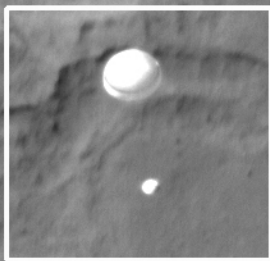
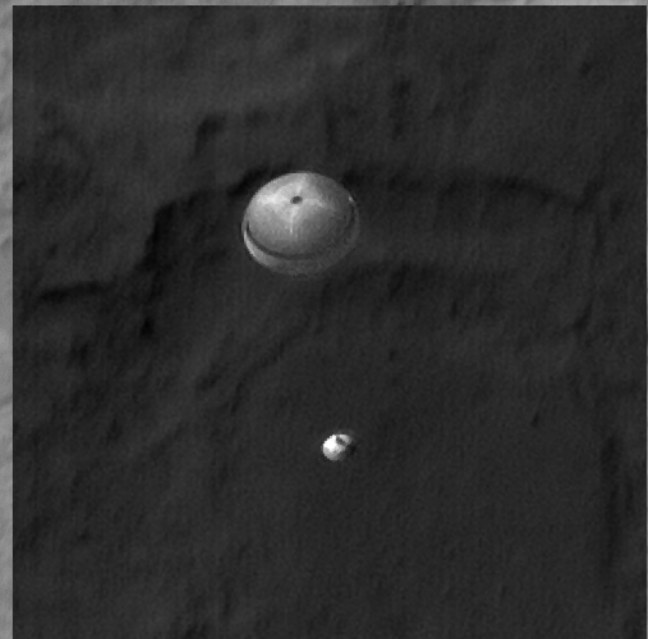


Lunar and Planetary Laboratory Newsletter

One for the History Books



NASA's Curiosity rover and its parachute were spotted by NASA's Mars Reconnaissance Orbiter as Curiosity descended to the surface on Aug. 5, 2012 PDT (Aug. 6 EDT).



The High-Resolution Imaging Science Experiment (HiRISE) camera captured this image of Curiosity while the orbiter was listening to transmissions from Curiosity.

Curiosity and its parachute are in the center of the white box; and a separate image is a smaller cutout of MSL stretched to avoid saturation. The rover is landing on the etched plains just north of the sand dunes that fringe "Mt. Sharp" (Aeolis Mons).

The parachute appears fully inflated and performing perfectly. Details in the parachute such as the band gap at the edges and the central hole are clearly visible. The cords connecting the parachute to the backshell cannot be seen, although they were seen in the image of Phoenix descending, perhaps due to the difference in lighting angles.



Welcome from the Director

Welcome to the first print edition of the LPL newsletter! We are going retro, adding an abbreviated print newsletter to the online edition available at http://www.lpl.arizona.edu/newsletter/fall_2012. One way to look at it is that the print edition is more for friends who just want to know what LPL is and what great things we've been doing, while the online edition contains all the "family" stories—who graduated, who had a baby (there always seem to be enough to have at least a couple of cute baby pictures), who has been doing things in their lives that the rest of the extended family may not have heard about. As always, we'd love to hear from former LPLers, both alumni and former faculty and staff.

New, too, beginning with this edition, is a spotlight on donors and gifts to LPL. The Lunar and Planetary Laboratory has accomplished some amazing things over its five-decade history, in the research that has been accomplished, the students who have been educated, and the spacecraft missions, asteroid surveys, and other technical programs that have been operated. In an environment as creative as this, it's not surprising that there are always a host of good ideas of things to do next. Some get funded (often by NASA), and become the success stories we all know. Many of these never get done because we never find a way to pay for them. Although we never expect gifts to replace the funding that we receive from the state for faculty salaries, or that we win in competitions for NASA grants and contracts, there are times when gifts make it possible for us to do things we couldn't do otherwise, or do the things we do better.

Beginning with this newsletter, we're going to try to spend a little space each time highlighting some gifts we have received, or specific activities that have been made possible by gifts. Also, we wanted you to know that there is a "wish list" of ideas that various people around the department have suggested. The full list contains about 40 items, ranging in amount from about \$30 (for a subscription to a magazine for the department library) to about \$20 million (to establish a world-class research center in an area where we already have a considerable amount of expertise, such as meteorite studies or theoretical astrophysics). We'd be glad to share the full list, but for now, the idea is just to provide food for thought.

For more information about opportunities for supporting LPL, contact me at tswindle@lpl.arizona.edu. Or, if you already know you're interested in helping out, you can just send a check, made payable to "University of Arizona Foundation" and with a note that it is for LPL, to our departmental address, 1629 E. University Blvd., Tucson AZ 85721. In the next few months, our web site will allow donors to give online.

In other news, it is my distinct pleasure to welcome Professor **Joe Giacalone** as the Assistant Department Head. Joe will primarily be responsible for curriculum issues at both the undergraduate and graduate levels. Since he has extensive experience teaching at both levels, as well as having been deeply involved with the graduate program in a number of other ways, he is uniquely suited to the job, and I'm grateful to have him in a leadership role.

LPL continues to produce great science (see the back page for links to more research news than we have in the print edition) and to find creative ways of sharing science with the community. Enjoy the newsletter!



Tim Swindle



DEPARTMENT

Assistant Department Head Named



Professor Joe Giacalone was named Assistant Department Head for the Department of Planetary Sciences. As Assistant Head, he oversees academics and student affairs, including admissions and curriculum, for the Department of Planetary Sciences.

Joe has been with LPL since starting as a post-doctoral research associate in 1993.

More information about Joe is available from his [web page](#).

NEWS

OSIRIS-REx Scientists Measure Yarkovsky Effect

Scientists with the University of Arizona-led asteroid sample return mission OSIRIS-REx have measured the orbit of their destination asteroid, 1999 RQ36, with such accuracy they were able to directly determine the drift resulting from a subtle but important force called the Yarkovsky effect – the slight push created when the asteroid absorbs sunlight and re-emits that energy as heat.

“OSIRIS-REx science team members **Steve Chesley** and **Mike Nolan** [LPL alumnus 1994] have achieved a spectacular result with this investigation,” said **Dante Lauretta**, the mission’s principal investigator and professor of planetary science at the UA. “This study is an important step in better understanding the Yarkovsky effect – a subtle force that contributes to the orbital evolution of new near-Earth objects.”

Lauretta added that “this information is critical for assessing the likelihood of an impact from our target asteroid and provides important constraints on its mass and density, allowing us to substantially improve our mission design.”

NASA detects, tracks and characterizes asteroids and comets passing close to Earth using both ground and space-based telescopes. The Near-Earth Object Observations Program, commonly called Spaceguard, discovers these objects, characterizes a subset of them, and establishes their orbits to determine if any could be potentially hazardous to our planet.

What OSIRIS-REx scientists are beginning to learn about Yarkovsky drift strengthens the idea that “the Yarkovsky effect can be used to probe the physical properties of asteroids that we can’t visit with spacecraft,” team member Chelsey said.

Recent Retirees

Bradford Castalia, a Principal Applications Systems Analyst/Developer with PIRL/HiRISE retired from LPL at the end of September 2012. Brad started at LPL in 1984.

Linda Hickcox, Senior Business Manager for HiRISE, retired on September 28, and promptly returned to a part-time version of her position on October 1. Linda began her career at LPL in 1987 as a Secretary II for PIRL.

Marianne Hamilton, who had been with LPL since 1980, returned to work part-time after her formal retirement in 2010. This past May, Marianne moved into a new position as an administrative assistant with the UA Tree Ring Laboratory.

Donita Vanture started at LPL in 1997 and supported staff for the Lunine and Jokiipii groups, as well as supporting the Theoretical Astrophysics Colloquium. Donita retired from the UA in July 2012.

FACULTY

Joellen Russell appointed

Dr. Joellen Russell, Associate Professor in the UA Department of Geosciences, has been named to a courtesy joint appointment in the Department of Planetary Sciences and Lunar and Planetary Laboratory. Professor Russell is currently serving as the major advisor for PTYS graduate student Juan Lora. She is collaborating with Assistant Professor Daniel Apai on a pending NASA astrobiology proposal, and continues her work with former LPL faculty member, Jonathan Lunine. Professor Russell earned her Ph.D. in Oceanography from Scripps Institution of Oceanography, University of California, San Diego: “The Biogeochemistry of Southern Ocean Intermediate and Mode Waters.”



OUTREACH

Summer Science Saturday a Success!



On July 28, 2012, LPL hosted Summer Science Saturday, a day-long celebration of science in anticipation of the landing of the MSL Curiosity Rover.

The event was a great success, with over 700 Tucsonans visiting LPL to learn about Mars, spectroscopy (PTYS graduate student Rob Zelle), and meteorites (LPL Meteorite Guru Dolores Hill). Mike Farmer displayed his Martian meteorites. The UA Department of Entomology and Insect Science brought bugs! Dr. Denise Meeks (Pima Community College NW) helped young people make planispheres. Sanlyn Buxner and Rob Bovill (Planetary Science Institute) compared and contrasted the Earth and Mars. Tucson's Titan Missile Museum brought a Newton's cradle, which demonstrates Newton's laws of motion. Professor Cecile McKee (UA Dept. of Linguistics) and her volunteers made spectrograms of visitor names. OSIRIS-REx was represented by Oliver Beres and Ross Dubois; they were a hit with their Comet Ice Cream (whole milk, salt, and comet additives)!



The Girl Scouts of Southern Arizona (GSSA) brought a renewable energy system that uses solar and micro hydro power, designed and built by the GSSA and the Tucson Solar Guild at Power Up camp—what a hit on a hot July day! Volunteers from the National Optical Astronomy Observatory spent the day making comets, using slinkys to demonstrate optical illusions, and helping the youngest guests make Play-Doh planets. One of the most popular stops was the Robotics activity (hosted by Caryl Jones and her volunteers from the Catalina Foothills Community Schools). David Acklam from the Kuiper Circle Outreach Committee told visitors all about LPL, and Kellee Hanson was there to represent the College of Sciences.

There were lectures by Dr. Veronica Bray (“The Dramatic Formation of Gale Crater: What Happens When an Asteroid Hits a Planet?”), Assistant Professor Shane Byrne (“Wet Clay on Ancient Mars”), and Professor Alfred McEwen (“HiRISE Imaging of Mars Landing Sites, Landers, and Rovers,” presented by Shane Byrne). And Dr. Bruce Bayly and his Physics Factory crew were, as always, super fun, educational, and engaging.



OUTREACH

LPL Co-hosts Venus Transit Viewing

LPL partnered with the Planetary Science Institute (PSI) and Flandrau Science Center to help Tucsonans view the June 5 transit of Venus. Viewing and lectures took place from 3 to 8 p.m. There were telescopes on the mall, and lots of eclipse glasses were available. Visitors could watch various live feeds of the transit. PSI Senior Education Specialist (and retired LPL faculty member) **Larry Lebofsky** lectured about the transit.

Hundreds of Tucsonans donned their transit glasses to enjoy the viewing party and a good time was had by all!

NEWS

Study: Better Odds That Life Crashed to Earth From Space

Chunks of rock laced with ingredients for life or early life forms could have traveled among our solar system and others much more frequently than previously thought possible, an international team of researchers including **Renu Malhotra** in the University of Arizona Lunar and Planetary Laboratory has discovered.

The researchers report in the journal *Astrobiology* that under certain conditions, there is a high probability that life came to Earth – or spread from Earth to other planets – during the solar system’s infancy when Earth and its planetary neighbors orbiting other stars would have been close enough to each other to exchange lots of solid material.

The findings provide the strongest support yet for “lithopanspermia,” the idea that basic life forms are distributed throughout the universe via meteorite-like planetary fragments cast forth by disruptions such as planet and asteroid collisions. Eventually, another planetary system’s gravity traps these roaming rocks, which can result in a mingling that transfers any living cargo.

“We wanted to know how debris left over from the formation of our solar system can get transported from one planetary system to another,” said Renu Malhotra, a professor of planetary science. “Even today, some of

Science Downtown

This past summer, LPL graduate students **Meghan Cassidy, James Keane, and Rob Zellem** were given the chance to run the Mars + Beyond exhibit at Tucson’s Science Downtown.

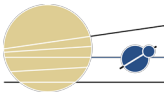
Along with LPL’s **Maria Schuchardt** and **Dolores Hill**, the grads held two public events which attracted over 500 people. “We were extremely excited for the amount of interest and support we received for our events at Science Downtown. We had a few outside groups run some activities, like UofA Connections [a University science outreach group] and Pima Air and Space Museum. The hundreds of people who came to our events just speaks volumes on how hungry Tucson is for science---they came to the events despite the summer heat and the downtown streetcar construction. We also made some great connections with other grads not only in LPL but also in other departments.”

While Science Downtown is slated to close this fall, Zellem hopes to bring this summer’s energy and experience on-campus to help promote the LPL brand.

these rocks leak out of the asteroid belt and hit planets,” she said. “That’s how we get meteorites. Some of them land on other planets, and some get thrown out of the solar system.”

“With this study, we wanted to find out what happens to those small rocks that are thrown out and escape the solar system. Where do they go?”

Previous research suggested that, typically, those small rocks called meteoroids leave the solar system at high speeds, making the chances of being snagged in the gravitational pull of another object highly unlikely.



GRADUATE



Three New Graduate Students for Fall 2012

LPL welcomed three new graduate students for the 2012/2013 academic year:

Ali Bramson: graduate of the University of Wisconsin, B.S. in Physics and Astronomy, working with Shane Byrne

Davin Flateau, B.S. in Physics from the University of Cincinnati, working with Daniel Apai

Jess Vriesema, M.S. in Physics from the University of Arizona and B.S. in Physics from Calvin College; working with Tamara Rogers

Welcome Ali, Davin, and Jess!

Recent PTYS/LPL Graduates



Fan Guo defended his dissertation titled “Effects of Turbulent Magnetic Fields on the Transport and Acceleration of Energetic Charged Particles: Numerical Simulations with Applications to Heliospheric Physics.” Joe Giacalone was Fan’s dissertation advisor. Fan will continue as a Research Associate with Joe Giacalone until graduation in December. He will then begin a postdoctoral position with the University of Alabama, working at the Los Alamos National Laboratory.

Priyanka Sharma defended her dissertation titled “Investigations of Titan’s Topography and Surface Roughness” on June 1, 2012. Shane Byrne was Priyanka’s dissertation advisor. She is currently a postdoctoral researcher at Caltech.

Congratulations to Fan and Priyanka!

Newest NESSF recipients

Three PTYS graduate students are recipients of new (Fall 2012) NASA Earth and Space Science Fellowship awards:

Juan Lora: “Modeling Titan’s Atmospheric Dynamics and their Interaction with Methane” (Russell)

Jamie Molaro: “Thermal Stress Weathering in the Inner Solar System” (Byrne)

Christa Van Laerhoven: “Secular Dynamics of Multi-Planet Systems: Implications for the History, Physical Characteristics, and Habitability of Planets” (Greenberg)

Congratulations to the newest recipients, and also to **Catherine Elder** and **Lissa Ong**, whose NESSF awards were renewed.

GTA Award

PTYS graduate student **Rob Zellem** is the recipient of the Outstanding Graduate Teaching Assistant Award for Spring 2012.

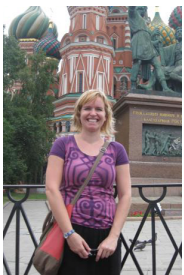
Rob earned the award for his work as a GTA for Professor Peter Smith’s PTYS 214 (Astrobiology) course. The student nomination forms cited Rob for well prepared lectures, for setting up telescope nights, for making complex concepts easy to understand, and for making learning fun. Rob worked closely with Peter Smith to design the two midterm exams and was proactive in asking for opportunities to teach the class.



INVEST IN LPL

Summer Travel for Shandel Award Recipients

This year, LPL was fortunate to be able to fund summer research travel for three graduate students thanks to support from the Shandel Education Plus Fund in Planetary Sciences and LPL. This fund was established by a generous donor and friend of LPL for the purpose of supporting travel expenses outside the state of Arizona during summer break. The award is open to students in the Department of Planetary Sciences and Lunar and Planetary Laboratory who propose to fund study, museum visits, special exhibits, seminars, instruction, competitions, research and other endeavors that are beyond those provided by the normal campus environment and are not part of the student's regular curriculum during the recipient's school year.



Ingrid Daubar traveled to Moscow to attend the 7th European Strategic Meteor Workshop: The Meteoroid Flux in the Martian Satellite System—Models, Predictions, Observational Data, and Implications.



Cecilia Leung spent much of Summer 2012 at the Southwest Research Institute in Boulder, where she became proficient in the use of the mesoscale numerical model MRAMS (Mars Regional Atmospheric Modeling System).



Juan Lora attended the Summer School on Atmospheric Modeling hosted by the Geophysical Fluid Dynamics Laboratory at Princeton. The purpose of this summer school was to introduce students to the

"art" of climate modeling (aspects of modeling that are typically neither taught nor formally presented), using the latest Earth model, Atmospheric Model 3, developed at the lab.

Largest Meteorite Hunt in History Yields Treasure for UA

To the untrained eye, the black, smooth-edged lump that is sitting under a glass cover looks similar to a piece of charcoal. But to scientists **Dante Lauretta** and **Ed Beshore** from the University of Arizona Lunar and Planetary Laboratory, it is one of the most intriguing stones they have ever seen.

"This meteorite is the oldest rock you'll ever find on Earth. In fact, it formed 50 to 60 million years before the Earth even existed," said Lauretta, who is a professor of planetary science and principal investigator of NASA's OSIRIS-REx mission, which will send a spacecraft to return a sample from an asteroid in 2023.

On the morning of April 22, around 8 a.m., residents of Nevada and California looked up when a bright fireball streaked across the sky, followed by a boom that rattled windows all across the Sierra Nevada. Some later said the flash of light was so blinding it made them think of a nuclear explosion.

It turns out they weren't too far off: NASA later stated a meteorite that plunged deep into the Earth's atmosphere, scattering shrapnel across a remote, mountainous area near Sutter's Mill in California, blew up with about one-third of the energy of the Hiroshima bomb.

Professional meteorite hunters Michael Farmer, Greg Hupe and Robert Ward, who recovered several chunks of the meteorite, have donated samples to the UA Lunar and Planetary Laboratory for scientific study. They estimated the parent asteroid to be roughly van-sized and weighing as much as 10 (empty) semi-trucks, before it hit the atmosphere over Nevada and California.

"The Lunar and Planetary Laboratory has a long tradition of working with the commercial meteorite community for the benefit of planetary science," Lauretta said. "We are especially grateful to Michael, Greg and Robert for this contribution along with the many other valuable specimens they have donated to LPL over the years."

Links to LPL News Stories

LPL Builds Excitement for Mars Landing with Summer Science Saturday

<http://uanews.org/videos/lpl-builds-excitement-mars-landing-summer-science-saturday>

Asteroid 1999 RQ36 Needs a Name!

<http://osiris-rex.lpl.arizona.edu/?q=node/503>

UA Mars Camera Helped Find Landing Spot, Snaps photo of Rover

<http://uanews.org/story/ua-mars-camera-helped-find-landing-spot-snaps-photo-rover>

100 days of science: Lab's Cameras Give Us Images from Other Spheres

<http://bit.ly/OFFgG3>

Rules of Planetary Placement

<http://bit.ly/SYHnJN>

Asteroid 1999 RQ36 Needs a Name!

<http://osiris-rex.lpl.arizona.edu>

OSIRIS-REx Scientists Measure Yarkovsky Effect

<http://uanews.org/node/47370>

Largest Meteorite Hunt in History Yields Treasure for UA

<http://uanews.org/node/47273>

The Flowing Sands of Mars

<http://uanews.org/node/47170>

Study: Better Odds that Life Crashed to Earth from Space

<http://uanews.org/story/study-better-odds-life-crashed-earth-space>

Scientists add 3-D twist to pictures from moon probe

<http://on.today.com/V51kgw>

Bounce, Skid, Wobble: How Huygens Landed on Titan

<http://uanews.org/story/bounce-skid-wobble-how-huygens-landed-titan>

Mars Mission Red All Over

<http://www.arizona.edu/features/mars-mission-red-all-over>

