

PLANETARY SCIENCE INSTITUTE

NEWSLETTER

Fall 2005 Vol. 6 , No. 3



PSI Retreat



PSI members at the 2005 PSI Retreat. Pictured left to right, front row: Elaine Owens, Steve Kortenkamp, Chris Holmberg, Mary Bourke, Candace Kohl, Betty Pierazzo, Bea Mueller, Lijie Han, Gil Esquerdo, Kim Kuhlman, Melissa Lane. Back row: Les Bleamaster, Matt Staid, David Levy, Nader Haghighipour, Stu Weidenschilling, Rose Early, Don Davis, Steve Saunders, Bill Hartmann, Dan Berman, Nalin Samarasinha, Elizabeth Turtle, Pasquale Tricarico, Mark Sykes, Randy Perry, Tim Hunter, Steve Metzger, David Lien, Paul Abell, Mark Everett, David Tarico, Bruce Barnett, David Crown, Frank Chuang, Steve Anderson, Asmin Pathare, Carol Neese, John Mason, Andy Nelson, Kelly Yoder. (Attendees not pictured: Ben Smith, James Ward.)

In late August, 44 members of PSI convened at the Hacienda Del Sol Guest Ranch Resort, in the Catalina foothills above Tucson, for a two-day retreat. Institute members from PSI’s Arizona headquarters were joined by those from Hawaii, California, Washington, Nevada, Wisconsin, South Dakota, New Mexico, Texas and Washington, DC. Each morning a full agenda greeted the scientists, Board of Trustees members and administrative staff. PSI scientists gave 15-minute presentations covering a wide variety of topics: sand dunes in Australia; dust devils; planet formations; NASA Mars Reconnaissance Orbiter 2005 mission; Deep Impact observations; solar nebulae; geomorphology of Mars, to name just a few. (Entire retreat agenda and photo album may be found on our website, www.psi.edu)

Group discussions focused on the Institute’s history, public outreach education programs, and future directions. The historic guest ranch was the perfect setting for our retreat, a quiet, beautiful place in which to get to know our colleagues, many of whom had never met before, and to understand more about their science investigations.

(More retreat photos page 5)

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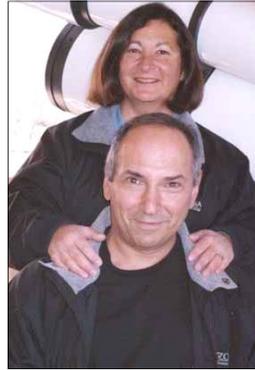
A Message from our Board Chair

by David H. Levy

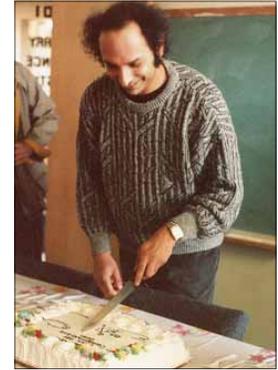
As a 501(c)(3) organization, Planetary Science Institute is governed by a Board of Trustees. After being asked by then-Director Don Davis to become a member back in 1998, I have served on the Board ever since, and became Chair last June.

The Board is filled with members who love PSI and work very hard to look after its health as an organization. Brent Archinal is with the U.S. Geological Survey in Flagstaff, and his claim to fame is his recently published, superb catalog of star clusters. Don Davis and Bill Hartmann are both very well known, having been founding scientists of PSI. Tim Hunter (Vice Chair) is co-founder of the International Dark-sky Association and recently won the Astronomical Society of the Pacific's amateur achievement award (see article on page 3). Candace Kohl, from U.C. San Diego's chemistry department, is especially interested in meteorites. John Mason (Secretary) is a consulting engineer with Allied Signal Aerospace. Carolyn Shoemaker is well known as a comet discoverer, and Benjamin Smith has a background in southwest archaeology and also a law degree. The Board meets several times per year.

I first joined PSI's ranks in 1982, as an observing assistant for the asteroid geodesy program headed by Stu Weidenschilling. We observed each month at Kitt Peak's No. 2 0.9m reflector, recording asteroid light curves with a view to understanding their shapes and densities. It was very hard work but magnificent in a way; in those days we enjoyed frigid nights in the



David and Wendee Levy and "Obadiah," their Schmidt camera that they use for comet hunting.



PSI helped David Levy celebrate his first comet discovery, 21 years ago!

dome, working right at the telescope. It was the start of a relationship that I have enjoyed with PSI for many happy years, and I am honored now to be the Chair of the Board of Trustees.

Editor's note: Besides being an amazing comet-discoverer — 21 comets total, among them the famous Shoemaker-Levy 9 comet that collided with Jupiter in 1994, co-discovered with Eugene and Carolyn Shoemaker — David has built the Jarnac Observatory in Vail, AZ., is the science editor for *Parade Magazine*, and is a contributing editor to *Sky and Telescope Magazine*. In addition, he won an Emmy for a Discovery Channel documentary, is a prolific writer, a popular lecturer, and a frequent television commentator. PSI is indeed fortunate to have David serving as our Board Chair.

Becoming A Martian: Notes from a Summer Intern

by Caroline O'Hara

In my first semester of college I was a biology major, but after realizing I did not want a career looking through a microscope in a lab, I switched to geophysics. My interests lie mainly in planetary geology and atmospheric science, where I can walk outside and put to use all that I learned in those hours spent in class. Having taken *both* of the atmospheric science classes offered at University of Texas, Austin, I can only hope to learn more on my own through books, looking at the sky (always interesting in Tucson) and even The Weather Channel. Since my dad is a geophysicist, our family vacations always comprised hiking, camping and "rock lessons" at various locations. Some might have found it boring, but I didn't, so here I am — like father like daughter. I plan to graduate from UT in about two years, go on to graduate school, then, hopefully, become an astronaut — go to infinity and beyond — and maybe teach about geology and space.



My search for a summer internship began last December at the Lunar & Planetary Institute (LPI) in Houston, and although they were unable to offer me a position, they sent my application to the Planetary Geology and Geophysics Undergraduate Research Program (PGGURP). As a result, I was offered a funded position working for Dr. Mary Bourke at PSI. Well, it

was either PSI or an REU (Research Experience for Undergrads) ecology/chemistry research position at Los Alamos National Lab, and although everyone told me I'd be crazy to spend the summer in Tucson, there was really no contest. I am so glad I came to work at the PSI as it has turned out to be a great learning opportunity and an incredible experience. UT has little in the planetary geology department; my coursework has me looking at central Texas limestone every weekend. But, at PSI I've had a continuing list of tasks: updating GIS (Geographic Information Systems) maps of four sites on Mars; creating geomorphologic maps of the Cunene Sand Sea in Africa and Dalhousie Springs, Australia; and drawing dune crests in Antarctica. Mary has been beyond helpful, as has everyone here at PSI. This has been my most rewarding internship because I have had the opportunity to be involved in so many great projects!

As an added bonus, I was even able to do some observing at the University of Arizona's 30-inch telescope on Mt. Bigelow, courtesy of my landlord, Andy Odell. I had never observed before, except through a table-top telescope in my backyard in Houston suburbia (and my, how nice the orange, light-polluted sky was!). I stayed up all night, with the help of some coffee, while we observed from 9:30 p.m. to 4:30 a.m. And, we discovered three near-earth objects: a comet and a potentially hazardous asteroid!

So, despite Mary being in the field most of the summer, a big computer crash, my running off to Florida to watch the shuttle *not* launch, and having only a swamp cooler (which does not really work in humidity), this has been one of my most enjoyable summers yet! I want to thank Mary, Andy, and everyone else at the PSI and wish them luck with their respective projects!

Prescient PSI!

by William K. Hartmann

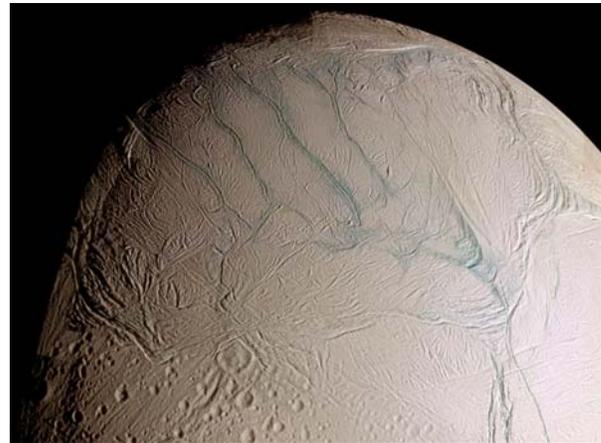
On the front page of our last issue of this Newsletter was an article about one of Saturn's moons, Enceladus. Only weeks after the article appeared, the Cassini spacecraft orbiting Saturn made discoveries that affirmed much of the discussion in our article!

As stated in the original article, much of Enceladus "seems to have been partly resurfaced, probably when deep fractures broke up old surface regions and allowed eruptions of interior water...". As we discussed, the heat source to melt ice and drive eruptions may be tidal heating, but this is still uncertain.

In July, the Cassini team announced discovery of a completely unexpected cloud or plume of water vapor escaping from Enceladus over the south polar region! In that region are a set of prominent parallel fractures called "tiger stripes" by the Cassini team. They have slightly different brightness and coloration than the surroundings, suggesting a different composition or texture of the ice along the fractures.

Cassini instruments pointed at the fractures revealed that, sure enough, heat is escaping there from the interior. The tiger-stripe fractures were found to be about 13° K warmer in temperature than the surrounding ice terrain (90 K is about -297°F) instead of 77 K (about -320°F). These findings suggest internal heating of Enceladus, melting of ice, and escape of water vapor along the southern fractures.

The temperatures are not exactly balmy, but — hey — Saturn is 10 times farther from the Sun than we are. Any source of local heating or evidence for underground liquid water is an exciting find, suggesting places where organic chemistry might be proceeding and we might look for clues about the origins of



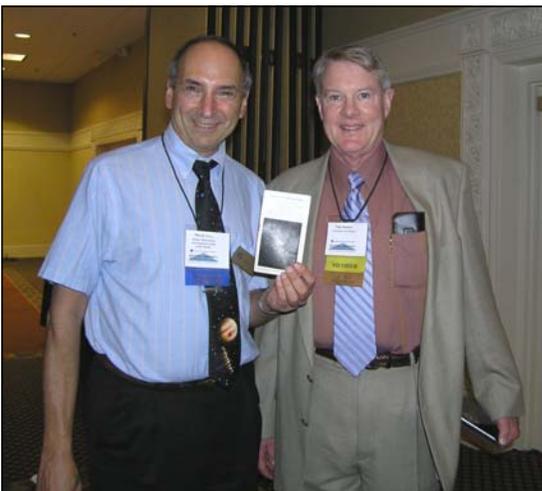
A mildly false-color image of Enceladus from the Cassini spacecraft shows the southern fractures which appear to be involved in active venting of water. South is at the top. The bluish tinge along the fractures shows areas of different surface material, probably vented from the cracks themselves. In an August 30 press conference, Cassini scientists affirmed that water vapor and probably ice crystals are being blown out of these cracks. (NASA/JPL/Space Science Institute PIA06254; additional processing at PSI.)

life. Enceladus is now firmly linked to Europa, Jupiter's icy moon, where we see evidence of a young icepack surface floating on a liquid water ocean. Enceladus is not that warm, but provides a missing link between totally frozen moons and moons with widespread ice melting.

The solar system keeps getting more and more diverse and interesting as we learn about individual distant worlds.

PSI Trustee Tim Hunter Honored

by Donald R. Davis



David Levy presented the Astronomical Society of the Pacific award to Tim Hunter (right), at the annual meeting held in Tucson, September 14-16, 2005. Congratulations, Tim!

The Astronomical Society of the Pacific presented its 2005 Amateur Achievement Award to Dr. Tim Hunter, a longtime friend and Board member of PSI. A medical doctor and very active amateur astronomer, Hunter is also the co-founder of the International Dark-sky Association (IDA), an organization that brings attention to the fact that we are losing our dark skies and need to work to save them. Based on Hunter's support and vision for over 15 years, IDA has grown from two members in 1988 to well over 10,000 today in 75 countries. His impact and positive influence in educating others in the prevention of light pollution have been invaluable: He has written captivating articles for most of the major astronomical magazines, and he is well known for his excellent lectures about astronomy and the IDA (his creativity makes his lectures fun for any age!). His passion for the skies and for astronomy will help all of us hold on to our heritage of dark skies.

Tim is also the principal force behind Grassland Observatory, housing a 24" telescope at a dark site near Sonoita, Arizona. A variety of stunning images taken at Grasslands are available at: <http://www.3towers.com/index.htm>.

He has also been honored with asteroid 6398 Timhunter, a somewhat eccentric and highly inclined mainbelt asteroid.

Director's Notes



The PSI Retreat kicked off what will be a regular annual event in the future. Given our geographical diversity, it is a real pleasure to have one time of year at which we can all get to know each other better, especially our growing number of new young scientists. It is also nice that people get to experience the monsoons and heat of Tucson desert summers!

In the course of the Retreat, I noted the number of conversations in which new collaborations and research ideas were being hatched among people meeting each other for the first time.

These are now coalescing into new proposals to NASA and other agencies. Enthusiasm at the meeting was high.

Our banquet was held at the famous J-Bar restaurant, and overseen by culinary master Janos Wilder. Over 60 people attended. The food was fabulous (the best banquet I have experienced). I guess we may have no choice but to return in the future.

The Retreat ended with consideration of the applications of Les Bleamaster and Matthew Balme to join the permanent PSI science staff as Research Scientists. Both Les and Matt were postdocs at the Institute and their first grant proposals were not only funded but very highly rated. They are productive researchers and add to the positive environment that is so valued at PSI. It was good to have this discussion among the largest number of PSI scientists ever gathered at one time, because it serves to reinforce the common vision we have of the Institute and to shape its direction. In the unanimous acceptance of Les and Matt, it was felt that they have bright futures ahead of them and that PSI is the kind of place where such futures can be realized.

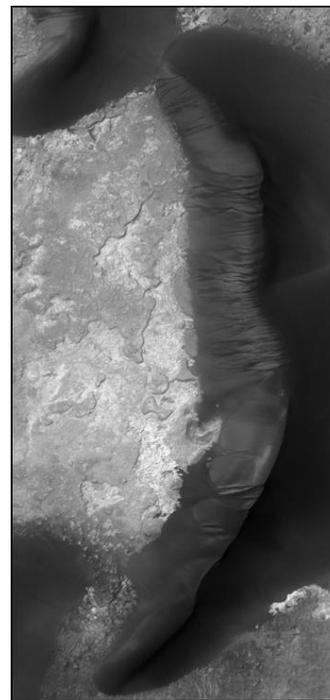
Mark V. Sykes
October 2005

Keynote Lecture on Snow and Ice in Mars Dunes by Daniel C. Berman and Mary Bourke

This September, PSI Research Scientist Dr. Mary Bourke was invited to give the Keynote Halstead Lecture at the British Association for the Advancement of Science held at Trinity College, Dublin (her hometown). Her lecture was on the presence of snow and ice in the sand dunes on Mars. She presented data that suggested the sand dunes are indurated (hardened) and proposed that the induration may be caused by layers of snow and ice. This idea was stimulated by combining the results of the Gamma Ray Spectrometer (GRS), onboard the Mars Odyssey satellite, with a geology map of the North Polar Sand Sea. The data indicate that the top 2 meters of the sand dunes that surround the north polar ice cap on Mars have approximately 40-50% water ice in the pore spaces.

A second observation of sand dunes located in the southern hemisphere of Mars shows that some dunes have evidence of (fluid) flow on their steep avalanche faces. Dr. Bourke has suggested that the source of the liquid for these channels may be beds of ice and snow in the sand dunes. However, she emphasized that there may be alternative explanations to both the induration (e.g. chemical induration, frozen CO₂) and the channels (seasonal frost, dry grain flow) on the dunes.

By analyzing satellite data, Dr. Bourke has been able to compare the geomorphic signatures of the Martian dunes to those found in cold deserts on Earth, particularly those located in the Arctic and Antarctic. She found many geomorphic similarities between these dunes and some of the dunes on Mars. The largest dune she has discovered on Mars (and the largest found in the entire solar system thus far), is Kaiser dune in the southern hemisphere. It is 475 meters high and 6 ½ kilometers wide, and may contain significant quantities of frozen water (see photo). Prior to Dr. Bourke's discovery, the highest megadunes in the solar system were located in the Badain Jaran Desert in China and stands at and 450 m high.



Kaiser dune — the dark region to the top and right of this image — is at present the largest sand dune in our solar system.

Although significant quantities of water have been detected by the GRS across vast regions on Mars, it is thought to be a mixture of soil and frozen water, a dirty ice or an icy dirt. If the hypothesis of snow and ice in the dunes is correct, then the buried snow packs may be a relatively cleaner source of frozen water.

Dr. Bourke's presentation garnered a lot of attention from the media due to the high potential this water may have for utilization by human explorers on Mars, as well as the implications for the possibility of present or past life on the planet.

PSI is pleased to acknowledge two companies for generously awarding grant monies to the California Science Education Field Trip Program in Summer, 2005. The Dwight Stuart Youth Foundation, Beverly Hills, awarded \$7,000 and Beckman Coulter, Fullerton, donated \$2,500. Our sincere thanks and appreciation go out to these institutions.

PSI Retreat Photo Collage



Top row, from left: Don Davis and Bill Hartmann; Elaine Owens, Mark Sykes and Bruce Barnett; rapt attendees; Nader Haghighipour.
 Second row: David Levy; Matthew Staid; Stephen Saunders; Lijie Han; Hacienda Del Sol Guest Ranch grounds.
 Third row: Hacienda del Sol courtyard; Mary Bourke; Nalin Samarasinha; Tim Hunter, Candace Kohl, John Mason, Ben Smith; Betty Pierazzo.

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The *Friends of PSI* are people like you — excited by the new worlds revealed in our exploration of the solar system and beyond, seeing the Earth as a planet for the first time, and wanting to participate in the expansion of human presence beyond the Earth. PSI scientists are active participants in this adventure. They travel to remote and dangerous regions on Earth to study processes found on other planets as well. They participate in missions to the Moon, Mars, Saturn, and

asteroids. They model the formation of the solar system and how planets can grow around other stars. They identify the location and nature of space resources to sustain the expansion of permanent human presence on the Moon, Mars, and beyond.

PSI scientists are helping to create the next generation of explorers, and reaching out to the public through lectures, books, and art. Please join us in this adventure by becoming a *Friend of PSI* and renewing your membership annually.

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Thank you!

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