

The Stargazer

July 2006

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		(change 'at' to @ to send email)	http://members.tripod.com/everett_astronomy

EAS BUSINESS...

**NEXT EAS MEETING - WEDNESDAY JULY 12TH
AT 6:30 PM AT THE EVERETT PUBLIC LIBRARY, IN
THE AUDITORIUM (DOWNSTAIRS)**

THIS MONTH'S MEETING PROGRAM:

July 12th (Wednesday night) presentation will be speaker **Carlton Rhoades**, discussing "The Next Asteroid" - near-Earth asteroids - risks, and strategies for addressing them. The presentation is from an expanded outline of a book in process, for the general readership.

The science part is explained in simple terms backed up by graphics. What is known and, importantly, not known is sorted out. This is organized in four sections:

- Just what are they?
- What happens if one comes along?
- Are we vulnerable?
- What can/should we do to mitigate the threat?

Map to library - <http://www.epls.org/about/mlmap.htm>

**2702 Hoyt Avenue
Everett, WA 98201**

Directions to library - <http://www.epls.org/about/mldirect.htm>

STAR PARTY INFO

Upcoming EAS star party schedule:

EAS member Ron Tam has offered a flexible opportunity to EAS members to come to his home north of Snohomish for observing on clear weekend evenings and for EAS starparties. Anyone wishing to do so needs to contact him in advance and confirm available dates, and let him know if plans change. "Our place is open for star parties any Saturday except July 15 and weekends of the Full Moon. People can call to get weather conditions or to confirm that there is a star party. Our phone number is (360) 568-5152. They can e-mail me too (tam1951@nwink.com) but I don't check my email daily. They can email me for directions if they never have been out here."

People should send also mail to the mail list to coordinate spur-of-the-moment observing get-togethers, on nights when the sky clears. We try to hold informal close-in star parties each month during the spring, summer, and fall months on a weekend near the New moon at a member's property or a local park. (call Mike Locke at (425) 259-5995 for info or check the EAS website.) Members contact Mike Locke for scope borrowing.

Other Western US Star Parties this season:

Jul 20-22 – Table Mt. Star Party (TMSP) 2006
<http://www.tmspa.com/> Ellensburg WA (sold out)

Jul 26-30 - Mt Bachelor Star Party (MBSP) 2006
<http://www.mbsp.org/> Mt. Bachelor (Bend) OR

Jul 28-30 - Klickitat July 2006 Star Party
<http://klickitatstarparty.net/> Goldendale WA

Jul 28-30 - Blue Mountain Star Party
http://www.tri-cityastronomyclub.org/bluemtn_starparty.htm Ukiah, OR

Aug 05-07 - Montana Starwatch, 2005 Great Falls, Montana
<http://www.montana.edu/smasweb/swatch.html>

Aug 11 - RCA Perseid Meteor Shower Watch - Rooster Rock State Park - located 22 miles east of Portland on I-84 (east of Sandy River) at exit 25, starting at 7:30 pm. Parking is \$3 per vehicle. For possible weather cancellation, call (503) 797-4610 for latest info. <http://www.onsi.edu/visit/planetarium/starparties.cfm>

Aug 24-27 – Oregon Star Party (OSP) Ochocco NF
<http://www.oregonstarparty.org/> Jul 28 reg deadline

Aug 19-Aug 27 - Mt. Kobau Star Party 2006
<http://www.mksp.ca/> Mt. Kobau, BC

Aug 18-20 - Klickitat August 2006 Star Party
<http://klickitatstarparty.net/> Goldendale WA

Aug 25-27 - Idaho Star Party
Bruneau Dunes State Park
<http://www.boiseastro.org/>

Sep 02 - RCA Autumnal Equinox Celebration - Rooster Rock State Park - located 22 miles east of Portland on I-84 (east of Sandy River) at exit 25, starting at 7:30 pm. Parking is \$3 per vehicle. For possible weather cancellation, call (503) 797-4610 for latest info. <http://www.onsi.edu/visit/planetarium/starparties.cfm>

Sep 20-23 - The Enchanted Skies Star Party 2006
<http://www.socorro-nm.com/starparty/> Socorro NM

Sep 22-24 - Klickitat September 2006 Star Party
<http://klickitatstarparty.net/> Goldendale WA

Sep 22-24 - Craters Star Party -
 Craters of the Moon National Monument, ID
<http://www.boiseastro.org/>

Sep 21-24 - Alberta Star Party 2006
<http://calgary.rasc.ca/asp2006.htm>

Sep 21-23 - California Star Party (CAS)
 San Jose Astronomical Association 2
 Lake San Antonio Park <http://www.sjaa.net/>

Oct 20-22 - Klickitat October 2006 Star Party
<http://klickitatstarparty.net/> Goldendale WA

Oct 19-22 - Annual Nightfall (RTMC)
 Riverside, CA

Nov 08 – RCA observing of the Mercury Transit
 OMSI East Parking Lot, Portland OR
<http://www.oms.edu/visit/planetarium/starparties.cfm>

\$\$ - FINANCIAL HEALTH - \$\$

The club maintains a \$650+ balance. We try to keep approximately a \$500 balance to allow for contingencies. .

CLUB SCOPES

SCOPE	LOAN STATUS	WAITING
10-INCH DOBSONIAN	ON LOAN	NO WAIT LIST
8-INCH DOBSONIAN	FREE	NO WAIT LIST

EAS members: contact Mike Locke at (425) 259-5995 or 'mlocke at lionmts.com' to borrow a scope.

ASTRO CALENDAR FOR 2005

July 2006

Jul 03 - Earth At Aphelion (1.017 AU From Sun)
Jul 12 – July EAS Meeting – Wednesday 6:30 PM Everett Public Library – NOTE WEEKNIGHT TIME !!!
Jul 20-22 – Table Mt. Star Party (TMSP) 2006
Jul 26-30 - Mt Bachelor Star Party (MBSP) 2006
 Jul 20 - 30th Anniversary (1976), Viking 1, Mars Landing
 Jul 29 - South Delta-Aquarids Meteor Shower Peak
 Jul 29 - Asteroid 15 Eunomia At Opposition (8.4 Magnitude)

August 2006

Aug 01 - Alpha Capricornids Meteor Shower Peak
 Aug 04 - Asteroid 6 Hebe At Opposition (7.8 Magnitude)
 Aug 06 - Southern Iota Aquarids Meteor Shower Peak
 Aug 07 - Mercury at Greatest Western Elongation
 Aug 10 - Mercury Passes 2.2 Degrees From Venus
 Aug 10 - Neptune at Opposition
 Aug 11 - Asteroid 1 Ceres Closest Approach To Earth (1.984 AU)
 Aug 12 - Perseids Meteor Shower Peak
 Aug 16 - Asteroid 1 Ceres At Opposition (7.6 Magnitude)
 Aug 20 - Mercury Passes 0.5 Degrees From Saturn
Aug 24-27 – Oregon Star Party (OSP) Ochocco NF
 Aug 25 - Northern Iota Aquarids Meteor Shower Peak
 Aug 26 - Venus Passes 0.1 Degrees From Saturn

September 2006

Sep 05 - Uranus at Opposition

Sep 07 - Partial Lunar Eclipse
 Sep 08 - 40th Anniversary (1966), 1st Star Trek Episode on TV
 Sep 22 - Annular Solar Eclipse
 Sep 23 - Autumnal Equinox (04:03 UT)
 Sep 23 - Cassini, Titan Flyby

October 2006

Oct 09 - Draconids Meteor Shower Peak
 Oct 17 - Mercury at Greatest Eastern Elongation (25 Degrees)
 Oct 21 - Orionids Meteor Shower Peak
 Oct 29 - Daylight Saving - Set Clock Back 1 Hour

November 2006

Nov 03 - Taurids Meteor Shower Peak
 Nov 08 - Mercury Transits the Sun
 Nov 13 - Asteroid 7 Iris At Opposition (6.8 Magnitude)
 Nov 17 - Leonids Meteor Shower Peak

December 2006

Dec 13 - Geminids Meteor Shower Peak
 Dec 22 - Winter Solstice, 00:22 UT
 Dec 22 - Ursids Meteor Shower Peak

January 2007

Jan 03 - Earth At Perihelion (0.983 AU From Sun)
 Jan 03 - Quadrantids Meteor Shower Peak
 Jan 08 - Stephen Hawking's 65th Birthday (1942)

February 2007

Feb 07 - Mercury at Greatest Eastern Elongation
 Feb 18 - Chinese New Year

March 2007

Mar 21 - Vernal Equinox, 00:07 UT

UW Astronomy Colloquium Schedule

The Astronomy Department weekly colloquium meets Thursdays at 4:00 pm in PAB A102 (the classroom part of the Physics/Astronomy Building complex).

OVER THE AIRWAVES

“Our group of radio script writers now consists of EAS and SAS members Jim Ehrmin, Greg Donohue, and Ted Vosk, who are now regularly writing and helping to produce our astronomy radio show, **"It's Over Your Head"** on radio station **KSER, FM 90.7**. The six-minute segment is broadcast **every Wednesday morning at approximately 7:20 A.M.** and gives a weekly look at what's up in the sky over Snohomish County, with other information. If you are a listener to the program, show your support by giving the program director of KSER a call!" Web page with lots of archives and other info is available at <http://www.itsoveryourhead.org/>

KPLU 88.5 FM National Public Radio has daily broadcasts of "Star Date" by the McDonald Observatory of the University of Texas at Austin, Monday through Friday at about 6:05 pm. The short 2 minute radio show deals with current topics of interest in astronomy. The University of Washington TV broadcasts programs from NASA at 12:00 AM Monday through Friday, 12:30 AM Saturday, and 1:30 AM Sunday on the Channel 27 cable station.

EAS LIBRARY – BOOK & VIDEO LIST

The EAS has a library of books, videotapes, and software for members to borrow. We always value any items you would like to donate to this library. You can contact a club officer or **Librarian Mike Locke**, phone (425) 259-5995, email mlocke at lioninc.com, to borrow or donate any materials. See list here:
http://members.tripod.com/everett_astronomy/eas_library.htm

MEMBERSHIP BENEFITS & INFORMATION

Membership in the **Everett Astronomical Society (EAS)** will give you access to all the material in the lending library. The library, which is maintained by Mike Locke, consists of several VCR tapes, many books, magazines, and software titles. Membership includes invitations to all of the club meetings and star parties, plus the monthly newsletter, *The Stargazer*. In addition you will be able to subscribe to *Sky and Telescope* for \$7 off the normal subscription rate, contact the treasurer for more information. Link to registration form: http://members.tripod.com/everett_astronomy/application.htm

(When renewing your subscription to *Sky & Telescope* you should send your S&T renewal form along with a check made out to **Everett Astronomical Society to the EAS address**. The EAS treasurer will renew your *Sky and Telescope* subscription for you. *Astronomy* magazine offers a similar opportunity to club members.)

EAS is a member of the **Astronomical League** and you will receive the Astronomical League's newsletter, *The Reflector*. Being a member also allows you the use of the club's telescopes, an award winning 10 inch Dobsonian mount reflector. Contact Mike Locke (425) 259-5995 to borrow a telescope. EAS dues are \$25.

Send your annual dues to the **Everett Astronomical Society**, P.O. Box 12746, Everett, WA 98206. Funds obtained from membership dues allows the Society to publish the newsletter, pay Astronomical League dues and maintain our library.

OBSERVER'S INFORMATION...

LUNAR FACTS

Jul 17	Last Quarter Moon
Jul 25	New Moon
Aug 02	First Quarter Moon
Aug 09	Full Moon
Aug 16	Last Quarter Moon
Aug 23	New Moon
Aug 31	First Quarter Moon
Sep 07	Full Moon
Sep 14	Last Quarter Moon
Sep 22	New Moon
Sep 30	First Quarter Moon
Oct 07	Full Moon

Digital Lunar Orbiter Photographic Atlas of the Moon

The Lunar and Planetary Institute has created a digital version of the Lunar Orbiter Photographic Atlas of the Moon, and Consolidated Lunar Atlas available online at:

<http://www.lpi.usra.edu/research/cia/menu.html>

http://www.lpi.usra.edu/research/lunar_orbiter

UP IN THE SKY -- THE PLANETS

Object	Rises	Transits	Sets	Con	Mag
Sun	5:21 am	13:14	21:06	Gem	-27.5
Mercury	Daylight	Daylight	Daylight	Can	+3.6
Venus	03:21 am	Daylight	Daylight	Tau	-3.9
Mars	Daylight	Daylight	22:44	Leo	+1.8
Jupiter	Daylight	20:17	1:22 am	Lib	-2.2
Saturn	Daylight	Daylight	22:13	Can	+0.4
Uranus	23:19	04:55 am	Daylight	Aqr	+5.8
Neptune	22:21	03:18 am	Daylight	Cap	+7.8
Pluto	Daylight	18:36	23:27	Ser	+13.9

(times local time for Everett PDT)

Transit times for Jupiter's Great Red Spot in 2006

http://skyandtelescope.com/observing/objects/planets/article_107_2.asp

NOAA SUN CALCULATOR

Need to know exactly what time the sun will set on Sept. 26, 2065? Or when it rose in 565 BC? How about the length of daylight a week from Tuesday in Albuquerque, N.M.? Just go to NOAA's solar calculator, now available on the Web. <http://www.srrb.noaa.gov/highlights/sunrise/gen.html>

INTERNATIONAL SPACE STATION – VISIBLE SEATTLE PASSES

ISS Visibility –

<http://spaceflight.nasa.gov/realdata/sightings/SSapplications/Post/SightingData/Seattle.html> or also see link <http://www.heavens-above.com/PassSummary.asp?lat=47.979&lng=-122.201&alt=0&loc=Everett&TZ=PST&satid=25544>

MEMBER NEWS

The Northwest Region of the Astronomical League (NWRAL) is putting together a new website and needs the following information from each club of the NWRAL. The EAS is looking for any information from members about the early history. Please contact Mark Folkerts if you have any info that could be of help. NWRAL would like a brief history of the club

- Club established date
- Who started the club
- When club joined the Astronomical League.

CONSTELLATION(S) OF THE MONTH: DELPHINUS

DELPHINUS: (The Dolphin or Porpoise). With a midnight culmination date of July 31st, Delphinus (abbreviated Del) is best viewed from August through September, and is thus well placed for summer viewing in the Northern Hemisphere. It contains the asterism known as "Job's Coffin", but has no associated Messier objects or meteor showers. Bordering constellations include Aquarius, Aquila, Equuleus, Pegasus, Sagitta, and Vulpecula. Delphinus ranks 61st in overall brightness among the constellations (overall brightness is calculated by dividing the number of visible stars in a constellation by the size of the constellation in square degrees, and then multiplying that number by 100). Delphinus ranks 69th in size, taking up only 188.54 square degrees (0.457% of the sky; note: this square degree factor would be the denominator in the above equation: the smaller the denominator the larger the result – in this case, overall brightness). The number of visible stars (stars brighter than magnitude 5.5) in this relatively small constellation is 11.

Delphinus is completely visible from latitudes North of -69 degrees, and completely invisible from latitudes South of -88 degrees. Its central point is at RA=20h39m, Dec.= +11.5 degrees. The solar conjunction date of Delphinus is January 31st.

Some interesting facts about Delphinus:

The common names of Alpha Delphinus (Sualocin) and Beta Delphinus (Rotanev) spelt backwards give the names of Nicolaus Venator, the assistant to the astronomer Giuseppe Piazzi. Both the early Greeks and Romans saw the outline of a dolphin in Delphinus. In Greek mythology, Delphinus rescued the poet Arion from sailors who planned to kill him, and brought the poet ashore at Tarentum. In appreciation, Poseidon permanently set the dolphin among the stars. Objects of note in this constellation include Gamma Delphini. This "star" is actually a double star: the primary is magnitude +4.5, and the secondary is fifth magnitude; they are separated by 10.1 arc seconds. NGC 6891 is a magnitude +10.5 planetary: it has a strong bluish tint, and

appears very rounded in an eight-inch scope. NGC 6905 is also a planetary nebula, about 40 arc seconds in diameter. If you have the opportunity for summer observing, try to either observe this area of the sky naked eye, or do a gentle binocular sweep of the beautiful areas surrounding the Milky Way, including the constellation of the "Dolphin".

YOUNG ASTRONOMER'S CORNER

Now is the time of year when many amateur astronomers' thoughts turn to observing outdoors with their telescopes, binoculars, etc..... Here are some helpful hints for observing at outdoor telescope "STAR" PARTIES this season: enjoy the night sky warmly and safely!!!!

★★ Dress warmly, or at least be prepared to do so. If the evening starts out warm, it may not end up that way!

★★ The warmest clothes include polypropylene worn directly against the skin; other warm clothes include those made of wool. Layered cotton clothing can also keep you warm, but you will tend to need more layering. Additionally, if cotton materials get wet, they do not transport moisture away from the body (like polypropylene and wool), but are rather more likely to chill you.

★★ Most body heat is radiated from the head, so make sure you have a good hat that also covers the ears. Good gloves are important as well. Polypropylene glove liners make excellent astronomy gloves because they are not bulky: it is thus easier to use equipment and read charts, etc....

★★ An excellent all-purpose piece of clothing for use in observing is a hooded-sweatshirt. A hooded sweatshirt can cut down on chilling winds entering down your neck: it essentially serves two purposes: it cuts down on the aforementioned wind effects, and it serves to contain body heat radiating from the head.

★★ Always wear warm socks. Socks that wick moisture away from the skin (such as wool or polypropylene) are excellent. Extra pairs for layering can come in handy too.

★★ A good windbreaker jacket (with an integral hood) is an excellent way to conserve body heat and minimize chill, and can be the outermost clothing in any necessary layering.

★★ Eat well and drink plenty of fluids to avoid dehydration. Good nutrition (including carrots which can improve night vision as a source of Vitamin A) and hydration can help to maintain alertness, body warmth, and help to battle fatigue. Most areas allow camp stoves, but open fires are prohibited. Alcohol and nicotine can interfere with the conservation of body heat. Also – and importantly – tobacco use can be very annoying to your fellow astronomers, as the majority are non-smokers. Further, some people have medical conditions which can be aggravated by cigarette smoke. If you must smoke, please smoke far enough away from people and delicate optical instruments which can pick up smoke film residues. So always be courteous to your fellow astronomers - and good to your own body - by not smoking!

★★ Always follow established STAR PARTY etiquette (which is usually published): red flashlights only at night, and extra batteries can be helpful. If you must listen to music, bring headsets, as your taste in music may be different than your neighbors. Follow STAR PARTY rules about pets: most allow them, but they must be leashed. ALWAYS ask another astronomer if it is OK to look through their scope before you do: some may be taking pictures, or they may not want to be disturbed at that particular time. Many if not most astronomers are very friendly and helpful – and love to have people look through their scopes – but be sure to ask first!

★★ STAR PARTIES are frequently held in remote areas. Always let someone know where you are and what your expected time of return will be: this is especially true if you go off on your own. In that respect, it is ALWAYS better to go in two's with a friend or fellow astronomer. If you have any allergies or other medical conditions, be sure to take your allergy and/or other medicines (including bee sting antidote and heart and asthma medicines, for example) with you: you will generally be at least an hour away from medical attention.

★★ You can enjoy a STAR PARTY without a telescope. IT IS NOT NECESSARY TO SPEND LOTS OF MONEY TO ENJOY THE NIGHT SKY. A lawn chair and a blanket, perhaps with a pair of binoculars and a basic night sky book or map of your choice, can result in countless hours of enjoyment and learning about astronomy without spending a lot of money or time in preparation. Going to an official STAR PARTY is a great way to learn and meet new people with varying levels of astronomy knowledge. NEVER be intimidated because you think someone may know more about the subject than you do: everybody starts somewhere!!!!!!.....and most astronomers love to answer questions about the night sky and astronomy equipment!!

★★ Finally, respect for your fellow astronomers by following the simple rules above, and respect for the environment while you are there (never leave trash; stay away from fragile areas of grass and wilderness), will also make your star party experience much more enjoyable. See you at an upcoming STAR PARTY!!

PLANETARY FOCUS, ASTRONOMY AND TELESCOPE "LINGO"; ASTRONOMY FUN FACTS, AND MIRROR IMAGES

Due to the summer vacation and observing season, these columns will return in time for the August newsletter. "Mirror Images" is intended as a bi-monthly column and last printed in June; it too will return in August.

ASTRONOMICAL NOTES -- ON & OFF THE WEB...

MYSTERIOUS LUNAR SWIRLS

Picture this: A cup of coffee, steaming and black. Add a dollop of milk and gently stir. Eddies of cream go swirling around the cup. Magnify that image a million times and you've got a Lunar Swirl. Lunar swirls are strange markings on the Moon that resemble the cream in your coffee - on a much larger scale. They seem to be curly-cues of pale moon dust, twisting and turning across the lunar surface for dozens of miles. Each swirl is utterly flat and protected by a magnetic field. What are they? "*We don't know,*" says Bob Lin, who has been studying the swirls for almost 40 years. "*These things are very strange.*" One of the swirls, Reiner Gamma, can be seen through a backyard telescope. It lies near the western shores of Oceanus Procellarum (the Ocean of Storms) and looks at first sight like a strangely disorganized crater. Indeed, that's what most astronomers thought it was until 1966 when the Lunar Orbiter II spacecraft flew overhead and photographed Reiner Gamma from point blank range. Whatever it was in that rainy black and white photo, it was not a crater. Before long, two more swirls were found on the Moon's farside. They lie directly opposite the nearside impact basins Mare Imbrium (the Sea of Rains) and Mare Orientale (the Eastern Sea). Impacts on one side of the Moon, it seemed, made swirls on the other side. No one could explain how.

The mystery deepened in 1972 when Lin and colleagues discovered that the swirls were magnetized. "*It was an accidental discovery,*" he recalls. As often happens in science, "*we were trying to learn about something completely different.*" Their

target was Earth's magnetic tail, a ropey pasta of magnetic force fields extending from Earth more than a million miles into deep space. The solar wind blowing against Earth's magnetic field makes the tail, and in the days of Apollo not much was known about it. To study the tail, "we built two small satellites and asked NASA to put them in orbit around the Moon."



The Moon is a great place to sample the Earth's magnetotail, he explains, because the Moon passes through the tail once a month as it orbits Earth. NASA said yes, and two "sub-satellites" were deployed by the crews of Apollo 15 in 1971 and Apollo 16 in 1972. "The astronauts pushed a button and the satellites were shoved into space by a spring," says Lin. Free of the Service Module (the Apollo mothership), they orbited the Moon, gathering data collected by onboard electron detectors and magnetometers. "We learned a lot about Earth's magnetic tail," says Lin. But they learned even more about the Moon:

As the sub-satellites flew just 60 miles above the lunar terrain, they passed in and out of strange magnetic domains. Magnetic force fields were sprouting out of the lunar surface, reaching up and affecting the satellites' sensors. "We realized that the crust of the Moon must be magnetized," he recalls. It wasn't a global magnetic field like Earth's, but rather a crazy-quilt of magnetic patches. The strongest fields were located above Lunar Swirls. "The swirls have magnetic fields measuring a few hundred nano-Tesla (nT) at ground level," says Lin. (Earth's magnetic field, for comparison, is 30,000 nT.) "If you walked around a swirl with a magnetic compass, the needle would swing back and forth in a confusing way. You'd quickly get lost because the magnetic fields are so jumbled." Lin believes these strange fields are an important clue to the origin of swirls, and he offers this possibility:

"Almost four billion years ago, the Moon had a liquid iron core and a global magnetic field. Suppose an asteroid hit the Moon. The blast would make a cloud of electrically conducting gas ('plasma') that would sweep around the Moon, pushing the global magnetic field in front of it. Eventually, the cloud would converge at a point directly opposite the impact, concentrating the magnetic field at that point." Eons later, the Moon's core cooled and its global magnetic field faded away. Only the strongest, tangled patches remained--the swirls. This idea provides an explanation for the light, creamy appearance of swirls. According to some researchers, moon dust is darkened by long exposure to solar wind. Maybe the swirls are light because they get less exposure: their magnetic fields deflect solar wind. If so, lunar swirls are merely a shadow of the magnetic forces arching above them.

It all sounds neat and tidy, but there's a problem: While two of the lunar swirls are directly opposite an impact basin, one is not: Reiner Gamma. The prototype swirl doesn't fit! "It's a real mystery," acknowledges Lin. More clues are on the way. NASA is returning to the Moon, eventually with people but first with robot scouts. Leading the way is Lunar Reconnaissance Orbiter (LRO), due to launch in 2008. Among other things, LRO will make detailed 3D maps of the whole Moon using a state-of-the-art camera and a laser. Its view of the swirls should be breathtaking.

Another NASA instrument, the Moon Mineralogy Mapper, is hitching a ride to the Moon onboard India's Chandrayaan-1 spacecraft, also due to launch in 2008. Using an infrared spectrometer, "M-cubed" will survey the lunar terrain and tell us in fantastic detail what minerals are in the ground. The whole Moon will be surveyed--including swirls. What are swirls made of? Are they truly flat? How does the cream differ from the coffee? Questions to ponder over your next cup of joe... http://science.nasa.gov/headlines/y2006/26jun_lunarswirls.htm

COMPUTERS ACCURATELY SIMULATE SUN'S CORONA

For the first time, researchers have developed a computer simulation that can accurately create a model of the sun's outer atmosphere, or corona. Funded by NASA and the National Science Foundation, the computer model marks the beginning of a new era in space weather prediction. By accurately simulating the behavior of the corona, scientists hope to eventually predict when it will produce flares and coronal mass ejections, huge clouds of hot plasma ejected from the sun. It's the same approach the National Weather Service uses to predict when the Earth's atmosphere will produce thunderstorms or hurricanes. Such predictions will help protect astronauts against radiation from flares and coronal mass ejections, in addition to mitigating disruptions on orbiting satellites and land-based communications and power systems. "This confirms that computer models can describe the physics of the solar corona," said Zoran Mikic. The turbulent corona is threaded with magnetic fields generated beneath the visible solar surface. The evolution of these magnetic fields causes violent eruptions and solar storms originating in the corona. The computer model was based on spacecraft observations of magnetic activity on the sun's surface, which affects and shapes the corona. The observations were made with the Michelson Doppler Imager instrument on the Solar and Heliospheric Observatory (SOHO) spacecraft. The team released simulated "photographs" of the March 29 total solar eclipse 13 days before and again 5 days before the actual event. Previous computer simulations were based on simplified models, so the calculations could be completed in a reasonable time. The new simulation is the first to base its calculations on the physics of how energy is transferred in the corona. Even using NASA and the National Science Foundation supercomputers, the calculations required four days to complete on about 700 computer processors. During a total solar eclipse, the moon blocks direct light from the sun, so the much fainter corona is visible. This is the only time the corona is visible from Earth without special instruments, and it resembles a white, lacy veil surrounding the black disk of the moon. Because the corona is always changing, each eclipse looks different. Since the physics of the corona is still not completely understood, the accuracy of the simulation will improve when our understanding of how energy flows through the corona improves. More detailed measurements of magnetic activity on the solar surface, like those expected from the Solar Dynamics Observatory scheduled to launch in 2008, will also improve the accuracy of the simulation. http://www.nasa.gov/vision/universe/solarsystem/corona_telecon.html

CHANDRA SOLVES BLACK HOLE PARADOX

Black holes light up the universe and astronomers may finally know how. New data from Chandra X-ray Observatory show for the first time powerful magnetic fields are the key to these brilliant and startling light shows. It is estimated up to one quarter of the radiation in the universe emitted since the big bang comes from material falling towards supermassive black holes, including those powering quasars, the brightest known objects. For decades, scientists have struggled to understand how black holes, the darkest objects in the universe, can be responsible for such prodigious amounts of radiation. New X-ray data from Chandra give the first clear explanation for what drives this process: magnetic fields. Chandra observed a black hole system in our galaxy, known as GRO J1655-40 (J1655, for short), where a black hole was pulling material from a companion star into a disk. *"By intergalactic standards J1655 is in our backyard, so we can use it as a scale model to understand how all black holes work, including the monsters found in quasars,"* said Jon M. Miller. Gravity alone is not enough to cause gas in a disk around a black hole to lose energy and fall onto the black hole at the rates required by observations. The gas must lose some of its orbital angular momentum, either through friction or a wind, before it can spiral inward. Without such effects, matter could remain in orbit around a black hole for a very long time. Scientists have long thought magnetic turbulence could generate friction in a gaseous disk and drive a wind from the disk that carries angular momentum outward, allowing the gas to fall inward. Using Chandra, Miller and his team provided crucial evidence for the role of magnetic forces in the black hole accretion process. The X-ray spectrum, the number of X-rays at different energies, showed the speed and density of the wind from J1655's disk corresponded to computer simulation predictions for magnetically-driven winds. The spectral fingerprint also ruled out the two other major competing theories to winds driven by magnetic fields. *"In 1973, theorists came up with the idea that magnetic fields could drive the generation of light by gas falling onto black holes,"* said co-author John Raymond. *"Now, over 30 years later, we finally may have convincing evidence."* This deeper understanding of how black holes accrete matter also teaches astronomers about other properties of black holes, including how they grow. *"Just as a doctor wants to understand the causes of an illness and not merely the symptoms, astronomers try to understand what causes phenomena they see in the universe,"* said co-author Danny Steeghs. *"By understanding what makes material release energy as it falls onto black holes, we may also learn how matter falls onto other important objects."* In addition to accretion disks around black holes, magnetic fields may play an important role in disks detected around young sun-like stars where planets are forming, as well as ultra-dense objects called neutron stars. <http://chandra.nasa.gov>

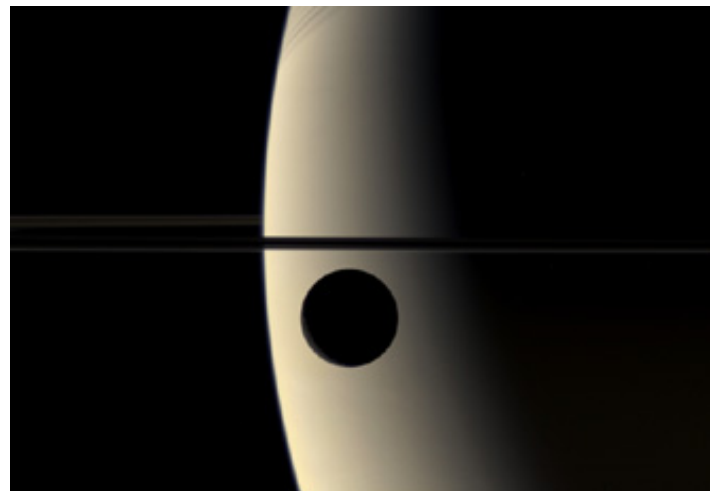
PLUTO'S TWO SMALL MOONS CHRISTENED 'NIX' AND 'HYDRA'

The names Nix and Hydra have been approved for the two small satellites of Pluto discovered in May 2005. The International Astronomical Union (IAU), the internationally recognized authority for assigning designations to celestial bodies, approved the names this week. A team of researchers used Hubble Space Telescope images to make the discovery in support of NASA's New Horizons mission to Pluto and the Kuiper Belt beyond. *"We're very pleased with the decision of the IAU,"* says co-leader of the discovery team, Dr. Alan Stern, principal investigator of the New Horizons mission. *"You're going to be hearing a lot more about Nix and Hydra in coming years - astronomers are already applying for telescope time to study their orbits and physical properties. And when New Horizons flies by Pluto in the summer*

of 2015, each will be mapped in detail." *"Pluto doesn't reveal its moons easily,"* adds discovery team co-leader and New Horizons Project Scientist Dr. Hal Weaver. *"It took 48 years after the discovery of Pluto to find Charon and another 27 years to find Nix and Hydra. Perhaps we won't have to wait as long for the next discovery because the New Horizons spacecraft will be making a rendezvous with Pluto in nine years and will be searching for other small satellites."* Nix and Hydra, roughly 5,000 times fainter than Pluto itself, are about two to three times as far from Pluto as its large moon, Charon, which was discovered in 1978. The nine-member discovery team selected the name Nyx for S/2005 P 2, the inner small satellite, and the name Hydra for S/2005 P 1, the outer small satellite. Because asteroid 3908 already bears the Greek name Nyx, the IAU changed Nyx to its Egyptian equivalent, Nix. In mythology, Nix is the goddess of darkness and night, befitting a satellite orbiting distant Pluto, the god of the underworld. Nix is also the mother of Charon, relevant to the giant impact believed to have created Pluto's three satellites, indicating Charon was borne of the material from which Nix formed. Hydra is the terrifying monster with the body of a serpent and nine heads, befitting the outermost moon of Pluto, the ninth planet in the solar system. In addition, just as Pluto's name begins with the letters "P" and "L" to honor Percival Lowell, who motivated the search that led to its discovery, Nix and Hydra honor the search for new satellites and the New Horizons mission to Pluto by starting with the letters "N" and "H." The first letter of Hydra also honors the Hubble Space Telescope that was used to detect the satellites. <http://www.swri.org/press/2006/nixhydra.htm>

CASSINI SPACECRAFT CAPTURES SATURNIAN MOON BALLET

The cold, icy orbs of the Saturn system come to life in a slew of new movie clips taken from the Cassini spacecraft showing the ringed planet's moons in motion. In addition to their drama and visual interest, scientists use these movies to refine their understanding of the orbits of Saturn's moons. Engineers at JPL use the same images, and the orbital positions of the moons, to help them navigate Cassini. The spacecraft is nearing the halfway mark of its prime four-year tour of Saturn and its moons.



Pictures capturing several moons in one frame are strikingly beautiful, especially when deliberately imaged in red, green and blue spectral filters, which allow scientists to create a color photo. One recent color image shows two of Saturn's most fascinating moons, icy-white Enceladus and orange, haze-enshrouded Titan. Still images and five short movie sequences acquired over the past six months are being released today at: <http://www.nasa.gov/cassini> , <http://saturn.jpl.nasa.gov> and <http://ciclops.org>

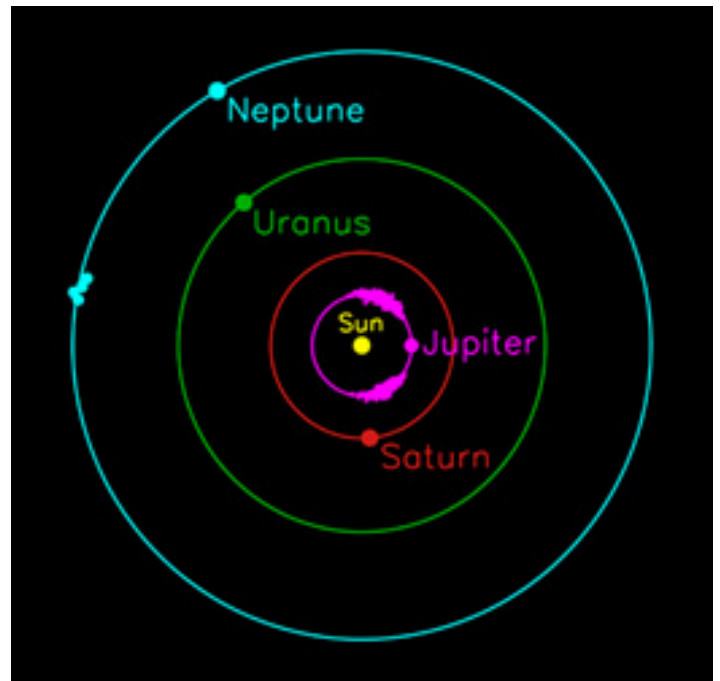
THREE NEW "TROJAN" ASTEROIDS FOUND SHARING NEPTUNE'S ORBIT

Three new objects locked into roughly the same orbit as Neptune - called "Trojan" asteroids - have been found by researchers. The discovery offers evidence that Neptune, much like its big cousin Jupiter, hosts thick clouds of Trojans in its orbit, and that these asteroids probably share a common source. It also brings the total of known Neptune Trojans to four. *"It is exciting to have quadrupled the known population of Neptune Trojans,"* said Scott Sheppard, lead author of the study. *"In the process, we have learned a lot both about how these asteroids become locked into their stable orbits, as well as what they might be made of, which makes the discovery especially rewarding."* The recently discovered Neptune Trojans are only the fourth stable group of asteroids observed around the Sun. The others are the Kuiper Belt just beyond Neptune, the Jupiter Trojans, and the main asteroid belt between Mars and Jupiter. Evidence suggests that the Neptune Trojans are more numerous than either the asteroids in the main belt or the Jupiter Trojans, but they are hard to observe because they are so far away from the Sun. Astronomers therefore require the largest telescopes in the world equipped with sensitive digital cameras to detect them.

Trojan asteroids cluster around one of two points that lead or trail the planet by about 60 degrees in its orbit, known as Lagrangian points. In these areas, the gravitational pull of the planet and the Sun combine to lock the asteroids into stable orbits synchronized with the planet. German Astronomer Max Wolf identified the first Jupiter Trojan in 1906, and since then, more than 1800 such asteroids have been identified marching along that planet's orbit. Because Trojan asteroids share a planet's orbit, they can help astronomers understand how planets form, and how the solar system evolved.

Researchers theorized that Trojans might also flank other planets, but evidence for this has surfaced only recently. In 2001, the first Neptune Trojan was spotted in the planet's leading Lagrangian point. In 2004, Sheppard and Chadwick Trujillo, who is also an author on the current study, found the second Neptune Trojan using Carnegie's Magellan-Baade 6.5 meter telescope in Las Campanas, Chile. They found two more in 2005, bringing the total to four, and observed them again using the 8-meter Gemini North telescope on Mauna Kea in Hawaii in order to accurately determine their orbits. All four of the known Neptune Trojans reside in the planet's leading Lagrangian point. One of the new Trojans has an orbit that is more steeply tilted to the plane of the solar system than the other three. Although only this one has such a steep orbit, the methods used to observe the asteroids are not sensitive to objects so far out of tilt with the rest of the solar system. The very existence of this Trojan suggests that there are many more like it, and that Neptune's Trojans as a whole occupy thick clouds with complex, interlaced orbits. *"We were really surprised to find a Neptune Trojan with such a large orbital inclination,"* Trujillo said. *"The discovery of the one tilted Neptune Trojan implies that there may be many more far from the solar system plane than near the plane, and that the Trojans are really a 'cloud' or 'swarm' of objects co-orbiting with Neptune."*

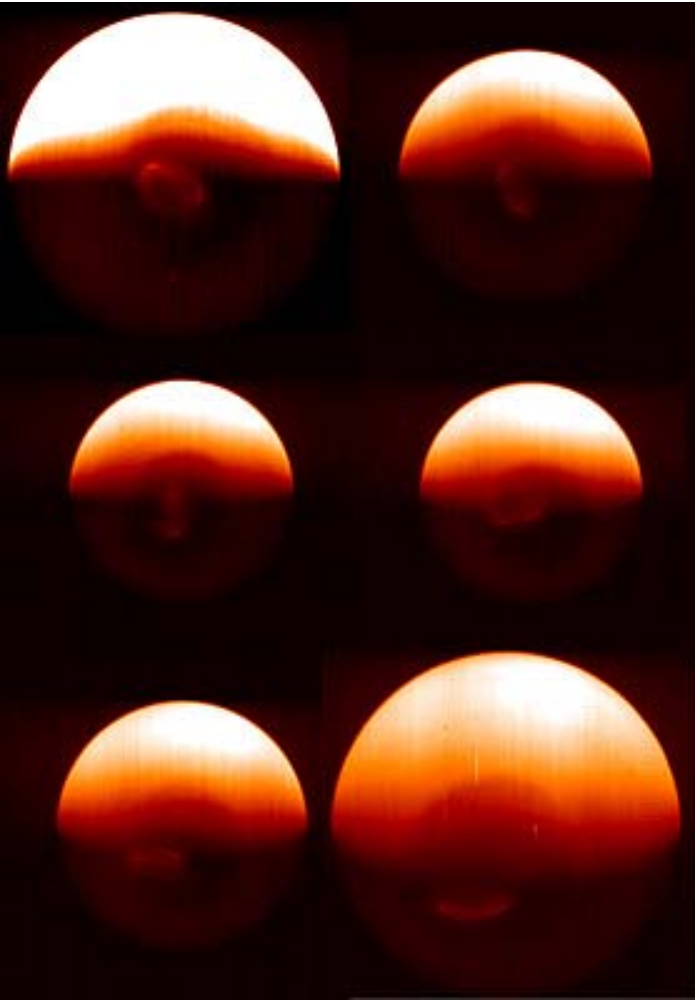
A large population of high-inclination Neptune Trojans would rule out the possibility that they are left over from early in the solar system's history, since unaltered primordial asteroid groups should be closely aligned with the plane of the solar system. These clouds probably formed much like Jupiter's Trojan clouds did: once the giant planets settled into their paths around the Sun, any asteroid that happened to be in the Trojan region "froze" into its orbit. Sheppard and Trujillo also compared, for the first time, the colors of all four known Neptune Trojans.



They are all about the same shade of pale red, suggesting that they share a similar origin and history. Although it is hard to tell for sure with only four on the books, the researchers believe that the Neptune Trojans might share a common origin with the Jupiter Trojans and outer irregular satellites of the giant planets. These objects might be the last remnants of the countless small bodies that formed in the giant planet region, most of which eventually became part of the planets or were tossed out of the solar system.

DOUBLE VORTEX AT VENUS SOUTH POLE UNVEILED!

ESA's Venus Express data undoubtedly confirm for the first time the presence of a huge 'double-eye' atmospheric vortex at the planet's south pole. This striking result comes from analysis of the data gathered by the spacecraft during the first orbit around the planet. On 11 April this year, Venus Express was captured into a first elongated orbit around Venus, which lasted 9 days, and ranged between 350 000 and 400 kilometers from Venus' surface. This orbit represented for the Venus Express scientists a unique opportunity to observe the planet from large distances. This made it possible to obtain first clues about the Venusian atmospheric dynamics on a global scale, before the spacecraft got closer and started observing the planet in greater detail. During this first orbit -- called the 'capture orbit' -- some of the Venus Express instruments were used to perform the first observations at different distances from Venus, for a few hours per time on six different slots between 12 and 19 April 2006. Amazing infrared, visible and ultraviolet images of the Venusian globe already reveal several atmospheric features of great interest. The most striking of these is a huge, double-eye atmospheric vortex over the south pole, not dissimilar from the equivalent structure present at the north pole -- the only one previously studied in some detail. Only glimpses of the stormy atmospheric behavior at the south pole were obtained by previous missions (Pioneer Venus and Mariner 10), but such a double-eye structure was never clearly seen before now. High velocity winds are known to spin westwards around the planet, and to take only four days to complete a rotation. This 'super-rotation', combined with the natural recycling of hot air in the atmosphere, would induce the formation of a vortex structure over each pole. But why two vortices?

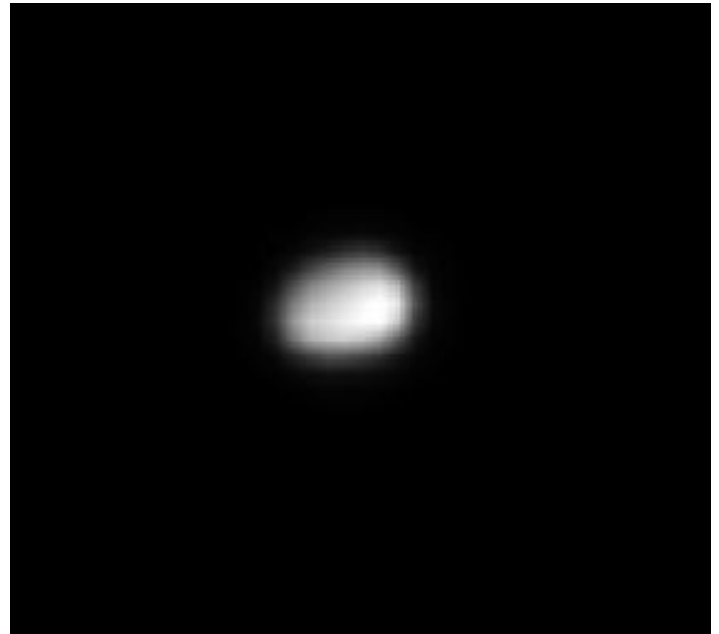


"We still know very little about the mechanisms by which the super-rotation and the polar vortexes are linked," said Han Svedhem, ESA's Venus Express Project Scientist. "Also, we are still not able to explain why the global atmospheric circulation of the planet results in a double and not single vortex formation at the poles. However the mission is just at the beginning and it's doing fine; we expect this and many other long-standing mysteries to be addressed and possibly solved by Venus Express," he added. Atmospheric vortexes are very complex structures that are very difficult to model, even on Earth. Thanks to these first pictures, it has also been possible to observe the presence of a collar of cold air around the vortex structure, possibly due to the recycling of cold air downwards. Views of the southern hemisphere of Venus in visible and ultraviolet light show interesting atmospheric stripe-like structures. Spotted for the first time by Mariner 10 in the 1970s, they may be due to the presence of dust and aerosols in the atmosphere, but their true nature is still unexplained. "Venus Express has the tools to investigate these structures in detail," added Svedhem. "Studies have already begun to dig into the properties of the complex wind fields on Venus, to understand the atmospheric dynamics on local and global scales." Venus Express also made use for the first time ever from orbit of the so-called 'infrared windows' present in the atmosphere of Venus -- if observed at certain wavelengths, it is possible to detect thermal radiation leaking from the deepest atmospheric layers, revealing what lies beneath the dense cloud curtain situated at about 60 kilometers altitude. The first infrared images making use of the 'windows' show complex cloud structures, all revealed by the thermal radiation coming up from different atmospheric depths. In the color scheme shown in the

image at right, the brighter the color (that is, the more radiation comes up from the lower layers), the less cloudy is the observed area.

During capture orbit, preliminary data about the chemical composition of the atmosphere were also retrieved. Venus' atmosphere is mainly composed of carbon dioxide (CO₂). The incoming solar radiation dissociates this molecule into carbon monoxide (CO) and oxygen in the upper atmospheric layers. In fact, Venus Express has already spotted the presence of an oxygen (O₂) airglow high in the atmosphere. However, Venus Express has revealed the presence of carbon monoxide as low as the cloud-layer top. Scientists will continue the data analysis and retrieval to understand the phenomenon, which is very important to clarify the complex chemical processes and cycles at work in the atmosphere of Venus under the influence of solar radiation. Since May 2006 Venus Express has been circling the planet in its final 24-hour orbit, ranging between 66,000 and 250 kilometers from Venus -- therefore at much closer distances with respect to the capture orbit. Venus Express scientists are now analyzing the new data coming in, which already show what seems to be exciting new features. "We have never seen Venus in such great detail so far. We are eagerly waiting for these new data to be available," concluded Svedhem. http://www.esa.int/esaCP/SEMVGQEFWEO_index_1.html

POLYDEUCES - NEW MOON OF SATURN



This magnified view shows tiny Polydeuces, a moon that was discovered by the Cassini spacecraft and is a mere 3 kilometers (2 miles) across. Along with much larger Helene (32 kilometers, or 20 miles across), Polydeuces orbits Saturn at the same distance as large, icy Dione (1,126 kilometers, or 700 miles across). Because this body was only recently discovered and is so small, scientists presently know precious little about it. Further observations by Cassini may yield additional insights about its nature and composition. The image was taken with the Cassini spacecraft narrow-angle camera on May 22 at a distance of approximately 45,000 miles. The image was obtained using a spectral filter sensitive to wavelengths of infrared. Scale in the original image was 1,423 feet per pixel. <http://photojournal.jpl.nasa.gov/catalog/PIA08209>

ENCELADUS EXUDES AN AIR OF MYSTERY

Atomic oxygen could never be confused with expensive perfume. But just as a fragrance lingering in the air of an empty room offers hints about a previous occupant, the cloud of oxygen the Cassini spacecraft encountered as it first approached Saturn turned out to be a calling card from another celestial presence, the tiny moon Enceladus. The oxygen was the first clue that much more is going on beneath Enceladus' icy surface than it first appeared. It took a while for scientists to get the message. Tracking down the oxygen's source led them to a most unusual spot in the solar system, a place that may possess one of the rarest and most sought-after substances in the universe - liquid water. Cassini's ultraviolet imaging spectrograph made its initial survey of Saturn's atmosphere late in December 2003 as the spacecraft neared the end of its seven-year voyage to the ringed planet. Along with the expected hydrogen, long known to be the gas giant's major component, the spectrograph detected the presence of oxygen. "We were the first to discover the oxygen in the Saturn system," says Dr. Larry Esposito, principal investigator for the instrument. Since Saturn's rings are made mostly of water ice, it wasn't surprising to find one ingredient of water, oxygen, in Saturn's atmosphere, he explains. The oxygen they observed was in the form of single oxygen atoms, called atomic oxygen, like that in water, H₂O. In January 2004, when it looked again at Saturn's atmosphere, it found a massive bubble of oxygen near Saturn's outermost ring, the E ring. Then just a few months later, much of the oxygen was gone. "What was surprising was the amount of oxygen we saw and how it changed," says Esposito. "This was the first sign that something unusual was going on." "Our first idea was that the collisions between small moons in the rings would release small puffs of ice and that ice would be broken down into its atoms, one of which would be atomic oxygen," Esposito explains. "We put out this hypothesis, but the idea didn't seem to be working out." What did work out were a host of observations in spring 2005 showing that something very odd was taking place on Enceladus, which just happens to orbit within the E ring, where the mysterious cloud of oxygen was first discovered. Cassini's magnetometer showed that the moon had an atmosphere. Too small to have enough gravity to hold on to an atmosphere for very long, Enceladus had to have a steady source of gas, such as geysers, to keep an atmosphere going. The cosmic dust analyzer detected a stream of particles around Enceladus. The scientists wondered whether these particles could be coming from the moon or from the E ring and if, perhaps, the moon itself might be the source of ice particles for the E ring. The Cassini science teams were eager to get a closer look. Mission navigators re-designed the spacecraft's trajectory to bring it closer to Enceladus than had been previously planned. "This is a big advantage of a mission like Cassini," according to Esposito. "You don't just fly by once, you can follow-up when something seems promising." In July 2005, Cassini cruised only 109 miles from Enceladus. The spacecraft's instruments revealed that the large dark cracks, dubbed "tiger stripes," on the moon's south pole were warm and spewing out water vapor and ice particles. The flyby occurred just when a star was moving behind the moon's southern pole. "As we watched the moon extinguish the light from the star, the spectrometer identified oxygen," says Esposito. "The starlight showed water molecules between us -- the spacecraft -- and the star. It showed a localized cloud of water near Enceladus." "We were able to measure the shape of the cloud, estimate the amount of water it contained and the rate it would be destroyed and produce oxygen," says Esposito. The amount of water they saw, about a million tons, was exactly that needed to provide a cloud of oxygen like the one they had first observed near the E ring more than a year earlier. "This was a most pleasing result," says Esposito. "We measured two new

distinct phenomena and found that they fit together." The mystery of the atomic oxygen was solved. At the same time, its source, the diminutive Enceladus revealed itself to be completely different than the cold, dead icy moon it should have been. Small as it is, it has an internal heat source and is geologically active. Its geysers throw out enough water vapor and ice to maintain the moon's atmosphere, feed the vast E ring, and decompose into clouds of oxygen like the one first spotted by Cassini on its way to Saturn. Not far beneath the moon's snowy white surface, scientists say, may be large pools of liquid water, warmed by the same heat source that powers its geysers. Its potential for water puts Enceladus into an elite group of places where life could exist. The Cassini spacecraft will swing back in 2008 for another look. <http://saturn.jpl.nasa.gov/science/moons/moonDetails.cfm?pageID=83>

WAS THERE LIFE ON MARS?

SHINY ROCK COATING MAY HOLD THE ANSWER

A mysterious shiny coating found on rocks in many of Earth's arid environments could reveal whether there was once life on Mars, according to new research. The research reveals that the dark coating known as desert varnish creates a record of life around it, by binding traces of DNA, amino acids and other organic compounds to desert rocks. Samples of Martian desert varnish could therefore show whether there has been life on Mars at any stage over the last 4.5 billion years. The researchers hope that these results will encourage any future Mars Sample Return mission to add desert varnish to its Martian shopping list. The source of the varnish, which looks like it has been painted onto the rocks, has intrigued scientists since the mid nineteenth century, including Darwin, who was so fascinated that he asked the geochemist Berzelius to investigate it. It was previously suggested that its dark color was the result of the presence of the mineral manganese oxide, and that any traces of life found within the varnish came from biological processes caused by microbes in this mineral. However, the new research used a battery of techniques, including high resolution electron microscopy, to show that any traces of life in the varnish do not come from microbes in manganese oxide. The research reveals that the most important mineral in the varnish is silica, which means that biological processes are not significant in the varnish's formation. On desert rock surfaces, silica is dissolved from other minerals and then gels together to form a glaze, trapping organic traces from its surroundings. Dr Randall Perry, lead author of the research, explained that as life is not involved in desert varnish formation, the varnish can act as an indicator of whether life was present or absent in the local environment. Dr Perry said: "If silica exists in varnish-like coatings in Martian deserts or caves, then it may entomb ancient microbes or chemical signatures of previous life there, too. Desert varnish forms over tens of thousands of years and the deepest, oldest layers in the varnish may have formed in very different conditions to the shallowest, youngest layer. "These lustrous chronicles of the local surroundings can provide a window back in time. Martian desert varnish would contain a fascinating chronology of the Martian setting," he added.

★ Desert varnish is found across the world in areas including the Atacama desert in Chile, the Mojave desert in Southern California, and Canyonlands National Park, Utah.

★ It is often found on canyon walls.

★ Desert varnish was used by prehistoric and Neolithic people to create images known as petroglyphs, which they crafted by scraping away the dark varnish to reveal the light rock underneath, like those in Grimes Point, Nevada.

★ Desert varnish is sometimes mistaken for fusion crust, the melted glassy exterior of a meteorite that forms when the meteorite passes through the atmosphere.

HUBBLE SPACE TELESCOPE ACS CAMERA RE-ACTIVATED

Engineers successfully activated the Advanced Camera for Surveys on Friday June 30 aboard the agency's Hubble Space Telescope. Checkout was completed with science observations scheduled to resume July 2. A pre-programmed observing sequence for normal camera science operations then began executing on July 2. *"This is the best possible news,"* said Ed Ruitberg. *"We were confident we could work through the camera issue, and now we can get back to doing more incredible science with the camera."*

Engineers received indications on Monday, June 19, that power supply voltages were out of acceptable limits, causing the camera to stop functioning. The instrument was taken off line, so engineers could study the problem and determine the appropriate remedy. Hubble observations continued using other onboard science instruments. Engineers began uploading commands to the instrument on June 29 in an effort to restore operational status. The third-generation Hubble instrument consists of three electronic cameras, filters and dispersers that detect light from the ultraviolet to the near infrared. Astronauts had installed the camera during a servicing mission in March 2002.

NEW PANORAMIC SURVEY TELESCOPE DEDICATED ON HALEAKALA MAUI TO FIND NEOs

The University of Hawaii's newest telescope, called PS1, was dedicated on Friday, June 30 in a ceremony on the summit of Haleakala, Maui, Hawaii. The telescope is a prototype for the larger Panoramic Survey Telescope and Rapid Response System, or Pan-STARRS, telescope scheduled to start scanning the skies for "killer asteroids" in 2010. Director Rolf Kudritzki described the dedication of PS1 as *"a historic event, since Pan-STARRS is the most important UH telescope project in 30 years."* PS1 achieved "first light" in late June, when engineers obtained test images of a number of stars. The telescope's mirror is only 71 inches in diameter, much smaller than the twin Keck telescopes on Mauna Kea, whose mirrors are nearly 400 inches each. What will make PS1 unique is that it will be equipped with the world's largest digital camera, which is currently under construction at the UH Institute for Astronomy's Manoa headquarters. This camera will contain 1.4 billion pixels--about 300 times more than is found in a typical commercial digital camera. Each night PS1 will produce about 2000 gigabytes of data, most of which will be sent by optical fiber to be analyzed at the Maui High Performance Computing Center in Kihei. Once the telescope is operational, the PS1 survey will survey the whole sky every few days to find celestial objects that change or move. In addition to discovering millions of asteroids, some of which might pose a danger to Earth, PS1 will collect data to be analyzed by Hawaii astronomers and an international consortium. The data collected will help answer questions in areas of astronomy ranging from our solar system to the entire observable universe.

In his speech at the dedication, Kudritzki noted that PS1 is the first astronomy project to be constructed on Haleakala following the guidelines established in the Haleakala High Altitude Observatory Site Long Range Development Plan. Kahu Charles Kauluwehi Maxwell Sr. provided the "sense of place" training for all PS1 construction personnel, and he also served as the cultural monitor who oversaw all construction.



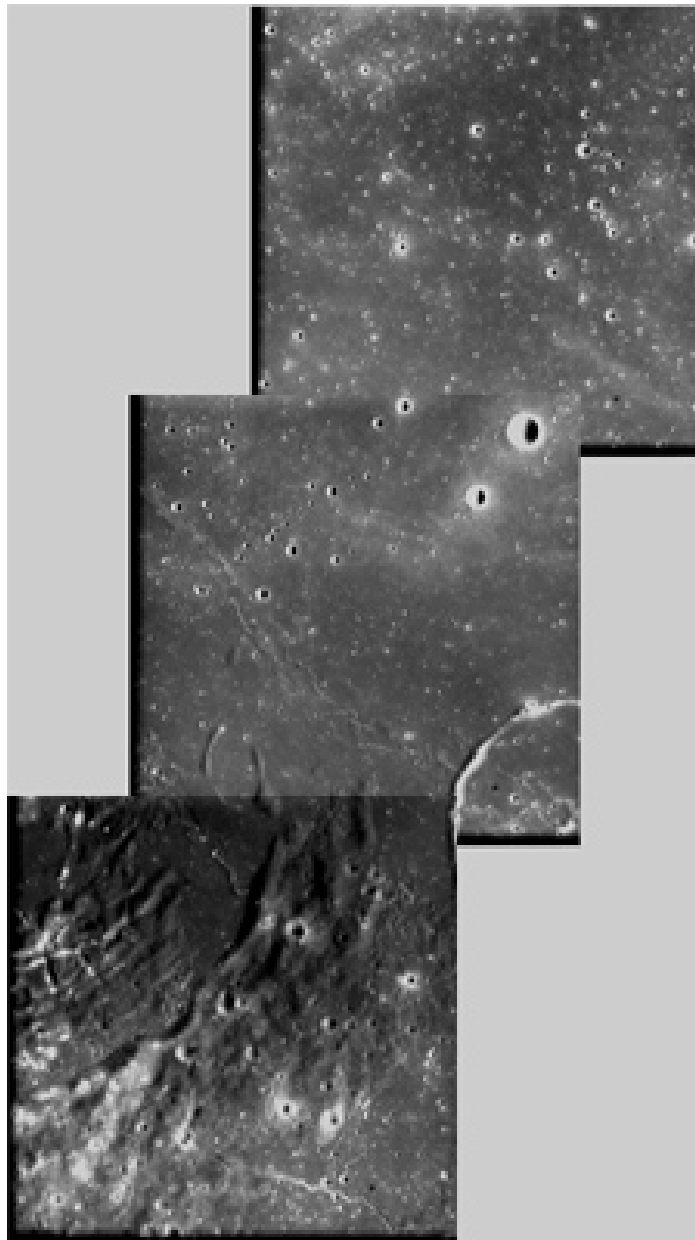
According to Hawaiian oral history, the ancient Hawaiian astronomers and their students studied the sky from Pu'u Kolekole on the summit of Haleakala. The culmination of the dedication ceremony was the blessing of the building by two of Maxwell's grandsons and the untying of the maile lei, an act of respect, an expression of sense of place, and an explicit acknowledgment of the ancient Hawaiian astronomers who first observed the universe from Haleakala.

MARE HUMORUM: CRATERS TELL THE STORY OF BASALT

A mosaic of images, taken by the advanced Moon Imaging Experiment (AMIE) on board ESA's SMART-1 spacecraft, shows Mare Humorum on the Moon. Mare Humorum, or 'Sea of Moisture', is a small circular mare on the lunar nearside, about 825 kilometers across. The mountains surrounding it mark the edge of an old impact basin which has been flooded and filled by mare lavas. These lavas also extend past the basin rim in several places. In the upper right are several such flows which extend northwest into southern Oceanus Procellarum. Mare Humorum was not sampled by the Apollo program, so its precise age could not be determined yet. However, geologic mapping indicates that its age is in between that of the Imbrium and the Nectaris basins, suggesting an age of about 3.9 billion years (with an uncertainty of 500 million years). Humorum is filled with a thick layer of mare basalt, believed to exceed 3 kilometers in thickness at the centre of the basin. On the north edge of Mare Humorum is the large crater Gassendi, which was considered as a possible landing site for Apollo 17. Mare Humorum is a scientifically interesting area because it allows the study of the relationships

among lunar mare filling, mare basin tectonics, and global thermal evolution to the major mascon maria regions of the moon's crust which contain a large amount of material denser than average for that area. Past studies revealed that craters in the mare Humorum sometimes excavate highland material, allowing to estimate the thickness from below the mare cover. Thanks to this, it was also possible to determine that the multiring structure of the Humorum basin has a diameter of 425 kilometers (results based on Clementine global topography data). In general, the chronology of lunar volcanism is based on the analysis of landing site samples from the Apollo and Luna missions, from the study of the relationship between the stratigraphy (layering of deposits) in different regions, and from the analysis of lunar craters how they degraded over time and how their distribution in number and size varies over the Moon's surface. From crater statistics, in the year 2000 Hiesinger and colleagues found that in Humorum there was a peak of eruptions at about 3.3-3.5 thousand million years ago. Gassendi crater - clue on the thermal history of Mare Humorum.

Another mosaic shows the inside of crater Gassendi on the Moon. Gassendi is an impact feature located on the near side of the Moon, at the northern edge of Mare Humorum. The hills on the lower right of the mosaic are the central peak of the crater, with a height of roughly 1.2 kilometers. Gassendi is a scientifically interesting site because it offers lunar landers the possibility of sampling ancient highland rocks (in the crater's central peak) as well as providing ages for both the Humorum impact basin and the Gassendi crater itself. However, because the terrain just outside the crater is quite rough, if a crew landed in this region, it would be pretty difficult to reach Gassendi's central peaks for sampling. Gassendi was considered as one of the three potential sites for the Apollo 17 mission, that eventually touched ground in the Taurus-Littrow valley. The age of Gassendi crater is estimated to be about 3.6 thousand million years (with an error of plus or minus 700 million years). When observed through spectroscopic analysis, crater Gassendi presents a 'behavior' very different from any other lunar crater. High resolution studies performed in the near-infrared light indicated the presence of extrusive volcanic material (that is volcanic material flowing out from the surface and then crystallizing) limited to the southern portion of Gassendi's floor, which is adjacent to Mare Humorum. The interpretation of these data suggested that the central part of the crater, including the peak complex, may have a more 'mafic' nature (that is a composition of rocks coming from the solidification of magma which are rich in iron and magnesium silicates, such as olivine and pyroxene), with a higher pyroxene component than surrounding highlands. The data interpretation also suggested that extensive extrusive volcanism may have occurred within the eastern portion of the floor, as also indicated by the significant presence of pyroxene that also corresponds to visible volcanic features. The western part of the crater floor, away from the geometric continuation of the western edge of Mare Humorum, is composed of highlands-rich material. The difference between the western and eastern side of the Gassendi floor-fractured crater may be strongly linked to the early thermal history of Mare Humorum. The crater is named after Pierre Gassendi (1592-1655), French philosopher, scientist and mathematician. In 1631, Gassendi became the first person to observe the transit of a planet across the Sun, viewing the transit of Mercury which Kepler had predicted.



FROM THE EDITOR'S TERMINAL

The Stargazer is your newsletter and therefore it should be a cooperative project. Ads, announcements, suggestions, and literary works should be received by the editor before the 1st of the month of publication, for example, material for May's newsletter should be received May 1st. If you wish to contribute an article or suggestions to *The Stargazer* please contact Mark Folkerts by email or by telephone (425) 486-9733 or co-editor Bill O'Neil, at (774) 253-0747.

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In July's Stargazer:

- **** **OBSERVER'S INFORMATION**
- **** **ASTRO CALENDAR**
- **** **SEASON STAR PARTY INFO**
- **** **YOUNG ASTRONOMER'S CORNER**
- **** **MYSTERIOUS LUNAR SWIRLS**
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- **** **CHANDRA SOLVES BLACK HOLE PARADOX**
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- **** **THREE NEW "TROJAN" ASTEROIDS FOUND SHARING NEPTUNE'S ORBIT**
- **** **DOUBLE VORTEX AT VENUS SOUTH POLE UNVEILED!**
- **** **POLYDEUCES - NEW MOON OF SATURN**
- **** **ENCELADUS EXUDES AN AIR OF MYSTERY**
- **** **WAS THERE LIFE ON MARS? SHINY ROCK COATING MAY HOLD THE ANSWER**
- **** **HUBBLE SPACE TELESCOPE ACS CAMERA RE-ACTIVATED**
- **** **NEW PANORAMIC SURVEY TELESCOPE DEDICATED ON HALEAKALA MAUI TO FIND NEOS**
- **** **MARE HUMORUM: WHERE CRATERS TELL THE STORY OF BASALT**

**The next EAS Meeting is 6:30 P.M. WEDNESDAY, July 12th 2006
 at the Everett Public Library Auditorium. NOTE MID-WEEK DATE !!!**