PLANETARY SCIENCE INSTITUTE

NEWSLETTER

SUMMER 2006 Vol.7, No.2

PSI Proposes a Distant Asteroid Mission

By Mark V. Sykes

PSI submitted its first mission proposal to NASA's Discovery Program in April, 2006. The spacecraft, named EVE (Exploring the Very Earliest Epoch), will rendezvous with and study the largest asteroid in the outer main belt, 10 Hygiea. Hygiea is a dark, C-type (carbonaceous) asteroid and is expected to have changed very little in its composition and location since its formation in the earliest years of the solar system. This mission will allow us to constrain the volatile and organic inventory of a particular region of the protoplanetary disk at that time, and the processes to which the asteroid has been exposed since then.

Hygiea is primitive, but its history has not been uneventful. Sometime in the distant past, it experienced a significant impact with another asteroid that resulted in the formation of an asteroid family (fragments orbiting the Sun in similar orbits). In addition, Hygiea itself is heterogeneous. Some areas on its surface have a composition that is pristine, while others have been exposed to liquid water and have been altered into other minerals.

Water is not expected to be liquid at Hygiea's distance from the Sun; however, dark carbonaceous material is often water-rich, and a large impact such as the one that formed the Hygiea family may have heated an area or areas on Hygiea's surface sufficiently to mobilize water and cause localized hydration of minerals.

There are other possible explanations. The Sun may have gone through a period of evolution called the T-Tauri phase that resulted in the more distant asteroids between Mars and Jupiter being heated. Alternatively, decaying radioisotopes may also have produced internal heating within the asteroid sufficient to cause water to flow for some period of time. By orbiting Hygiea and making observations, EVE will be able to distinguish among these different scenarios and provide important constraints on what conditions in the early solar system were like.

To save costs, EVE is nearly identical to the Dawn spacecraft and instrumentation. The spacecraft is to be built by the Or-

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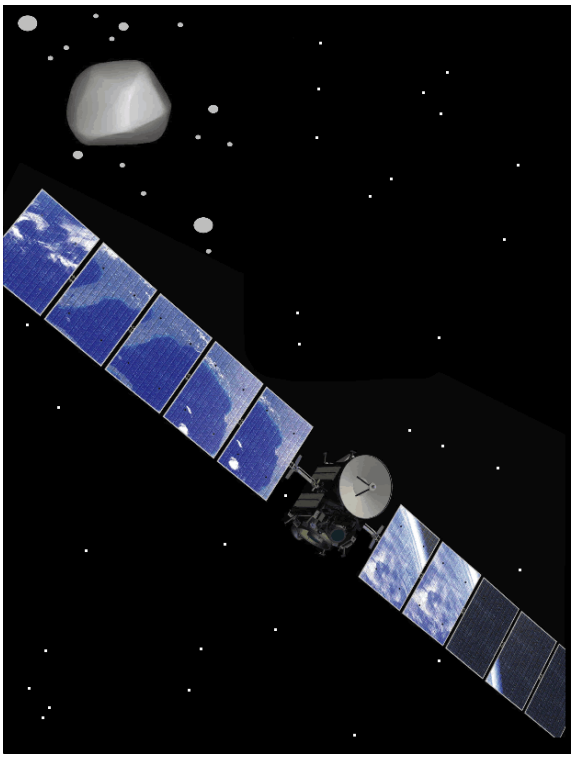


Artist's conception of the EVE spacecraft approaching asteroid 10 Hygiea.

Inside this issue:

New Research Scientist, Matt Balme

Matt Balme joined PSI as a research scientist in February 2006, having received funding from the Mars Data Analysis Program (MDAP) to study small-scale aeolian features on Mars — his first independent grant as a principal investigator.

Matt was born and raised on the south coast of England. He moved to London in his late teens to study for a degree in Physics with Space Science at University College London (UCL), and was awarded his MSci in 1997. He remained at UCL for his Ph.D., but defected from the Physics and Astronomy department to the Geology department to develop his interest in planetary surfaces. For his graduate work, Matt combined experimental fracture mechanics measurements with observations of fracture patterns on the surface of Venus and developed a new model for closely-spaced parallel fracturing on planetary surfaces. He received the Geology Department Momber scholarship while working toward his Ph.D., and his doctorate in 2001.

From UCL, Matt moved to Arizona State University, in Phoenix, and spent two years as a postdoctoral student with Ron Greeley. His work on dust devils on Earth and Mars again followed a multidisciplinary approach, combining laboratory simulations, field measurements and spacecraft remote observations to understand the role of dust devils in the Martian climate. Highlights of his time at ASU included speeding across the Nevada desert in an instrumented truck chasing dust devils, and working at the NASA Ames MARSWIT (Martian Surface Wind Tunnel) facility — a huge vacuum chamber that allows large-scale experiments to be performed under Martian atmospheric conditions.

Following a brief spell as a Beagle 2 camera team member (the ill-fated British Mars Lander that was a part of the European Mars Express mission) in late 2003, Matt collaborated with Mary Bourke, then at Oxford University, to study dunes on Mars. When Mary moved to PSI Tucson, Matt followed as a postdoctoral researcher and it was with her guidance and encouragement that he was awarded the MDAP award in 2005. In 2005 he also managed to cram in a six-month spell working at Université de Paris-Sud in France, with Nicolas Mangold and Francois Costard, mapping small fluvial-like gullies on Mars.

Having had four different research positions in three different countries in the last five years, Matt is now looking forward to a few good years of stability. Matt will be at PSI Tucson for four months a year and will spend the remaining eight in England at Open University. This allows him to avoid both the British winter and the Tucson summer — a great deal as far as he is concerned. This is doubly true as Matt's two main hobbies are rock climbing and dining on Mexican food. It is no surprise that he has made PSI his winter retreat!

Welcome aboard, Matt; we'll see you in February!

PSI Proposes Distant Asteroid Mission

(continued from front page)

bital Sciences Corporation and the ion propulsion system will be delivered by the Jet Propulsion Laboratory in California. The imaging system is provided by the Max Planck Society in Lindau, Germany (in cooperation with DLR Berlin and IDA Braunschweig).

To map surface mineralogies, the Istituto di Fisica dello Spazio Interplanetario of Italy is providing a mapping spectrometer. Elemental composition of the outer layer of the asteroid will be determined by a Neutron/Gamma-ray Spectrometer built by Los Alamos National Laboratory (New Mexico).

If the proposal is successful, EVE will be launched in October 2011 and will arrive at Hygiea in 2021.

Mark Sykes will be the principal investigator of the EVE mission. For further information contact him at sykes@psi.edu .

Dawn Update

By Mark V. Sykes

After cancellation and resurrection last March, the Discovery mission, Dawn, is now scheduled for launch on June 20, 2007, a delay of one year from its original launch date. After a flyby of Mars, in 2009, Dawn will rendezvous with the two largest asteroids between Mars and Jupiter — Vesta, in 2011, and Ceres, in 2015.

Vesta has a diameter of 525 km and is covered with basalt from an early period of heating, melting and core formation. A giant crater over 300 km in diameter covers its south pole. About 4% of meteorites falling to Earth are thought to have originated from Vesta.

Ceres has a diameter of 975 km and a very smooth surface containing clay minerals. It has an ice-rich mantle and rocky core and some models predict the existence of a subsurface ocean that may be present today.

Dawn is technically challenging, being the first ever multiple-rendezvous mission and the first science planetary mission by the US to use solar electric ion propulsion.

PSI scientists Bill Feldman and Mark Sykes are Co-Investigators and members of the Dawn Science Team.

Hirdy Miyamoto, New PSI Affiliate

Hideaki "Hirdy" Miyamoto joined PSI as an Affiliate Scientist in January, 2006. He is an assistant professor in the Department of Geosystem Engineering, University of Tokyo, where he seeks to understand the inherent relationship between surface landforms on terrestrial planets and their environmental evolutions. He received his B.A. in Geology from the University of Tokyo in 1995, and his M.S. in Geology in 1997, where he worked mainly on computational fluid dynamics and its applications to planetary science.

In 1999, Hirdy became a tenured assistant professor in the School of Engineering, University of Tokyo, and he received his Ph.D. in Earth and Planetary Science from University of Tokyo in 2000. From 2002-2004, he worked at the Lunar and Planetary Laboratory, University of Arizona, as a visiting scholar, where he started a series of collaborations with PSI scientists.

Hirdy is working on developing numerical models of large-scale features on terrestrial planets including those associated with lava flows, debris flows, glacier flows, cataclysmic floods, and mantle convections. He has been involved in most of the Japanese solid-body exploration missions. He was a science team member of the Mars Dust Counter onboard the Nozomi spacecraft, which was the first Japanese interplanetary space mission (although it did not achieve Mars orbit). He is a Co-Investigator for the imaging camera of the Lunar-A mission as well as for the SELENE lunar mission, which will be launched next summer. He worked as a Co-Investigator for the AMICA imaging camera onboard the Hayabusa mission, which successfully rendezvoused with a small asteroid, Itokawa. The size of this asteroid is ~300 m, which is by far the smallest among those observed by spacecraft. Hayabusa found that the surface of Itokawa is covered by both smooth and rough terrains, which indicates the existence of regolith on its surface. He is now working on the formational processes of the regolith through image analysis and numerical modeling.

Hirdy is currently a Co-Investigator on a NASA MDAP award to PSI entitled *Investigations of Ice-Driven Degradation Styles on Mars.* This project, which also involves David Crown (PI), Dan Berman, and Frank Chuang, is designed to explore the geology of mid-latitudes in the northern and southern hemispheres of Mars with the intent to advance our knowledge of the history, abundance, distribution, and role of water/ice. This investigation links PSI's expertise in Martian geomorphology with Hirdy's abilities to model the emplacement of three-dimensional geologic flows. Hirdy and David Crown have also recently published a paper in the Journal of Volcanology and Geothermal Research entitled *A Simplified Two-Component Model for the Lateral Growth of Pahoehoe Lobes*, which reports on combined field, laboratory, and theoretical modeling of lava flows.

Hirdy lives in Tokyo with his wife, Yuki, and their newborn baby daughter, Mana. We are delighted that Hirdy has joined PSI.

Director's Note:
PSI Surveys Planetary Community

With U.S. solar system exploration facing continued pressure on its science programs from NASA management, PSI conducted a nationwide survey of the planetary science community to determine funding priorities for NASA science programs. The survey was co-sponsored by the University of Arizona's Lunar and Planetary Lab, the SETI Institute, and the Space Science Institute.

The response was huge.

Within hours, we had received hundreds of completed surveys. By the end, more than 1,000 people had responded, which, by some estimates, represents half of the planetary scientists in the United States. The survey showed that the planetary community has clear priorities: If science programs are to be cut at NASA, the flagship mission programs should be delayed or sacrificed first. Highest priority was given to preserving the small basic research and analysis programs and small competed mission programs (e.g., Discovery).

However, the community was also willing to stretch out small- and medium-mission opportunities if that would allow a flagship mission to be squeezed in. The critical role of the NASA research and analysis programs to solar system exploration was laid out in some detail by the more than 400 individual comments accompanying the survey responses (our community is not shy about expressing itself!). Many Representatives and Senators have made very supportive statements and circulated letters in support of restoring funds to these programs. Congress is finalizing the NASA budget for fiscal 2007, so we will see, hopefully soon, how our activities over the previous months will finally play out.

NASA Administrator Griffin was criticized by both Congress and the community for stripping the agency of its science advisory structure. A new advisory structure is being implemented, but it seems to be designed to funnel advice up to the NASA Administrator and only informally to the Science Mission Directorate, where science programs are managed. Nevertheless, PSI will continue to provide input to whatever process is put in place.

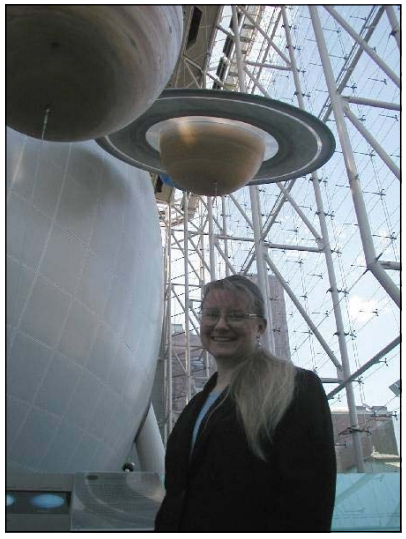
Mark Sykes
July 2006

Award-Winning PSI

Thanks to 3M Foundation

PSI is especially pleased to acknowledge the 3M Foundation for generously awarding a $5,000 grant to our California Science Education Field Trip Program. 3M ESPE representatives Eric Feldhaus and Mari Simonson presented the check in May, 2006, at our Laguna Niguel field trip classroom. The picture (above) features, from left to right, Bill Schramm (PSI Field Trip Program Director), Eric Feldhaus (Product Manager, 3M ESPE, Irvine, CA), and Sylvia McDonald (PSI Field Trip Program Administrator).

We offer our sincere thanks and deepest appreciation to the 3M Foundation for their generous support of this valuable community program for Orange County elementary school students!



Jennifer Grier appointed new DPS Education Officer.

We are proud to report that in April, 2006, the Division of Planetary Sciences (DPS) Committee elected Jennifer Grier to the position of Education Officer for a three-year term expiring at the 2009 Fall DPS meeting. She will be leading the Education and Public Outreach Subcommittee (EPOS) — an important group within the DPS that has been under the leadership of Larry Lebofsky (a former PSI employee) for many years.

Congratulations, Jennifer!

ONR Commends PSI

PSI staff received a commendation from the Office of Naval Research (ONR) for the timeliness and accuracy of its reporting on the NASA grants that ONR processes. PSI's efforts in this area "contributed significantly to ONR San Diego exceeding its closeout goals." During the presentation, ONR representative Renee Luna noted that the PSI administrative team earns the highest marks at ONR for its continuing performance.

Bravo, Team PSI!

Receiving an award from ONR, from left: Kelly Yoder, Mark Sykes, Bruce Barnett, Renee Luna (ONR), and Mary Lolos. Elaine Owens is absent from the picture.

Award from Fluor Foundation

PSI expresses its great appreciation to the Fluor Foundation for its recent award of $1,500 to help support the PSI California Science Education Field Trip Program, which is operated from our Laguna Niguel office.

We are grateful to Fluor for giving us this opportunity to continue with our much needed science program for school-age children. Through assistance like this from Fluor, and other companies, we will be able to go on with our mission to foster science literacy in the general public by helping students continue to experience the wonders of science and promote their academic success in the future.

Thank you, Fluor Foundation!

PSI Welcomes Matt Chamberlain

In early 2006, Matt Chamberlain started work as a postdoctoral research scientist at PSI, having moved from the Lunar and Planetary Laboratory (LPL), University of Arizona, where he earned his Ph.D. His current research is thermal modeling of surfaces of Mars and asteroids.

Growing up in Sydney, Australia, Matt developed an early interest in science and the outdoors, which led him to study geology and geophysics for a BSc from the University of New South Wales (UNSW). In 1993, as an undergraduate, he used magnetic and gamma ray data to map the geology around Wellington in central New South Wales.

After his initial academic years, Matt went walkabout, traveling and working in New Zealand, Canada and Central America. Along the way he looked for gold in Otago in the South Island, collected till samples for diamonds in the tundra of Victoria Island, and conducted electromagnetic surveys in British Columbia.

Back in Australia, Matt worked as crew chief for an airborne electromagnetic survey for a year before returning to UNSW and ultimately receiving a Graduate Diploma in Physics (1997-98). His graduate research included monitoring the sky brightness from the Antarctic Plateau, at a wavelength of 10 microns, the highlight of which was a trip to the South Pole.

Matt decided to go to the University of Arizona for his Ph.D. after reading about LPL in an article on the Lunar Prospector. In the meantime, he went back to work as a field geophysicist, this time doing ground-based electromagnetic surveys.

In 2000, Matt and his wife, Yen, arrived in Tucson. He began his Ph.D. at LPL doing infrared spectroscopy with Bob Brown and published a spectrum of Jupiter's moon Himalia taken with VIMS (Variable Infrared Mapping Spectrometer) during the Cassini flyby of Jupiter. The main part of Matt's dissertation was work done with Bill Boynton, using thermal models applied to the surface of Mars in order to predict where ground ice would be stable.

Here at PSI, he and Mark Sykes are applying these surface thermal models to asteroids. These models will be used to interpret ground-based infrared and sub-millimeter observations of asteroids and, hopefully, support the Dawn mission.

Matt Chamberlain, holding Corey, and Yen, with daughter Kiera, in the Colorado Rocky Mountains, 2005.

While in Tucson, Matt and Yen have become the proud parents of two adorable children: daughter Kiera Xuan (age 3) and son Corey Minh (1).

Being a keen outdoorsman, Matt particularly appreciates the incessant fine weather in Tucson. He is an avid runner and endurance athlete: his best time for 26.2 miles is 2:59:40, and he completed an ironman triathlon in just under 11 hours (Boulder, 2002). In 2000, he was fifth in the World Rogaining Championships (similar to orienteering). And if that weren't enough, just to prove that as a dad he can still keep active(!), he rode the 252-mile Cochise County Cycling Classic last year, and just completed his first 100-mile ultra-marathon this July, in 28:52.

Matt also acquired the taste for canyoning, or canyoneering, in the sandstone plateaus surrounding Sydney. In those days, he spent every weekend crawling into cold, wet, dark, rocky slots that have been sliced into the rocks there. While in Tucson, he has been active in exploring the creeks in the nearby mountains and finding that Arizona has its own canyons hidden away.

We are very pleased to welcome Matt to PSI!

Les and Jana, happy in their new home.

Bleamaster Relocates

Les Bleamaster and family moved to Texas in June. Although he will continue to be involved with PSI research and education in an off-site scientist position, we will miss his daily presence in the Tucson office.

Les's new address is 3635 Mill Meadow Drive, San Antonio, TX 78247.

Save Trees

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Thank you!

PLANETARY SCIENCE INSTITUTE Newsletter Published Quarterly

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