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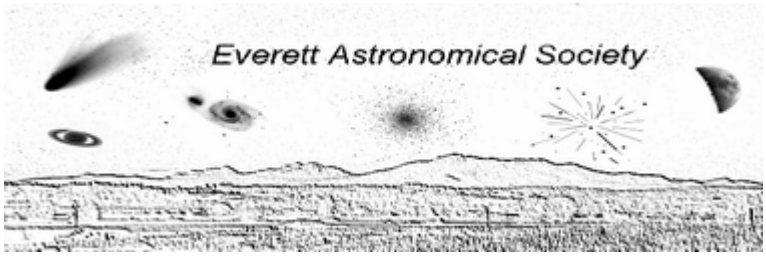
Volume MMVI. No. 6



The Stargazer

June 2006

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VP & Librarian: Mike Locke	(425) 259-5995	mlocke at lionmts.com	**P.O. Box 12746**
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Web assistance: Cody Gibson	(425) 348-1608	sircody01 at comcast.net	*See EAS website at:*
		(change 'at' to @ to send email)	http://members.tripod.com/everett_astronomy

EAS BUSINESS…

NEXT EAS MEETING - SATURDAY JUNE 17TH AT 3:00 PM AT THE EVERETT PUBLIC LIBRARY, IN THE AUDITORIUM (DOWNSTAIRS)

The presentation with be 'Explore The Invisible Universe' – slide and video materials from Night Sky Network, that were presented by NASA's Dr. Michelle Thaller.

Next month's July 12th (Wednesday night) presentation will be speaker Carlton Rhoades, discussing Near Earth Asteroids – Risks, and strategies for addressing them.

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@nwlink.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 for additional dates.) Members contact Mike Locke for scope borrowing.

Other Western US Star Parties this season:

Jun 21-26 - Shingletown Star Party 2006
http://www.shingletownstarparty.org/ Mt. Shasta, CA
Registration due May 1.

Jun 22-25 - The Rocky Mountain Star Stare (RMSS)
http://www.rmss.org/ Pike Nat Forest, Colorado Springs, CO

Jun 23-25 Craters Star Party
Craters of the Moon National Monument, ID
http://www.boiseastro.org/

Jul 08 – RCA Lunar Viewing - 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 to get the latest information. http://www.omsi.edu/visit/planetarium/starparties.cfm

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

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.omsi.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.omsi.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.omsi.edu/visit/planetarium/starparties.cfm

$$ - Financial Health - $$

The club maintains a $500+ 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

June 2006

Jun 17 – June EAS Meeting – 3:00 PM Everett Public Library
Jun 21 - Summer Solstice, 12:26 UT
Jun 18 - Mars Passes 0.6 Degrees from Saturn
Jun 21 - Summer Solstice, 12:26 UT
Jun 21 - Mercury at Greatest Eastern Elongation
Jun 29 - Asteroid 2 Pallas At Opposition (9.5 Magnitude)

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

April 2007

Apr 01 - Daylight Saving - Set Clock Ahead 1 Hour
Apr 08 - Easter Sunday
Apr 11-17 - Astronomy Week
Apr 16 - Astronomy Day
Apr 22 - Lyrids Meteor Shower Peak

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 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

Jun 18	Last Quarter Moon
Jun 25	New Moon
Jul 03	First Quarter Moon
Jul 11	Full Moon
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
Sep 31	First Quarter Moon
Sep 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/cla/menu.html
http://www.lpi.usra.edu/research/lunar_orbiter

Up In The Sky -- The Planets

Object	Rises	Transits	Sets	Con	Mag
Sun	**5:10 am**	**13:10**	**21:09**	**Tau**	**-27.5**
Mercury	5:44 am	Daylight	**22:53**	**Gem**	**+0.3**
Venus	**03:29 am**	Daylight	Daylight	**Ari**	**-3.9**
Mars	Daylight	Daylight	**23:46**	**Can**	**+1.8**
Jupiter	Daylight	**21:58**	3:03	Lib	**-2.4**
Saturn	Daylight	Daylight	**23:44**	**Can**	**+0.4**
Uranus	**1:02 am**	Daylight	Daylight	Aqr	+5.8
Neptune	**0:05 am**	**4:59 am**	Daylight	**Cap**	**+7.9**
Pluto	Daylight	**1:12 am**	Daylight	**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. NRWAL 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: CORONA AUSTRALIS

CORONA AUSTRALIS: (The Southern Crown). With a midnight culmination date of June 30th, Corona Australis (abbreviated CrA) is perfectly placed for winter viewing in the Southern Hemisphere (i.e., when it is summer in the North). It contains no asterisms or Messier objects, but it does contain the radiant of one meteor shower: the Corona Australids (March 16th). Bordering constellations include Ara, Sagittarius, Scorpius, and Telescopium. Corona Australis ranks 2nd 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). Only the constellation of Crux has a higher overall brightness. Corona Australis ranks 80th in size, taking up only 127.69 square degrees (0.310% 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 in this small constellation is relatively large: there are 21 stars brighter than magnitude 5.5.

Corona Australis is completely visible from latitudes South of +44 degrees, and completely invisible from latitudes North of +53 degrees. Its central point is at RA=18h35m, Dec.= -41.5 degrees. The solar conjunction date of Corona Australis is December 31st. Some interesting facts about CrA:

If the brightest stars of nearby Sagittarius form a 'teapot', then the brighter stars (gamma, alpha, beta, delta, zeta, eta, theta) of CrA are well known to form the 'slice of lemon' nearby. Gamma CrA is a very interesting double star: both stars are main sequence stars of spectral type F-8, and they are almost exactly of the same magnitude (4.84 and 5.08). Sir John Herschel is quoted as calling this double star "superb". (However, the pair is separated by only 1.2 arc seconds, rendering it difficult to separate with telescopes smaller than 6 inches of aperture. The orbital period of the system is 122 years.) An easier – but still beautiful - double star to separate within the borders of CrA is Kappa CrA: its separation is 21.2 arc seconds, and its magnitudes are 6.0 and 6.5. Corona Australis contains an interesting NGC object of note: NGC 6541. This is a bright (magnitude 6.1) globular cluster with a moderately compressed core and a loosely structured outer halo. Even though the brightest members of the cluster are at magnitude 12.3, it is still possible to resolve the cluster with 6-inch or larger scopes. Corona Australis – if you ever have the opportunity to visit the Southern Hemisphere – provides a very interesting binocular sweep.

ASTRONOMY AND TELESCOPE / EQUIPMENT "LINGO"

ASTRONOMY LINGO: ***SUPERGALACTIC PLANE:*** The dominant plane of the greatest concentration of nearby galaxy clusters in the sky, which passes through the Virgo Cluster of galaxies.

TELESCOPE / EQUIPMENT LINGO: ***SPITZER SPACE TELESCOPE:*** Formerly SIRTF (Space Infrared Telescope Facility), the SST was launched in August 2003, and is designed to take images and spectra – of infrared emissions in the wavelength range between 3 and 180 microns - by detecting infrared energy in these wavelengths radiated by celestial objects blocked by Earth's atmosphere. (Most infrared energy is blocked by Earth's atmosphere and cannot be observed with ground-based telescopes.) SST-observable objects may include deep space gas and dust clouds, which can obscure areas of star formation, galaxy centers, and newly forming planetary systems. SST can also detect cooler objects such as very dim or non-visible smaller stars, giant molecular clouds, and extra-solar planets. The telescope must be cooled to near absolute zero so that it can detect infrared emissions from space without interference potentially caused by its own heat energy. The SST was the last mission in NASA's Great Observatories Program: four orbiting observatories which also included the Compton Gamma Ray Observatory; the Hubble Space Telescope; and the Chandra X-Ray Observatory.

ASTRONOMY FUN FACTS

**Because of vast lava flows, the surface of the Jovian moon Io is less than 10 million years old, and Io is the only body in the Solar System that is turning itself inside out volcanically! On Earth, this "renewal" is accomplished not volcanically, but rather by earthworms!

Sinope, one of the outermost moons of Jupiter, is only 9 miles in diameter and is 400 million miles from Earth – making it, among other things – a remarkable accomplishment that it was even discovered at all…and in no less than ***1914* (by astronomer Seth Nicholson)!!

**Sinope is approximately 14.7 million miles from Jupiter, and it takes more than 2 years to orbit the giant planet. Sinope is thus about 61 times farther away from Jupiter than our Moon is to Earth, and it lies at about 1/6th the Sun-Earth distance from Jupiter. Because of this distance, an Apollo spacecraft traveling at the average Earth to Moon velocity would take 6 months to travel from Jupiter to its tiny moon Sinope!

"MIRROR" IMAGES

"MIRROR" IMAGES": Because we live in the Northern Hemisphere, we often tend to focus (in both observing and reading) on celestial objects in this hemisphere. The point of this column is to inform club members about similar objects in the Southern Hemisphere (to the ones we are already familiar with in the Northern Hemisphere). The general class of object will first be defined, and then a representative object from each hemisphere will be described. ***Note: "MIRROR" IMAGES" is strictly the name of the new column, and is not intended to imply that there is optical mirror symmetry between the two objects.***

CLASS OF OBJECT: MIRA STARS: Variable stars whose luminosities vary over a long period of time. The prototype is Mira in the constellation of Cetus the Whale. Mira stars are long-period pulsating variables. These are either red giants or red supergiants that have periods ranging from around 80 to 1000 days, and a range of brightness from about 2.5 magnitudes to sometimes exceeding 10 magnitudes. The maximum brightness can vary considerably between periods; because of the large amplitude, they are easily recognizable and their high luminosity permits detection at great distances. Ninety percent of these stars have spectra that can be classified as either Me stars (hydrogen emission lines in addition to molecular bands of titanium oxide that are characteristic of M stars); Ce (carbon) stars; or Se (zirconium) stars: there are bright emission lines present in the spectra in addition to molecular bands. The pulsations of these huge variable stars are not very stable, and there is evidence of shock waves developing within the fragile atmospheres which travel outward, heating the gas and causing the production of these emission lines. Although the visual range of Mira stars is large, the infrared range is much smaller, and many of them are indeed infrared sources. Expanding envelopes of gas frequently contain condensed dust grains (which produce detectable infrared emissions), and simple molecules. In fact, Mira stars often show MASER (microwave amplification by stimulated emission of radiation) emission from hydroxyl, water, and silicon monoxide molecules in their outer atmospheres.

REPRESENTATIVE NORTHERN HEMISPHERE OBJECT: T Cephei.

REPRESENTATIVE SOUTHERN HEMISPHERE OBJECT: Mira (omicron Ceti): Also known as "the Wonderful", Mira is the prototype star for this class (see above).

ASTRONOMICAL NOTES -- ON & OFF THE WEB…

KILLER CRATER FOUND UNDER ANTARCTIC ICE

Planetary scientists have found evidence of a meteor impact much larger and earlier than the one that killed the dinosaurs -- an impact that they believe caused the biggest mass extinction in Earth's history. The 300-mile-wide crater lies hidden more than a mile beneath the East Antarctic Ice Sheet. And the gravity measurements that reveal its existence suggest that it could date back about 250 million years – the time of the Permian-Triassic extinction, when almost all animal life on Earth died out. Its size and location -- in the Wilkes Land region of East Antarctica, south

of Australia -- also suggest that it could have begun the breakup of the Gondwana supercontinent by creating the tectonic rift that pushed Australia northward.

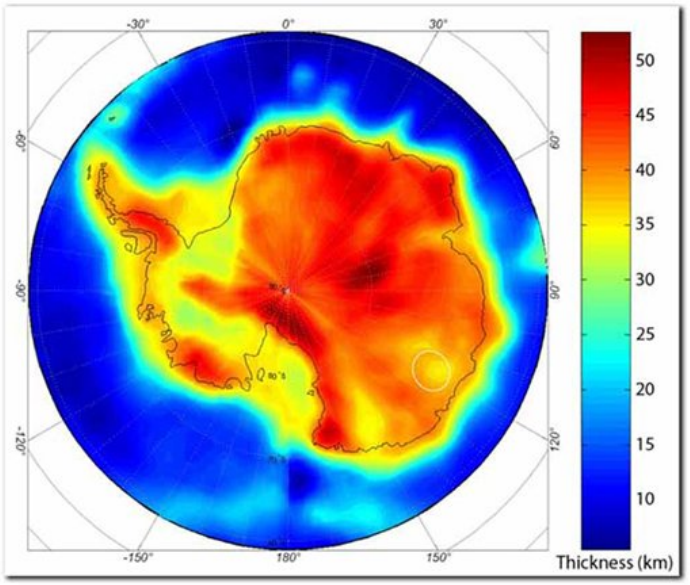
Scientists believe that the Permian-Triassic extinction paved the way for the dinosaurs to rise to prominence. The Wilkes Land crater is more than twice the size of the Chicxulub crater in the Yucatan peninsula, which marks the impact that may have ultimately killed the dinosaurs 65 million years ago. The Chicxulub meteor is thought to have been 6 miles wide, while the Wilkes Land meteor could have been up to 30 miles wide -- four or five times wider. "*This Wilkes Land impact is much bigger than the impact that killed the dinosaurs, and probably would have caused catastrophic damage at the time*," said Ralph von Frese, a professor of geological sciences. He and Laramie Potts, a postdoctoral researcher in geological sciences, led the team that discovered the crater.

The scientists used gravity fluctuations measured by the GRACE satellites to peer beneath Antarctica's icy surface, and found a 200-mile-wide plug of mantle material -- a mass concentration, or "mascon" in geological parlance -- that had risen up into the Earth's crust. Mascons are the planetary equivalent of a bump on the head. They form where large objects slam into a planet's surface. Upon impact, the denser mantle layer bounces up into the overlying crust, which holds it in place beneath the crater. When the scientists overlaid their gravity image with airborne radar images of the ground beneath the ice, they found the mascon perfectly centered inside a circular ridge some 300 miles wide -- a crater easily large enough to hold the state of Ohio. Taken alone, the ridge structure wouldn't prove anything. But to von Frese, the addition of the mascon means "impact." Years of studying similar impacts on the moon have honed his ability to find them. "*If I saw this same mascon signal on the moon, I'd expect to see a crater around it*," he said. "*And when we looked at the ice-probing airborne radar, there it was*."

"*There are at least 20 impact craters this size or larger on the moon, so it is not surprising to find one here*," he continued. "*The active geology of the Earth likely scrubbed its surface clean of many more*." He and Potts admitted that such signals are open to interpretation. Even with radar and gravity measurements, scientists are only just beginning to understand what's happening inside the planet. Still, von Frese said that the circumstances of the radar and mascon signals support their interpretation. "*We compared two completely different data sets taken under different conditions, and they matched up*," he said.

To estimate when the impact took place, the scientists took a clue from the fact that the mascon is still visible. "*On the moon, you can look at craters, and the mascons are still there*," von Frese said. "*But on Earth, it's unusual to find mascons, because the planet is geologically active. The interior eventually recovers and the mascon goes away*." He cited the very large and much older Vredefort crater in South Africa that must have once had a mascon, but no evidence of it can be seen now. "*Based on what we know about the geologic history of the region, this Wilkes Land mascon formed recently by geologic standards -- probably about 250 million years ago*," he said. "*In another half a billion years, the Wilkes Land mascon will probably disappear, too*." Approximately 100 million years ago, Australia split from the ancient Gondwana supercontinent and began drifting north, pushed away by the expansion of a rift valley into the eastern Indian Ocean. The rift cuts directly through the crater, so the impact may have helped the rift to form, von Frese said.

But the more immediate effects of the impact would have devastated life on Earth. "*All the environmental changes that would have resulted from the impact would have created a highly caustic environment that was really hard to endure. So it makes sense that a lot of life went extinct at that time*," he said. He and Potts would like to go to Antarctica to confirm the finding. The best evidence would come from the rocks within the crater. Since the cost of drilling through more than a mile of ice to reach these rocks directly is prohibitive, they want to hunt for them at the base of the ice along the coast where the ice streams are pushing scoured rock into the sea. Airborne gravity and magnetic surveys would also be very useful for testing their interpretation of the satellite data, they said.



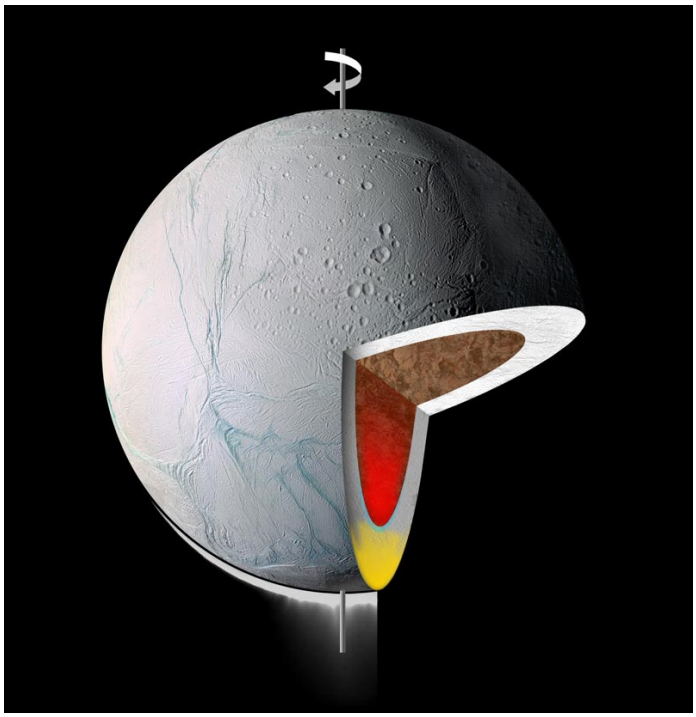
SATURN'S MOON ENCELADUS ROLLED OVER

Saturn's moon Enceladus - an active, icy world with an unusually warm south pole - may have performed an unusual trick for a planetary body. New research shows Enceladus rolled over, literally, explaining why the moon's hottest spot is at the south pole. Enceladus recently grabbed scientists' attention when the Cassini spacecraft observed icy jets and plumes indicating active geysers spewing from the tiny moon's south polar region. "*The mystery we set out to explain was how the hot spot could end up at the pole if it didn't start there*," said Francis Nimmo, assistant professor of Earth sciences. The researchers propose the reorientation of the moon was driven by warm, low-density material rising to the surface from within Enceladus. A similar process may have happened on Uranus' moon Miranda, they said. "*It's astounding that Cassini found a region of current geological activity on an icy moon that we would expect to be frigidly cold, especially down at this moon's equivalent of Antarctica*," said Robert Pappalardo, co-author and planetary scientist at JPL. "*We think the moon rolled over to put a deeply seated warm, active area there*."

Rotating bodies, including planets and moons, are stable if more of their mass is close to the equator. "*Any redistribution of mass within the object can cause instability with respect to the axis of rotation. A reorientation will tend to position excess mass at the equator and areas of low density at the poles*," Nimmo said. This is precisely what happened to Enceladus. Nimmo and Pappalardo calculated the effects of a low-density blob beneath the surface of Enceladus and showed it could cause the moon to roll over by up to 30-degrees and put the blob at the pole. Pappalardo used an analogy to explain the Enceladus rollover. "*A spinning bowling ball will tend to roll over to put its holes -- the axis with the least*

mass -- vertically along the spin axis. Similarly, Enceladus apparently rolled over to place the portion of the moon with the least mass along its vertical spin axis," he said. The rising blob (called a "diapir") may be within either the icy shell or the underlying rocky core of Enceladus. In either case, as the material heats up it expands and becomes less dense, then rises toward the surface. This rising of warm, low-density material could also help explain the high heat and striking surface features, including the geysers and "tiger-stripe" region suggesting fault lines caused by tectonic stress.

Internal heating of Enceladus probably results from its eccentric orbit around Saturn. "*Enceladus gets squeezed and stretched by tidal forces as it orbits Saturn, and that mechanical energy is transformed into heat energy in the moon's interior*," added Nimmo. Future Cassini observations of Enceladus may support this model. Meanwhile, scientists await the next Enceladus flyby in 2008 for more clues.



Floating Rubble Pile Asteroid Itokawa is a Pristine Record of Solar System's History

A small, near-Earth asteroid named Itokawa is just a pile of floating rubble, probably created from the breakup of an ancient planet, according to a researcher who was part of the Japanese space mission Hayabusa. The finding suggests that asteroids created from rubble would be pristine records of early planet formation. Daniel Scheeres, associate professor of aerospace engineering, was part of the team that determined the asteroid's mass, surface environment, and gravitational pull and helped interpret the images that were taken of the asteroid from the spacecraft. The Hayabusa space probe arrived at asteroid Itokawa last fall and orbited for three months. During that time it descended twice to the surface of the asteroid, which is named for the father of Japanese rocketry, to collect samples. In 2010 the probe will return to Earth and eject a sample canister that will reenter the atmosphere and land in central Australia. Researchers hope this will be the first asteroid sample brought back to Earth.

Scheeres said that the confirmation of Itokawa's makeup as rubble rather than a single rock has large implications for theories of how asteroids evolved, and will lead to a better understanding of the early solar system. Asteroids are thought to be the remnants of material that formed the inner planets, which include Earth, and could bear the record of events in the early stages of planet formation. It is a significant finding that Itokawa is a pile of rocks ranging in size from tiny sand grains all the way up to boulders 50 meters wide, because it verifies a number of theories about the makeup and history of asteroids. The existence of very large boulders and pillars suggests that an earlier "parent" asteroid was shattered by a collision and then re-formed into a rubble pile, the researchers conclude. It's likely that most asteroids have a similar past, Scheeres said. "*Analysis of the asteroid samples will give us a snapshot of the early solar system, and provide valuable clues on how the planets were formed*." Also, knowing if an asteroid is a single, big rock or a pile of rubble will have a major influence on how to nudge it off course, Scheeres said, should its orbit be aimed at Earth. An asteroid collision with Earth, while unlikely, could have disastrous consequences. It's widely thought that an asteroid collision caused the mass extinction of dinosaurs 65 million years ago, so some have discussed ways to demolish or steer an approaching asteroid, should we see one coming.

Another striking finding, Scheeres said, is that regions of Itokawa's surface are smooth, "*almost like a sea of desert sand*" and others are very rugged. This indicates that the surfaces of asteroids are, in some sense, active, with material being moved from one region to another. Gravity holds the mass of rubble together. "*These are the first such detailed observations of an asteroid from this close*," Scheeres said.

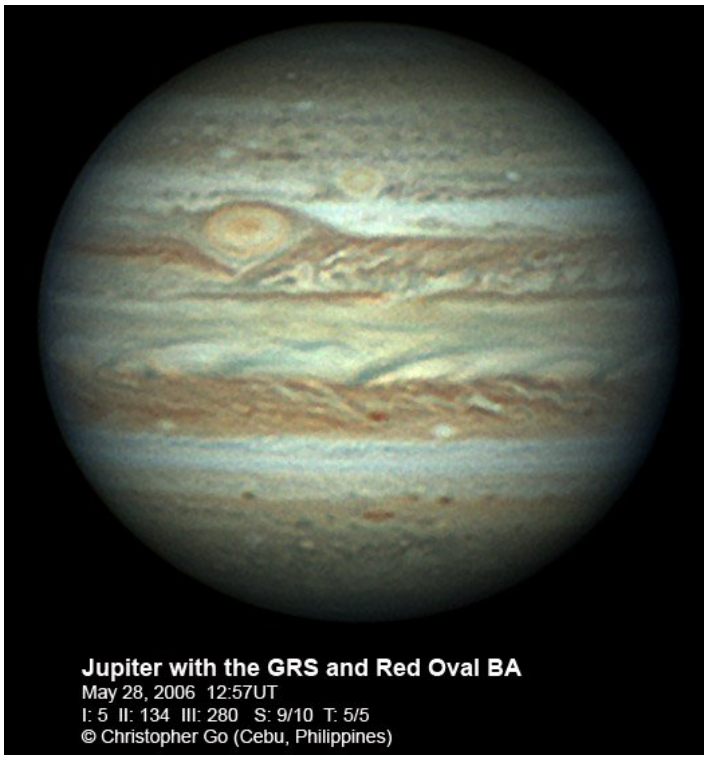
http://www.isas.jaxa.jp/e/index.shtml

Huge Red Storms Converge On Jupiter

The two biggest storms in the solar system are about to go bump in the night, in plain view of backyard telescopes. Storm #1 is the Great Red Spot, twice as wide as Earth itself, with winds blowing 350 mph. The behemoth has been spinning around Jupiter for hundreds of years. Storm #2 is Oval BA, also known as "Red Jr.," a youngster of a storm only six years old. Compared to the Great Red Spot, Red Jr. is half-sized, able to swallow Earth merely once, but it blows just as hard as its older cousin. The two are converging. Closest approach: the 4th of July, according to Amy Simon-Miller who has been monitoring the storms using the

Hubble Space Telescope. "*There won't be a head-on collision*," she says. "*The Great Red Spot is not going to 'eat' Oval BA or anything like that*." But the storms' outer bands will pass quite close to one another - and no one knows exactly what will happen.

Amateur astronomers are already monitoring the event. Christopher Go of the Philippines took the picture above using his 11-inch telescope on May 28th. "*The distance between the storms is shrinking visibly every night*," he says. Similar encounters have happened before, notes JPL's Glenn Orton, a colleague of Simon-Miller. "*Oval BA and the Great Red Spot pass each other approximately every two years*." Previous encounters in 2002 and 2004 were anti-climatic. Aside from some "roughing" around the edges, both storms survived apparently unaltered. This time might be different. Simon-Miller and Orton think Red Jr. could lose its red color, ironically, by passing too close to the Great Red Spot. Red Jr./Oval BA wasn't always red. For five years, 2000 to 2005, the storm was pure white like many other small "white ovals" circling the planet. In 2006 astronomers noticed a change: a red vortex formed inside the storm, the same color as the powerful Great Red Spot. This was a sign, researchers believed, that Oval BA was intensifying. The color of the Great Red Spot itself is a mystery. A popular theory holds that the storm dredges up material from deep inside Jupiter's atmosphere, lifting it above the highest clouds where solar ultraviolet rays turn "chromophores" (color-changing compounds) red. A beefed-up Oval BA could suddenly do the same.



Bumping up against the Great Red Spot, however, could weaken Oval BA, turning it white again. Simon-Miller explains: "*We believe the Great Red Spot will push Oval BA toward a southern jet stream, which is blowing against the oval's counterclockwise rotation*." This would slow Oval BA's spin, possibly reversing the process that reddened it in the first place. What will actually happen? "*We'll see*," she says. That's what telescopes are for.

Note to sky watchers: Jupiter is easy to find. It pops out of the evening twilight before any other star, surprisingly bright. Look for it halfway up the southeastern sky at sunset: sky map http://science.nasa.gov/headlines/y2006/images/redperil/skymap_north.gif

JUPITER'S "BIG BROTHER" HAS MOON-FORMING DUST DISK

Earth's Moon was created by an early collision with another large planetary body. It was a "chip off the old block." Mars captured its asteroidal moons as they passed by. But Jupiter made its own moons out of dust and gas remaining from its formation. Now, observations by astronomer Subhanjoy Mohanty and his colleagues provide the first direct evidence for a dusty disk around a distant planet that in mass would be Jupiter's "big brother." "*It is quite possible that moons or moonlets could form out of this disk, just as they have around the giant planets in our own solar system*," said Mohanty.

The team studied a planetary mass object known as 2MASS1207-3932B, which is located about 170 light-years from Earth in the direction of the constellation Centaurus. 2M1207B, as it is abbreviated, orbits a tiny brown dwarf star at a separation of about 40 astronomical units, or 3.7 billion miles - comparable to the size of Pluto's orbit. That separation is much larger than typical for binary brown dwarf systems. The wide separation may indicate that the duo formed in relative isolation, far from passing stars that could have pulled them apart. "*This system probably won't survive for long. It won't last 5 billion years like our solar system has*," said Mamajek. "*All it would take is for a more massive interloper star to come along and yank the planet away from the brown dwarf*."

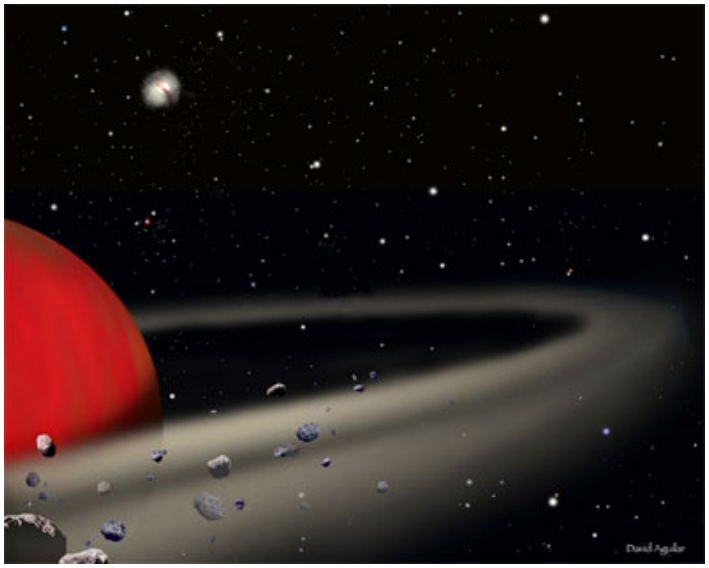
Observations by Mohanty's team showed that the brown dwarf has a mass of about 25 Jupiters and a temperature of 4100 degrees Fahrenheit (2600 K). Its companion 2M1207B weighs about 8 times Jupiter and has a temperature of 2400 degrees F (1600 K). Both objects are warm due to their young age of 5-10 million years, having retained the heat of formation.

Given those temperatures, the team then calculated the expected brightness of both objects. The brown dwarf matched predictions but its companion was about 8 times fainter than expected. After examining several potential causes, the team concluded that the only plausible explanation was the presence of an edge-on dusty disk that blocked most of the planet's light. The planet is seen only in light scattered from the disk.

Spectral analysis shows that 2M1207B is a gas giant like Jupiter with no solid surface. As a result, it would be a poor abode for life. Any moons that might form around it, however, could prove more hospitable.

The large mass of 2M1207B relative to the brown dwarf star poses a puzzle for planetary formation theories. Typical planets like those in our solar system are less than one-hundredth the size of the central star. In contrast, 2M1207B holds one-third as much mass as the brown dwarf. "*Mass ratios of that size are more typical for binary stars than for planetary systems*," said Mohanty. "*2M1207B probably formed like a star, together with the brown dwarf, rather than from core accretion like giant planets around other stars*."

Mohanty and his colleagues plan to study the polarization of light from 2M1207B in order to investigate the inclination of its disk as well as the size of dust grains within the disk. Further studies await the next generation of large telescopes, such as the Giant Magellan Telescope and the Atacama Large Millimeter Array, which may be able to directly detect the disk around the planetary mass companion.



ANCIENT ROCK CARVING LINKED TO ASTRONOMICAL EVENT?

At the beginning of the wildly popular film The Da Vinci Code, the lead character played by Tom Hanks delivers a presentation titled "The Interpretation of Symbols" and begins by saying "*Symbols are a language that can help us understand our past*." Two astronomers could not agree more.

A petroglyph possibly depicts the supernova of A.D. 1006 and the constellation Scorpius. The boulder on which the petroglyphs appear is located in White Tanks Regional Park, Phoenix, AZ. http://galileo.apo.nmsu.edu/~jcb/sn1006/SN1006_glyph_800_by_600.jpg

They announced this week what is believed to be a link between a historical stellar event and the meaning behind an ancient symbol. John Barentine, an astronomer with Apache Point Observatory and Gilbert A. Esquerdo, Research Assistant with Planetary Science Institute, believe an early rock carving, or petroglyph, found in the White Tanks Regional Park in Arizona depicts the well-known supernova of A.D. 1006. The petroglyph is located in an area once occupied by prehistoric Native Americans called the Hohokam. From about A.D. 500-1100, the Hohokam are believed to have lived in this area, outside of what is now Phoenix, Arizona.

Until now, the one-thousand year old supernova was thought to only have been recorded by star watchers in the Old World. Simultaneous written records from Asia, the Middle East and Europe recognize the appearance of a "new star" in the modern constellation of Lupus on May 1, 1006. Confirmation of this proposition would advance understanding of prehistoric Native American astronomy and traditions concerning the night sky. On believing he may have found the first New World record of the exploding star, Barentine says, "*The supernova of 1006 was perhaps the brightest such event visible from Earth for thousands of years, reaching the brightness of a quarter moon at peak, yet to date no representations of the event have been identified in Native American art. If confirmed, this discovery supports the idea that ancient Native Americans were aware of changes in the night sky and moved to commemorate them in their cultural record. It may also be of benefit to archaeologists trying to fix precise dates to petroglyphs in the Southwest and elsewhere in the world, providing a rare opportunity to relate a specific historical event to its depiction in rock art*."

Traditionally, assigning dates of origination to prehistoric Native American art has been extremely difficult because of the lack of a written language and little continuity with the culture and folklore of historic Native American tribes. Barentine, who studies Southwest archeology as a hobby says, "*Quantitative methods such as carbon-14 dating are alternative means to assign ages to works of prehistoric art, but they lack precision of more than a few decades, so any depiction in art that can be fixed to a specific year is extremely valuable*." Though he admits, "*Without my background in astronomy, I probably wouldn't have recognized the petroglyph for what it might represent*."

Simulated night sky looking south from the location of the petroglyph at midnight on May 1, 1006. The horizon profile is a true representation of the site horizon, made from photographs taken at the site and placed correctly with respect to the stars and the direction of true south. The supernova appears just above the horizon near center; the constellation Scorpius grazes the horizon left of center. http://galileo.apo.nmsu.edu/~jcb/sn1006/sky_and_horizon_1024_by_619.jpg

Barentine and Esquerdo created an accurate model of the night sky on May 1, 1006, to show that the relative position of the supernova with respect to the constellation Scorpius matches the relative placement of scorpion and star symbols on the rock. Petroglyphs such as these are among the most durable and longest lasting human art forms. They are made by pecking, or hammering away, at the rock surface using a smaller, handheld rock. It is the enduring image on this rock that inspired Esquerdo as he says, "*Standing in the desert heat after studying the petroglyphs, the span of the ages hit home. One thousand years ago, someone else was standing in that exact spot looking upon the depiction they created of the star they had seen in previous nights. It was the change in the sky that had brought that artist as well as us to that spot one thousand years apart*."

Similar petroglyphs have been identified as likely depictions of historic astronomical events in the prehistoric Southwest. One of the most widely recognized examples is the pictograph near Penasco Blanco in Chaco Canyon National Monument, New Mexico. There, a painted rock symbol is theorized to depict the supernova of July 4, 1054. As for the White Tanks Regional Park petroglyph in Arizona and its suspected relationship to the 1006 astronomical event, the results are not fully conclusive. The proposition is advanced and supported through circumstantial evidence. However, chemical dating, which relies on the abundance of certain elements in the rock varnish, could help confine the range of dates in which the petroglyph was created. A result substantiating an early 11th century date of origin would lead considerable credence to the claim that the prehistoric symbol represents the 1006 supernova event. Indeed, "*Symbols are a language that can help us understand our past*."

INFANT BETA PICTORIS SOLAR SYSTEM AWASH IN CARBON

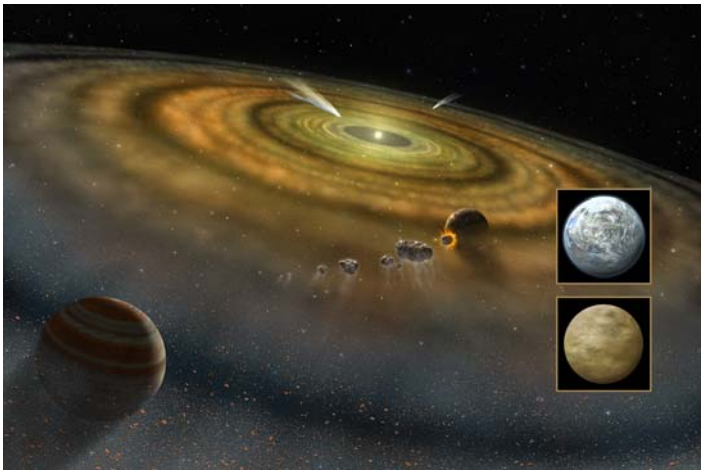
Scientists using the Far Ultraviolet Spectroscopic Explorer, or FUSE, have discovered abundant amounts of carbon gas in a dusty disk surrounding a young star named Beta Pictoris. The star and its emerging solar system are less than 20 million years old, and planets may have already formed. The abundance of carbon gas in the remaining debris disk indicates that Beta Pictoris' planets could be carbon-rich worlds of graphite and methane, or the star's environs might resemble our own solar system in its early days. The new measurements make Beta Pictoris the first disk of its kind whose gas has been comprehensively studied. The discovery settles a long-standing scientific mystery about how the gas has lingered in this debris disk, yet raises new questions about the development of solar systems. "*There is much, much more carbon gas than anyone expected*," said Aki Roberge, lead author on the report. "*Could this be what our own solar system looked like when it was young? Are we seeing the formation of new types of worlds? Either prospect is fascinating*."

The carbon gas detected by the spacecraft comes from unseen asteroids or comets orbiting the star that collide with each other and release material. The mere presence of gas in the Beta Pictoris disk has been a mystery. Theoretical models predict that intense light from the young star should rapidly blow the gas away. The overabundance of carbon, discovered now for the first time, explains why the disk retains so much gas. Carbon is less susceptible to expulsion than other elements, and it retards the clearing effect. Beta Pictoris, about 60 light years away from Earth, is 1.8 times more massive than our sun. At eight to 20 million years old, it is very young. This young star's disk was discovered in 1984. Earlier observations with the Hubble Space Telescope and the Keck telescope hinted that a Jupiter-like planet may have already formed in this disk, and rocky terrestrial planets may be forming. Such planets would be too small and faint to observe with current instruments. The terrestrial planets in our solar system -- Mercury, Venus, Earth and Mars -- formed from the collision of smaller planetary bodies such as asteroids about five billion years ago. During the few hundred million years after Earth was formed, asteroids and comets might have smashed into our planet to deliver virtually all of the water and organic material we see today. These materials are the building blocks of life on Earth.

Asteroids and comets orbiting Beta Pictoris might contain large amounts of carbon-rich material, such as graphite and methane. Planets forming from or impacted by such bodies would be very different from those in our solar system and might have methane-rich atmospheres, like Titan, a moon of Saturn.

"*What we have learned in the past ten years is that our galaxy is filled with other solar systems, and each one is different from the next,"* said Marc Kuchner, an expert on extra-solar planets. "*Beta Pictoris may be telling us something about the variety of planets that might be out there; some might be carbon planets, very different from the Earth*."

Alternatively, Beta Pictoris might be similar to how our solar system was long ago. While local asteroids and comets don't seem carbon-rich today, some research suggests that certain meteorites called enstatite chondrite meteorites formed in a carbon-rich environment. Some scientists also speculate that Jupiter has a carbon core. "*We might be observing processes that occurred early in our solar system's development*," said co-author Alycia Weinberger.



http://www.nasa.gov/vision/universe/starsgalaxies/betapicMM.html http://fuse.pha.jhu.edu

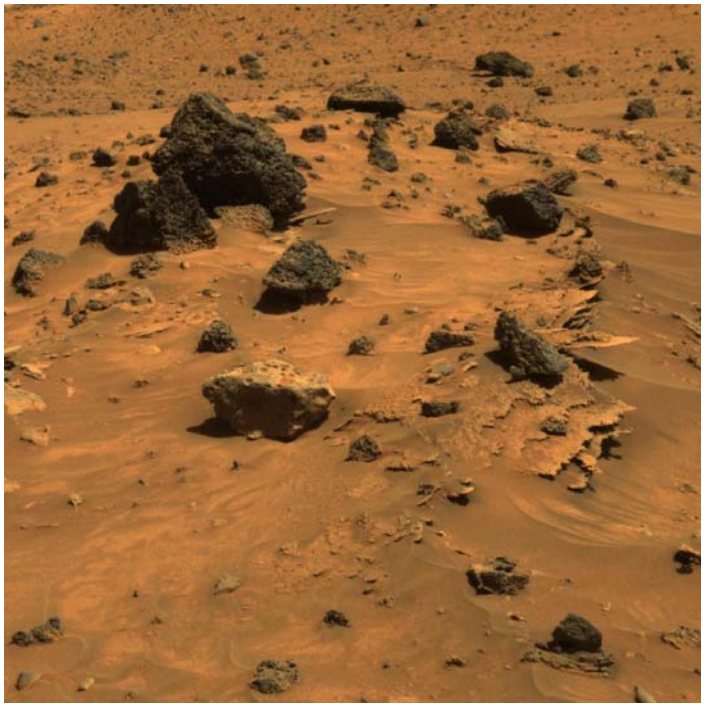
CORKSCREW ASTEROID 2003 YN107 – TEMPORARY MOON

A tiny asteroid looping around Earth for the past seven years is about to leave the neighborhood. Earth has a "second moon." Asteroid 2003 YN107 is looping around our planet once a year. Measuring only 20 meters across, the asteroid is too small to see with the unaided eye, but it is there. This news, believe it or not, is seven years old. "*2003 YN107 arrived in 1999*," says Paul Chodas of the Near Earth Object Program at JPL, "*and it's been corkscrewing around Earth ever since*." Because the asteroid is so small and poses no threat, it has attracted little public attention. But Chodas and other experts have been monitoring it. "*It's a very curious object*," he says. Most near-Earth asteroids, when they approach Earth, simply fly by. They come and they go, occasionally making news around the date of closest approach. 2003 YN107 is different: It came and it stayed. "*We believe 2003 YN107 is one of a whole population of near-Earth asteroids that don't just fly by Earth. They pause and corkscrew in our vicinity for years before moving along*." These asteroids are called Earth Coorbital Asteroids or "coorbitals" for short. Essentially, they share Earth's orbit, going around the Sun in almost exactly one year. Occasionally a coorbital catches up to Earth from behind, or vice versa, and the dance begins: The asteroid, while still orbiting the sun, slowly corkscrews around our planet. "*These asteroids are not truly captured by Earth's gravity*," notes Chodas. "*But from our point of view, it looks like we have a new moon*." Astronomers know of at least four small asteroids that can do this trick: 2003 YN107, 2002 AA29, 2004 GU9 and 2001 GO2. "*There*

may be more," says Chodas. He believes the list will grow as asteroid surveys improve in sky coverage and sensitivity. At the moment, only two coorbitals are actually nearby: 2003 YN107 and 2004 GU9. The others are scattered around Earth's orbit. 2004 GU9 is perhaps the most interesting. It measures about 200 meters across, relatively large. And according to calculations just published, it has been looping around Earth for 500 years--and may continue looping for another 500. It's in a remarkably stable "orbit." Right now, however, researchers are paying more attention to 2003 YN107 for one simple reason: it's about to depart. The asteroid's corkscrew path is lopsided and on June 10th it will dip within 3.4 million km of Earth, slightly closer than usual. Earth's gravity will then give the asteroid the nudge it needs to leave. "*This is a chance to observe one of these asteroids [on the way out],"* explains Chodas. It won't be gone forever. In about 60 years 2003 YN107 will lap Earth again, resuming its role as a temporary, corkscrewing moonlet. In due course, other coorbitals will do the same. Each encounter is an opportunity for study--and possibly profit. Even the most powerful telescopes cannot see much of these tiny asteroids; they're just specks in the eyepiece. But one day, when the space program is more advanced, it might be possible to visit, explore the moonlets and tap their resources. "*For now, they're just a curiosity*," says Chodas. News flash: Earth is about to lose a moon. More to come.

POSSIBLE IRON METEORITE FOUND IN MARS COLUMBIA HILLS

The rock in the center foreground of the picture (below) is suspected of being an iron meteorite. The panoramic camera on the Mars Exploration Rover Spirit took this image during the rover's 809th Martian day (April 12, 2006). The foreground rock, informally named "Allan Hills," and a similar rock called "Zhong Shan," just out of the field of view to the left, have a smoother texture and lighter tone than other rocks in the area. The texture and glossiness of this pair reminded some members of the rover science team of a rock called "Heat Shield Rock," which was observed by Opportunity, Spirit's twin, in the Meridiani region of Mars more than a year ago. Examination of that rock's composition confirmed it to be an iron meteorite http://photojournal.jpl.nasa.gov/catalog/PIA07269



Observations of Allan Hills and Zhong Shan with Spirit's miniature thermal emission spectrometer indicate that they are very reflective, like Heat Shield Rock. They are the first likely meteorites found by Spirit. Rocks in the vicinity of Spirit's winter station are being assigned informal names honoring Antarctic research stations. Zhong Shan is an Antarctic base established by China in 1989. Allan Hills is a site where meteorites are frequently collected because they are relatively easy to see as dark rocks on the bright Antarctic ice. The most famous Allan Hills meteorite from Antarctica actually came from Mars and landed on Earth. If the Zhong Chang and Allan Hills rocks seen by Spirit do turn out to be iron-rich meteorites, they may have originated from an asteroid and landed on Mars. This view is an approximately true-color rendering that combines images taken through the panoramic camera's 753-nanometer, 535-nanometer, and 432-nanometer filters. It is a portion of an image previously released http://photojournal.jpl.nasa.gov/catalog/PIA08095

FIRST EXPLANATION OF THE NEAR CONSTANT PLANET-TO-MOONS MASS-RATIO-SCALE OF 1 : 10,000 FOR THE GAS PLANET SATELLITE SYSTEMS

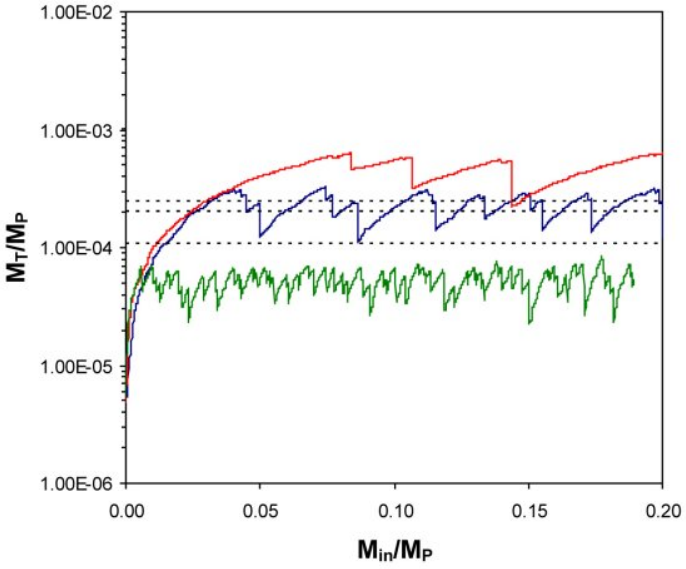
Each of our Solar System's outer gaseous planets hosts a system of multiple satellites, and these objects include Jupiter's volcanic Io and Europa with its believed subsurface ocean, as well as Titan with its dense and organic-rich atmosphere at Saturn. While individual satellite properties vary, the systems all share a striking similarity: the total mass of each satellite system compared to the mass of its host planet is very nearly a constant ratio, roughly 1:10,000. Researcher recently published an explanation as to why the gaseous planets display this consistency, and why the satellites of gas planets are so much smaller compared to their planet than the principal satellites of solid planets. Jupiter's four Galilean satellites are each roughly similar in size, while Saturn has one large satellite together with numerous much smaller satellites. Even so, the total mass in both satellite systems is about a hundredth of one percent (0.0001) of the respective planet's mass. The Uranian satellite system structure is similar to that of Jupiter, and it also exhibits the same mass ratio. In contrast, the large satellites of solid planets contain much larger fractions of their planet's masses, with the Moon containing 1 percent (0.01) of the Earth's mass, and Pluto's satellite, Charon, containing more than 10 percent (0.1) of its mass.

Why do the gas planets, each with unique formation histories of their own, have satellite systems containing a consistent fraction of each planet's mass, and why is this fraction so small compared to solid planet satellites? Dr. Robin Canup and Dr. William Ward propose that it was the presence of gas, primarily hydrogen, during the formation of these satellites that limited their growth and selected for a common satellite system mass fraction. As the gas planets formed, they accumulated hydrogen gas and solids such as rock and ice. The final stage of a gas planet's formation is believed to involve an inflow of both gas and solids from solar orbit into planetary orbit, producing a disk of gas and solids orbiting the planet in its equatorial plane. It is within that disk that the satellites are believed to have formed.

Canup and Ward considered that a growing satellite's gravity induces spiral waves in a surrounding gas disk, and that gravitational interactions between these waves and the satellite cause the satellite's orbit to contract. This effect becomes stronger as a satellite grows, so that the bigger a satellite gets, the faster its orbit spirals inward toward the planet. The team proposes that the balance of two processes -- the ongoing inflow of material to the satellites during their growth and the loss of satellites to collision with the planet -- implies a maximum size for

a gas planet satellite consistent with observations. Using both numerical simulations and analytical estimates of the growth and loss of satellites, the team shows that multiple generations of satellites were likely, with today's satellites being the last surviving generation that formed as the planet's growth ceased and the gas disk dissipated. Canup and Ward demonstrate that during multiple cycles of satellite growth and loss, the fraction of the planet's mass contained in its satellites at any given time maintains a value not very different from 0.0001 across a wide range of model parameter choices.

The team's direct simulations are also the first to produce satellite systems similar to those of Jupiter, Saturn and Uranus in terms of number of satellites, their largest masses and the spacings of the large satellite orbits. "*We believe our results present a strong case that the satellite systems of Jupiter and Saturn formed within disks produced as the planet itself was in its final growth stages*," says Canup. "*However, the origin of the Uranian satellite system remains more uncertain, and the likelihood of our results being applicable to that planet depends on how Uranus achieved its nearly 98-degree axial tilt, which is a topic of active study*." For extrasolar systems, this research suggests that the largest satellites of a Jupiter-mass planet would be Moon-to-Mars sized, so that Jovian-sized exoplanets would not be expected to host satellites as large as the Earth. This is relevant to the potential habitability of satellites in extrasolar systems.



- Graphic courtesy of Southwest Research Institute

Red, blue and green curves are results of three simulations of satellite growth and loss within a disk supplied by an inflow of gas and solids. Plotted is the total mass of all orbiting satellites in each case scaled to the planet's mass, MT/MP, as a function of the total fraction of the planet's mass delivered by the inflow, Min/MP, which is a quantity that is proportional to the total elapsed simulation time. For comparison, the black dotted lines are corresponding values for the satellite systems of Jupiter, Saturn and Uranus, respectively. In these simulations, a constant inflow rate is considered in order to illustrate cycles of satellite growth and loss. The inflow of solid material to the protosatellite disk causes MT/MP to increase with time until large satellites form and are lost to collision with the planet (indicated by the discrete jumps downward in MT/MP). Once large satellites have been lost to orbital decay, continued inflow causes a new generation of satellites to grow, and the cycle repeats. Throughout the process, MT/MP oscillates about a fairly constant value. The three simulations consider a wide range (a span of a factor of 500) for the key parameters that affect the amount of gas in the disk when large satellites form http://www.swri.edu/press/2006/canupfigure.htm

A METEOROID HITS THE MOON

There's a new crater on the Moon. It's about 14 meters wide, 3 meters deep and precisely one month, eleven days old. NASA astronomers watched it form: "On May 2, 2006, a meteoroid hit the Moon's Sea of Clouds (Mare Nubium) with 17 billion joules of kinetic energy—that's about the same as 4 tons of TNT," says Bill Cooke, the head of NASA's Meteoroid Environment Office. "The impact created a bright fireball which we video-recorded using a 10-inch telescope." Lunar impacts have been seen before--"stuff hits the Moon all the time," notes Cooke--but this is the best-ever recording of an explosion in progress: "The duration of the fireball was only four-tenths of a second," says Cooke. "A student member of our team, Nick Hollon, spotted the flash." Taking into account the duration of the flash and its brightness (7th magnitude), Cooke was able to estimate the energy of impact, the dimensions of the crater, and the size and speed of the meteoroid. "It was a space rock about 10 inches (25 cm) wide traveling 85,000 mph (38 km/s)," he says. If a rock like that hit Earth, it would never reach the ground. "Earth's atmosphere protects us," Cooke explains. "A 10-inch meteoroid would disintegrate in mid-air, making a spectacular fireball in the sky but no crater." The Moon is different. Having no atmosphere, it is totally exposed to meteoroids. Even small ones can cause spectacular explosions, spraying debris far and wide.

According to the Vision for Space Exploration, NASA is sending astronauts back to the Moon. Are these meteoroids going to cause a problem? "That's what we're trying to find out," says Cooke. "No one knows exactly how many meteoroids hit the Moon every day. By monitoring the flashes, we can learn how often and how hard the Moon gets hit." The work is underway. Using a computerized telescope built by Rob Suggs and Wesley Swift of the Marshall Space Flight Center, Cooke's group is monitoring the night side of the Moon "as often as ten times a month, whenever the lunar phase is between 15% and 50%."

During a telescope test last November 7th, Suggs and Swift recorded an explosion on their very first night of observing. A piece of debris from Comet Encke struck the plains of Mare Imbrium, making a crater about 3 meters wide. Now that regular monitoring has begun, Cooke's group has already found a second impact, the May 2nd event, in only 20 hours of watching. This time, they believe, the impactor was a random meteoroid, "a sporadic," from no particular comet or asteroid. "We've made a good beginning," says Cooke, but much work remains. He would like to observe all year long, watching the Moon as it passes in and out of known meteoroid streams. "This would establish a good statistical basis for planning [activities on the Moon]."

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.

The Star Gazer
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Everett, WA 98206

In June's Stargazer:

The next EAS Meeting is 3:00 P.M. SATURDAY, June 17th 2006 at the Everett Public Library Auditorium.