Mystery Mars Picture
William K. Hartmann & Dan Berman

During our work on the Mars Global Surveyor imaging team, we have occasion to study hundreds of images freshly sent from Mars. In past issues of this newsletter we've presented some examples. This feature is an attempt to bring you some interesting new images.

We picked the image shown here because it is completely weird! It shows what seems to be a tongue-shaped lobe of material, several hundred meters wide, that looks very much like it has flowed downslope through a gap between two hills, like molasses. This area lies on the sloping inner wall of a large crater, and the flow seems to be material that originated higher in the wall.

This image is part of a long strip-shaped image across a Martian crater at latitude -38 degrees and longitude 247 degrees, an area of very old surface, known for so-called softened terrain. At PSI we have developed the hypothesis that some of the softening is related to viscous flow in ground ice deposits, known to exist at these latitudes. In other words, the area is something like arctic tundra, and the flow we see here may be an actual glacial feature, where ice-rich soil has flowed downhill. Other similar features, not so beautifully defined, can be found nearby.

The image is cataloged as M18-00897 and is used courtesy of NASA, JPL, and Malin Space Science Systems. More Mars images can be found on a fantastic web site maintained by the builders of the Mars Global Surveyor camera, Malin Space Science Systems. Their web site is www.msss.com.

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A view of the RCT taken right after it was painted. In this photo by Gil Esquerdo, the telescope appears to be painted in shades of purple. This effect is caused by the fact that the dome slit was only partially open to keep any paint spray from leaving the dome. You can also see the light banding effect on the inside of the dome in the back of the photo. So rest assured that the telescope mount is all one color, one wonderful purple color!

The Robotically Controlled Telescope (RCT) Project: AN UPDATE  Don Davis

PSI scientists Steve Howell and Don Davis attended the spring meeting of the RCT consortium hosted by Dr. Don Walter at South Carolina State University (SCSU) in Orangeburg, S.C. on April 15-16, 2001 (yes, the 15th was Easter Sunday). In addition to reviewing progress on the refurbishment of the telescope, the participants discussed options for obtaining one new consortium member to replace UC Berkeley who declined to participate when it came time to formalize the consortium. The issue of obtaining a maintenance contract with EOST was addressed and negotiations with EOST are currently under way. The CCD camera has been ordered from SITe in San Diego, CA; we expect delivery by late August. We hope to have "first light" at the refurbished RCT by late autumn and acceptance testing completed by the end of 2001. Science observations are anticipated to begin in early 2002.

The formal RCT meeting was augmented by a luncheon with the President of SCSU, the Dean of Science, several of the physics faculty, and interested students. Dr. Richard Gelderman wowed the audience with a visually exciting PowerPoint presentation of the RCT and its science goals.

On a less positive note, we recently learned that the Research Corporation rejected our proposal for $15,000 to purchase computers and ancillary equipment for data acquisition and analysis for the RCT Extra-Solar Planet Search. While we will seek other funding sources, the project is being seriously jeopardized by the lack of computers and scientists to do data reduction and analysis, particularly given that we plan to start science observations in 7-8 months. Without additional support we fear that the data bits will be "warehoused," not the way we want to start the project. Meanwhile, additional proposals are being written to generate science support. You can keep up on the latest RCT news at the website: http://www.psi.edu.rct.

Much progress has been made on refurbishing the 50" telescope on Kitt Peak since the last newsletter.

Let us know what you think of the new paint job - - it was the talk of the mountain!
JUMPING JUPITERS!

or

Solving the Mystery of Planets around Other Stars

William K. Hartmann & Stu Weidenschilling

One of the most exciting developments of 1990s astronomy was the discovery of planets orbiting other stars. This proved that our solar system is not unique - or did it? None of these newly discovered systems looks like our own. Of more than sixty planets discovered to date, all are huge, most with masses comparable to Jupiter's or larger. That is not totally surprising as big planets are easier to find, and present methods are not sensitive enough to detect Earth-like planets. The real surprise is their orbits. Most are close to their stars, some at distances as small as a few percent of Earth's distance from the Sun. Also perplexing is the fact that many of these planets have eccentric orbits, swooping close to their stars and then moving much farther away during the course of their short "year."

It is believed that planets start to grow from dust grains, debris left over in nebulae around young stars. They collide and aggregate into larger bodies. The gravity of the largest bodies allows them to sweep up the rest of the mass near their orbits in donut-shaped zones around the star. The most widely accepted theory assumed that hydrogen-rich giant planets like Jupiter could form only in the outer, cold part of a planetary system, where ice could condense. The ice would provide extra mass for growing planets, allowing their gravity to capture gas and turn them into giants. Jupiter-scale objects close to stars, where it would have been too hot for ice to condense, violate this idea. Researchers have sought ways in which planets that formed far from their stars could migrate inward, and how their orbits could be changed from orderly circles to elongated ellipses.

Stuart Weidenschilling of PSI's Tucson office is working to explain these strange planets in collaboration with Dr. Francesco Marzari of the University of Padua, Italy. They call their theory "Jumping Jupiters." They asked what would happen if three bodies grew large enough to capture gas, instead of the two (Jupiter and Saturn) that did so in our solar system? By integrating possible orbits on computers, they found that such systems are unstable. Each time two planets pass each other in their orbits, their large gravity disturbs each other's motion. Eventually their orbits become so eccentric that they can cross. Close encounters occur, allowing sudden large changes in their orbits, and a cosmic game of billiards ensues. The game may end with two planets colliding, but more often one is thrown out of the system completely. The inner survivor is typically left in an eccentric orbit closer to the star than the innermost starting orbit, and the outer in a much more distant orbit. Because the orbital evolution is so complex, it is impossible to predict the final orbits; it is necessary to perform many simulations and compile statistics of the outcomes. Stu and Francesco predict that most stars with one known close planet will eventually be found to have another one at a larger distance.

This work seems to explain some of the puzzles of extrasolar planetary systems. At the same time, it raises a philosophically interesting point: If a system of planets starts out with regular circular orbits, but may be disrupted when giant planets are thrown around, how common are systems like ours? A "rogue" Jupiter would probably throw smaller Earth-like planets into the star, or out of the system altogether, destroying any chance for life to evolve. Is the fact that our own system is so orderly due to the fact that we are here to observe it? Another project at PSI may help to answer that question. Steve Howell and his colleagues are proceeding with the development of an observational method that may detect many more planets. Stay tuned for future developments....
Robert J. Parks is known casually as Bob to his friends and fellow board members of the Planetary Science Institute’s Board of Trustees, of which he is the Treasurer. Having retired in 1987 from his notable scientific career, he now enjoys his retirement with such activities as windsurfing, snow and water-skiing, weekly tennis, folk dancing, and active swimming and hiking. He also has over 1200 hours in the air flying light planes and as a soaring pilot.

As a student, he graduated with honors from the prestigious California Institute of Technology, and soon became employed by that same institute working at the Jet Propulsion Laboratory (JPL) in Pasadena, California. During his time there he oversaw several of the most notable projects in unmanned space exploration history, including acting as Voyager project manager and overseeing nearly all of the Mariner probes and the Viking orbiter-lander project to Mars. As Director of Unmanned Lunar and Planetary Missions at JPL, he oversaw probes to every planet in the Solar System except Pluto. Mr. Parks maintains his marriage of fifty-four years and raised three sons. This remarkable success is due, as his wife Hanne says, to common interests and continually enjoying activities together. Their active camaraderie is a source of happiness for both.

The work he does now for the PSI keeps him close to the fervent scientific activity with planetary science. When asked about his current position, he said he is “very happy to be on the Board of Trustees here at PSI,” and “very positive about the work being done.” His own work during his career was as historically important as it was scientifically significant, and it is no surprise that the mysteries of the Universe still captivate his attention. Outside of his love for sports, keeping up on the latest ideas and discoveries in the rapidly evolving field of modern cosmology is his favorite pastime. His wife describes him as a man of wisdom and a lover of books. One can easily see what a value to have this man, so instrumental to the exploration of our neighborhood of the universe, and so thoughtful about its elusive nature, still active and curious, and devoted to the Planetary Science Institute.

Program Director Dick Kenealy Injects Fun into Science Education

Dick Kenealy’s presentation is “excellent for creating interest in becoming scientists or furthering their science background,” says a satisfied teacher who recently attended a science education field trip program for elementary school students presented by PSI.

A retired college professor and engineer, Dick Kenealy volunteers at PSI giving lectures, demonstrations, and creating and supervising “hands-on” activities as part of the field trip program. He also maintains a curriculum that relates directly to many California Science Content Standards that are in place for teachers today.

While the “Journey through the Solar System” field trip primarily deals with planetary science, physical science, earth science, thermal energy, and earth system energy, investigation and experimentation are also covered in the 2½ hour program. Fun and exciting demonstrations involving liquid nitrogen and dry ice are used to introduce basic principles of chemistry and physics.

Kenealy’s degrees include Bachelor of Science in Electrical Engineering and Master of Science in Physics. After working in industry as an engineer for several years, Kenealy began teaching physics, astronomy, and electronics courses at L.A. City College, California State University Los Angeles, and East L.A. College, which included 13 years as Department Chairman. He taught for over 30 years and began volunteering at PSI in 1992.

“Dick Kenealy is the heart and soul of our field trip program,” says Don Davis, Director of the Institute. When asked why he volunteers his time at the Institute, Kenealy mentions that he has accumulated a lot of knowledge during his 30 years of teaching and wants to share it with elementary children to help them develop an interest in science.

A resident of San Juan Capistrano for over 14 years, Kenealy enjoys racquetball and spending time with his boogie board at the beach in San Clemente. His wife Peggy also volunteers at PSI during the activity portion of the program.

To reach Dick Kenealy or PSI call (949) 240-2010, visit the web site at www.psi.edu.

SCIENCE EDUCATION HIGH PRIORITY AT PSI

Our California office has a fantastic science education field trip program for elementary school students that is held throughout the school year. Please contact the Institute at 949/240-2010 or go to our website www.psi.edu for more information.

CORRECTION
Please excuse our error in the last issue.
As we all know,
NEAR-Shoemaker’s descent was to the surface of Eros, not Mars!!
Our face is red!
Recent months have been exciting at PSI. First, we welcome three new staff members: Dr. Catherine Weitz, Dr. David Crown and Dr. Melissa Lane. Cathy joined us on May 21, 2001, and she will be on assignment at NASA Headquarters where she is the Deputy Scientist for the Mars 2003 Rover Project. David joined our staff at the beginning of this month as a Research Scientist. He got off to a rousing start by having his proposal for Mars research funded even before he arrived at PSI. David is located in Pittsburgh for the next year, and we hope that he will join us in Tucson after that time. Melissa was successful in getting her Mars proposal funded and will work as an off-site PSI scientist in Tempe, Arizona. Congratulations to all!

Dr. Bruce Betts completes his stay at NASA Headquarters at the end of this month. Bruce is returning to southern California where he will divide his time between Mars research at PSI and directing science education programs with The Planetary Society in Pasadena. Welcome back, Bruce. And, Bruce was also instrumental in bringing Cathy, David and Melissa to PSI. Thanks, Bruce, for recruiting such excellent talent.

Dr. Elena Mason, fresh from defending her Ph.D. thesis at Wyoming in April, returned to Italy for a well deserved vacation before assuming her new position as a post-doctoral researcher at the European Southern Observatory in Chile. Best wishes, Elena.

PSI is becoming a very distributed organization: currently we have offices in Tucson and southern California, along with off-site employees in Boston, Pittsburgh, Phoenix and Washington, D.C. The ability to attract top-notch scientific talent is enhanced by being geographically flexible. A challenge that comes with this is the lack of frequent face-to-face contact. This obstacle can be overcome through diligent use of email, telephone and fax - but it takes a conscious effort to maintain communications and keep everyone aware of the full range of activities at PSI. Suggestions as to ways to improve communications within our coast-to-coast Institute are always welcome.

Students find Possible New Gravitational Lens in the FSVS

Kunegunda Belle

Being a diligent reader of the PSI newsletter, I am sure that you recall a previous article by Mark Huber detailing the Faint Sky Variability Survey. But just in case you accidentally missed that issue.... The Faint Sky Variability Survey (led in part by Steve Howell) was initiated to study faint and variable sources using the Wide Field Camera on the Isaac Newton Telescope on La Palma. The FSVS is already proving to be a gold mine of fascinating new objects, yet there is still more to uncover. I realized that this type of survey was ideal for finding gravitational lenses. Briefly, gravitational lensing is an astrophysical phenomenon which occurs when (in the case of extra galactic objects), a low red shift (nearby) galaxy is along our line of sight to a high red shift (far away) quasar and bends the light from the quasar, causing multiple images of the distant quasar to be visible.

Why are we interested in discovering gravitationally lensed quasars? Gravitational lensing has proven to be a powerful tool for investigating a variety of astrophysical phenomena. From determining cosmological parameters to peering into the inner regions of quasars, the action of gravitational lensing allows us a glimpse into the universe which modern technology and telescopes can not obtain by themselves. Since the discovery of the first gravitationally lensed quasar, gravitationally lensed systems have been used to determine Hubble's constant, constrain the cosmological constant, and study the mass distributions of medium red shift galaxies.

Mark Huber and I plan to obtain confirming spectroscopic observations this summer using the 4-m William Herschel Telescope located on the Canary Islands.
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William and Janet Romanishin

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Gilbert A. Esquerdo, Undergraduate Research Assistant
Ethan Goldman, Student Researcher
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