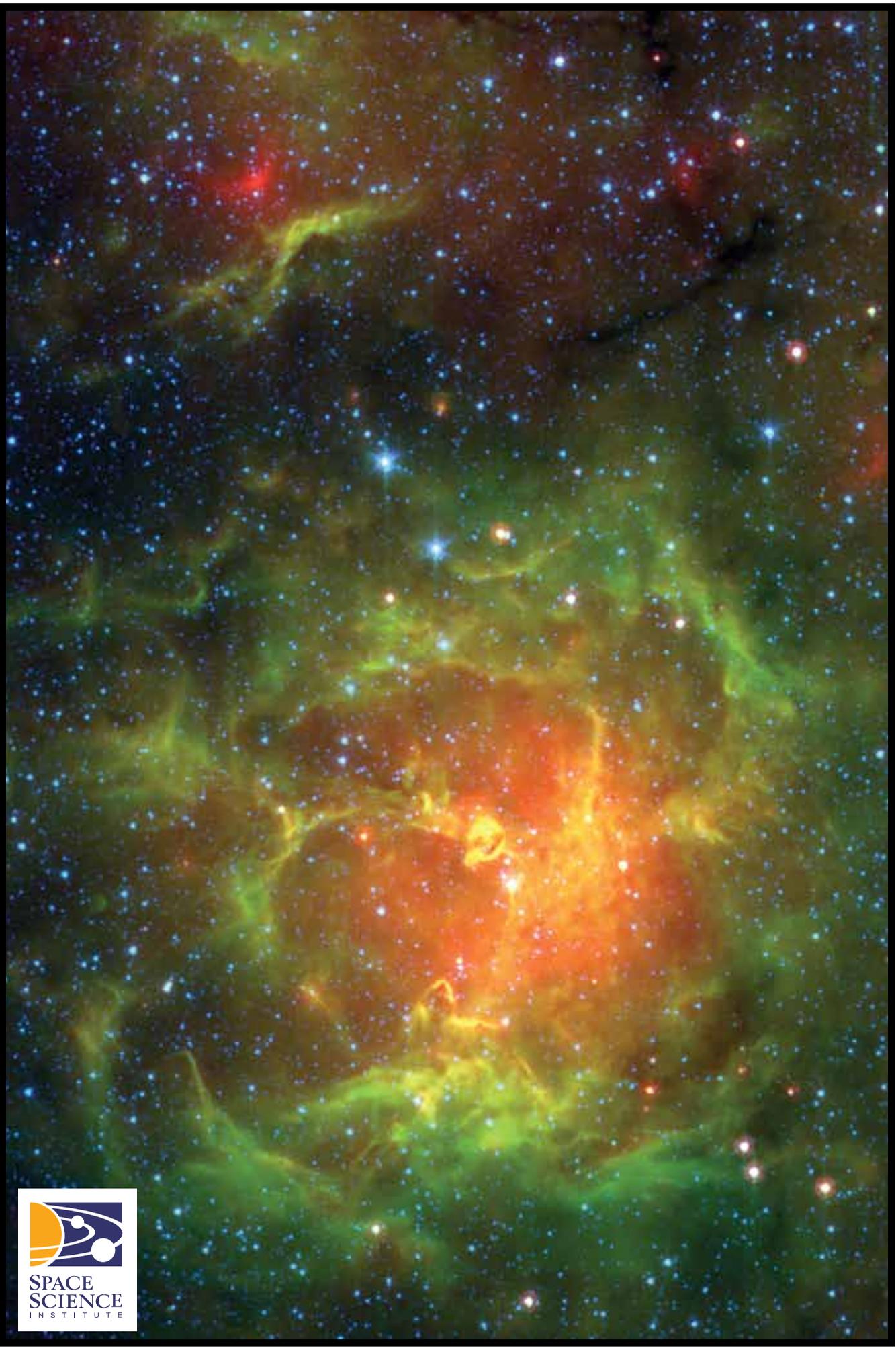


ANNUAL REPORT 2008

Space Science Institute · 4750 Walnut Street · Suite 205 · Boulder, Colorado 80301 · 720.974.5888 · www.space-science.org



OUR VISION

Expand humankind's understanding and appreciation of planet Earth, the Solar System, and the universe beyond.

MESSAGE FROM THE DIRECTOR

Excite. Explore. Discover. These words describe our efforts in both science research and education. In fact, they define the essence of our mission: to integrate world-class research with innovative education programs within a single institution. The SSI Board of Directors, with its experience and expertise in a range of business, science, and educational areas, provides guidance and vision to our enterprise. They—along with our senior management—have created an environment that continues to draw world-class scientists to the Institute and enables us to develop education and outreach programs that benefit millions of people worldwide. This past year SSI processed \$5M in grant & contract funding.

SSI has a robust scientific Research Branch with scientists participating in robotic missions such as the Mars Exploration Rovers, in flight missions such as Cassini and the Spitzer and Hubble Space Telescopes, and in ground-based observation programs using facilities located all over the world. SSI researchers have been awarded numerous research and analysis grants, and also serve on a number of scientific boards and committees helping to plan future missions.

SSI's Flight Operations branch is home to the Cassini Imaging Central Laboratory for Operations (CICLOPS). CICLOPS is the center for uplink and downlink operations for the imaging science experiment on the Cassini mission to Saturn. The Cassini mission continues to revise our view of the Saturn system. In 2008, Cassini images graced the pages of scores of magazines and websites around the globe. The Cassini spacecraft performed two daring flybys of Saturn's moon Enceladus, passing through the geyser-like jets emanating from the moon's south polar "tiger stripe" region. Over the course of five months, Cassini tracked a powerful electrical storm that raged in Saturn's southern hemisphere—in a region nicknamed "Storm Alley" by mission scientists. This storm featured lightning bolts 10,000 times more powerful than those on Earth.

In 2008, SSI's Education Branch was awarded two large grants from NSF: *Space Weather Outreach* and *Asteroids*. Several workshops for formal and informal educators were conducted. The 3,000 square-foot *Alien Earths* exhibition continued its tour. The 3,500 square-foot *Giant Worlds* traveling exhibition began its national tour in February 2008 at the Orlando Science Center in Florida. SSI also continued to enhance its documentary film production capabilities with the launch of the Northrup Grumman supported documentary *Inspire Me: Weightless Flights of Discovery*.

Our headquarters, located in Boulder, Colorado, enables us to maintain strong collaborations with a number of the major players in the research, education, and aerospace industries, including the University of Colorado, NOAA's Space Weather Prediction Center, National Center for Atmospheric Research, Lockheed Martin Astronautics, and Ball Aerospace. However, our impact reaches far beyond Colorado. We seek and encourage strong ties to corporations, foundations, and institutions in Colorado and elsewhere.

The upcoming year is one of great promise. New scientific discoveries will be made and new education programs will be launched, both of which will engage the public and excite their imaginations about the wonder and beauty of the universe. Come join our voyage of discovery.

With warmest regards,

Paul B. Dusenbery, Ph.D.
Executive Director and Chairman of the Board

RESEARCH

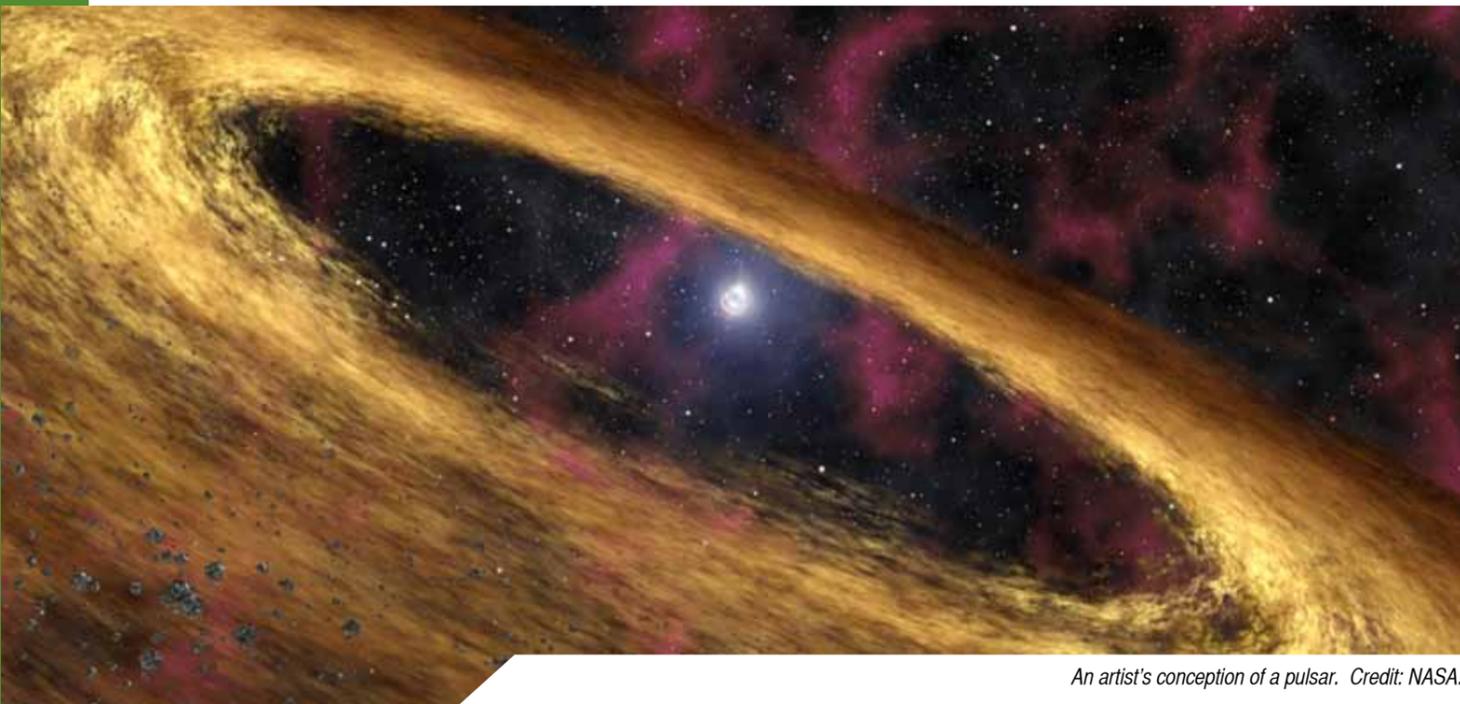
FLIGHT OPERATIONS

EDUCATION

FINANCIAL REPORT

PUBLICATIONS

RESEARCH



An artist's conception of a pulsar. Credit: NASA.

SSI's Research Branch scientists participate in a diverse array of space science activities. Our research program (both on-site and off-site) includes earth science, planetary science, and astrophysics. Our research team's expertise continues to grow, and currently includes investigations of phenomena on the Earth, in atmospheres, and on surfaces of other bodies in our Solar System. Our researchers also study the early stages of the lifecycles of stars within our galaxy as well as quasars.

SSI researchers are closely connected to the operations of current spacecraft facilities such as the Spitzer and Hubble Space Telescopes, the Mars Reconnaissance Orbiter, and the Mars Exploration Rover missions. Such participation extends beyond scientific support and analyses to include both tactical and strategic planning. SSI scientists are also deeply engaged in future space science projects, including the James Webb Space Telescope and future Mars mission opportunities.

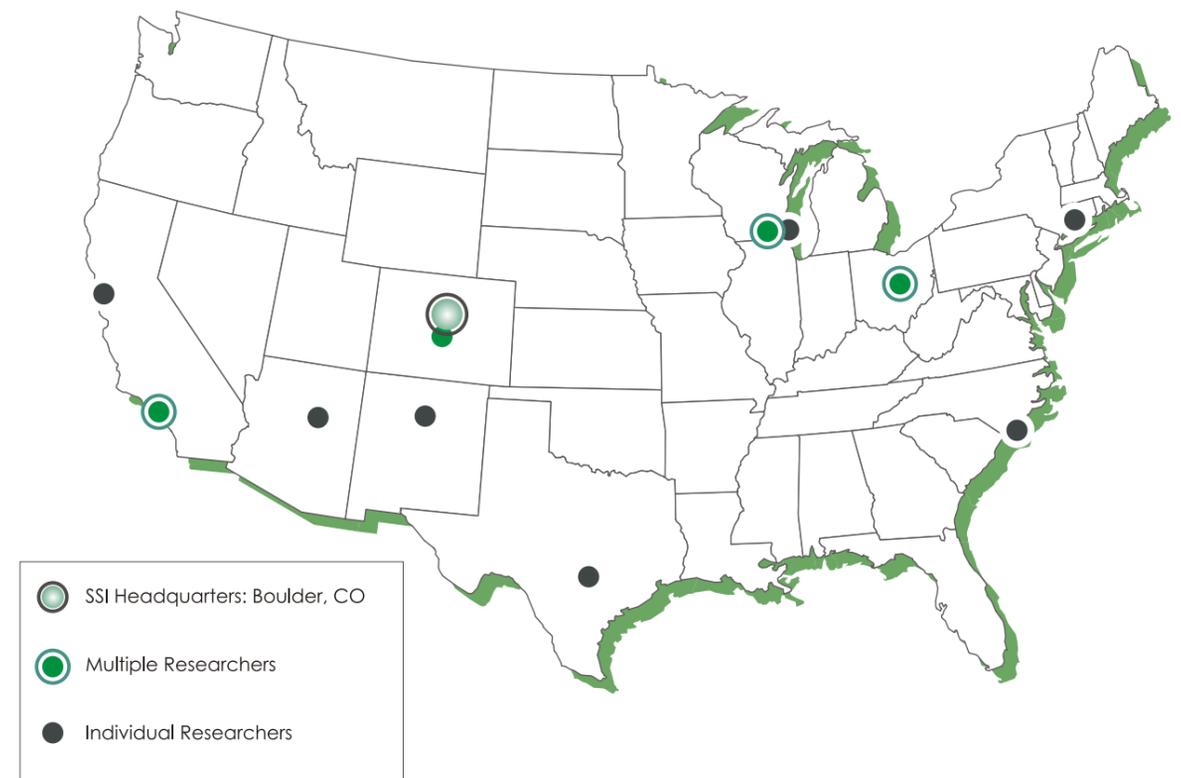
SSI's off-site and on-site researchers form a network of entrepreneurial scientists who are individually supported by multiple grants. Our structure facilitates dynamic, collaborative efforts among fields of research that are traditionally separated at many academic institutions. We continue to seek other new and creative opportunities to increase the health and vitality of our Research Branch.

Cover: An infrared composite image of the Trifid Nebula located 5,400 light-years away in the constellation Sagittarius. Credit: NASA/Spitzer/Inside Front Cover: This view of Victoria crater is looking north from "Duck Bay" towards the dramatic promontory called "Cape Verde" on Mars. Credit: NASA/JPL/Cornell.

SSI'S OFF-SITE RESEARCH OPTION

SSI has been a pioneer in remote employment, a mode that is both family- and environmentally-friendly. The long-distance nature of most scientific collaborative research is conducive to remote employment, since interactions can be readily accomplished via the internet and phone, and supplemented by occasional travel. Access to fast computers no longer requires large institutional support, and most journals are fully accessible over the internet, mitigating the need for institutional libraries. Instrument development, which does require large institutional support, can be done in collaboration with existing facilities such as those at Lockheed Martin and Ball Aerospace. The map below shows where SSI's researchers are located in the United States.

Space Science Institute

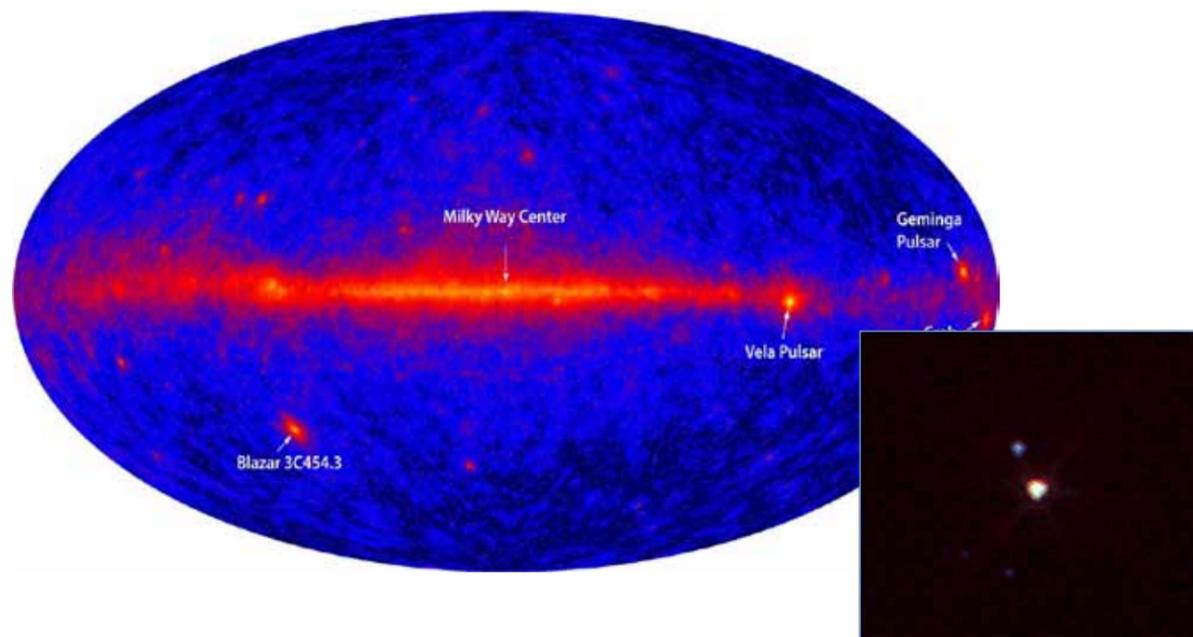


SSI's off-site option continues to be one of our fastest-growing areas. SSI management is aware of the potential challenges of rapid growth. We continue to develop our administrative support in ways that will enable our institution and our researchers to grow and thrive.

2008 RESEARCH HIGHLIGHTS

BLAZARS IN THE NIGHT SKY

A blazar is among the most violent phenomena in the universe: a galaxy with a supermassive black hole at its center that spews out material at relativistic speeds in tightly confined jets. During the violent processing, some of the photons can be scattered from their initial infrared wavelengths all the way up to highly energetic gamma rays. NASA launched the Fermi mission in May 2008 to study gamma ray emission from blazars and pulsars. The mission's "First Light" image shows blazar 3C454.3, the brightest blazar in the sky during the early months of the mission. SSI's Senior Research Scientist Ann Wehrle (LaCanada, CA Office) and colleagues simultaneously observed the blazar with the Spitzer Space Telescope, an infrared observatory, to correlate variations in infrared and gamma ray brightness which will help determine the physical properties of the jet, such as the particle density, speed and energy distribution. The inset shows the blazar as seen with the infrared camera at wavelengths of 3.6, 4.5, and 5.8 microns in August 2008.



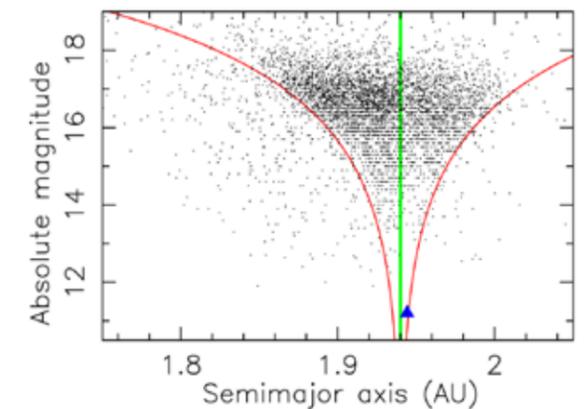
The Fermi satellite, launched in 2008, mapped the gamma ray sky with one of its instruments, the LAT. Shown in false color, the all-sky view shows the Milky Way's galactic plane and several bright sources, including the blazar 3C454.3. Credit: NASA, DOE, International LAT Team.

The inset shows a Spitzer Space Telescope close-up view of the blazar, along with foreground stars and galaxies, obtained simultaneously by Ann Wehrle and collaborators. Credit: Spitzer Space Telescope (NASA).

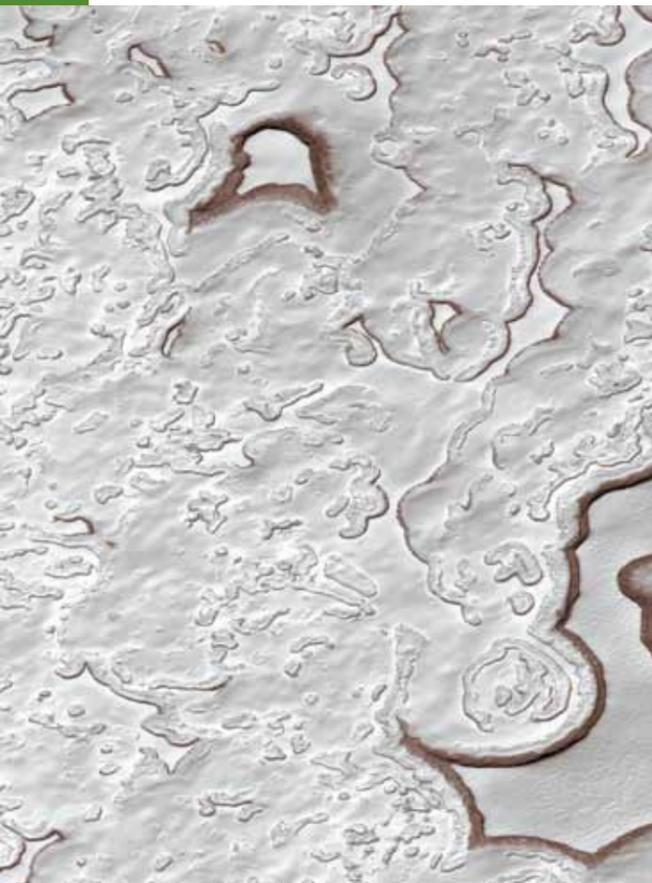
HANGING WITH THE HUNGARIAS

Asteroids, like people, like to hang out together. When asteroids go "clubbing," it's not somewhere in the Big City. Instead, the Solar System is their playground, the most popular spot being "The Main Belt," which is located between the orbits of Mars and Jupiter. Within the Main Belt, you'll find a number of asteroid "groups," asteroids of different types but with similar orbital characteristics. However, some of these groups are special in that everyone had the same parent: they are true "families." Sometimes, you'll also find a few "friends and distant cousins" hanging out with the family. Such is the case of the Hungaria asteroids, who frequent only the inner reaches of the main belt and rarely mix with the larger crowd.

SSI Senior Research Scientist Alan Harris (LaCanada, CA Office) and Research Scientist Brian D. Warner (Colorado Springs, CO Office) have been studying the Hungaria asteroids for several years and found some very interesting family traits that may lead to a broader understanding of how all asteroids were formed and evolved over time and even how sunlight can change their nature. Using data from the asteroid lightcurve database that Harris and Warner maintain that is used by the entire planetary science community, the pair noticed a distinctive grouping of the Hungaria asteroids when plotting an asteroid's size versus its average distance from the Sun. The "V" pattern seen in the plot (which includes about 5,000 Hungarias and not just those with known rotation rates) is a strong indicator of asteroids having a common origin. The largest among these is 434 Hungaria (the dark triangular point at the bottom of the "V"), which seems to have drifted away from the centerline of the "V" shape. This drift can be explained by sunlight pushing on the asteroid so that its orbit changes size (the Yarkovsky effect). If the asteroid is spinning in a "prograde" direction (the same direction as the Earth spins), then the orbit size should increase. Using techniques that generate the shape and spin direction of an asteroid from a set of lightcurves (plots of brightness versus time), it was shown that 434 Hungaria does indeed have a prograde rotation. A detailed paper looking at the rotation rates and orbital dynamics of the Hungarias has been submitted to Icarus, the professional journal for planetary science.



A plot of the Hungaria family of asteroids showing the boundaries of the family and the offset of its largest member from the center of the "V" shape. Credit: David Vokrouhlick, SwRI.



Small scale structure in the south polar ice cap on Mars
Credit: NASA, JPL.

POLES APART

SSI Senior Research Scientist Philip James (Arizona Office) has studied the polar caps of Mars since he worked on the Viking mission in the 1970s. His studies have focused on how changes in climate and the behavior of the caps.

William Herschel, the discoverer of Uranus, observed the seasonal cycles of the Martian Polar Caps in 1784. Percival Lowell believed that these changes signaled melting water ice and popularized the concept that a system of artificial canals transported the melting cap water to irrigation sites. A few dissenting scientists proposed that the caps were made of dry ice, and Mariner 4 proved their view to be prophetic, though the north cap does, in fact, include a water ice core.

The caps have a strange history of confounding expectations as the quality of available observations has improved. Recent high resolution images of the remnant of dry ice that remains at the end of summer in the south reveal that the small scale structure is much more complex and enigmatic than had been expected. A small portion of this terrain, which has been nickname "Swiss cheese" by some, is shown in the image above. Dr. James is currently studying these complex

structures at the South Pole to determine how they arise and how changes observed are related to the climate and weather on Mars.

THE MARTIAN ROVERS

The Mars Exploration Rovers, named Spirit and Opportunity, completed their fifth year of exploring Mars. For most of 2008, the Spirit rover remained parked on a steep sunward slope where its dusty solar arrays provided just enough power for the robot to survive the local Martian winter. Although it could not resume exploration until October, it scanned its cameras to create a multispectral view of its surroundings, called the Bonestell panorama. With its x-ray spectrometer, Spirit determined that local surface material is in a class with unusually high chlorine content, an indicator of previous aqueous activity.

In August, the Opportunity rover completed its exploration of the 800 m diameter Victoria crater by reaching the crater rim and beginning a challenging trek toward a much larger (22 km in diameter) crater, Endeavor. SSI Senior Scientist Ben Clark (Denver, CO Office) assisted in compositional

measurements of water-modified sediment layers and presented analyses showing a correspondence with layers in Endurance crater, some 12 km away. SSI Senior Research Scientist Bill Farrand (Boulder, CO Office) worked with multispectral data from Opportunity and Spirit, as well as from the Mars Reconnaissance Orbiter (MRO), to reveal the classes of soils, sediments and rocks which populate the terrain at these two sites.

Through a synthesis of data from Spirit, Opportunity and MRO, SSI Senior Scientists Mike Wolff (Brookfield, WI Office) and Todd Clancy (Bald Head Island, NC Office) continued to help monitor and predict the course of Martian atmospheric dust and storm activity as an aid to rover activity planning and for building climate models of the red planet.

GLOBAL CHANGES ON VENUS

SSI Senior Research Scientist Todd Clancy (Bald Head Island, NC Office), Research Scientist Brad Sandor (Boulder, CO Office) and colleagues have used the James Clerk Maxwell Telescope (JCMT), on Mauna Kea, Hawaii to discover and study global change in Venus' middle atmosphere (70-120 km altitude).

The goal of early work was to measure water content of Venus atmosphere. Contrary to all theoretical assumptions that water content was constant, it was discovered that water abundance over the entire planet was changing very rapidly, both increasing and decreasing, by a factor of 30 or more. In contrast, water vapor in Earth's atmosphere—averaged over the whole planet—does not change. Now the goal of water vapor research is to understand how and why the discovered variability exists.

A similar early goal was to measure the amounts of sulfur dioxide (SO₂) and sulfur monoxide (SO) in Venus' atmosphere. Theory predicted that each gas would be present in amounts barely detectable with our observing method, and constant over time. Again, a discovery of extreme global change was made. SO₂ and SO each vary more than 30-fold over time, for reasons that are not understood. The goal of ongoing work includes finding patterns in time-dependence of sulfur-bearing gases, and to understand the physics and chemistry that drive this behavior.

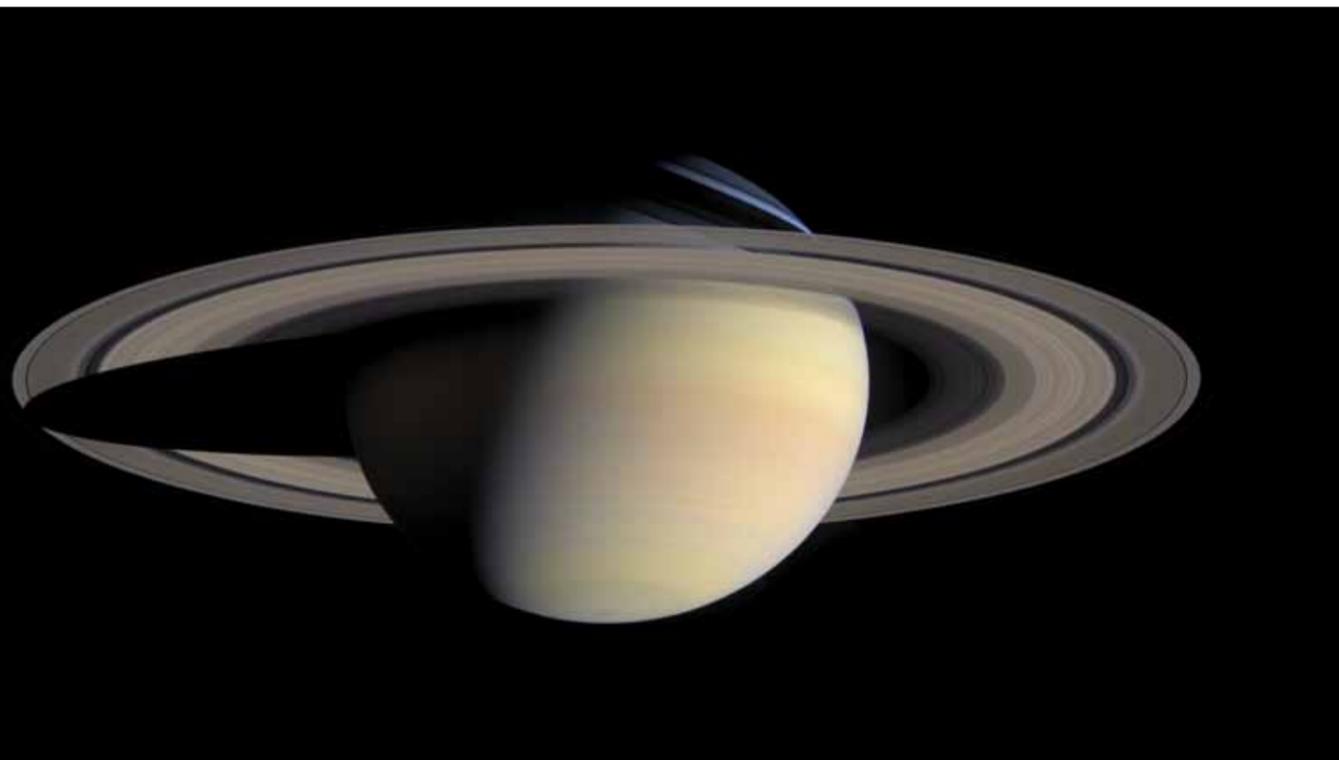


False color image collected after Opportunity emerged from the inner rim of the Victoria crater, showing rocks on the outer rim, as well as the inner bowl and steep inner cliffs of the crater.
Credit: NASA, JPL.



James Clerk Maxwell Telescope, Mauna Kea, HI.
Credit: Brad Sandor.

FLIGHT OPERATIONS



The Planet Saturn. Credit: NASA, Space Science Institute.

The Cassini Imaging Central Laboratory for Operations (CICLOPS) is located at SSI's Boulder, CO office. CICLOPS is the center for uplink and downlink operations for the imaging science experiment on the Cassini mission to Saturn. All images produced by the two powerful telescopic cameras onboard Cassini (the Imaging Science Subsystem) make their way across more than a billion and a half kilometers (1 billion miles) of space to be archived in databases at CICLOPS and made available to imaging team members across the globe.

The Cassini-Huygens mission continues to change our view of the Saturn system. Since arriving at Saturn in the summer of 2004, the intrepid spacecraft has completed numerous close flybys of Saturn's moons, providing new perspectives and a wealth of data about this unique collection of objects. Cassini has monitored powerful lightning-generated radio outbursts and cloud activity produced by giant storms on Saturn that dwarf those on Earth. The Huygens probe's landing on haze-shrouded Titan, as well as Cassini's continuing survey of this moon from space, has provided tantalizing glimpses of a world that is at once remarkably Earth-like, yet also frigid and alien. The startling revelation that Saturn's small, icy moon Enceladus may possess underground reservoirs of liquid water has widened the range of environments that might be hospitable for life.

Images taken by Cassini are selected for release to the public at CICLOPS. Chosen images and movie sequences are processed to ensure quality, including the best possible color. The final products are posted to the CICLOPS website at <http://ciclops.org> for distribution. Also posted on the CICLOPS site are imaging news stories, upcoming mission events, public discussions, Saturn-inspired artwork, and more.

Cassini's landmark exploration of the ringed planet, its mysterious moons and its complex magnetic environment will continue through at least July 2010, and perhaps beyond. CICLOPS and the Cassini mission scientists and engineers are now hard at work executing the two-year Cassini Equinox Mission, the first extension beyond Cassini's prime mission (which ended in 2008). The Equinox Mission will end in July 2010. Work is now underway to plan a much longer second extension that could last from mid-2010 through Saturn's northern summer solstice in 2017.

The Cassini-Huygens mission is a cooperative project of NASA, the European Space Agency, and the Italian Space Agency. The Jet Propulsion Laboratory, a division of the California Institute of Technology in Pasadena, CA, manages the Cassini-Huygens mission for NASA's Science Mission Directorate, Washington, D.C.

CASSINI / SATURN RESEARCH



Secrets of Saturn's Strangest Moon, by Dr. Carolyn Porco. Credit: Scientific American.

Led by Cassini Imaging Team leader Dr. Carolyn Porco, CICLOPS came to SSI in August 2003. Fourteen scientists from the United States and Europe comprise the imaging team that uses Cassini's cameras to investigate many unique features of the Saturn system.

The Imaging Team continues to publish findings from their investigations, deepening our knowledge about Saturn and the processes by which planets—and whole planetary systems—form and develop with time.

In 2008, Cassini images graced the pages of scores of magazines and websites around the globe. The mission continues to generate exciting science and exquisite imagery from the Saturn frontier. An article on Saturn's active moon, Enceladus, written by Dr. Porco was published in *Scientific American* in December 2008.



FLYING THROUGH ENCELADUS' PLUMES

The Cassini spacecraft performed two daring flybys of Saturn's moon Enceladus, passing through the geyser-like jets emanating from the moon's south polar "tiger stripe" region. The spacecraft snatched up precious samples that contained reasonably complex organic materials and also acquired a set of superb images during a specially designed maneuver to avoid image smear. These images have bolstered the thinking that condensation from the jets erupting from the surface may create ice plugs that close off old vents and force new vents to open.

In high-resolution images of the surface of Saturn's moon Enceladus, Cassini pinpointed the sources of jets emanating from the moon's south polar region. Credit: NASA, JPL, Space Science Institute.

LONG-LIVED THUNDERHEAD

Over the course of five months, Cassini tracked a powerful electrical storm that raged in Saturn's southern hemisphere in a region nicknamed "Storm Alley" by mission scientists. It was the longest continually observed electrical storm ever monitored by Cassini, and amateur astronomers across Earth kept watch when the spacecraft's attention was elsewhere. Saturn's electrical storms resemble terrestrial thunderstorms, but on a much larger scale. Storms on Saturn have diameters of several thousand kilometers (thousands of miles), and this storm featured lightning bolts 10,000 times more powerful than those on Earth.

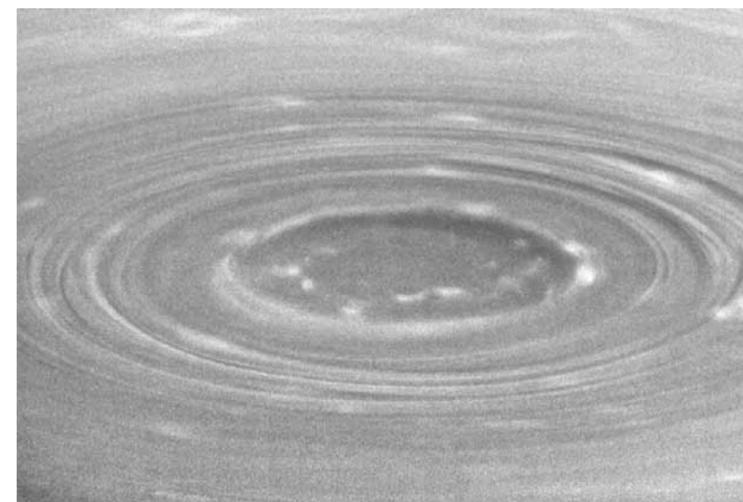


Saturn's long-lived electrical storm stands out in this sharpened, enhanced color view of the planet's southern hemisphere. Credit: NASA, JPL, Space Science Institute.

BRIGHT ARCS AND SMALL MOONS

Cassini scientists detected three faint, partial rings—or ring arcs—around Saturn, each of which contain a small moon. The moons Anthe, Methone and the newfound S/2008 S 1 orbit within ring arcs in locations, called resonances, where the gravity of the nearby larger moon Mimas disturbs their orbits. Scientists believe the ring arcs likely consist of material knocked off these small moons by micrometeoroid impacts or collisions with even smaller solid bodies within the arcs. The gravitational resonances with Mimas keep this material from spreading around Saturn to form a complete ring.

A faint arc of material orbits with Saturn's small moon Anthe. Credit: NASA, JPL, Space Science Institute.



LOOKING IN THE EYE OF A MONSTROUS VORTEX

High-resolution images of the huge vortex at Saturn's south pole provided valuable insight about the mechanisms that power the planet's atmosphere. In these images that are ten times more detailed than any before seen, what appear like puffy clouds in the "eye" of the storm are believed to be deep convective structures.

Shadows reveal the topography of Saturn's south polar vortex. Credit: NASA, JPL, Space Science Institute.

EDUCATION



Panoramic view of the Giant Worlds exhibition at the Orlando Science Center. Credit: Space Science Institute.

SSI's Education Branch is involved in a variety of innovative projects that promote inquiry and science literacy. We foster collaboration between scientists and educators to bring the knowledge and excitement of scientific discovery to audiences across the country. In addition, our programs help cultivate a greater appreciation and understanding of science in the general public. They span a range of audience needs and delivery methods: including traveling museum exhibitions; award-winning educational films, videos, and websites; hands-on teaching resources and activities; educator workshops; outreach to underserved

GUIDING PRINCIPLES

- Plan strategically for continued innovation
- Integrate science research and science education
- Contribute significantly to educational research
- Ensure scientific accuracy in all activities
- Evaluate all products and disseminate results
- Cultivate mutually beneficial partnerships in science and education communities
- Excite learners of all ages, ethnicities, and learning modalities with the thrill of scientific discovery

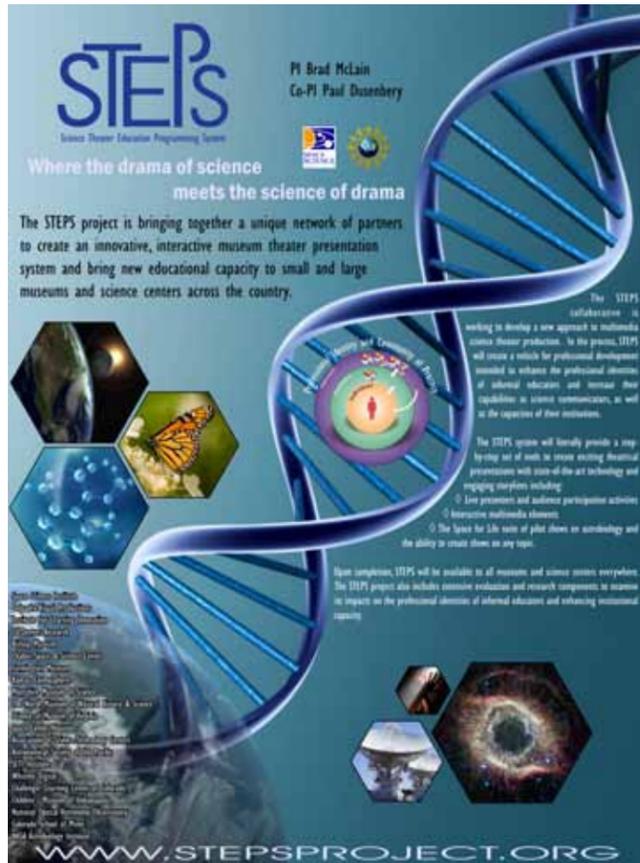
audiences, such as girls' groups, and Hispanic, Native American and rural communities; and successful partnership building between scientists and educators. SSI is committed to evaluating its projects and conducting educational research in order to improve outcomes and to increase the efficacy of science education and outreach programs everywhere.

EDUCATION PROGRAM IMPACTS FOR 2008:

- 360,000 visitors to SSI educational websites
- 300,000 visitors to SSI museum exhibits
- 25,000 downloads of SSI educational materials, activities, and resources distributed online
- 250 participants in educator workshops, virtual workshops, and conference presentations

SSI's educational projects include large-scale, institutional-level efforts, like the STEPS project funded by the National Science Foundation (NSF) and the *Giant Worlds* exhibition funded by NSF and NASA. They also include smaller-scale programs that focus on individual scientists seeking educational support for research projects, such as an asteroids project called *Finding NEO* with SSI Senior Research Scientist Al Harris (La Canada, CA Office). This strategic approach allows SSI to leverage the needs and effectiveness of both types of endeavors. Further, it allows our staff to explore new methods of education and effectively "scale up" those methods that show promise.

In keeping with that strategy, SSI is pursuing new directions for educational programming. These include the continued development of documentary film production capabilities and an emerging partnership with the American Library Association to pilot small library-based science exhibits. SSI is exploring the application of internet and multimedia technologies to the facilitation of social learning experiences. SSI and its partners are leading the way to a new generation of educational innovation, which bridges the worlds of scientific research and communication.



2008 EDUCATION HIGHLIGHTS

WHERE THE DRAMA OF SCIENCE MEETS THE SCIENCE OF DRAMA

Imagine a low-cost, easily customizable system delivering high-quality, media-enhanced theatrical performances tailored to virtually any topic. A nationwide collaboration between science and multimedia professionals is perfecting this low-cost alternative to travelling exhibits. STEPS—or the Science Theater Education Programming System—will provide a Step-by-Step Show Planner enabling museums and science centers of all sizes to create their own state-of-the-art, live presentations featuring engaging storylines, interactive multimedia elements, and audience participation activities. The Space for Life suite of pilot shows will provide a starting point, illuminating astrobiology basics and discussing the vast possibilities for life in our universe.

STEPS is made possible by a grant from the NSF. Senior Education Associate Brad McLain (Boulder, CO Office) is the project's principal investigator. He recently completed the film *Inspire Me* and has been recognized for his award-winning *Alien Earths* video short. Partners include: Del Padre Digital, the Institute for Learning Innovation, CU-Denver Research, the Bishop Museum, Chabot Space & Science Center, the Farmington Museum, the Kansas Cosmosphere, the Montshire Museum of Science, the North Museum of Natural History & Science, the Science Museum of Virginia, Space Center Houston, the Association of Science-Technology Centers, the Astronomical Society of the Pacific, the SETI Institute, Whitney Digital, Challenger Learning Center of Colorado, the Children's Museum of Indianapolis, the National Optical Astronomy Observatory, the Colorado School of Mines, and the NASA Astrobiology Institute. For more information, visit www.stepsproject.org. STEPS will be available in fall of 2010.

“A journey of a thousand miles begins with a single STEP.” — Lao Tzu

NEW LIFE & NEW DANGER: HYDROBOTIC EXPLORATION OF THE POLAR OCEANS

Deep in the frigid waters of the Polar Regions lie untold dangers, conditions so harsh that even remotely-manned hydrobotic explorers struggle to navigate in safety. While striving to maintain physical integrity, avoid fuse overloads, and evade the tangles of their own tethers, these hydrobots pursue the mysteries of undiscovered life. The missions of these brave bots, if successful, will help us test methods for finding life on other worlds known to have liquid water, like Jupiter's moon Europa and Saturn's moon Enceladus.

The Polar-SIM is an ambitious new venture into digital media and learning, designed to give users a realistic experience of cutting-edge underwater exploration in Antarctica. The project is funded by the National Science Foundation and produced by the Space Science Institute in Boulder, Colorado (Principal Investigator: Senior Education Associate Brad McLain, Boulder, CO Office).

The centerpiece of Polar-SIM is a computer-based simulation of configuring, piloting, and operating a hydrobot in polar ocean and sub-glacial lake waters. Users make design decisions and conduct sonar mapping and bio-census of the sea floor. They face problems of navigation, power, and buoyancy while operating the bot's cameras, lights and propellers. Captains will experience both the frustrations and rewards of deep sea exploration, exposing a generation of young Earth scientists to the importance of the polar realms.

SSI is partnering with the Marine Advanced Technology Education (MATE) Center to provide training for students in actual hydrobot competitions. A substantial research component will examine learning and transfer from virtual experience to real-world application. Additional partners include Moss Landing Marine Laboratories, Knight-Williams Research Communications, eduweb, NASA's Jet Propulsion Laboratory, and the Colorado Consortium for Earth and Space Science Education. Additional information can be found at www.hydrobot.org. Polar-SIM will be available winter of 2009.



Searching for life in the frigid waters of Polar-SIM. Credit: Space Science Institute.



A family plays Space Challenge in the Giant Worlds exhibit, Orlando, FL.
Credit: Space Science Institute

ASTEROIDS! AN ASTRONOMY EDUCATION PROGRAM FOR SCIENCE CENTERS AND LIBRARIES

Asteroids and comets are popular subjects for movies like Armageddon and Deep Impact, but they are also playing their own starring roles in NASA research. In 2001, NASA's NEAR Shoemaker spacecraft dramatically landed on the asteroid Eros. In 2005, NASA's Deep Impact's probe collided with Tempel 1, exploring beneath the comet's surface. In 2007, NASA launched the Dawn spacecraft to the Main Asteroid Belt. With all this interest, asteroids and comets are compelling subjects for an exhibition.

The NSF is funding the development of the *Asteroids!* exhibition (Principal Investigator: Paul Dusenbery, Boulder, CO Office), with additional support coming from the NSF and NASA funded *Finding NEO* project (Principal Investigator: James Harold, Boulder, CO Office). The Astronomical Society of the Pacific and NASA's WISE and Dawn missions are project partners.

The centerpiece of the comprehensive informal education project is a 3,000-square foot traveling exhibit. To maximize audience reach, the *Asteroids!* project includes four satellite Small Exhibit Components (SECs) that will be used in a host venue's community and at science centers and libraries across the country. Each measures about 300-square feet in size. SSI is developing an Education/Outreach Program for museum educators, docents, and amateur astronomers, as well as a Professional Development Program for science center and library staff and other informal education professionals. A public website will provide an interactive clearinghouse for all the project's components.

Jeff Kennedy Associates is designing the exhibits and three teams of middle school students from North Carolina, New Mexico, and Colorado are assisting with the development process. Each team will create an exhibit or multimedia piece for their communities. The Institute for Learning Innovation will conduct all phases of program evaluation, including a research project about the use of Web 2.0 in the development process.



Artist conception of NASA's Deep Impact mission to comet Tempel 1. Credit: NASA

FINANCIAL REPORT

Space Science Institute Summary Statement of Financial Position as of December 31, 2008 and 2007

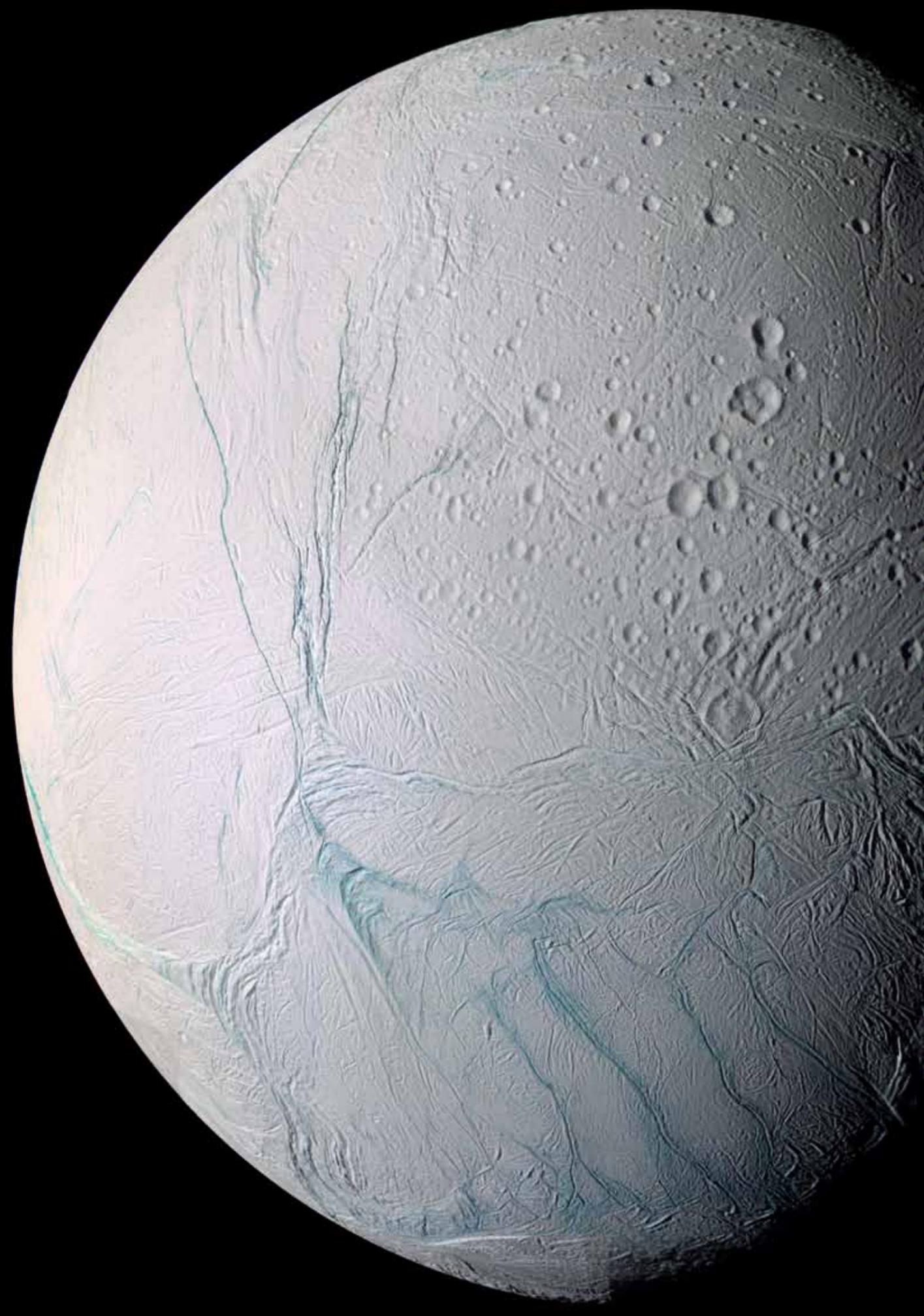
	2008	2007
Assets		
<i>Assets</i>		
Cash and cash equivalents	\$ 392,131	\$ 503,150
Accounts receivable	682,189	841,463
Prepaid expenses and deposits	64,056	60,913
Net furniture, equipment, and property	<u>96,203</u>	<u>131,570</u>
<i>Total assets</i>	<u>\$ 1,234,579</u>	<u>\$ 1,537,096</u>
Liabilities and Net Assets		
<i>Liabilities</i>		
Accounts payable and accrued liabilities	\$ 264,551	\$ 453,755
Deferred revenues	355,075	424,153
Line of credit	<u>375,000</u>	<u>351,500</u>
<i>Total liabilities</i>	<u>994,626</u>	<u>1,229,408</u>
<i>Net assets</i>		
Unrestricted	163,377	251,102
Temporarily restricted	<u>76,576</u>	<u>56,586</u>
<i>Total net assets</i>	<u>239,953</u>	<u>307,688</u>
<i>Total liabilities and net assets</i>	<u>\$ 1,234,579</u>	<u>\$ 1,537,096</u>

Summary Statement of Activities for the years ended December 31, 2008 and 2007

	2008	2007
Support and revenue		
Grants, contracts, and cooperative agreements	\$ 4,956,323	\$ 5,696,465
Contributions	2,850	16,000
Exhibit income	29,350	113,294
Interest income	264	225
Gain/(Loss) on disposal of equipment	<u>-</u>	<u>(9,445)</u>
<i>Total support and revenue</i>	<u>4,988,787</u>	<u>5,816,539</u>
Expenses		
Program services	5,016,325	5,755,253
General and administrative	<u>40,199</u>	<u>(51,432)</u>
<i>Total expenses</i>	<u>5,056,524</u>	<u>5,703,821</u>
Change in net assets	<u>(67,737)</u>	<u>112,718</u>
Net assets, beginning of year	<u>307,688</u>	<u>194,970</u>
Net assets, end of year	<u>\$ 239,951</u>	<u>\$ 307,688</u>

The summary financial information does not include sufficient detail or disclosures to constitute presentation in conformity with accounting principles generally accepted in the United States of America. If the omitted detail or disclosures were included, they might influence the user's conclusions about the Organization's financial position, changes in net assets, and cash flows. Accordingly such information should be read in conjunction with the Organization's audited financial statements for the years ended December 31, 2008 and 2007, from which the summarized information was derived. A copy is available upon request.

Right Page: Saturn's icy moon Enceladus. Credit: NASA/JPL/Space Science Institute.
Next Page: Stunning view as the Sun sank below the rim of Gusev crater on Mars.
Credit: NASA/JPL/Texas A&M/Cornell.





PUBLICATIONS & ACTIVITES

R. TODD CLANCY

PROFESSIONAL ORGANIZATIONS & SERVICE

American Geophysical Union, Member
AAS Division of Planetary Sciences, member
Mars Fundamental Research Program panel review, member
ESA-NASA Joint Instrument Definition Team (JIDT) for the 2016 Orbiter, member

PUBLICATIONS

Malin, M. C., et al., Climate, weather, and north polar observations from the Mars Reconnaissance Orbiter Mars Color Imager, *Icarus*, 194, p. 501-512, 2008.

Clancy, R.T., B.J. Sandor, and G.H. Moriarty-Schieven, Venus Upper Atmospheric CO, Temperature, and Winds across the Afternoon/Evening Terminator from June 2007 JCMT Sub-millimeter Line Observations, *Plan. Space Sci.*, 56, 1344-1354, 2008.

Franck Lefevre, Jean-Loup Bertaux, R. Todd Clancy, Therese Encrenaz, Kelly Fast, Francois Forget, Sebastien Lebonnois, Franck Montmessin, and Severine Perrier, Heterogeneous chemistry in the atmosphere of Mars, *Nature*, 454, 971-975, 2008.

Mustard, J. F., et al., Hydrated silicate minerals on Mars observed by the Mars Reconnaissance Orbiter CRISM instrument, *Nature*, 454, 305-309, 2008.

McGuire, P. C. et al., MRO/CRISM retrieval of surface Lambert albedos for multispectral mapping of Mars with DISORT-based radiative transfer using historical climatology for temperatures, aerosol opacities, and atmospheric pressures, *IEEE Transactions on Geoscience and Remote Sensing*, 46, 4020-4040, 2008.

Bell, III J. F., et al., Mars Reconnaissance Orbiter Mars Color Imager (MARCI): Instrument description, calibration, and Performance, *J. Geophys. Res.*, in press, 2009.

Wolff, M. J., M. D. Smith, R. T. Clancy, R. Arvidson, M. Kahre, F. Seelos, IV, S. Murchie, and H. Savijarvi, Wavelength dependence of dust aerosol single scattering albedo as observed by CRISM, *J. Geophys. Res.*, in press, 2009.

Smith, M. D., M. J. Wolff, R. T. Clancy, and S. L. Murchie, CRISM Observations of Water Vapor and Carbon Monoxide, *J. Geophys. Res.*, in press, 2009.

Clancy, R. T., M. J. Wolff, M. C. Malin, B. A. Cantor, and T. I. Michaels, Valles Marineris Cloud Trails, *J. Geophys. Res.*, in review, 2009.

Clancy, R. T., M. J. Wolff, B. A. Whitney, B. A. Cantor, M. D. Smith, and T. H. McConnochie, Extension of atmospheric dust loading to high altitudes during the 2001 global dust storm: MGS TES limb observations, submitted to *Icarus*, 2009.

MEETINGS AND CONFERENCE PROCEEDINGS

Clancy, R. T., M. J. Wolff, B. A. Whitney, M. D. Smith, and B. A. Cantor, High altitude dust global distribution, vertical mixing, and particle sizes during the 2001 planet-encircling dust storm, *Third International Workshop on the Mars Atmosphere: Modeling and Observations*, LPI Contribution No. 1447, p. 9084, Williamsburg, VA, November 10-13, 2008.

BENTON C. CLARK

PROFESSIONAL ORGANIZATIONS & SERVICE

Mars Exploration Program Analysis and Review Team (MART), Member
Science Team Member, Mars Exploration Rovers (MER) Missions
Co-Investigator, Phoenix Mars Lander Mission
Co-Investigator, Stardust NExT Mission
Co-Investigator, Mars Science Laboratory (MSL), ChemCam Instrument
Co-Investigator, Urey Science Experiment, Exo-Mars Mission
Advisor to NASA on Planetary Protection
American Astronomical Society (AAS), Division for Planetary Science (DPS), Member
American Association for the Advancement of Science (AAAS), Member
Mars Exploration Program Analysis Group (MEPAG), Member (charter-present)

PUBLICATIONS

S. W. Squyres, R. E. Arvidson, S. Ruff, R. Gellert, R. V. Morris, D. W. Ming, L. Crumpler, J. D. Farmer, D. J. Des Marais, A. Yen, S. M. McLennan, W. Calvin, J. F. Bell, III, B. C. Clark, A. Wang, T. J. McCoy, M. E. Schmidt, and P. A. de Souza (2008), Jr. Detection of Silica-Rich Deposits on Mars. *Science* 320: 1063-1067 [DOI: 10.1126/science.1155429]

Usui T., H. Y. McSween Jr., B. C. Clark III (2008), Petrogenesis of high-phosphorous Wishstone Class rocks in Gusev Crater, Mars. *J. Geophys. Res.*, 113, E12S44, doi:10.1029/2008JE003225.

Schuerger, Andrew C. and Clark, Benton C. (2008). Viking Biology Experiments: Lessons Learned and the Role of Ecology in Future Mars Life-Detection Experiments. *Space Science Reviews*, 135, 233-243.

Bada, J. L.; Ehrenfreund, P.; Grunthaner, F.; Blaney, D.; Coleman, M.; Farrington, A.; Yen, A.; Mathies, R.; Amudson, R.; Quinn, R.; Zent, A.; Ride, S.; Barron, L.; Botta, O.; Clark, B.; Glavin, D.; Hofmann, B.; Josset, J. L.; Rettberg, P.; Robert, F.; Sephton, M. (2008), Urey: Mars Organic and Oxidant Detector. *Space Science Reviews*, 135, 269-279.

Westphal, A. J.; Bastien, R. K.; Borg, J.; Bridges, J.; Brownlee, D. E.; Burchell, M. J.; Cheng, A. F.; Clark, B. C.; Djouadi, Z.; Floss, C.; Franchi, I.; Gainsforth, Z.; Graham, G.; Green, S. F.; Heck, P. R.; Horányi, M.; Hoppe, P.; Horz, F. P.; Huth, J.; Kearsley, A.; Leroux, H.; Marhas, K.; Nakamura-Messenger, K.; Sandford, S. A.; See, T. H.; Stadermann, F. J.; Teslich, N. E.; Tsitrin, S.; Warren, J. L.; Wozniakiewicz, P. J.; Zolensky, M. E. (2008). Discovery of non-random spatial distribution of impacts in the Stardust cometary collector. *Meteoritics & Planetary Science*, 43, 415-429.

Yen A. S., et al. (2008), Hydrothermal processes at Gusev Crater: An evaluation of Paso Robles class soils, *J. Geophys. Res.*, 113, E06S10, doi:10.1029/2007JE002978.

Knoll A. H., et al. (2008), Veneers, rinds, and fracture fills: Relatively late alteration of sedimentary rocks at Meridiani Planum, Mars, *J. Geophys. Res.*, 113, E06S16, doi:10.1029/2007JE002949.

Plemmons D. H., M. Mehta, B. C. Clark, S. P. Kounaves, L. L. Peach Jr., N. O. Renno, L. Tamppari, S. M. M. Young (2008), Effects of the Phoenix Lander descent thruster plume on the Martian surface, *J. Geophys. Res.*, 113, E00A11,

doi:10.1029/2007JE003059.

- Smith P. H., et al. (2008), Introduction to special section on the Phoenix Mission: Landing Site Characterization Experiments, Mission Overviews, and Expected Science, *J. Geophys. Res.*, 113, E00A18, doi:10.1029/2008JE003083.
- Arvidson R. E., et al. (2008), Spirit Mars Rover Mission to the Columbia Hills, Gusev Crater: Mission overview and selected results from the Cumberland Ridge to Home Plate, *J. Geophys. Res.*, 113, E12S33, doi:10.1029/2008JE003183.
- Ming D. W., et al. (2008), Geochemical properties of rocks and soils in Gusev Crater, Mars: Results of the Alpha Particle X-Ray Spectrometer from Cumberland Ridge to Home Plate, *J. Geophys. Res.*, 113, E12S39, doi:10.1029/2008JE003195.
- Morris R. V., et al. (2008), Iron mineralogy and aqueous alteration from Husband Hill through Home Plate at Gusev Crater, Mars: Results from the Mössbauer instrument on the Spirit Mars Exploration Rover, *J. Geophys. Res.*, 113, E12S42, doi:10.1029/2008JE003201.

MEETINGS AND CONFERENCE PROCEEDINGS

- Ming, D. W. et al., (15 co-authors) (2008), Geochemical properties of rocks and soils in Gusev Crater, Mars: APXS results from Cumerland Ridge to Home Plate. *Lunar and Planetary Science XXXIX*, Abstract #1068.
- Yen, A.S., R. V. Morris, B. C. Clark, R. Gellert (2008), A simplified view of the geochemical diversity surrounding Home Plate. *Lunar and Planetary Science XXXIX*, Abstract #2364.
- R. V. Morris, D. W. Ming, R. Gellert, A. Yen, B. C. Clark, T. G. Graff, R. E. Arvidson, S. W. Squyres (2008), The hydrothermal system at Home Plate in Gusev Crater, Mars: Formation of high silica material by acid-sulfate alteration of basalt. *Lunar and Planetary Science XXXIX*, Abstract #2208.

PAUL DUSENBERY

PROFESSIONAL ORGANIZATIONS & SERVICE

Proposal Reviewer, National Science Foundation
Proposal Reviewer, National Aeronautics and Space Administration
Journal of Geophysical Research
Member, 29th Street Wonder of Science Project
Member of AGU, AAS, DPS, NSTA, and ASCD

MEETINGS, CONFERENCE PROCEEDINGS, & ACTIVITIES

- Dusenbery, P. and C. Wuth, SSI Booth, AAS Winter Meeting, Seattle, WA, January, 2008
- Dusenbery, P., Measuring Up Conference, Plenary Session Panel, Boulder, CO, April, 2008
- Dusenbery, P., Curtis, L., Harold, J., SSI booth, ASTC Annual Meeting, Los Angeles, CA, October 2008
- Dusenbery, P., Cosmic Journey: A Voyage through Space and Time, Invited Talk, National Renewable Energy Lab, Golden, CO, November 2008.
- Dusenbery, P., Space Weather Outreach: Connection to STEM Standards, Fall AGU Meeting, San Francisco, CA, December, 2008
- Dusenbery, P., J. Harold, L. Curtis, B. McLain, Space Weather Outreach: An Informal Education Perspective, Fall AGU Meeting, San Francisco, CA, December, 2008

WILLIAM FARRAND

PROFESSIONAL ORGANIZATIONS & SERVICE

Geological Society of America, Member
American Geophysical Union, Member
American Society of Photogrammetry and Remote Sensing, Member
Institute of Electrical and Electronics Engineers, Member

PUBLICATIONS

- Farrand, W. H., E. Merenyi, J. R. Johnson and J.F. Bell III (2008) Comprehensive mapping of spectral classes in the imager for Mars Pathfinder Super Pan, *Mars*, 4, 33.
- Farrand, W.H., J.F. Bell III, J.R. Johnson, J.L. Bishop, and R.V. Morris (2008) Multispectral imaging from Mars Pathfinder, In *The Martian Surface: Composition, Mineralogy, and Physical Properties* (J.F. Bell III, ed.), Cambridge University Press, pp. 265-280.
- Arvidson, R.E., S.W. Ruff, R.V. Morris, D.W. Ming, L.S. Crumpler, A.S. Yen, S.W. Squyres, R.J. Sullivan, J.F. Bell III, N.A. Cabrol, B.C. Clark, W.H. Farrand, et al. (2008), Spirit Mars Rover Mission to the Columbia Hills, Gusev Crater: Mission overview and selected results from the Cumberland Ridge to Home Plate, *J. Geophys. Res.*, 113, E12S33, doi:10.1029/2008JE003183.
- Calvin, W.M., J.D. Shoffner, J.R. Johnson, A.H. Knoll, J.M. Pockock, S.W. Squyres, C.M. Weitz, R.E. Arvidson, J.F. Bell III, P.R. Christensen, P.A. de Souza Jr., W.H. Farrand, et al. (2008), Hematite spherules at Meridiani: Results from MI, Mini-TES, and Pancam, *J. Geophys. Res.*, 113, E12S37, doi:10.1029/2007JE003048.
- Knoll, A.H., B.L. Jolliff, W.H. Farrand, J.F. Bell III, B.C. Clark, R. Gellert, M.P. Golombek, J.P. Grotzinger, K.E. Herkenhoff, J.R. Johnson, S.M. McLennan, R.V. Morris, S.W. Squyres, R. Sullivan, N.J. Tosca, A. Yen, and Z. Learner (2008), Veneers, rinds, and fracture fills: Relatively late alteration of sedimentary rocks at Meridiani Planum, Mars, *J. Geophys. Res.*, 113, E06S16, doi:10.1029/2007JE002949.
- Schmidt, M.E., S.W. Ruff, T.J. McCoy, W.H. Farrand, J.R. Johnson, R. Gellert, D.W. Ming, R.V. Morris, N. Cabrol, K.W. Lewis, and C. Schroeder (2008) Hydrothermal origin of halogens at Home Plate, Gusev Crater, *J. Geophys. Res.*, 113, E06S12, doi:10.1029/2007JE003027.
- Schröder, C., D. S. Rodionov, T. J. McCoy, B. L. Jolliff, R. Gellert, L. R. Nittler, W. H. Farrand, J. R. Johnson, S. W. Ruff, J. W. Ashley, D. W. Mittlefehldt, K. E. Herkenhoff, I. Fleischer, A. F. C. Haldemann, G. Klingelhöfer, D. W. Ming, R. V. Morris, P. A. de Souza, S. W. Squyres, C. Weitz, A. S. Yen, J. Zipfel, and T. Economou. (2008) Meteorites on Mars observed with the Mars Exploration Rovers, *J. Geophys. Res.*, 113, E06S22, doi:10.1029/2007JE002990.

MEETINGS AND CONFERENCE PROCEEDINGS

- Farrand, W.H., M.D. Lane, and B.R. Edwards (2008) North and south: Possible tuyas and hyaloclastite hills on the northern plains and in the southern Dorsa Argentea region of Mars, *Lunar and Planetary Science XXXIX*, #1761.
- Farrand, W.H., J.R. Johnson, M. Schmidt, and J.F. Bell III (2008) VNIR spectral differences on natural and brushed/wind-abraded surfaces on Home Plate, Gusev Crater, Mars: Spirit Pancam and HiRISE color observations, *Lunar and Planetary Science XXXIX*, #1774.

JOSEPH M. HAHN

PROFESSIONAL ORGANIZATIONS & SERVICE

American Astronomical Society (AAS), member
AAS Division for Planetary Science (DPS), member
AAS Division on Dynamical Astronomy (DDA), member

PUBLICATIONS

Hahn, Spitale, & Porco, 2008, Dynamics of the Sharp Edges of Broad Planetary Rings, submitted to the *Astrophysical Journal* December 2008, accepted April 2009.
Hahn, 2008, The Secular Evolution of a Close Ring-Satellite System: The Excitation of Spiral Density Waves at a Nearby Gap Edge, *Astrophysical Journal*, 680, 1569.

MEETINGS AND CONFERENCE PROCEEDINGS

Hahn, Spitale, & Porco, The Outer Edges of Saturn's Main Rings, poster given at the 2008 DPS meeting in Ithaca, NY.
Hahn, Spitale, & Porco, The Physics of the Sharp Edges of Broad Planetary Rings, talk given at the 2008 DDA meeting in Boulder, CO.
Spitale, Porco, Colwell, & Hahn, Kinematics of the Outer Edges of Saturn's A and B Rings, talk given at the 2008 DDA meeting in Boulder, CO.
Stubbs, Glenar, Hahn, Cooper, Farrell, & Vondrak, 2008, Predictions for the Lunar Horizon Glow Observed by the Lunar Reconnaissance Orbiter Camera, talk given at the 39th Lunar and Planetary Science Conference, League City, TX.

OTHER ACTIVITIES

The research proposal "Optical Scattering Processes Observed from the Moon: Measurements, Models and Implications", submitted by PI Stubbs and Co-I Hahn, was selected for 3 years of funding by NASA's Lunar Advanced Science and Exploration Research (LASER) program.
The research proposal "Planetary Perturbations of Circumstellar Debris Disks", submitted by PI Hahn, was selected for 2 years of funding by the Cycle 17 Hubble Theory/Archival Research program.
Reviewed several proposals submitted to NASA's Origins of Solar System's research program.
Joined the LOC for the AAS's Division on Dynamical Astronomy (DDA) annual conference for 2011, which will be hosted by Fritz Benedict here in Austin, TX.
Elected to the AAS/DDA Committee on March 3, 2008.
Organized and chaired the Special Session titled "DDA: The Dynamics of Astrophysical Disks" at the winter AAS meeting here in Austin, TX.

HEIDI B. HAMMEL

PROFESSIONAL ORGANIZATIONS & SERVICE

American Astronomical Society (AAS), Division for Planetary Science (DPS)
AAS Education Committee: member (2008 - present)
AAS George Van Biesbroeck Prize Committee: member (2006 - 2008); chair (2008)
AAAS Section D (Astronomy)
Council (2008 - present)
The Planetary Society, Board of Directors (2005-present)
NASA Advisory Activities
Outer Planets Assessment Group - "OPAG" (2008 - present)
Astrophysics Subcommittee (2006 - 2008)
NOAO Committee for Access to Large Telescopes for Astronomical Instruction and Research - "ALTAIR" (2008 - present)
AAAC/NSF Exoplanet Task Force (2006 - 2008)
Team Member, Science Working Group, AURA/NOAO Giant Segmented Mirror Telescope development project (2007 - present)
Interdisciplinary Scientist, James Webb Space Telescope (2002 - present)
John J. McCarthy Observatory, Board of Directors, New Milford, CT (2005-present)
Astronomy commentator, The Danbury News-Times, Danbury, CT (2001-present)
October 2008, Hubble working again
October 2008, Hubble Data Formatter Failure
September 2008, Hubble Servicing Mission
June 2008, Pluto's status

PUBLICATIONS

Goldman, B., M. C. Cushing, M. S. Marley, É. Artigau, K. S. Baliyan, V. J. S. Béjar, J. A. Caballero, N. Chanover, M. Connelley, R. Doyon, T. Forveille, S. Ganesh, C. R. Gelino, H. B. Hammel, J. Holtzman, S. Joshi, U. C. Joshi, S. K. Leggett, M. C. Liu, E. L. Martín, V. Mohan, D. Nadeau, R. Sagar, and D. Stephens. CLOUDS search for variability in brown dwarf atmospheres. I: Infrared spectroscopic time series of L/T transition brown dwarfs. *Astronomy & Astrophysics* 487, 277-292 (2008).
Sitko, M. L., W. J. Carpenter, R. L. Kimes, J. L. Wilde, D. K. Lynch, R. W. Russell, R. J. Rudy, S. M. Mazuk, C. C. Venturini, R. C. Puetter, C. A. Grady, E. F. Polomski, J. P. Wisniewski, S. M. Brafford, H. B. Hammel, and R. B. Perry. Variability of disk emission in pre-Main Sequence and related stars. I. HD 31648 and HD 163296 - isolated Herbig Ae stars driving Herbig-Haro flows. *Astrophysical Journal* 678, 1070-1087 (2008).

MEETINGS AND CONFERENCE PROCEEDINGS

World Science Festival, New York City
2008 Advisor (<http://www.worldsciencefestival.com/about-us/advisors/heidi-hammel>)
May 2008 Speaker, "IJK" talkback, New Victory Theater on Broadway (<http://www.worldsciencefestival.com/2008-festival/events/all-events/ijk-talkback>)
Panelist, "Encouraging Girls in Science and Engineering: Inspiring Stories from Women in the Field", sponsored by the National

Academy of Sciences, National Science Teachers Association Annual Convention, Boston, MA (March 2008)
AAS Shapley Lectureship, Guilford Technical Community College: visit included talks to
two Astronomy 101 classes, a live TV interview, and two public lectures.
Greensboro, North Carolina (March 2008)
Science Coordinator, "Giant Worlds: A Voyage to the Outer Solar System" Museum Exhibit, Space Science Institute, Boulder, CO
(2005 – 2008); see <http://www.giantworlds.org/>
July 2008, "New World Kids and the Next Literacy" summer preschool, The Aldrich Contemporary Art Museum, Ridgefield, CT
June 2008, Sarah Noble Intermediate School, all Sixth Grade classes, New Milford, CT
June 2008, Ridgebury Elementary School, all Third Grade classes, Ridgefield, CT
April 2008, Montford Academy, all students, Katonah, NY

INVITED TALKS

September 2008, "Hubble Space Telescope: The Last Servicing Mission," Ridgefield Library, Ridgefield, CT [general public]
June 2008, "The Future of Exploration in Astronomy," ECAR Summer Symposium, Boulder, CO [professional administrators of
information technology]
March 2008, "Town Hall Meeting on U.S. Space Policy," joint presentation with Bill Nye, Erika Wagner, and Gerry Haas, sponsored
by The Planetary Society, Brookline, MA [general public]
September 2008, "Telescopes in Space," Invited Speaker, Westport Y Womens Club, Westport, CT [general public]
May 2008, "Telescopes in Space," Invited Speaker, Ridgefield Men's Club, Ridgefield, CT [retired men]
April 2008, "Uranus and Neptune: Understanding the Ice Giants," Keynote Speaker, NorthEast Astronomy Forum, Rockland
Community College, Suffern, NY

ALAN W. HARRIS

PROFESSIONAL ORGANIZATIONS & SERVICE

American Geophysical Union (AGU), Member
American Astronomical Society (AAS), member
AAS Division of Planetary Sciences (DPS), member
AAS Division for Dynamical Astronomy (DDA), member
International Astronomical Union (IAU), member
American Association for the Advancement of Science (AAAS), Fellow
Society for Astronomical Sciences (SAS), member

PUBLICATIONS

Pravec, P.; Harris, A. W.; Vokrouhlický, D.; Warner, B. D.; Kušnirák, P.; Hornoch, K.; Pray, D. P.; Higgins, D.; Oey, J.; Galád, A.;
Gajdoš, Š.; Kornoš, L.; Világi, J.; Husárik, M.; Krugly, Yu. N.; Shevchenko, V.; Chiorny, V.; Gaftonyuk, N.; Cooney, W. R.;
Gross, J.; Terrell, D.; Stephens, R. D.; Dyvig, R.; Reddy, V.; Ries, J. G.; Colas, F.; Lecacheux, J.; Durkee, R.; Masi, G.; Koff,
R. A.; Goncalves, R. 2008. Spin rate distribution of small asteroids. *Icarus*, 197, 497-504.
Shepard, M. K.; Clark, B. E.; Nolan, M. C.; Howell, E. S.; Magri, C.; Giorgini, J. D.; Benner, L. A. M.; Ostro, S. J.; Harris, A. W.;

Warner, B.; Pray, D.; Pravec, P.; Fauerbach, M.; Bennett, T.; Klotz, A.; Behrend, R.; Correia, H.; Coloma, J.; Casulli, S.;
Rivkin, A. 2008. A radar survey of M- and X-class asteroids. *Icarus*, 195, 184-205.

Harris, A. W., Fahnestock, E. G., Pravec, P. 2009. On the shapes and spins of "rubble pile" asteroids. *Icarus* 199, 310-318.
Warner, B. D., Harris, A. W., Vokrouhlický, D., Nesvorný, D., Bottke, W. F. 2009. Analysis of the Hungaria Population. *Icarus*, in
press.
Warner, B. D., Harris, A. W., Pravec, P. 2009. The asteroid lightcurve database. *Icarus*, in press.

MEETINGS AND CONFERENCE PROCEEDINGS

Harris, Alan W.; Fahnestock, E. G.; Pravec, P. 2008. Regulation of Primary Spin Rate of Asynchronous Binary Asteroids by "Tidal
Saltation". *Bul. Amer. Astron. Soc.* 40, ???.
Harris, A. W. 2008. The Limits of Stable Shapes of "Rubble Pile" Asteroids. *Bul Amer. Astron. Soc.* 40, 498.
Jones, R. Lynne; Chesley, S. R.; Connolly, A. J.; Harris, A. W.; Ivezić, Z.; Knezevic, Z.; Kubica, J.; Milani, A.; Trilling, D. E.;
Pierfederici, F.; LSST Solar System Science Collaboration. 2008. Solar System Science with LSST. *Bul. Amer. Astron. Soc.*
40, 453.
Stephens, Robert D.; Warner, B. D.; Shepard, M. K.; Harris, A. W. 2008. Lightcurve and Radar Observations and Analysis of 11
Parthenope and 678 Fredegundis. *Bul Amer. Astron. Soc.* 40, 439.
Warner, Brian D.; Harris, A.; Vokrouhlický, D.; Nesvorný, D.; Bottke, W. F. 2008. Evidence of Yarkovsky and YORP Migration from
the Distribution of Hungaria Family Members. *Bul Amer. Astron. Soc.* 40, 425.
Chesley, Steven R.; Brown, M. E.; Durech, J.; Harris, A. W.; Ivezić, Ž.; Jones, R. L.; Knežević, Z.; LSST Solar System Science
Collaboration 2009. Cataloging and Characterizing the Small Bodies of the Solar System with LSST. *Bul. Amer. Astron. Soc.*
41, ???.

DEAN HINES, PH. D

PROFESSIONAL ORGANIZATIONS & SERVICE

NASA Science Investigations: NICMOS/HST Instrument & Science Team; MIPS/Spitzer Instrument and Science Team; FEPS
Legacy Program Data Lead, PI, Co-I on HST & Spitzer GO Programs
American Astronomical Society (1986 – present)
Spitzer TAC Panel Member (2006, 2007, 2008)
NASA Herschel Science Center Readiness Review Committee (2007, 2009)
Spitzer Science Center Source List Review Committee (2009)
Referee for *Astrophysical Journal* (ApJ), *Astrophysical Letters* (ApJL), *Monthly Notices of the Royal Astronomical Society* (MNRAS),
Astronomy & Astrophysics, *Publication of the Astronomy Society of Japan* (PASJ)

PUBLICATIONS

Author/coauthor of 119 refereed publications on spectro- and imaging polarimetry, infrared astronomy, space-based instrumentation,
quasars and other ultraluminous galaxies, evolved stars, and planetary debris disks (6 in 2008).
Carpenter, J.M., et al. 2008, "The Formation and Evolution of Planetary Systems: Description of the Spitzer Legacy Science
Database", *ApJS*, 179, 423

Pinte et al. 2008, "Probing Dust Grain Evolution in IM Lupi's Circumstellar Disc. Multi-Wavelength Observations and Modeling Of The Dust Disc", A&A, 489, 633
Rebull, L.M. et al. 2008, "Spitzer/MIPS Observations of Stars in the b Pictoris Moving Group," ApJ, 681, 1484
Bouwman, J. et al. 2008, "The formation and evolution of planetary systems: Grain growth and chemical processing of dust in TTS systems" ApJ, 683, 479
Hillenbrand, L.A. et al. 2008, "The Complete Census of 70- μ m-Bright Debris Disks within the FEPS (Formation and Evolution of Planetary Systems) Spitzer Legacy Survey of Sun-like Stars," ApJ, 677, 630
Meyer, M.R., et al. 2008, "Evolution of Mid-Infrared Excess around Sun-like Stars: Constraints on Models of Terrestrial Planet Formation," ApJ, 673, L181

MEETINGS AND CONFERENCE PROCEEDINGS

Batcheldor, D., et al. 2008, "High Accuracy Imaging Polarimetry with NICMOS," in Astronomical Polarimetry 2008. Science from Small to Large Telescopes" La Malbaie, Quebec, Canada, 2008
Orton, G., et al. 2008, "Recent Spitzer mid-ir spectroscopy and supporting ground-based observations of Uranus," 37th COSPAR Scientific Assembly. Held 13-20 July 2008, in Montreal, Canada., p.2304, 37, 2304

CAROLYN PORCO

PROFESSIONAL ORGANIZATIONS & SERVICE

Honorary Member, Board of Advisors, Pop!tech Institute, 2006-
Co-Leader, Enceladus Focus Group, 2006-

PUBLICATIONS

Giese, B., Denk, T., Neukum, G., Roatsch, T., Helfenstein, P., Thomas, P.C., Turtle, E.P., McEwen, A., Porco, C.C. (2008). The topography of Iapetus' leading side. *Icarus* 193, 359-371.
Tiscareno, M.S., Burns, J.A., Hedman, M.M., Porco, C.C. (2008). The Population of Propellers in Saturn's A Ring. *Astron. J.* 135, 1083-1091.
Jacobson, R., Spitale, J., Porco, C.C., Beurle, K., Cooper, N., Evans, M.W., Murray, C.D. (2008). Revised Orbits of Saturn's Small Inner Satellites. *Astron. J.* 135, 261-263.
Dyudina, U.A., Ingersoll, A.P., Ewald, S.P., Vasavada, A.R., West, R.A., Del Genio, A.D., Barbara, J.M., Porco, C.C., Achterberg, R.K., Flasar, F.M., Simon-Miller, A.A., Fletcher, L.N. (2008). Dynamics of Saturn's South Polar Vortex. *Science* 319, 1801.
Cooper, N.J., Murray, C.D., Evans, M.W., Beurle, K., Jacobson, R.A., Porco, C.C. (2008). Astrometry and Dynamics of Anthe (S/2007 S 4), A New Satellite of Saturn. *Icarus* 195, 765-777.

INVITED TALKS

"Cassini Explores the Saturn System". Invited presentation to the Monterey Bay Aquarium Research Institute (MBARI), March 3, 2008.
"Highlights from Cassini at Saturn". Invited colloquium to the Center for Astrophysics, Cambridge, MA. Dec 4, 2008.

"Enceladus 2008: Cassini Flies Low". Invited talk to the AGU Fall meeting, San Francisco, CA., Dec 15, 2008.
Presentations on Cassini to the Entertainment Gathering (EG) conference, Los Angeles, CA December 4, 2007; the Digital Life Design (DLD) 2008 conference, Munich, Germany, January 2008.
"Traveling Saturn". Invited keynote presentation at UNAVCO meeting, Boulder, CO, March 11, 2008.
"At Saturn: Tripping the Flight Fantastic". Invited public lecture held in conjunction with the American Astronomical Society's Division on Dynamical Astronomy meeting, Boulder, CO, April 28, 2008.
"Our Place in the Cosmos". Invited presentation to a global audience on Pangea Day, May 10, 2008 (<http://www.pangeaday.org/>). Sponsored by TED (the Sapling Foundation) and other companies.
Acceptance speech, Isaac Asimov Science Award, American Humanist Association, Washington, DC, June 7, 2008.
"Cassini to Saturn". Invited keynote presentation of the Institute for Electrical and Electronic Engineers, Centennial Symposium, Ft. Wayne, Indiana, August 14, 2008.
"At Saturn: Tripping the Light Fantastic". Invited public lectures to: the Mars Society meeting, Boulder, CO, August 16, 2008; the Hayden Planetarium, American Museum of Natural History, New York, NY Sept. 15, 2008; Lucasfilm's Industrial Light and Magic, San Francisco, CA., Sept. 24, 2008;

OTHER ACTIVITIES

What I've Changed by Mind About". Essay for "The Edge" World Question Center, January 2008. (http://www.edge.org/q2008/q08_10.html#porco)
"The Restless World of Enceladus". *Scientific American*, December 2008. <http://www.sciam.com/article.cfm?id=enceladus-secrets>
The Blue Dot Report: A Look at Our Place in Space. Radio Interview, April 15, 2008.
"Science and Spirituality: An Interview with Carolyn Porco". *The Humanist journal*, vol. 68, January/February 2008.
"The Universe in 2008". *Seed magazine*, January/February 2008, p. 71
The Blue Dot Report: A Look at Our Place in Space. Radio Interview, April 2008: http://www.csuchico.edu/ncnhm/spots/Number_53.mp3
"NASA Has Its Closest Look at Geysers on Saturn Moon", Interview in *New York Times*, August 15, 2008: <http://www.nytimes.com/2008/08/16/science/space/16cassini.html?8br>; *USA Today*, August 20, 2008.
"Exclusive Interview with Carolyn Porco – Star Trek's New Science Advisor" :<http://trekmovie.com/2008/02/11/interview-with-star-treks-new-science-advisor/>"CarolynPorcoTalks'StarTrekXI" : <http://www.cinemaspy.ca/article.php?id=857>
"Former Tucsonan Consults on Star Trek": http://www.azstarnet.com/sn/ent_index/226976
"Boulder Scientist To Help Create 'Star Trek' World" : <http://cbs4denver.com/entertainment/star.trek.cassini.2.674116.html>
"The 2008 Smart List: Fifteen People the Next President Should Listen To", *Wired Magazine*, October 2008. http://www.wired.com/politics/law/magazine/16-10/sl_porco
"Meet Carolyn Porco", *Boulder Magazine*, Fall 2008, p. 35.

BRAD SANDOR

PROFESSIONAL ORGANIZATIONS & SERVICE

American Geophysical Union, Member
AAS Division of Planetary Sciences, Member
Mars Data Analysis Program (MDAP) Review Panel

PUBLICATIONS

Clancy, R.T., B.J. Sandor, and G.H. Moriarty-Schieven. Venus upper atmospheric CO, temperature, and winds across the afternoon/evening terminator from June 2007 JCMT sub-millimeter line observations. *Planetary and Space Science*, v.56. pp. 1344–1354. 2008.

MEETINGS AND CONFERENCE PROCEEDINGS

Clancy, R.T., B.J. Sandor, and G.H. Moriarty-Schieven. Temporal and Spatial Variability of the Venus Lower Thermosphere/Mesosphere (80-115 km) Temperatures, from James Clerk Maxwell Telescope (JCMT) Sub-millimeter 12CO/13CO observations during 2001, 2002, 2004, 2006, and 2007 Inferior Conjunctions. *Venus Express Workshop*. La Thuille, Italy. March, 2008.

Clancy, R.T., B.J. Sandor, and G.H. Moriarty-Schieven. Time Variability of the Venus Lower Thermosphere/Mesosphere (80-115 km) Circulation from James Clerk Maxwell Telescope (JCMT) Sub-millimeter 12CO/13CO observations during 2001, 2002, 2004, 2006, and 2007 Inferior Conjunctions. *Venus Express Workshop*. La Thuille, Italy. March, 2008.

Sandor, B.J., R.T. Clancy, and G.H. Moriarty-Schieven. CO, H₂O, SO₂ and SO in the Venus Mesosphere: Observations of Extreme & Rapid Variation. *Venus Express Workshop*. La Thuille, Italy. March, 2008.

Sandor, B.J., R.T. Clancy, G.H. Moriarty-Schieven and F.P. Mills. Diurnal & Altitude Behavior of SO₂ and SO in the Venus Mesosphere. October 2008 meeting of the DPS. 2008.

MICHAEL L. SITKO

PROFESSIONAL ORGANIZATIONS AND SERVICE

Cincinnati Observatory Center: Board of Directors & Education Committee

Member: International Astronomical Union, American Astronomical Society, Division for Planetary Sciences, Astronomical Society of the Pacific, Meteoritical Society, Planetary Society

Referee for *Planetary & Space Science*, *Astronomical Journal*, *Astrophysical Journal*

PUBLICATIONS

“Variability of Disk Emission in Pre-Main Sequence and Related Stars. I. HD 31648 and HD 163296 - Isolated Herbig Ae Stars Driving Herbig-Haro Flows”, M.L. Sitko, W.J. Carpenter, R.L. Kimes, J.L. Wilde, D.K. Lynch, R.W. Russell, R.J. Rudy, S.M. Mazuk, and C.C. Venturini, R.C. Puetter, C.A. Grady, E.F. Polomski, J.P. Wisniewski, S.M. Brafford, H. B. Hammel, R.B. Perry, *ApJ*, 678, 1070-1087 (2008).

“Ultraviolet Spectroscopy of HD 44179”, M.L. Sitko, L.S. Bernstein, and R.J. Glinski, *ApJ*, 680, 1426-1437 (2008).

MEETINGS AND CONFERENCE PROCEEDINGS

“Dust Properties of Comet 73P/Schwassmann-Wachmann 3 Fragments B and C”, D.E. Harker, M.L. Sitko, C.E. Woodward, D.H. Wooden, R.W. Russell, & D.K. Lynch. 2008, LPICo1405.8040. *Asteroids, Comets, & Meteors 2008*, Baltimore, MD July 14-18, 2008.

“Spitzer Spectroscopy of Comet 73P/Schwassmann-Wachmann 3”, M.L. Sitko, E.F. Polomski, C.M. Lisse, D.E. Harker, D.K. Lynch, R.W. Russell, M.S. Kelley, B.A. Whitney, & M.J. Wolff. 2008, LPICo1405.8101. *Asteroids, Comets, & Meteors 2008*, Baltimore, MD July 14-18, 2008.

“Six Comets in the Infrared: Clues to the Formation and Evolution of the Solar System”, C.M. Lisse, M.L. Sitko, W.T. Reach, N. Dello Russo, & Y.R. Fernandez. 2008, LPICo1405.8224. *Asteroids, Comets, & Meteors 2008*, Baltimore, MD July 14-18, 2008.

“A Spectral Survey of Six Comets in the Infrared”, C.M. Lisse, M.L. Sitko, W.T. Reach, Y.R. Fernandez, & M.S. Kelley. 2008, DPS40.0506. Division for Planetary Sciences, Ithaca, NY, October 2008.

“Observations of Accretion Disks and the Origin of Processed Material in Kuiper Belt Comets”, M. Sitko. Timber Cove II Stardust Workshop, Timber Cove CA, October 26-30, 2008.

OTHER PRESENTATIONS

“Observations of Accretion Disks around Young Stars and the Origin of Processed Material in Kuiper belt Comets”, Timber Cove II Stardust Workshop, October, 2008.

OTHER TALKS

“Development of Planetary Systems” – Cincinnati Observatory Center, 3/08

“Development of Planetary Systems” – UC Clermont, 5/08

“Observing at NASA’s Infrared Telescope facility (IRTF)” - Cincinnati Observatory Center, 11/08

GORDEN VIDEEN

PROFESSIONAL ORGANIZATIONS & SERVICE

Journal of Quantitative Spectroscopy and Radiative Transfer, Associate Editor

Scientific Organizing Committee: 11th Conference on Electromagnetic and Light Scattering by Nonspherical Particles: Theory, Measurements, and Applications held in Hatfield, UK, September 2008.

Co-Chair: Sendai Light Scattering Workshop, Sendai Japan, November 2008

PUBLICATIONS

Shkuratov Y, Opanasenko N, Opanasenko A, Zubko E, Bondarenko S, Kaydash V, Videen G, Velikodsky Y, Korokhin V, 2008: Polarimetric mapping of the Moon at a phase angle near the polarization minimum. *Icarus* 198, 1-6.

Zubko E, Shkuratov Yu, Mishchenko M, and Videen G. 2008: Light scattering in a finite multi-particle system. *J. Quant. Spectrosc. Radiative Transfer* 109, 2195-2206 .

Tyynela J, Muinonen K, Zubko E, and Videen G. 2008: Interrelating scattering characteristics to internal electric fields for Gaussian-random-sphere particles. *J. Quant. Spectrosc. Radiative Transfer* 109, 2207-2218.

Gangl M, Kocifaj M, Videen G, Horvath H. 2008: Light scattering by coated nano-sized carbonaceous particles. *Atmos. Env.* 42, 2571-2581.

Kocifaj M, Kundacik F, Videen G. 2008: Optical properties of single mixed-phase aerosol particles. *J. Quant. Spectrosc. Radiative Transfer* 109, 2108-2123.

- Petrov D, Shkuratov Y, Videen G. 2008: Reply to comment on “optimized matrix inversion technique for the T-matrix method.” *Opt. Lett.* 33, 1367.
- Kocifaj M, Videen G. 2008: Optical behavior of composite carbonaceous aerosols: DDA and EMT approaches. *J. Quant. Spectrosc. Radiative Transfer* 109, 1404-1416.
- Mishchenko MI, Videen G, Khlebtsov NG, Wriedt T, Zakharova NT. 2008: Comprehensive T-matrix reference database: A 2006-07 update. *J. Quant. Spectrosc. Radiative Transfer* 109, 1447-1460.
- Petrov D, Shkuratov Y, Videen G. 2008: Sh-matrices method applied to light scattering by finite circular cylinders. *J. Quant. Spectrosc. Radiative Transfer* 109, 1474-1495.
- Mishchenko MI, Videen G, Menguc MP. 2008: The tenth electromagnetic and light scattering conference. *J. Quant. Spectrosc. Radiative Transfer* 109, 1335-1337.
- Petrov D, Shkuratov Y, Videen G. 2008: Influence of corrugation on light-scattering properties of capsule and finite-cylinder particles: Analytic solution using Sh-matrices. *J. Quant. Spectrosc. Radiative Transfer* 109, 650-669.
- Petrov D, Shkuratov Y, Videen G. 2008: Analytic light-scattering solution of two merging spheres using Sh-matrices. *Opt. Comm.* 281, 2411-2423.
- Garcia-Camara, B., Moreno, F., Gonzalez, F., Saiz, J. M., Videen, G., 2008: Light scattering resonances in small particles with electric and magnetic properties. *J. Opt. Soc. Am. A* 25, 327-334.

MEETINGS AND CONFERENCE PROCEEDINGS

- G. Videen, D. Petrov and Yu. Shkuratov, “New analytical tools for calculating optical properties of irregularly shaped particles,” 2008 Scientific Conference on Obscuration and Aerosols, 26 June 2008, Aberdeen, Maryland.
- J. Tyynela, E. Zubko, K. Muinonen, and G. Videen, “Angular-scattering, negative-polarization and intensity-enhancement studies of spheroids,” *Proceedings of the 11th Conference on Electromagnetic and Light Scattering by Non-Spherical Particles: Theory, Measurements, and Applications*, September 7-12 2008, Hatfield, England, 97-100.
- E. Zubko, D. Petrov, Yu. Shkuratov, H. Okamoto, K. Muinonen, H. Kimura, T. Yamamoto, and G. Videen, “Applicability of discrete-dipole approximation to conductive particles,” *Proceedings of the 11th Conference on Electromagnetic and Light Scattering by Non-Spherical Particles: Theory, Measurements, and Applications*, September 7-12 2008, Hatfield, England, 117-120.
- K. Muinonen, Timo Nousiainen, O. Muñoz, H. Erkkilä and G. Videen, “Ray-optics radiative-transfer method for scattering by inhomogeneous Gaussian random particles,” *Proceedings of the 11th Conference on Electromagnetic and Light Scattering by Non-Spherical Particles: Theory, Measurements, and Applications*, September 7-12 2008, Hatfield, England, 133-136.
- T. Nousiainen, E. Zubko, J. Niemi, K. Kupiainen, M. Lehtinen, K. Muinonen, and G. Videen, “Optical modeling of thin calcite flakes using DDA,” *Proceedings of the 11th Conference on Electromagnetic and Light Scattering by Non-Spherical Particles: Theory, Measurements, and Applications*, September 7-12 2008, Hatfield, England, 137-140.
- K. Muinonen, H. Parviainen, J. Nyrönen, and G. Videen, “Scalar approximation to coherent backscattering by spherical media,” *Proceedings of the 11th Conference on Electromagnetic and Light Scattering by Non-Spherical Particles: Theory, Measurements, and Applications*, September 7-12 2008, Hatfield, England, 185-188.
- V. Psarev, A. Ovcharenko, Yu. Shkuratov, and G. Videen, “Colorimetric behavior of photometric opposition effect,” *Proceedings of the 11th Conference on Electromagnetic and Light Scattering by Non-Spherical Particles: Theory, Measurements, and Applications*, September 7-12 2008, Hatfield, England, 189-192.
- E. Zubko, H. Kimura, Yu. Shkuratov, K. Muinonen, T. Yamamoto, and G. Videen, “Light scattering by agglomerated debris particles composed of highly absorbing material,” *Proceedings of the 11th Conference on Electromagnetic and Light Scattering by Non-Spherical Particles: Theory, Measurements, and Applications*, September 7-12 2008, Hatfield, England, 213-216.

- D. Petrov, Yu. Shkuratov, and G. Videen, “Applying the Sh-matrices approach to small lenses with spherical surfaces,” *Proceedings of the 11th Conference on Electromagnetic and Light Scattering by Non-Spherical Particles: Theory, Measurements, and Applications*, September 7-12 2008, Hatfield, England, 353-356.
- E. Zubko, Y. Shkuratov, M. Mishchenko, and G. Videen, “Linear polarization of fluffy particles,” *AOGS, Busan Korea*, 16-20 June, 2008.

BRIAN D. WARNER

PROFESSIONAL ORGANIZATIONS & SERVICE

AAS Division of Planetary Sciences, member
 Society for Astronomical Sciences, board member
 Minor Planet Bulletin, Acting Editor

PUBLICATIONS

- Stephens, R.D., Warner, B.D., Harris, A.W., Shepard, M.K. (2008). “Lightcurve and Radar Observations and Analysis of 11 Parthenope and 678 Fredegundis”. *B.A.A.S.* 40, #38.11.
- Warner, B.D., Harris, A.W., Pravec, P., Benner, L.A.M. (2008). “Lightcurve Photometry Opportunities:” (with Durech, J.)
 October – December 2008 *Minor Planet Bulletin* 35, 186-189.
 July – September 2008 *Minor Planet Bulletin* 35, 139-141.
 (with Kaasalainen, M.)
 April – June 2008 *Minor Planet Bulletin* 35, 93-91.
 January - March 2008 *Minor Planet Bulletin* 35, 38-40.
- Warner, B.D. (2008). “A Preliminary Shape and Spin Axis Model for 595 Polyxena”. *Minor Planet Bulletin* 35, 171-172.
- Warner, B.D., Durech, J., Fauerbach, M., Marks, S. (2008). “Shape and Spin Axis Models for Four Asteroids”. *Minor Planet Bulletin* 35, 167-171.
- Warner, B.D. (2008). “Asteroid lightcurve analysis at the Palmer Divide Observatory: February–May 2008”. *Minor Planet Bulletin* 35, 163-167.
- Warner, B.D. (2008). “Asteroid lightcurve analysis at the Palmer Divide Observatory: December 2007 – March 2008”. *Minor Planet Bulletin* 35, 95-98.
- Warner, B.D. (2008). “Asteroid Lightcurve Analysis at the Palmer Divide Observatory: December 2007 – March 2008”. *Minor Planet Bulletin* 35, 95-98
- Warner, B.D., Higgins, D. (2008). “Lightcurve Analysis of 3415 Danby”. *Minor Planet Bulletin* 35, 103.
- Warner, B.D., Stephens, R.D. (2008). “A Preliminary Shape and Spin Axis for 76 Freia”. *Minor Planet Bulletin* 35, 84-85.
- Warner, B.D., Husarik, H. (2008). “Lightcurve Analysis of (21028) 1989 TO”. *Minor Planet Bulletin* 35, 75-76.
- Warner B.D., Harris, A.W. (SSI), Pravec, P., Stephens, R.D., Pray, D.P., Cooney, Jr., W.R., Gross, J., Terrell, D., Gajdos, S., Galad, A., Krugly, Y. (2008). “1453 Fennia: A Hungaria Binary”. *Minor Planet Bulletin* 35, 73-74.
- Warner, B.D. (2008). “Asteroid Lightcurve Analysis at the Palmer Divide Observatory: September-December 2007”. *Minor Planet Bulletin* 35, 67-71.
- Warner, B.D. (2008). “Asteroid Lightcurve Analysis at the Palmer Divide Observatory: June-October 2007”. *Minor Planet Bulletin* 35,

56-60.

- Warner, B.D., Vander Haagen, G.A. (2008). "Lightcurve Analysis of 1565 Lemaitre". *Minor Planet Bulletin* 35, 52.
- Warner, B.D., Higgins, D. (2008). "Lightcurve Analysis of 654 Zelinda". *Minor Planet Bulletin* 35, 32-33.
- Warner, B.D. (2008). "Asteroid-Deepsky Appulses in 2008". *Minor Planet Bulletin* 35, 27.
- Warner, B.D., Behrend, R., Poncy, R., Coliac, J-F. (2008). "Lightcurve Analysis of 758 Mancunia". *Minor Planet Bulletin* 35, 25.
- Warner, B.D., Higgins, D., Dyvig, R., Reddy, V., Durech, J. (2008). "A Shape and Spin Axis Model for the Hungaria Asteroid, 1600 Vyssotsky". *Minor Planet Bulletin* 35, 13-14.
- Stephens, R.D., Warner, B.D. (2008). "Lightcurve Analysis of 12008 Kandrup". *Minor Planet Bulletin* 35, 8.

MEETINGS AND CONFERENCE PROCEEDINGS

- Warner, B.D., Harris, A.W., Vokrouhlický, D., Nesvorný, D., Bottke, W.F. (2008). "Evidence of Yarkovsky and YORP Migration from the Distribution of Hungaria Family Members". *B.A.A.S* 40, #22.02.
- Conference: 27th Annual Symposium on Telescope Science, Society for Astronomical Sciences, Big Bear, CA, May 20-22.
- Conference: Division of Planetary Sciences, Ithaca, NY, Oct. 18-22, 2008

ANN E. WEHRLE

PROFESSIONAL ORGANIZATIONS & SERVICE

- SIM Lite Astrometric Observatory, Book Chapter Author and Co-author, JPL Document 400-1360, in press February 2009
- Spitzer Space Telescope, Proposal Reviewer, Extragalactic and AGN Panel, 2008
- American Astronomical Society, Member

MEETINGS AND CONFERENCE PROCEEDINGS

- Unwin, S. C., Wehrle, A. E., Meier, D. L., Jones, D. L., and Piner, B. G.,
2008, Quasar astrophysics with the Space Interferometry Mission, A Giant Step: from Milli- to Micro-arcsecond Astrometry, Proceedings of the International Astronomical Union, IAU Symposium, Volume 248, 288-289
- Wehrle, A. E. and Unwin, S. C., 2008, Prospects for Observing Quasar Jets with the Space Interferometry Mission PlanetQuest, Extragalactic Jets: Theory and Observation from Radio to Gamma Ray, in Extragalactic Jets: Theory and Observation from Radio to Gamma Ray ASP Conference Series, Vol. 386, proceedings of the conference held 21-24 May, 2007 in Girdwood, Alaska, USA. Edited by Travis A. Rector and David S. De Young. San Francisco: Astronomical Society of the Pacific, 386, 265-269
- Unwin, S. C., Shao, M., Tanner, A. M., Allen, R. J., Beichman, C. A., Boboltz, D., Catanzarite, J. H., Chaboyer, B. C., Ciardi, D. R., Edberg, S. J., Fey, A. L., Fischer, D. A., Gelino, C. R., Gould, A. P., Grillmair, C., Henry, T. J., Johnston, K. V., Johnston, K. J., Jones, D. L., Kulkarni, S. R., Law, N. M., Majewski, S. R., Makarov, V. V., Marcy, G. W., Meier, D. L., Olling, R. P., Pan, X., Patterson, R. J., Pitesky, J. E., Quirrenbach, A., Shaklan, S. B., Shaya, E. J., Strigari, L. E., Tomsick, J. A., Wehrle, A. E., and Worthey, G., 2008, Taking the Measure of the Universe: Precision Astrometry with SIM PlanetQuest, Publications of the Astronomical Society of the Pacific, 120, 38-88

JOHN WEISS

PROFESSIONAL ORGANIZATIONS & SERVICE

- American Astronomical Society
AAS Division of Planetary Sciences, member AAS Division on Dynamical Astronomy, member American Association for the Advancement of Science, member

PUBLICATIONS

- Tiscareno, M. S., Perrine, R. P., Richardson, D. C., Hedman, M. M., Weiss, J. W., Porco, C. P., Burns, J. A., 2009. An Analytic Parameterization of Self-Gravity Wakes in Saturn's Rings", Submitted to The Astronomical Journal.
- Porco, C.C., Weiss, J.W., Richardson, D., Dones, L., Quinn, T., Kehoe, T., Throop, H., 2008. "Scattering in Saturn's Rings: Basic Formulation, Ring Thickness, and the A Ring Azimuthal Asymmetry". *The Astronomical Journal*, 136, 2172-2200

MEETINGS AND CONFERENCE PROCEEDINGS

- Weiss, J.W., Porco, C.P., Richardson, D.C., Dones, L., and Spitale, J.N. (2008). "Saturn's A-Ring Azimuthal Asymmetry Observed at High Solar Phase: Implications for Particle Properties", American Astronomical Society, Division for Planetary Sciences Annual Meeting 40, #29.01 20
- Weiss, J.W., Porco, C.P., and Tiscareno, M.S. (2008). "Edge-Waves in Ring Gaps and the Determination of Masses of Embedded Satellites", American Astronomical Society, Division on Dynamical Astronomy Annual Meeting 39, #18.02

PUBLIC TALK

- "Cassini Update" – Boulder Astronomy and Space Society, 5/08

MICHAEL WOLFF

PROFESSIONAL ORGANIZATIONS & SERVICE

- MRO/MARCI Science Team, Co-Investigator
MRO/CRISM Science Team
MER Science Team, Co-Investigator
Peer Reviewer: *Astrophysical Journal*, *Icarus*, *Journal of Quantitative Spectroscopy and Radiative Transfer*, *Journal of Geophysical Research*, *Monthly Notices of the Royal Astronomical Society*, *Planetary and Space Science*
American Astronomical Society (including Division of Planetary Science), member
American Geophysical Union, member
Institute of Electrical and Electronics Engineers (Computers), member
International Astronomical Union, member

REFEREED PUBLICATIONS

- McGuire, P. C., M. J. Wolff, and 22 co-authors, MRO/CRISM Retrieval of Surface Lambert Albedos for Multispectral Mapping of Mars With DISORT-Based Radiative Transfer Modeling: Phase 1—Using Historical Climatology for Temperatures, Aerosol Optical Depths, and Atmospheric Pressures, *EEE Transactions on Geoscience and Remote Sensing*, 46, issue 12, 4020-4040, 2008.
- Tamppari, L. K, and 16 co-authors including M.J. Wolff, Expected atmospheric environment for the Phoenix landing season and location, *Journal of Geophysical Research*, 113, E10, CiteID E00A20, 2008.
- Seelos, K. D., and 13 co-authors including M.J. Wolff, Geomorphologic and mineralogic characterization of the northern plains of Mars at the Phoenix Mission candidate landing sites, *Journal of Geophysical Research*, 113, E9, CiteID E00A13, 2008.
- Mustard, J.F., and 35 co-authors including M.J. Wolff, Hydrated silicate minerals on Mars observed by the Mars Reconnaissance Orbiter CRISM instrument, *Nature*, 454, 305-309, 2008.
- Whitney, B.A., and 54 co-authors including M.J. Wolff, Spitzer Sage Survey of the Large Magellanic Cloud. III. Star Formation and ~1000 New Candidate Young Stellar Objects, *Astronomical Journal*, 136, 18-43, 2008.
- Soderblom, J.M., J.F. Bell, J.R. Johnson, J. Joseph, and M.J. Wolff, Mars Exploration Rover Navigation Camera in-flight calibration, *Journal of Geophysical Research*, 113, E6, CiteID E06S19, 2008.
- Malin, M.C., and 9 co-authors including M.J. Wolff, Climate, weather, and north polar observations from the Mars Reconnaissance Orbiter Mars Color Imager, *Icarus*, 194, 501-512, 2008.
- Noe Dobrea, E., J.F. Bell, M.J. Wolff, K. Noll, A. Lubenow, and C.C. Million, Global-scale near infrared variability on Mars: Analysis of 2003 Mars opposition observations from HST/NICMOS, *Icarus*, 193, 112-124, 2008.



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