. A., K. E. Whitaker, I. Labbé, P. G. van Dokkum, M. Franx, R. Quadri, et al., Galaxy clustering in the NEWFIRM Medium Band Survey: the relationship between stellar mass and dark matter halo mass at  $1 < z < 2$ , *Astrophys. J.* 728, 46, 2011.
- Whitaker, K. E., P. G. van Dokkum, G. Brammer, M. Kriek, M. Franx, I. Labbé, et al., The age spread of quiescent galaxies with the NEWFIRM Medium-band Survey: identification of the oldest galaxies out to  $z \sim 2$ , *Astrophys. J.* 719, 1715, 2010.
- Whitmore, B. C., R. Chandar, H. Kim, C. Kaleida, . . . P. J. McCarthy, et al., Using H $\alpha$  morphology and surface brightness fluctuations to age-date star clusters in M83, *Astrophys. J.* 729, 78, 2011.
- Whitmore, B. C., R. Chandar, F. Schweizer, et al., The Antennae Galaxies (NGC 4038/4039) revisited: advanced camera for surveys and NICMOS observations of a prototypical merger, *Astron. J.* 140, 75, 2010.
- Wijesinghe, D. B., A. M. Hopkins, R. Sharp, M. Gunawardhana, . . . B. Madore, . . . M. Seibert, et al., Galaxy and mass assembly (GAMA): dust obscuration in galaxies and their recent star formation histories, *Mon. Not. Roy. Astron. Soc.* 410, 2291, 2011.
- Williams, R. J., J. S. Mulchaey, J. A. Kollmeier, and T. J. Cox, Discovery of a large-scale galaxy filament near a candidate intergalactic X-ray absorption system, *Astrophys. J. Lett.* 724, L25, 2010.
- Williger, G. M., R. F. Carswell, R. J. Weymann, et al., The low-redshift Ly $\alpha$  forest towards 3C 273, *Mon. Not. Roy. Astron. Soc.* 405, 1736, 2010.
- Wilson, J. C., F. Hearty, M. F. Skrutskie, S. Majewski, . . . J. Crane, et al., The Apache Point Observatory Galactic Evolution Experiment (APOGEE) high-resolution near-infrared multi-object fiber spectrograph, in *Ground-based and Airborne Instrumentation for Astronomy III*, SPIE Proceedings 7735, I. S. McLean, S. K. Ramsay, and H. Takami, eds., p. 77351C, American Institute of Physics, Melville, N.Y., 2010.
- Windhorst, R. A., S. H. Cohen, N. P. Hathi, P. J. McCarthy, . . . M. Seibert, et al., The Hubble Space Telescope Wide Field Camera 3 early release science data: panchromatic faint object count for 0.2-2  $\mu$ m wavelength, *Astrophys. J. Suppl. Ser.* 193, 27, 2011.
- Wolf, J., G. D. Martinez, J. S. Bullock, M. Kaplinghat, M. Geha, R. R. Muñoz, J. D. Simon, and F. F. Avedo, Accurate masses for dispersion-supported galaxies, *Mon. Not. Roy. Astron. Soc.* 406, 1220, 2010.
- Wong, K. C., C. R. Keeton, K. A. Williams, I. G. Momcheva, and A. I. Zabludoff, The effect of environment on shear in strong gravitational lenses, *Astrophys. J.* 726, 84, 2011.
- Wuyts, S., T. J. Cox, et al., On sizes, kinematics, M/L gradients, and light profiles of massive compact galaxies at  $z \sim 2$ , *Astrophys. J.* 722, 1666, 2010.
- Yan, H.-J., R. A. Windhorst, N. P. Hathi, S. H. Cohen, R. E. Ryan, R. W. O'Connell, and P. J. McCarthy, Galaxy formation in the reionization epoch as hinted by Wide Field Camera 3 observations of the Hubble Ultra Deep Field, *Res. Astron. Astrophys.* 10, 867, 2010.
- Yan, H.-J., M. A. Zamojski, R. A. Windhorst, P. J. McCarthy, et al., Probing very bright end of galaxy luminosity function at  $z > 7$  using Hubble Space Telescope pure parallel observations, *Astrophys. J. Lett.* 728, L22, 2011.
- Yan, R., L. C. Ho, et al., AEGIS: demographics of X-ray and optically selected active galactic nuclei, *Astrophys. J.* 728, 38, 2011.
- Yu, Z., F. Yuan, and L. C. Ho, On the origin of ultraviolet emission and the accretion model of low-luminosity active galactic nuclei, *Astrophys. J.* 726, 87, 2011.
- Yuan, F., J. Lin, K. Wu, and L. C. Ho, A magneto-hydrodynamical model for the formation of episodic jets, in *Accretion and Ejection in AGN: A Global View*, ASP Conf. Series 427, L. Maraschi et al., eds., p. 135, Astronomical Society of the Pacific, San Francisco, 2010.
- Yuan, F., Z. Yu, and L. C. Ho, Revisiting the "fundamental plane" of black hole activity at extremely low luminosities, in *Accretion and Ejection in AGN: A Global View*, ASP Conf. Series 427, L. Maraschi et al., eds., p. 36, Astronomical Society of the Pacific, San Francisco, 2010.
- Yuma, S., K. Ohta, K. Yabe, K. Shimasaku, M. Yoshida, M. Ouchi, I. Iwata, and M. Sawicki, Stellar populations of Ly $\alpha$  emitters at  $z = 4.86$ : a comparison to  $z \sim 5$  Lyman break galaxies, *Astrophys. J.* 720, 1016, 2010.

## PLANT BIOLOGY

- Bais, P., S. Moon, K. He, R. Leita, K. Dreher, T. Walk, Y. Sucaet, L. Barkan, G. Wohlgemuth, E. S. Wurtele, P. Dixon, O. Fiehn, B. M. Lange, V. Shulaev, L. W. Sumner, R. Welti, B. Nikolau, S. Y. Rhee, and J. A. Dickerson, PlantMetabolomics.org: a web portal for plant metabolomics experiments, *Plant Physiol.* 152, 1807-1816, 2010.
- Barton, M. K., Twenty years on: the inner workings of the shoot apical meristem, a developmental dynamo, *Dev. Biol.* 341, 95-113, 2010.
- Bittner, C. X., A. Loaiza, I. Ruminot, V. Larenas, T. Sotelo-Hitschfeld, R. Gutierrez, A. Cordova, A. Valdebenito, W. B. Frommer, and L. F. Barros, Real-time metabolic rate analysis in single astrocytes, *Front. Neuroenerg.* 2, 1-11, 2010.
- Briggs, W. R., A wandering pathway from Minnesota wildflowers to phototropins to bacterial virulence, *Annu. Rev. Plant Biol.* 61, 1-20, 2010.
- Chen, J., L. Ji, W. Hsu, K.-L. Tan, and S. Y. Rhee, Exploiting domain knowledge to improve biological significance of biclusters with key missing genes, *IEEE 25th International Conference on Data Engineering (ICDE '09)*, doi: 10.1109/ICDE.2009.205, 2009
- Frommer, W. B., CO2mmon sense, *Science* 327, 275-276, 2010.
- Frommer, W. B., Grand opportunities in physiology to address the grand challenges facing the planet, *Front. Physiol.* 1, 1-3, 2010.
- Frommer, W. B., and U. Sonnewald, Progress in physiological research and its relevance for agriculture and ecology, *Curr. Opin. Plant Biol.* 13, 227-232, 2010.
- Gene Ontology Consortium, The Gene Ontology in 2010: extensions and refinements, *Nucl. Acids Res.* 38, D331-D335, 2010.
- Gómez-García, M. R., M. Davison, M. Blain-Hartnung, A. R. Grossman, and D. Bhaya, Alternative pathways for phosphate metabolism in thermophilic cyanobacteria from microbial mats, *ISME J.*, Epub, July 15, 2010.
- Gómez-García, M. R., M. Davison, M. Blain-Hartnung, A. R. Grossman, and D. Bhaya, Metabolism of phosphonates by the thermophilic *Synechococcus* spp. from microbial mats, *ISME J.*, doi: 10.1038/ismej.2010.96, 2010.
- Gonzalez-Ballester, D., D. Casero, S. Cokus, M. Pellegrini, S. S. Merchant, and A. R. Grossman, RNA-Seq analysis of sulfur-deprived *Chlamydomonas* cells reveals aspects of acclimation critical for cell survival, *Plant Cell* 22, 1-27, 2010.
- Gonzalez-Ballester, D., and A. R. Grossman, Sulfur limitation from the physiological to the genomic, chap. 5 of *The Chlamydomonas Sourcebook*, E. Harris, D. Stern, and G. Witman, eds., pp. 159-188, Elsevier, Oxford, U.K., 2009.
- Grossman, A., S. J. Karpowicz, M. Heinnickel, D. Dewez, B. Hamel, R. Dent, K. K. Niyogi, X. Johnson, J. Alric, F. A. Wollman, H. Li, and S. S. Merchant, Comparative genomics in the identification of genes in the green lineage and that impact photosynthesis, *Photosyn. Res.* 106, 3-17, 2010.
- Grossman, A., K. R. M. Mackey, and S. Bailey, A perspective on photosynthesis in the oligotrophic oceans: hypotheses concerning alternative routes of electron flow, *J. Phycol.*, doi: 10.1111/j.1529-8817.2010.00852.x, 2010.
- Gutierrez, R., G. Grossmann, W. B. Frommer, and D. W. Ehrhardt, Opportunities to explore plant membrane organization with super-resolution microscopy, *Plant Physiol.* 154, 463-466, 2010.
- Jensen, S., A.-S. Steunou, D. Bhaya, M. Kühl, and A. R. Grossman, In situ dynamics of O<sub>2</sub>, pH, and cyanobacterial transcripts associated with inorganic carbon concentration, photosynthesis, and detoxification of reactive oxygen species in hot spring microbial mats, *ISME J.*, Epub Aug. 26, 2010.
- Jurkuta, R. J., N. J. Kaplinsky, J. E. Spindel, and M. K. Barton, Partitioning the apical domain of the *Arabidopsis* embryo requires the BOBBER1 NudC domain protein, *Plant Cell* 21, 1957-1971, 2009.
- Kim, T.-W., S. Guan, Y. Sun, Z. Deng, J.-X. Shang, Y. Sun, A. L. Burlingame, and Z.-Y. Wang, Brassinosteroid signal transduction from cell-surface receptor kinases to nuclear transcription factors, *Nature Cell Biol.* 11, 1254-1262, 2009.
- Kim, T.-W., and Z.-Y. Wang, Brassinosteroid signal transduction from receptor kinases to transcription factors, *Annu. Rev. Plant Biol.* 61, 681-704, 2010.
- Kutschera, U., and W. R. Briggs, From Charles Darwin's botanical country-house studies to modern plant biology, *Plant Biol.* 11, 785-795, 2009.
- Kutschera, U., Z. Deng, J. A. Oses-Prieto, A. L. Burlingame, and Z.-Y. Wang, Cessation of coleoptile elongation and loss of auxin sensitivity in developing rye seedlings: a quantitative proteomic analysis, *Plant Signal. Behav.* 5, 509-517, 2010.
- Lalonde, S., A. Sero, R. Pratelli, G. Pilot, J. Chen, M. A. Sardi, S. A. Parsa, D.-Y. Kim, B. R. Acharya, E. V. Stein, H.-C. Hu, F. Villiers, K. Takeda, Y. Yang, Y. S. Han, R. Schwacke, W. Chiang, N. Kato, D. Loqué, S. M. Assmann, J. M. Kwak, J. Schroeder, S. Y. Rhee, and W. B. Frommer, A membrane protein/signaling protein interaction network for *Arabidopsis* version AMPv2, *Front. Plant Physiol.* 1, 1-14, 2010.
- Lamesch, P., K. Dreher, D. Swarbreck, R. Sasidharan, L. Reiser, and E. Huala, Using the Arabidopsis information resource (TAIR) to find information about *Arabidopsis* genes, *Curr. Protoc. Bioinformatics*, Chapter 1:Unit 1.11, 2010.
- Lanquar, V., D. Loqué, and W. B. Frommer, Ammonium transporters: regulation in oligomeric complexes, *Plant Signal. Behav.* 3, 5(6), 2010.
- Lanquar, V., D. Loqué, F. Hörmann, S. Lalonde, N. von Wirén, and W. B. Frommer, Ammonium-dependent phosphorylation of the ammonium transporter AMT1;1, *Plant Cell* 21, 3610-3622, 2009.
- Lee, I., B. Ambaru, P. Thakkar, E. Marcotte, and S. Y. Rhee, Rational association of genes with traits using a genome-scale gene network for *Arabidopsis thaliana*, *Nat. Biotechnol.* 2, 149-156, 2010.
- Mackey, K. R. M., T. Rivlin, A. R. Grossman, A. F. Post, and A. Paytan, Picophytoplankton responses to changing nutrient and light regimes during a bloom, *Mar. Biol.* 156, 1531-1546, 2009.
- Moseley, J., D. Gonzalez-Ballester, and A. R. Grossman, Intersection between sulfur and phosphorus deprivation responses in *Chlamydomonas*, *Genetics* 181, 889-905, 2009.
- Moseley, J., and A. R. Grossman, Phosphorus limitation from the physiological to the genomic, chap. 6 of *The Chlamydomonas Sourcebook*, E. Harris, D. Stern, and G. Witman, eds., pp. 189-216, Elsevier, Oxford, U.K., 2009.
- Murphy, A., B. Schulz, and W. B. Frommer, Evaluating the function of putative hormone transporters, *Plant Signal. Behav.* 4, 147-148, 2009.
- Peers, G., T. B. Truong, D. Elrad, E. Ostendorf, A. R. Grossman, M. Hippler, and K. K. Niyogi, A *Chlamydomonas* mutant reveals a role of L1818/LHCSR proteins in regulation of photosynthesis, *Nature* 462, 518-521, 2009.
- Pootakham, W., D. Gonzalez-Ballester, and A. R. Grossman, Function, localization, and regulation of sulfate transporters of *Chlamydomonas reinhardtii*, *Plant Physiol.* 153, 1653-1658, 2010.
- Pratelli, R., L. Voll, A. Weber, W. B. Frommer, and G. Pilot, Stimulation of non-selective amino acid efflux by a family of glutamine dumper proteins, *Plant Physiol.* 152, 762-773, 2009.
- Ryu, W.-H., S.-J. Bai, J. S. Park, Z. Huang, J. Moseley, T. Fabian, R. Fasching, A. R. Grossman, and F. B. Prinz, Direct extraction of photosynthetic electrons from single algal cells using a nano-probing system, *Nano Lett.* 10, 1137-1143, 2010.
- Salwinski, L., L. Licata, A. Winter, D. Thorneycroft, J. Khadake, A. Ceol, A. C. Aryamontri, R. Oughtred, M. Livstone, L. Boucher, D. Botstein, K. Dolinski, T. Berardini, E. Huala, M. Tyers, D. Eisenberg, G. Cesareni, and H. Hermjakob, Recurated protein interaction datasets, *Nat. Methods* 6, 860-861, 2009.
- Shibagaki, N., and A. R. Grossman, Binding of cysteine synthase to the STAS domain of sulfate transporter and its regulatory consequences, *J. Biol. Chem.* 285, 25094-25102, 2010.
- Takanaga, H., and W. B. Frommer, Plasma membrane GLUT facilitators mediate glucose transport during ER transit, *FASEB J.* 24, 2849-2858, 2010.
- Tang, W., Z. Deng, and Z.-Y. Wang, Proteomics shed light on the brassinosteroid signaling mechanisms, *Curr. Opin. Plant Biol.* 13, 27-33, 2010.
- Tseng, T.-S., and W. R. Briggs, The *Arabidopsis* rcn1 mutation confers impaired dephosphorylation of Phot2 resulting in enhanced blue-light responses, *Plant Cell* 22, 125-134, 2010.
- Zhang, L.-Y., M. Bai, J. Wu, J.-Y. Zhu, H. Wang, W. Wang, Z. Zhang, Y. Sun, J. Zhao, X. Sun, H. Yang, Y. Xu, S.-H. Kim, S. Fujioka, W. Lin, K. Chong, T.-G. Lu, and Z.-Y. Wang, Antagonistic H1H/bHLH transcription factors mediate BR regulation of cell elongation and plant development in rice and *Arabidopsis*, *Plant Cell* 21, 3767-3780, 2009.
- Zhang, P., K. Dreher, A. Karthikeyan, A. Chi, A. Pujar, R. Caspi, P. Karp, V. Kirkup, M. Latendresse, C. Lee, L. A. Mueller, R. Muller, and S. Y. Rhee, Creation of a genome-wide metabolic pathway database for *Populus trichocarpa* using a new approach for reconstruction and curation of metabolic pathways for plants, *Plant Physiol.* 153, 1479-1491, 2010.



DEPARTMENT OF  
TERRESTRIAL MAGNETISM

Here updated through September 1, 2011. The list is regularly updated on the DTM Web site (<http://www.dtm.ciw.edu>).

- 6842 Adams, E. R., M. López-Morales, J. L. Elliot, S. Seager, and D. J. Osip, Six high-precision transits of OGLE-TR-113b, *Astrophys. J.* 721, 1829-1834, 2010.
- 6932 Adams, E. R., M. López-Morales, J. L. Elliot, S. Seager, and D. J. Osip, Transit timing variation analysis of OGLE-TR-132b with seven new transits, *Astrophys. J.* 728, 125, 2011.
- 6930 Albrecht, S., J. N. Winn, J. A. Johnson, R. P. Butler, J. D. Crane, S. A. Shectman, I. B. Thompson, N. Narita, B. Sato, T. Hirano, K. Enya, and D. Fischer, Two upper limits on the Rossiter-McLaughlin effect, with differing implications: WASP-1 has a high obliquity and WASP-2 is indeterminate, *Astrophys. J.* 738, 50, 2011.
- 6862 Alexander, C. M. O'D., Modeling diffusive dissolution in silicate melts, *Geochim. Cosmochim. Acta* 75, 588-607, 2011.
- 6942 Alexander, C. M. O'D., Carbonaceous chondrites (Organic chemistry of), in *Encyclopedia of Astrobiology*, M. Gargaud et al., eds., pp. 247-248, Springer, New York, 2011.
- 6924 Anchieta, M. C., C. J. Wolfe, G. L. Pavlis, F. L. Vernon, J. A. Eakins, S. C. Solomon, G. Laske, and J. A. Collins, Seismicity around the Hawaiian Islands recorded by the PLUME seismometer networks: insight into faulting near Maui, Molokai, and Oahu, *Bull. Seismol. Soc. Am.* 101, 1742-1758, 2011.
- Anderson, B. J., J. A. Slavin, H. Korth, S. A. Boardsen, T. H. Zurbuchen, J. M. Raines, G. Gloeckler, R. L. McNutt, Jr., and S. C. Solomon, The dayside magnetospheric boundary layer at Mercury, *Planet. Space Sci.*, in press.
- 6895 Anglada-Escudé, G., A. P. Boss, and A. J. Weinberger, Ground-based astrometric planet searches using medium-sized telescopes, in *Pathways towards Habitable Planets*, V. Coudé du Foresto, D. M. Gelino, and I. Ribas, eds., pp. 401-402, Conference Series, Vol. 430, Astronomical Society of the Pacific, San Francisco, 2010.
- 6934 Aponte, J. C., M. R. Alexandre, Y. Wang, A. J. Brearley, C. M. O'D. Alexander, and Y. Huang, Effects of secondary alteration on the composition of free and IOM-derived monocarboxylic acids in carbonaceous chondrites, *Geochim. Cosmochim. Acta* 75, 2309-2323, 2011.
- 6904 Aulbach, S., T. Stachel, L. M. Heaman, R. A. Creaser, and S. B. Shirey, Formation of cratonic subcontinental lithospheric mantle and complementary komatiite from hybrid plume sources, *Contrib. Mineral. Petrol.* 161, 947-960, 2011.
- Baker, D. M. H., J. W. Head, S. C. Schon, C. M. Ernst, L. M. Prockter, S. L. Murchie, M. S. Robinson, B. W. Denevi, S. C. Solomon, C. R. Chapman, and R. G. Strom, The transition from complex crater to peak-ring basin on Mercury: new observations from MESSENGER flyby data and constraints on basin formation models, *Planet. Space Sci.*, in press.
- Baker, D. N., D. Odstrcil, B. J. Anderson, C. N. Arge, M. Benna, G. Gloeckler, H. Korth, L. R. Mayer, J. M. Raines, D. Schriver, J. A. Slavin, S. C. Solomon, P. Trávníček, and T. H. Zurbuchen, The space environment of Mercury at the times of the second and third MESSENGER flybys, *Planet. Space Sci.*, in press.
- 6902 Belton, M. J. S., K. J. Meech, S. Chesley, J. Pittichová, B. Carcich, M. Drahos, A. Harris, S. Gillam, J. Veverka, N. Mastrodomos, W. Owen, M. F. A'Hearn, S. Bagnulo, J. Bai, L. Barrera, F. Bastien, J. M. Bauer, J. Bedient, B. C. Bhatt, H. Boehnhardt, N. Brosch, M. Buie, P. Candia, W.-P. Chen, P. Chiang, Y.-J. Choi, A. Cochran, C. J. Crockett, S. Duddy, T. Farnham, Y. R. Fernández, P. Gutiérrez, O. R. Hainaut, D. Hampton, K. A. Herrmann, H. Hsieh, M. A. Kadooka, H. Kaluna, J. Keane, M.-J. Kim, K. Klaasen, J. Kleyna, K. Krisciunas, L. M. Lara, T. R. Lauer, J.-Y. Li, J. Licandro, C. M. Lisse, S. C. Lowry, L. McFadden, N. Moskovitz, B. Mueller, D. Polishook, N. S. Raja, T. Riesen, D. K. Sahu, N. Samarasingha, G. Sarid, T. Sekiguchi, S. Sonnett, N. B. Suntzeff, B. W. Taylor, P. Thomas, G. P. Tozzi, R. Vasundhara, J.-B. Vincent, L. H. Wasserman, B. Webster-Schultz, B. Yang, T. Zenn, and H. Zhao, *Stardust-NExT, Deep Impact*, and the accelerating spin of 9P/Tempel 1, *Icarus* 213, 345-368, 2011.
- 6911 Benecchi, S. D., K. S. Noll, D. C. Stephens, W. M. Grundy, and J. Rawlins, Optical and infrared colors of transneptunian objects observed with HST, *Icarus* 213, 693-709, 2011.
- 6913 Bochanski, J. J., S. L. Hawley, and A. A. West, The Sloan Digital Sky Survey data release 7 spectroscopic M dwarf catalog. II. Statistical parallax analysis, *Astron. J.* 141, 98, 2011.
- Borg, L. E., J. E. Connelly, M. Boyet, and R. W. Carlson, Chronological evidence that the Moon is either young or did not have a global magma ocean, *Nature*, in press.
- 6877 Borucki, W. J., D. G. Koch, G. Basri, N. Batalha, A. Boss, T. M. Brown, D. Caldwell, J. Christensen-Dalsgaard, W. D. Cochran, E. DeVore, E. W. Dunham, A. K. Dupree, T. N. Gautier III, J. C. Geary, R. Gilliland, A. Gould, S. B. Howell, J. M. Jenkins, H. Kjeldsen, D. W. Latham, J. J. Lissauer, G. W. Marcy, D. G. Monet, D. Sasselov, J. Tarter, D. Charbonneau, L. Doyle, E. B. Ford, J. Fortney, M. J. Holman, S. Seager, J. H. Steffen, W. F. Welsh, C. Allen, S. T. Bryson, L. Buchhave, H. Chandrasekaran, J. L. Christiansen, D. Ciardi, B. D. Clarke, J. L. Dotson, M. Endl, D. Fischer, F. Fressin, M. Haas, E. Horch, A. Howard, H. Isaacson, J. Kolodziejczak, J. Li, P. MacQueen, S. Meibom, A. Prsa, E. V. Quintana, J. Rowe, W. Sherry, P. Tenenbaum, G. Torres, J. D. Twicken, J. Van Cleve, L. Walkowicz, and H. Wu, Characteristics of *Kepler* planetary candidates based on the first data set, *Astrophys. J.* 728, 117, 2011.
- 6917 Borucki, W. J., D. G. Koch, G. Basri, N. Batalha, T. M. Brown, S. T. Bryson, D. Caldwell, J. Christensen-Dalsgaard, W. D. Cochran, E. DeVore, E. W. Dunham, T. N. Gautier III, J. C. Geary, R. Gilliland, A. Gould, S. B. Howell, J. M. Jenkins, D. W. Latham, J. J. Lissauer, G. W. Marcy, J. Rowe, D. Sasselov, A. Boss, D. Charbonneau, D. Ciardi, L. Doyle, A. K. Dupree, E. B. Ford, J. Fortney, M. J. Holman, S. Seager, J. H. Steffen, J. Tarter, W. F. Welsh, C. Allen, L. A. Buchhave, J. L. Christiansen, B. D. Clarke, S. Das, J.-M. Désert, M. Endl, D. Fabrycky, F. Fressin, M. Haas, E. Horch, A. Howard, H. Isaacson, H. Kjeldsen, J. Kolodziejczak, C. Kulesa, J. Li, P. W. Lucas, P. Machalek, D. McCarthy, P. MacQueen, S. Meibom, T. Miquel, A. Prsa, S. N. Quinn, E. V. Quintana, D. Ragozzine, W. Sherry, A. Shporer, P. Tenenbaum, G. Torres, J. D. Twicken, J. Van Cleve, L. Walkowicz, F. C. Wittenborn, and M. Still, Characteristics of planetary candidates observed by *Kepler*. II. Analysis of the first four months of data, *Astrophys. J.* 736, 19, 2011.
- 6855 Boss, A. P., Giant planet formation by disk instability in low mass disks? *Astrophys. J. Lett.* 725, L145-L149, 2010.
- 6896 Boss, A. P., Are we on the verge of finding alien life? *BBC Focus Mag.* 213, 23, 2010.
- 6897 Boss, A. P., Formation of giant planets by disk instability on wide orbits around protostars with varied masses, *Astrophys. J.* 731, 74, 2011.
- Boss, A. P., Evolution of the solar nebula. IX. Gradients in the spatial heterogeneity of the short-lived radioisotopes  $^{60}\text{Fe}$  and  $^{26}\text{Al}$  and the stable oxygen isotopes, *Astrophys. J.*, in press.
- Boss, A. P., D. M. Hudgins, and W. A. Traub, New worlds, new horizons, and NASA's approach to the next decade of exoplanet discoveries, in *The Astrophysics of Planetary Systems: Formation, Structure, and Dynamical Evolution*, A. Sozzetti, M. G. Lattanzi, and A. P. Boss, eds., International Astronomical Union Symposium 276, Cambridge University Press, in press.
- 6882 Brozović, M., R. A. Jacobson, and S. S. Sheppard, The orbits of Neptune's outer satellites, *Astron. J.* 141, 135, 2011.
- 6939 Buntain, J., M. Lugaro, R. J. Stancliffe, A. Karakas, L. Nittler, and P. Hoppe, Wind beyond the tip of the AGB and its relevance to stardust grain data, in *Proceedings of the 11th Symposium on Nuclei in the Cosmos*, POS(NIC XI)139, Proceedings of Science, SISSA, Trieste, Italy, 2010.
- Busemann, H., N. H. Spring, C. M. O'D. Alexander, and L. R. Nittler, Raman spectroscopy on cometary and meteoritic organic matter, *Spectrosc. Lett.*, in press.
- 6944 Carlson, R. W., Absolute age determinations: Radiometric, in *Encyclopedia of Solid Earth Geophysics*, H. K. Gupta, ed., pp. 1-8, Springer, Dordrecht, 2011.
- 6849 Chambers, J. E., Stellar elemental abundance patterns: implications for planet formation, *Astrophys. J.* 724, 92-97, 2010.
- 6859 Chambers, J., Terrestrial planet formation, in *Exoplanets*, S. Seager, ed., pp. 297-317, University of Arizona Press, Tucson, 2010.
- 6891 Chambers, J., Formation of habitable planets, in *Origins and Evolution of Life: An Astrobiological Perspective*, M. Gargaud, P. López-García, and H. Martin, eds., pp. 136-153, Cambridge University Press, Cambridge, 2011.
- 6931 Chanamé, J., Schwarzschild models for the Galaxy, in *Highlights of Astronomy* 15, I. F. Corbett, ed., pp. 190-191, Cambridge University Press, Cambridge, 2010.

- 6907 Cheng, X., F. Niu, P. G. Silver, and R. M. Nadeau, Seismic imaging of scatterer migration associated with the 2004 Parkfield earthquake using waveform data of repeating earthquakes and active sources, *Bull. Seismol. Soc. Am.* 101, 1291-1301, 2011.
- 6883 Cipriani, A., E. Bonatti, and R. W. Carlson, Nonchondritic  $^{142}\text{Nd}$  in suboceanic mantle peridotites, *Geochem. Geophys. Geosyst.* 12, Q03006, doi:10.1029/2010GC003415, 2011.
- 6879 Cloutis, E. A., T. Hiroi, M. J. Gaffey, C. M. O'D. Alexander, and P. Mann, Spectral reflectance properties of carbonaceous chondrites: 1. CI chondrites, *Icarus* 212, 180-209, 2011.
- \_\_\_\_\_, Cody, G. D., E. Heying, C. M. O'D. Alexander, L. R. Nittler, A. L. D. Kilcoyne, S. A. Sandford, and R. M. Stroud, Establishing a molecular relationship between chondritic and cometary organic solids, *Proc. Natl. Acad. Sci. USA*, in press.
- 6844 Cooper, L. B., T. Plank, R. J. Arculus, E. H. Hauri, P. S. Hall, and S. W. Parman, High-Ca boninites from the active Tonga Arc, *J. Geophys. Res.* 115, B10206, doi:10.1029/2009JB006367, 2010.
- 6872 Coughlin, J. L., M. López-Morales, T. E. Harrison, N. Ule, and D. I. Hoffman, Low-mass eclipsing binaries in the initial *Kepler* data release, *Astron. J.* 141, 78, 2011.
- \_\_\_\_\_, De Gregorio, B. T., R. M. Stroud, G. D. Cody, L. R. Nittler, A. L. D. Kilcoyne, and S. Wirick, Correlated microanalysis of cometary organic grains returned by Stardust, *Meteorit. Planet. Sci.*, in press.
- 6854 Desch, S. J., M. A. Morris, H. C. Connolly, and A. P. Boss, A critical examination of the X-wind model for chondrule and calcium-rich, aluminum-rich inclusion formation and radionuclide production, *Astrophys. J.* 725, 692-711, 2010.
- \_\_\_\_\_, Doyle, L. R., J. A. Carter, D. C. Fabrycky, R. W. Slawson, S. B. Howell, J. N. Winn, J. A. Orosz, A. Prsa, W. Welsh, S. N. Quinn, D. Latham, G. Torres, L. Buchhave, G. W. Marcy, J. J. Fortney, A. Shporer, E. B. Ford, J. J. Lissauer, D. Ragozzine, M. Rucker, N. Batalha, J. M. Jenkins, W. J. Borucki, D. Koch, C. K. Middour, J. R. Hall, S. McCauliff, M. N. Fanelli, E. V. Quintana, M. J. Holman, D. A. Caldwell, M. Still, R. P. Stefanik, W. R. Brown, G. A. Esquerdo, S. Tang, G. Furesz, J. C. Geary, P. Berlind, M. L. Calkins, D. R. Short, J. H. Steffen, D. Sasselov, E. W. Dunham, W. D. Cochran, A. Boss, M. R. Haas, D. Buzasi, and D. Fischer, KOI1611: a transiting, circumbinary planet around a low mass-ratio eclipsing binary, *Science*, in press.
- 6874 Eagar, K. C., M. J. Fouch, D. E. James, and R. W. Carlson, Crustal structure beneath the High Lava Plains of eastern Oregon and surrounding regions from receiver function analysis, *J. Geophys. Res.* 116, B02313, doi:10.1029/2010JB007795, 2011.
- 6906 Fassett, C. I., S. J. Kadish, J. W. Head, S. C. Solomon, and R. G. Strom, The global population of large craters on Mercury and comparison with the Moon, *Geophys. Res. Lett.* 38, L10202, doi:10.1029/2011GL047294, 2011.
- \_\_\_\_\_, García-Melendo, E., and M. López-Morales, Potential biases in the detection of planetary systems with large transit timing variations, *Mon. Not. Roy. Astron. Soc.*, in press.
- 6846 Gómez-Pérez, N., and S. C. Solomon, Mercury's weak magnetic field: a result of magnetospheric feedback? *Geophys. Res. Lett.* 37, L20204, doi:10.1029/2010GL044533, 2010.
- 6893 Gottsmann, J., S. De Angelis, N. Fournier, M. Van Camp, S. Sacks, A. Linde, and M. Ripepe, On the geophysical fingerprint of Vulcanian explosions, *Earth Planet. Sci. Lett.* 306, 98-104, 2011.
- 6910 Grundy, W. M., K. S. Noll, F. Nimmo, H. G. Roe, M. W. Buie, S. B. Porter, S. D. Benecchi, D. C. Stephens, H. F. Levison, and J. A. Stansberry, Five new and three improved mutual orbits of transneptunian binaries, *Icarus* 213, 678-692, 2011.
- 6938 Gyngard, F., L. R. Nittler, E. Zinner, and J. Jose, Oxygen-rich stardust from novae, in *Proceedings of the 11th Symposium on Nuclei in the Cosmos*, POS(NIC XI)141, Proceedings of Science, SISSA, Trieste, Italy, 2010.
- 6916 Hauri, E. H., T. Weinreich, A. E. Saal, M. C. Rutherford, and J. A. Van Orman, High pre-eruptive water contents preserved in lunar melt inclusions, *Science* 333, 213-215, 2011.
- 6920 Heimpel, M., and N. Gómez-Pérez, On the relationship between zonal jets and dynamo action in giant planets, *Geophys. Res. Lett.* 38, L14201, doi:10.1029/2011GL047562, 2011.
- 6845 Heinonen, J. S., R. W. Carlson, and A. V. Lutinen, Isotopic (Sr, Nd, Pb, and Os) composition of highly magnesian dikes of Vestfjella, western Dronning Maud Land, Antarctica: a key to the origins of the Jurassic Karoo large igneous province? *Chem. Geol.* 277, 227-244, 2010.
- 6894 Herd, C. D. K., A. Blinova, D. N. Simkus, Y. Huang, R. Tarozo, C. M. O'D. Alexander, F. Gyngard, L. R. Nittler, G. D. Cody, M. L. Fogel, Y. Kebukawa, A. L. D. Kilcoyne, R. W. Hiltz, G. F. Slater, D. P. Glavin, J. P. Dworkin, M. P. Callahan, J. E. Elsila, B. T. De Gregorio, and R. M. Stroud, Origin and evolution of prebiotic organic matter as inferred from the Tagish Lake meteorite, *Science* 332, 1304-1307, 2011.
- \_\_\_\_\_, Ho, G. C., R. D. Starr, R. E. Gold, S. M. Krimigis, J. A. Slavin, D. N. Baker, B. J. Anderson, R. L. McNutt, Jr., L. R. Nittler, and S. C. Solomon, Observations of suprathermal electrons in Mercury's magnetosphere during the three MESSENGER flybys, *Planet. Space Sci.*, in press.
- 6881 Honeycutt, R. K., S. Kafka, H. Jacobson, A. A. Henden, D. Hoffman, T. Maxwell, J. W. Robertson, and K. Croxall, The 2001-2003 low state of nova Lacertae 1950 (DK Lac), *Astron. J.* 141, 122, 2011.
- 6880 Honeycutt, R. K., J. W. Robertson, and S. Kafka, The dwarf nova outbursts of nova Her 1960 (=V446 Her), *Astron. J.* 141, 131, 2011.
- \_\_\_\_\_, Howard, A. W., G. Á. Bakos, J. Hartman, G. Torres, A. Shporer, T. Mazeh, G. Kovacs, D. W. Latham, R. W. Noyes, D. A. Fischer, J. A. Johnson, G. W. Marcy, G. A. Esquerdo, B. Béky, R. P. Butler, D. D. Sasselov, R. P. Stefanik, G. Perumilly, J. Lázár, I. Papp, and P. Sári, HAT-P-17b,c: a transiting, eccentric, hot Saturn and a long-period, cold Jupiter, *Astrophys. J.*, in press.
- 6927 Hoyer, S., P. Rojo, and M. López-Morales, Search for exoplanets using TTVs in the southern hemisphere, in *Pathways towards Habitable Planets*, V. Coudé du Foresto, D. M. Gelino, and I. Ribas, eds., pp. 462-463, Conference Series, Vol. 430, Astronomical Society of the Pacific, San Francisco, 2010.
- 6905 Hoyer, S., P. Rojo, M. López-Morales, R. F. Díaz, J. Chambers, and D. Minniti, Five new transit epochs of the exoplanet OGLE-TR-111b, *Astrophys. J.* 733, 53, 2011.
- 6915 Jackson, M. G., and R. W. Carlson, An ancient recipe for flood-basalt genesis, *Nature* 476, 316-319, 2011.
- 6945 James, D. E., Lithosphere, Continental, in *Encyclopedia of Solid Earth Geophysics*, H. K. Gupta, ed., pp. 675-681, Springer, Dordrecht, 2011.
- 6925 Jang-Condell, H., Observable differences between core accretion and disk instability, in *Bioastronomy 2007: Molecules, Microbes, and Extraterrestrial Life*, K. J. Meech et al., eds., pp. 305-310, Conference Series, Vol. 420, Astronomical Society of the Pacific, San Francisco, 2009.
- 6918 Jiang, N., R. W. Carlson, and J. Guo, Source of Mesozoic intermediate-felsic igneous rocks in the North China craton: granulite xenolith evidence, *Lithos* 125, 335-346, 2011.
- \_\_\_\_\_, Kafka, S., Challenges to observations of low mass binaries, in *From Interacting Binaries to Exoplanets: Essential Modeling Tools*, International Astronomical Union Symposium 282, Cambridge University Press, New York, in press.
- \_\_\_\_\_, Kafka, S., The changing nature of QU Carinae: SNeIa progenitor or a hoax? in *Binary Paths to Type Ia Supernovae Explosions*, R. Di Stefano and M. Orio, eds., International Astronomical Union Symposium 281, Cambridge University Press, New York, in press.
- 6841 Kafka, S., C. Tappert, T. Ribeiro, R. K. Honeycutt, D. W. Hoard, and S. Saar, Low-state magnetic structures in polars: nature or nurture? *Astrophys. J.* 721, 1714-1724, 2010.
- 6864 Kafka, S., and R. Williams, The 2010 early outburst spectrum of the recurrent nova U Scorpii, *Astron. Astrophys.* 526, A83, 2011.
- 6922 Kebukawa, Y., C. M. O'D. Alexander, and G. D. Cody, Compositional diversity in organic matter in type 1, 2, and 3 chondrites as detected by infrared spectroscopy, *Geochim. Cosmochim. Acta* 75, 3530-3541, 2011.
- \_\_\_\_\_, Kerber, L., J. W. Head, D. T. Blewett, S. C. Solomon, L. Wilson, S. L. Murchie, M. S. Robinson, B. W. Denevi, L. M. Prockter, and D. L. Domingue, The global distribution of pyroclastic deposits on Mercury: the view from MESSENGER flybys 1-3, *Planet. Space Sci.*, in press.
- \_\_\_\_\_, Korh, H., B. J. Anderson, T. H. Zurbuchen, J. A. Slavin, S. Perri, S. A. Boardsen, D. N. Baker, S. C. Solomon, and R. L. McNutt, Jr., The interplanetary magnetic field environment at Mercury's orbit, *Planet. Space Sci.*, in press.

- Lawrence, D. J., J. K. Harmon, W. C. Feldman, J. O. Goldsten, D. A. Paige, P. N. Peplowski, E. A. Rhodes, C. M. Selby, and S. Solomon, Predictions of MESSENGER Neutron Spectrometer measurements for Mercury's north polar region, *Planet. Space Sci.*, in press.
- 6839 Leahy, G. M., J. A. Collins, C. J. Wolfe, G. Laske, and S. C. Solomon, Underplating of the Hawaiian Swell: evidence from teleseismic receiver functions, *Geophys. J. Int.* 183, 313-329, 2010.
- 6867 Li, J.-Y., M. J. Kuchner, R. J. Allen, and S. S. Sheppard, Measuring the sizes, shapes, surface features, and rotations of Solar System objects with interferometry, *Icarus* 211, 1007-1021, 2011.
- 6909 Lim, L. F., J. P. Emery, and N. A. Moskovitz, Mineralogy and thermal properties of V-type Asteroid 956 Elisa: evidence for diogenitic material from the Spitzer IRS (5-35  $\mu\text{m}$ ) spectrum, *Icarus* 213, 510-523, 2011.
- 6898 Liu, L., Y. Tan, D. Sun, M. Chen, and D. Helmberger, Trans-Pacific whole mantle structure, *J. Geophys. Res.* 116, B04306, doi:10.1029/2010JB007907, 2011.
- 6937 Liu, M.-C., L. R. Nittler, C. M. O'D. Alexander, and T. Lee, Protosolar irradiation in the early Solar System: clues from lithium and boron isotopes, in *Proceedings of the 11th Symposium on Nuclei in the Cosmos*, POS(NIC XI)145, Proceedings of Science, SISSA, Trieste, Italy, 2010.
- 6860 Long, M. D., and P. G. Silver, Shear wave splitting and mantle anisotropy: measurements, interpretations, and new directions, in *Arrays and Array Methods in Global Seismology*, Y. J. Gu, ed., pp. 139-193, Springer, Dordrecht, 2010. [Reprinted from *Surv. Geophys.* 30, 407-461, 2009.]
- 6928 Martín, E. L., E. Guenther, C. del Burgo, F. Rodler, C. Álvarez, C. Baffa, V. J. S. Béjar, J. A. Caballero, R. Deshpande, P. Esparza, M. López-Morales, A. Moitinho, D. Montes, M. M. Montgomery, E. Pallé, R. Tata, L. Valdivielso, and M. R. Zapatero Osorio, NAHUAL: a next-generation near infrared spectrograph for the GTC, in *Pathways towards Habitable Planets*, V. Coudé du Foresto, D. M. Gelino, and I. Ribas, eds., pp. 181-187, Conference Series, Vol. 430, Astronomical Society of the Pacific, San Francisco, 2010.
- 6840 McNutt, R. L., Jr., S. C. Solomon, P. D. Bedini, E. J. Finnegan, D. G. Grant, and the MESSENGER Team, The MESSENGER mission: results from the first two Mercury flybys, *Acta Astronaut.* 67, 681-687, 2010.
- 6901 Meech, K. J., J. Pittichová, B. Yang, A. Zenn, M. J. S. Belton, M. F. A'Hearn, S. Bagnulo, J. Bai, L. Barrera, J. M. Bauer, J. Bedient, B. C. Bhatt, H. Boehnhardt, N. Brosch, M. Buie, P. Candia, W.-P. Chen, S. Chesley, P. Chiang, Y.-J. Choi, A. Cochran, S. Duddy, T. L. Farnham, Y. Fernández, P. Gutiérrez, O. R. Hainaut, D. Hampton, K. Herrmann, H. Hsieh, M. A. Kadooka, H. Kaluna, J. Keane, M.-J. Kim, J. Kleyna, K. Krisciunas, T. R. Lauer, L. Lara, J. Licandro, S. C. Lowry, L. A. McFadden, N. Moskovitz, B. E. A. Mueller, D. Polishook, N. S. Raja, T. Riesen, D. K. Sahu, N. H. Samarasingha, G. Sarid, T. Sekiguchi, S. Sonnett, N. Suntzeff, B. Taylor, G. P. Tozzi, R. Vasundhara, J.-B. Vincent, L. Wasserman, B. Webster-Schultz, and H. Zhao, *Deep Impact, Stardust-NExT* and the behavior of Comet 9P/Tempel 1 from 1997 to 2010, *Icarus* 213, 323-344, 2011.
- 6870 Meschiri, S., G. Laughlin, S. S. Vogt, R. P. Butler, E. J. Rivera, N. Haghighipour, and P. Jalowiczor, The Lick-Carnegie Survey: four new exoplanet candidates, *Astrophys. J.* 727, 117, 2011.
- 6926 Meschiri, S., A. S. Wolf, E. Rivera, G. Laughlin, S. Vogt, and P. Butler, The Systemic Console package, in *Pathways towards Habitable Planets*, V. Coudé du Foresto, D. M. Gelino, and I. Ribas, eds., pp. 503-504, Conference Series, Vol. 430, Astronomical Society of the Pacific, San Francisco, 2010.
- 6908 Millan-Gabet, R., E. Serabyn, B. Mennesson, W. A. Traub, R. K. Barry, W. C. Danchi, M. Kuchner, C. C. Stark, S. Ragland, M. Hrynevych, J. Woillez, K. Stapelfeldt, G. Bryden, M. M. Colavita, and A. J. Booth, Exozodiacal dust levels for nearby main-sequence stars: a survey with the Keck Interferometer Nuller, *Astrophys. J.* 734, 67, 2011.
- 6919 Moskovitz, N., and E. Gaidos, Differentiation of planetesimals and the thermal consequences of melt migration, *Meteorit. Planet. Sci.* 46, 903-918, 2011.
- 6933 Moskovitz, N. A., and R. J. Walker, Size of the group IVA iron meteorite core: constraints from the age and composition of Muonionalusta, *Earth Planet. Sci. Lett.* 308, 410-416, 2011.
- 6851 Muterspaugh, M. W., B. F. Lane, S. R. Kulkarni, M. Konacki, B. F. Burke, M. M. Colavita, M. Shao, W. I. Hartkopf, A. P. Boss, and M. Williamson, The PHASES differential astrometry data archive. V. Candidate substellar companions to binary systems, *Astron. J.* 140, 1657-1671, 2010.
- 6921 Narendranath, S., P. S. Athiray, P. Sreekumar, B. J. Kellett, L. Alha, C. J. Howe, K. H. Joy, M. Grande, J. Huovelin, I. A. Crawford, U. Unnikrishnan, S. Lalita, S. Subramaniam, S. Z. Weider, L. R. Nittler, O. Gasnault, D. Rothery, V. A. Fernandes, N. Bhandari, J. N. Goswami, M. A. Wieczorek, and the C1XS Team, Lunar X-ray fluorescence observations by the Chandrayaan-1 X-ray Spectrometer (C1XS): results from the nearside southern highlands, *Icarus* 214, 53-66, 2011.
- \_\_\_\_\_ Oberst, J., S. Elgner, F. S. Turner, M. E. Perry, R. W. Gaskell, M. T. Zuber, M. S. Robinson, and S. C. Solomon, Radius and limb topography of Mercury obtained from images acquired during the MESSENGER flybys, *Planet. Space Sci.*, in press.
- 6943 O'Neil, J., Nuvvuagittuq (Porpoise Cove) greenstone belt, in *Encyclopedia of Astrobiology*, M. Gargaud et al., eds., pp. 1155-1158, Springer, New York, 2011.
- 6900 O'Neil, J., D. Francis, and R. W. Carlson, Implications of the Nuvvuagittuq greenstone belt for the formation of Earth's early crust, *J. Petrol.* 52, 985-1009, 2011.
- 6936 Papineau, D., B. T. De Gregorio, G. D. Cody, J. O'Neil, A. Steele, R. M. Stroud, and M. L. Fogel, Young poorly crystalline graphite in the >3.8-Gyr-old Nuvvuagittuq banded iron formation, *Nature Geosci.* 4, 376-379, 2011.
- 6838 Papineau, D., B. T. De Gregorio, R. M. Stroud, A. Steele, E. Pecoits, K. Konhauser, J. Wang, and M. L. Fogel, Ancient graphite in the Eoarchean quartz-pyroxene rock from Akilia in southern West Greenland II: isotopic and chemical compositions and comparison with Paleoproterozoic banded iron formations, *Geochim. Cosmochim. Acta* 74, 5884-5905, 2010.
- \_\_\_\_\_ Peplowski, P. N., D. T. Blewett, B. W. Denevi, L. G. Evans, D. J. Lawrence, L. R. Nittler, E. A. Rhodes, C. M. Selby, and S. C. Solomon, Mapping iron abundances on the surface of Mercury: predicted spatial resolution of the MESSENGER Gamma-Ray Spectrometer, *Planet. Space Sci.*, in press.
- \_\_\_\_\_ Perry, M. E., D. S. Kahan, O. S. Barnouin, C. M. Ernst, S. C. Solomon, M. T. Zuber, D. E. Smith, R. J. Phillips, D. K. Srinivasan, J. Oberst, and S. W. Asmar, Measurement of the radius of Mercury by radio occultation during the MESSENGER flybys, *Planet. Space Sci.*, in press.
- 6889 Pietruszka, A. J., M. J. Keyes, J. A. Duncan, E. H. Hauri, R. W. Carlson, and M. O. Garcia, Excesses of seawater-derived  $^{234}\text{U}$  in volcanic glasses from Loihi Seamount due to crustal contamination, *Earth Planet. Sci. Lett.* 304, 280-289, 2011.
- 6887 Poppenhaeger, K., L. F. Lenz, A. Reiners, J. H. M. M. Schmitt, and E. Shkolnik, A search for star-planet interactions in the  $\nu$  Andromedae system at X-ray and optical wavelengths, *Astron. Astrophys.* 528, A58, 2011.
- \_\_\_\_\_ Preusker, F., J. Oberst, J. W. Head, T. R. Watters, M. S. Robinson, M. T. Zuber, and S. C. Solomon, Stereo topographic models of Mercury after three MESSENGER flybys, *Planet. Space Sci.*, in press.
- 6863 Qin, L., L. R. Nittler, C. M. O'D. Alexander, J. Wang, F. J. Stadermann, and R. W. Carlson, Extreme  $^{54}\text{Cr}$ -rich nano-oxides in the CI chondrite Orgueil—implication for a late supernova injection into the solar system, *Geochim. Cosmochim. Acta* 75, 629-644, 2011.
- 6865 Qin, L., D. Rumble, C. M. O'D. Alexander, R. W. Carlson, P. Jenniskens, and M. H. Shaddad, The chromium isotopic composition of Almahata Sitta, *Meteorit. Planet. Sci.* 45, 1771-1777, 2010.
- 6912 Raymond, S. N., P. J. Armitage, A. Moro-Martín, M. Booth, M. C. Wyatt, J. C. Armstrong, A. M. Mandell, F. Selsis, and A. A. West, Debris disks as signposts of terrestrial planet formation, *Astron. Astrophys.* 530, A62, 2011.
- \_\_\_\_\_ Rhodes, E. A., L. G. Evans, L. R. Nittler, R. D. Starr, A. L. Sprague, D. J. Lawrence, T. J. McCoy, K. R. Stockstill-Cahill, J. O. Goldsten, P. N. Peplowski, D. K. Hamara, W. V. Boynton, and S. C. Solomon, Analysis of MESSENGER Gamma-Ray Spectrometer data from Mercury flybys, *Planet. Space Sci.*, in press.
- 6940 Rubin, V. C., An interesting voyage, *Annu. Rev. Astron. Astrophys.* 49, 1-28, 2011.
- 6875 Russo, R. M., A. Gallego, D. Comte, V. I. Mocanu, R. E. Mordie, C. Mora, and J. C. VanDecar, Triggered seismic activity in the Lique-Otqui fault zone, southern Chile, during the 2007 Aysen seismic swarm, *Geophys. J. Int.* 184, 1317-1326, 2011.
- \_\_\_\_\_ Schon, S. C., J. W. Head, D. M. H. Baker, C. M. Ernst, L. M. Prockter, S. L. Murchie, and S. C. Solomon, Eminescu impact structure: insight into the transition from complex crater to peak-ring basin on Mercury, *Planet. Space Sci.*, in press.

- 6853 Schröder, C., K. E. Herkenhoff, W. H. Farrand, J. E. Chappelow, W. Wang, L. R. Nittler, J. W. Ashley, I. Fleischer, R. Gellert, M. P. Golombek, J. R. Johnson, G. Klingelhöfer, R. Li, R. V. Morris, and S. W. Squyres, Properties and distribution of paired candidate stony meteorites at Meridiani Planum, Mars, *J. Geophys. Res.* 115, E00F09, doi:10.1029/2010JE003616, 2010.
- 6850 Sheppard, S. S., and C. A. Trujillo, The size distribution of the Neptune Trojans and the missing intermediate-sized planetesimals, *Astrophys. J. Lett.* 723, L233-L237, 2010.
- \_\_\_\_\_, Sheppard, S. S., A. Udalski, C. Trujillo, M. Kubiak, G. Pietrzynski, R. Poleski, I. Soszynski, M. K. Szymański, and K. Ulaczyk, A southern sky and galactic plane survey for bright Kuiper Belt objects, *Astron. J.*, in press.
- 6914 Shirey, S. B., and S. H. Richardson, Start of the Wilson cycle at 3 Ga shown by diamonds from subcontinental mantle, *Science* 333, 434-436, 2011.
- 6876 Shkolnik, E. L., M. C. Liu, I. N. Reid, T. Dupuy, and A. J. Weinberger, Searching for young M dwarfs with GALEX, *Astrophys. J.* 727, 6, 2011.
- 6861 Silver, P. G., and M. D. Long, The non-commutivity of shear wave splitting operators at low frequencies and implications for anisotropy tomography, *Geophys. J. Int.* 184, 1415-1427, 2011.
- \_\_\_\_\_, Simon, T. A., W. A. Ward, Jr., and A. P. Boss, Performance analysis of Intel multiprocessors using astrophysics simulations, *Concurr. Comput. Pract. Exper.*, in press.
- 6878 Sing, D. K., J.-M. Désert, J. J. Fortney, A. Lecavelier des Etangs, G. E. Ballester, J. Cepa, D. Ehrenreich, M. López-Morales, F. Pont, M. Shabram, and A. Vidal-Madjar, Gran Telescopio Canarias OSIRIS transiting exoplanet atmospheric survey: detection of potassium in XO-2b from narrowband spectro-photometry, *Astron. Astrophys.* 527, A73, 2011.
- 6871 Solomon, S. C., A new look at the planet Mercury, *Phys. Today* 64 (no. 1), 50-55, 2011.
- 6892 Sozzetti, A., D. W. Latham, G. Torres, A. P. Boss, B. W. Carney, S. G. Korzennik, J. B. Laird, and R. P. Stefanik, The Keck metal-poor planet search: on the frequency of gas giant planets in the metal-poor regime, *Mem. Soc. Astron. Ital. Suppl.* 14, 173-176, 2010.
- \_\_\_\_\_, Sozzetti, A., M. G. Lattanzi, and A. P. Boss, eds., *The Astrophysics of Planetary Systems: Formation, Structure, and Dynamical Evolution*, International Astronomical Union Symposium 276, Cambridge University Press, in press.
- \_\_\_\_\_, Stark, C. C., The transit light curve of an exozodiacal dust cloud, *Astron. J.*, in press.
- \_\_\_\_\_, Strom, R. G., M. E. Banks, C. R. Chapman, C. I. Fassett, J. A. Forde, J. W. Head III, W. J. Merline, L. M. Prockter, and S. C. Solomon, Mercury crater statistics from MESSENGER flybys: implications for stratigraphy and resurfacing history, *Planet. Space Sci.*, in press.
- 6941 Stroud, R. M., M. F. Chisholm, P. R. Heck, C. M. O'D. Alexander, and L. R. Nittler, Supernova shock-wave-induced co-formation of glassy carbon and nanodiamond, *Astrophys. J. Lett.* 738, L27, 2011.
- 6866 Sun, D., and D. Helmberger, Upper-mantle structures beneath USArray derived from waveform complexity, *Geophys. J. Int.* 184, 416-438, 2011.
- \_\_\_\_\_, Sundberg, T., S. A. Boardsen, J. A. Slavin, L. G. Blomberg, J. A. Cumnock, S. C. Solomon, B. J. Anderson, and H. Korth, Reconstruction of propagating Kelvin-Helmholtz vortices at Mercury's magnetopause, *Planet. Space Sci.*, in press.
- 6869 Tinney, C. G., R. P. Butler, H. R. A. Jones, R. A. Wittenmyer, S. O'Toole, J. Bailey, and B. D. Carter, The Anglo-Australian Planet Search. XX. A solitary ice-giant planet orbiting HD 102365, *Astrophys. J.* 727, 103, 2011.
- 6890 Tinney, C. G., R. A. Wittenmyer, R. P. Butler, H. R. A. Jones, S. J. O'Toole, J. A. Bailey, B. D. Carter, and J. Horner, The Anglo-Australian Planet Search. XXI. A gas-giant planet in a one year orbit and the habitability of gas-giant satellites, *Astrophys. J.* 732, 31, 2011.
- 6886 Trujillo, C. A., S. S. Sheppard, and E. L. Schaller, A photometric system for detection of water and methane ices on Kuiper belt objects, *Astrophys. J.* 730, 105, 2011.
- 6899 Villagómez, D. R., D. R. Toomey, E. E. E. Hoof, and S. C. Solomon, Crustal structure beneath the Galápagos Archipelago from ambient noise tomography and its implications for plume-lithosphere interactions, *J. Geophys. Res.* 116, B04310, doi:10.1029/2010JB007764, 2011.
- 6848 Vogt, S. S., R. P. Butler, E. J. Rivera, N. Haghighipour, G. W. Henry, and M. H. Williamson, The Lick-Carnegie Exoplanet Survey: a 3.1M<sub>J</sub> planet in the habitable zone of the nearby M3V star Gliese 581, *Astrophys. J.* 723, 954-965, 2010.
- 6923 von Braun, K., T. S. Boyajian, S. R. Kane, G. T. van Belle, D. R. Ciardi, M. López-Morales, H. A. McAlister, T. J. Henry, W.-C. Jao, A. R. Riedel, J. P. Subasavage, G. Schaefer, T. A. ten Brummelaar, S. Ridgway, L. Sturmann, J. Sturmann, J. Mazingue, N. H. Turner, C. Farrington, P. J. Goldfinger, and A. F. Boden, Astrophysical parameters and habitable zone of the exoplanet hosting star GJ 58, *Astrophys. J. Lett.* 729, L26, 2011.
- 6852 Wagner, L., D. W. Forsyth, M. J. Fouch, and D. E. James, Detailed three-dimensional shear wave velocity structure of the northwestern United States from Rayleigh wave tomography, *Earth Planet. Sci. Lett.* 299, 273-284, 2010.
- 6884 Wahhaj, Z., M. C. Liu, B. A. Biller, F. Clarke, E. L. Nielsen, L. M. Close, T. L. Hayward, E. E. Mamajek, M. Cushing, T. Dupuy, M. Tecza, N. Thatte, M. Chun, C. Ftaclas, M. Hartung, I. N. Reid, E. L. Shkolnik, S. H. P. Alencar, P. Artymowicz, A. Boss, E. de Gouveia Dal Pino, J. Gregorio-Hetem, S. Ida, M. Kuchner, D. N. C. Lin, and D. W. Toomey, The Gemini NICI Planet-Finding Campaign: discovery of a substellar L dwarf companion to the nearby young M dwarf CD-35 2722, *Astrophys. J.* 729, 139, 2011.
- \_\_\_\_\_, Walter, M. J., S. C. Kohn, D. Araujo, G. P. Bulanova, C. B. Smith, E. Gaillou, J. Wang, A. Steele, and S. B. Shirey, Deep mantle cycling of oceanic crust: evidence from diamonds and their mineral inclusions, *Science*, in press.
- 6858 Weinberger, A. J., E. E. Becklin, I. Song, and B. Zuckerman, The absence of cold dust and the mineralogy and origin of the warm dust encircling BD +20 307, *Astrophys. J.* 726, 72, 2011.
- 6873 West, A. A., D. P. Morgan, J. J. Bochanski, J. M. Andersen, K. J. Bell, A. F. Kowalski, J. R. A. Davenport, S. L. Hawley, S. J. Schmidt, D. Bernat, E. J. Hilton, P. Muirhead, K. R. Covey, B. Rojas-Ayala, E. Schlawin, M. Gooding, K. Schluns, S. Dhital, J. S. Pineda, and D. O. Jones, The Sloan Digital Sky Survey data release 7 spectroscopic M dwarf catalog. I. Data, *Astron. J.* 141, 97, 2011.
- 6847 Wittenmyer, R. A., S. J. O'Toole, H. R. A. Jones, C. G. Tinney, R. P. Butler, B. D. Carter, and J. Bailey, The frequency of low-mass exoplanets. II. The "period valley," *Astrophys. J.* 722, 1854-1863, 2010.
- 6929 Wittenmyer, R. A., C. G. Tinney, R. P. Butler, S. J. O'Toole, H. R. A. Jones, B. D. Carter, J. Bailey, and J. Horner, The frequency of low-mass exoplanets. III. Toward  $\eta_{\oplus}$  at short periods, *Astrophys. J.* 738, 81, 2011.
- 6868 Wittenmyer, R. A., C. G. Tinney, S. J. O'Toole, H. R. A. Jones, R. P. Butler, B. D. Carter, and J. Bailey, On the frequency of Jupiter analogs, *Astrophys. J.* 727, 102, 2011.
- 6888 Wolfe, C. J., S. C. Solomon, G. Laske, J. A. Collins, R. S. Detrick, J. A. Orcutt, D. Bercovici, and E. H. Hauri, Mantle P-wave velocity structure beneath the Hawaiian hotspot, *Earth Planet. Sci. Lett.* 303, 267-280, 2011.
- 6857 Yabuta, H., C. M. O'D. Alexander, M. L. Fogel, A. L. D. Kilcoyne, and G. D. Cody, A molecular and isotopic study of the macromolecular organic matter of the ungrouped C2 WIS 91600 and its relationship to Tagish Lake and PCA 91008, *Meteorit. Planet. Sci.* 45, 1446-1460, 2010.
- 6935 Yabuta, H., G. D. Cody, C. M. O'D. Alexander, A. L. D. Kilcoyne, E. Araki, and S. A. Sandford, New development of the study on the early solar system history through  $\mu$ -XANES analyses of cometary and meteoritic organic matter using scanning transmission X-ray microscope [in Japanese], *Chikyukagaku [Geochemistry]* 43, 155-168, 2009.
- 6903 Yokoyama, T., C. M. O'D. Alexander, and R. J. Walker, Assessment of nebular versus parent body processes on presolar components present in chondrites: evidence from osmium isotopes, *Earth Planet. Sci. Lett.* 305, 115-123, 2011.
- 6843 Zega, T. J., C. M. O'D. Alexander, H. Busemann, L. R. Nittler, P. Hoppe, R. M. Stroud, and A. F. Young, Mineral associations and character of isotopically anomalous organic material in the Tagish Lake carbonaceous chondrite, *Geochim. Cosmochim. Acta* 74, 5966-5983, 2010.
- 6885 Zega, T. J., C. M. O'D. Alexander, L. R. Nittler, and R. M. Stroud, A transmission electron microscopy study of presolar hibonite, *Astrophys. J.* 730, 83, 2011.
- 6856 Zimmer, M. M., T. Plank, E. H. Hauri, G. M. Yogodzinski, P. Stelling, J. Larsen, B. Singer, B. Jicha, C. Mandeville, and C. J. Nye, The role of water in generating the calc-alkaline trend: new volatile data for Aleutian magmas and a new tholeiitic index, *J. Petrol.* 51, 2411-2444, 2010.

# A Gift for the Future

One of the most effective ways of supporting the work of the Carnegie Institution is to include the institution in your estate plans. By making a bequest, you can support the institution well into the future.

A bequest is both a tangible demonstration of your dedication to the Carnegie Institution and a way to generate significant tax savings for your estate. Some bequests to Carnegie have been directed to fellowships, chairs, and departmental research projects. Some have been additions to the endowment, while others have been unrestricted.

The following sample language can be used in making a bequest to the Carnegie Institution:

“I give and bequeath the sum of \$\_\_\_\_\_ (or % of my residuary estate) to the Carnegie Institution of Washington, 1530 P Street, N.W., Washington, DC 20005-1910.”

## For Additional Information

**See the Carnegie Website:**

[www.CarnegieScience.edu/support](http://www.CarnegieScience.edu/support)

**Or Call:**

The Office of Advancement  
202.387.6400

**Or Write:**

Rick Sherman  
The Office of Advancement  
Carnegie Institution  
1530 P. Street N.W.  
Washington, D.C. 20005-1910