



The Stargazer

Jul 2005

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The Stargazer
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See EAS website at:

http://members.tripod.com/everett_astronomy

EAS BUSINESS...

NEXT EAS MEETING - SUNDAY JULY 31ST AT 3:00 PM AT THE EVERETT PUBLIC LIBRARY, IN THE AUDITORIUM (DOWNSTAIRS)

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>

Scheduled Meeting Dates: (NOTE THAT THEY CHANGE)

Jul 31 – EAS Meeting – SUNDAY 3:00 PM at Everett Public Library - Origins, pt. 2, with Neil Degrasse Tyson

Aug 27 - EAS Meeting – SUNDAY 3:00 PM at Everett Public Library

CLUB STAR PARTY INFO

Upcoming star party schedule:

Friday and Saturday July 29th and 30th, at Ron Tam's house in Snohomish.

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.

Camp Delaney Star Party – Labor Day Weekend ---

"My name is Cliff Mygatt and I am the President of the Olympic Astronomical Society in Bremerton. I would like to invite your EAS members to our annual camp Delaney star party at Sun Lakes state park. The star party will be over Labor Day weekend. We have had several of your members attend over the years. If any members are interested, they can contact me at cliffandchris@wavecable.com Cost is \$50.00 due to additional day of food and lodging. Anyone interested in attending can get a registration form from me, which needs to be in by 24 Aug. . Thanks, LCDR Cliff Mygatt"

Oregon Star Party – Labor Day Weekend -

I would like to ask that you include a note in your next newsletter, and/or announce at your next meeting that our registration for the 2005 Oregon Star Party is online and available. It is a short 3 months until OSP and we have a great lineup of speakers, events, and of course, the dark central Oregon skies. We invite your members to tour our website at <http://www.oregonstarparty.org> to obtain more information, register, and plan for a great Labor Day star party. Thanks much, and I hope we see you soon!

- Bill Jensen, OSP Committee

Klickitat County Star Party(s) <http://klickitatstarparty.net/>

August 5th - 7th, 2005

Sept 30th - Oct 2nd, 2005

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

The club maintains a \$500+ balance. We try to keep approximately a \$500 balance to allow for contingencies. Emailing a digital copy of the newsletter has been suggested to reduce printing and postage costs, and speed up delivery, please email Mark if electronic copy would be OK for you.

CLUB SCOPES

SCOPE	LOAN STATUS	WAITING
10-INCH DOBSONIAN	ON LOAN	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 2005

Jul 04 - Deep Impact, Comet Tempel 1 impact/flyby
 Jul 04 - Earth at aphelion (1.017 AU From Sun)
 Jul 12 - Asteroid 3259 Brownlee closest approach to Earth (2.19 AU)
 Jul 21 - Largest full moon for 2005
 Jul 23 - 10th Anniversary (1995), Discovery of Comet Hale-Bopp
 Jul 27-29 - South Delta-Aquarids meteor shower peak
Jul 31 - EAS MEETING - SUNDAY 3:00 PM at Everett Public Library
 Jul 30-Aug 07 Mt. Kobau Star Party – Osyoos BC

August 2005

Aug 01 - Alpha Capricornids Meteor Shower Peak
Aug 4-6 - Table Mountain Star Party

Aug 04 - Furthest lunar apogee of 2005
 Aug 05 - Neil Armstrong's 75th birthday (1930)
 Aug 06 - Southern Iota Aquarids meteor shower peak
 Aug 08 - Moon 1.0 right of Venus
 Aug 08 - Neptune at opposition – visible all night
 Aug 11 - Perseid meteor watch - Rooster Rock St Park - Columbia Gorge
 Aug 12 - Perseids meteor shower peak
 Aug 24 - Mercury at Greatest Western Elongation (18 degrees from Sun)
 Aug 25 - Northern Iota Aquarids meteor shower peak
Aug 27 - EAS MEETING - Saturday 4:00 PM at Everett Public Library
 Aug 31 - Uranus at opposition – visible all night

September 2005

Sep 01 - Uranus at opposition
 Sep 01 - Venus passes 1.2 degrees from Jupiter
 Sep 03 - New Moon
 Sep 03 - Potential Saturday EAS star party night, location TBD
Sep 1-4 - Oregon Star Party
Sep 2-5 - Olympic Astronomy – Dry Falls Star Party
 Sep 05 - Labor Day holiday
 Sep 07 - Moon occults Venus
 Sep 22 - Autumnal Equinox (22:23 UT) – 1st day of autumn N hemisphere
Sep 24 - EAS MEETING - Saturday 4:00 PM at Everett Public Library

October 2005

Oct 01 - Potential Saturday EAS star party night, location TBD
 Oct 03 - New Moon
 Oct 03 - Annular Solar Eclipse, Visible From Africa
 Oct 04 - Moon occults Mercury
 Oct 05 - Mercury passes 1.3 degrees from Jupiter
 Oct 09 - Draconids meteor shower Peak
 Oct 16 - Venus occults PPM 265560 (7.7 Magnitude Star)
 Oct 17 - Partial Lunar eclipse
 Oct 21 - Orionid meteor shower peak
Oct 29 - EAS MEETING - Saturday 4:00 PM at Everett Public Library
 Oct 30 - Daylight Saving - set clock back 1 Hour

November 2005

Nov 01 - New Moon
 Nov 05 - Potential Saturday EAS star party night, location TBD
 Nov 03 - Taurids meteor shower peak
 Nov 03 - Mercury at its Greatest Eastern Elongation (23 Degrees)
 Nov 03 - Venus at its Greatest Eastern Elongation (47 Degrees)
 Nov 07 - Mars at opposition
Nov 19 - EAS MEETING - Saturday 4:00 PM at Everett Public Library

December 2005

Dec 02 - 10th anniversary (1995), SOHO Launch
 Dec 12 - Moon occults Mars
 Dec 12 - Mercury at its Greatest Western Elongation (21 Degrees)
 Dec 13 - Geminids meteor shower peak
 Dec 21 - Winter Solstice, 18:35 UT
 Dec 22 - Ursids meteor shower peak
Dec 10th or 17th – EAS Dinner - Saturday 7:00 PM

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 06	New Moon
Jul 14	First Quarter Moon
Jul 21	Full Moon
Jul 28	Last Quarter Moon
Aug 05	New Moon
Aug 13	First Quarter Moon
Aug 19	Full Moon
Aug 26	Last Quarter Moon
Sep 03	New Moon
Sep 11	First Quarter Moon
Sep 18	Full Moon
Sep 25	Last Quarter 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	5:45 am	13:16	20:44	Can	-27
Mercury	Daylight	Daylight	Daylight	Can	+0.3
Venus	Daylight	Daylight	22:03	Leo	-3.9
Mars	23:47	Daylight	Daylight	Psc	-0.5
Jupiter	Daylight	Daylight	23:05	Vir	-1.8
Saturn	5:11 am	Daylight	Daylight	Can	+0.2
Uranus	21:51	3:19 am	Daylight	Aqr	+5.7
Neptune	20:55 am	1:49 am	Daylight	Cap	+7.8
Pluto	Daylight	21:57 am	2:55 am	Ser	+13.9

(times local time for Everett PDT)

Transit times for Jupiter's Great Red Spot in 2005

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.srb.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

PICTURES BY LAST MONTH'S SPEAKER JIM TEGERDINE, ON THE NASA AND SPACEWEATHER.COM WEB SITES:

METEOR:

<HTTP://WWW.SPACEWEATHER.COM/SWPOD2005/31JUL05/TEGERDINE.JPG>

HYDROGEN-ALPHA SOLAR:

<HTTP://WWW.SPACE.COM/AMAZINGIMAGES/CTE.PHP?GUID=42ECC97BDF751.12221231&CAT=S>

<HTTP://WWW.SPACE.COM/AMAZINGIMAGES/CTE.PHP?GUID=42E7ED7EBA0909.81099386&CAT=S>

<HTTP://WWW.SPACE.COM/AMAZINGIMAGES/CTE.PHP?GUID=42EADE9BD01485.32351444&CAT=S>

Seattle Astro Society is trying to get a dark sky site.

"We feel that we need to raise \$25,000 in order to buy something appropriate on the other side of the mountains. We are making good progress within SAS. The deal basically is \$250 for dark sky membership, and some relatively nominal sum for annual dark sky dues. One would have to be a SAS member to do this, but that is a rather nominal charge. We were wondering if anyone in your club would be interested in taking part. I personally think that the dark sky site is a necessary thing for SAS to do; otherwise, the club really has little tangible to offer its members. With a dark sky site, even city-bound members would have a place within a few hours where they could view from a dark site; even us suburban folks would benefit, I think. Thanks for your consideration." -- Mark de Regt, SAS.

CONSTELLATIONS OF THE MONTH:

CORONA BOREALIS: (The Northern Crown). With a midnight culmination date of May 19th, Corona Borealis is perfectly placed for spring viewing. It contains no asterisms, but the stars of the constellation do trace out an "upside-down letter 'C'" (the closed portion of the 'C' faces south), situated between the Northern constellations of Bootes and Hercules. The only other bordering constellation is that of Serpens, located to its south. Corona Borealis ranks 11th in overall brightness among the constellations, but 73rd in size; it takes up almost 179 square degrees of the entire sky (0.433%). It contains no known meteor showers, and no Messier objects. Corona Borealis is completely visible from latitudes North of -50 degrees, and completely invisible from latitudes South of -64 degrees. It has 22 stars greater than magnitude 5.5, and its central point is at RA=15h48m, Dec.= +33 degrees. The solar conjunction date of Corona Borealis is November 18th. Even though Corona Borealis has no Messier objects or known meteor showers, besides being a visually beautiful constellation, it does contain two very interesting objects in their own right. Near epsilon Corona Borealis, a nova suddenly flared up in May, 1866. It reached 2nd magnitude and remained easily visible for over a week. It is now known as the "Blaze Star" (also known as T Corona Borealis), and is the most famous example of a recurring nova. (It last brightened, to 3rd magnitude, in 1946). There is also another interesting variable star within Corona Borealis (CrB), known as R CrB. It is normally a 6th magnitude star, but it dims (at irregular intervals) to as low as 15th magnitude. It is suspected that clouds of carbon (e.g., soot and graphite) are emitted from the star and therefore dim its light; when these materials are reabsorbed, the star brightens. There are two well-known legends associated with the constellation of Corona Borealis. The Native (North) American Indians considered it to be a semicircle of chiefs, at council to discuss the future of their peoples. In ancient Greek mythology, Ariadne (daughter of King Minos) was asked by Bacchus (the god of vegetation and wine) to marry him. But Ariadne did not believe that Bacchus was a god. To prove that he was, Bacchus asked Venus (goddess of love) to design a crown of jewels as his wedding present to Ariadne. When Ariadne saw the crown, she believed that Bacchus was a god, and consented to marry him. Bacchus was so overwhelmed with joy, that he threw the crown into the heavens, where it has resided and shone ever since. Corona Borealis is a visually beautiful Northern constellation, and is well placed to be easily enjoyed by any spring sky-watcher.

YOUNG ASTRONOMER'S CORNER

The Young Astronomer's Corner will return in August, 2005. Enjoy any star parties that you have the opportunity to go to!

ASTRONOMY AND TELESCOPE LINGO

ASTRONOMY LINGO: COMET BENNETT - BENNETT'S COMET (1970 II): A long-period comet discovered in 1969 by J.C. Bennett from South Africa. It passed perihelion on March 20, 1971, and by this time the comet was a zero-magnitude object with a tail 11 degrees long and an inclination of 90 degrees. The Orbiting Geophysical Observatory revealed the comet to be surrounded by a huge hydrogen envelope. (editor's note: this happens to be the first comet observed by EAS president Mark Folkerts, which he first saw through a kitchen window – it was gloriously bright!)

TELESCOPE LINGO: PAUL-BAKER TELESCOPE: A wide field-of-view, compact three mirror telescope, modeled by Maurice Paul in 1935 and modified by James Baker in approximately 1945. This telescope is able to produce a high quality image on a

flat focal plane, with very low image extension: a paraboloidal primary, a convex ellipsoidal secondary, and a concave spherical tertiary mirror are used.

PLANETARY FOCUS

This month, our guest planet is Neptune, and these are the facts:

Rotation around the Sun: every 164.79 years

Orbit: from 29.76 (closest or 'perihelion') to 30.36 (furthest or 'aphelion') Astronomical Units (AU)*; this is an orbit that varies between approximately 2.77 billion and 2.82 billion miles from the sun. (*Note: One AU equals approximately 93 million miles).

Inclination of Orbit to Ecliptic: 1.8 degrees.

Mean Orbital Velocity: 5.43 km/sec.

Diameter at Equator: 50,538 kilometers (or 31,586 miles).

Mass: 17.2 (approximately 17.2 times more massive than earth); (5.9742 x 10^{e24} (10 to the 24th power)) kilograms = 1 Earth Mass).

Density: approximately 1.80 times that of water (global density).

Surface Gravity (Earth = 1): 1.19

Period of Rotation on its own axis: approximately 18 hours, 25 minutes.

Axis tilt: 29.56 degrees.

Satellites (moons): 8, as well as planetary rings.

Special Notes About Neptune: Neptune is the fourth largest planet in the solar system (one of the gas giants) in terms of equatorial diameter, but is more massive than Uranus, the third largest planet in diameter. Neptune is the most distant of the giant planets, and was discovered in 1846 by J.G. Galle at the Berlin Observatory, based on French (Urbain Leverrier) predictions resulting from disturbances in the orbit of Uranus (there were similar estimates made by Englishman John C. Adams). Neptune returns to opposition two days later every year, and appears as an indistinct magnitude 7.7 bluish-green object in binoculars; in fact, no markings can be seen on its bluish-green disk from earth-bound telescopes. Neptune's color arises primarily from methane within its atmosphere, which is principally helium and hydrogen and a blend of methane, water, and ammonia. In 1989, Voyager 2 sent back remarkable images of Neptune during its fly-by. The Great Dark Spot was noted in its atmosphere. Like Jupiter's Great Red Spot, it occupies a equivalent proportion of the surface area of Neptune (as the GRS does of Jupiter's surface area), and is a high-pressure system around which near-supersonic winds flow in an anti-clockwise circuit. The Great Dark Spot measures approximately 12,000 by 8,000 kilometers. At about 50-70 kilometers above the main cloud plane, there are whitish cirrus-like clouds composed of methane ice crystals. Neptune also has belts and zones similar to Jupiter's, only much fainter. The core of Neptune is believed to be rocky, composed primarily of silicon and iron. The atmosphere of Neptune revolves more slowly than its core, and this is opposite to the atmospheres of the other gas giants; the implication is that circulation of Neptune's atmosphere may take place in a retrograde (backward or opposite) manner. Neptune also gives off more energy than it receives from the Sun, suggesting that it has its own internal source of heat; the planet also has a magnetic field, which is somewhat weaker than that of the other gas giant planets. Four dark planetary rings were discovered during the Voyager 2 fly-by in 1989.

Neptune has 8 known moons; six of them were discovered during the 1989 Voyager 2 fly-by, and the remaining two (Triton and Nereid) were discovered from Earth. Triton is the largest moon of Neptune, and was discovered the same year (1846) as the planet itself; it is about ¾ the size of our own Earth's Moon. Interestingly, Triton has an orbit in the opposite direction to that of Neptune (retrograde), and is slowly coiling its way down towards Neptune. Triton is a very cold moon, and has a thin atmosphere of mostly nitrogen, with some methane and carbon monoxide. Its South Pole cap is pinkish in color (probably nitrogen snow and ice). Triton's face has been shown to have both craters and long cracks, but no mountains; its surface resembles that of a cantaloupe. It has also been noted to have geysers of nitrogen, some reaching 8 km in height! Nereid was discovered from Earth in 1949, and has a very eccentric orbit (going from 2 to 10 million kilometers from the planet at various times during its orbit). When we talk about Pluto next month in our last column of this present series, we will tell you why Neptune, and not Pluto, is sometimes the farthest planet from the Sun. Can you guess why? Stay tuned; see you next month!

ASTRONOMY FUN FACTS

★★ The Milky Way Galaxy is so large, that a powerful flash of light generated at one edge of the Milky Way (and traveling at 186,000 miles/second), would take 100,000 years to reach the other side!! (Another way of saying the same thing: our Milky Way Galaxy is approximately 100,000 light years across!)

★★ Can you go on a multi-trillion mile, and multi-million year, voyage, without ever turning back, and still only wind up at your place or origin? Well, technically, yes! If a star-ship left Earth at about 190,000 miles per hour, in about 115 million years (!), it would meet up with the Earth and Sun again because of the rotation of the Milky Way Galaxy. Had it never left Earth, it would have "arrived" at about the same time! Of course, it would have been without all the great adventures of the journey, many of which would have become lore, legend, and conversations of countless new generations, eons before the actual arrival!

★★ The great comet of 1843 had a tail that stretched halfway across the sky; it was estimated to be about 500 million miles long (about Jupiter's distance from the Sun). This comet's tail, if wrapped around the Earth's equator, would circle it about 20,000 times!

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: OPTICAL DOUBLE STARS: A pair of stars that *appear* close together in the sky (as opposed to actually *being* close together in the sky: this would be a physical double star system). Optical double stars appear close together because they lie in roughly the same direction – the same line of sight – as seen from Earth. However, unlike physical doubles, they share no gravitational attraction, as they are too far apart to be members of the same stellar system.

REPRESENTATIVE NORTHERN HEMISPHERE OBJECT:

Albireo (Beta Cygni): This very famous, and very beautiful, double star is a favorite of all astronomers, and a favorite new object of all budding night-sky enthusiasts. It is the second brightest "star" (i.e., it is actually two stars) in Cygnus. The primary star is an orange giant with an apparent visual magnitude of 3.1 and is of spectral type K5-II; the secondary, 35 arc seconds away, is deep blue, has an apparent visual magnitude of 5.1, and is of spectral type B8-V. Albireo is 120 parsecs distant from Earth, and its individual components are separated by about 400 billion miles.

REPRESENTATIVE SOUTHERN HEMISPHERE OBJECT: AL GIEDI (Alpha Capricorni):

The brighter of the two stars in this system has an apparent visual magnitude of 3.6, and is a light yellow spectral type G3 supergiant. The dimmer of the pair has an apparent visual magnitude of 4.2, is also light yellow in color, and is classified as a G9 giant. Interestingly, each member of this optical double star system has dimmer, closer companions as well. The G3 supergiant in the line-of-sight Alpha Capricorni star system lies 110 light-years away from Earth, but the G9 giant lies much further away.....1,600 light-years away to be exact!!

ASTRONOMICAL NOTES -- ON & OFF THE NET...**DEEP IMPACT TELLS A TALE OF THE COMET**

Data from Deep Impact's instruments indicate an immense cloud of fine powdery material was released when the probe slammed into the nucleus of comet Tempel 1 at 6.3 miles per second.

The cloud indicated the comet is covered in the powdery stuff. The Deep Impact science team continues to wade through gigabytes of data collected during the July 4 encounter with the 3-mile-wide by 7-mile-long comet.

"The major surprise was the opacity of the plume the impactor created and the light it gave off," said Deep Impact Principal Investigator Dr. Michael A'Hearn. *"That suggests the dust excavated from the comet's surface was extremely fine, more like talcum powder than beach sand. And the surface is definitely not what most people think of when they think of comets -- an ice cube."* How can a comet hurtling through our solar system be made of a substance with less strength than snow or even talcum powder? *"You have to think of it in the context of its environment,"* said Pete Schultz, Deep Impact scientist. *"This city-sized object is floating around in a vacuum. The only time it gets bothered is when the sun cooks it a little or someone slams an 820-pound wakeup call at it at 23,000 miles per hour."*

The data review process is not overlooking a single frame of approximately 4,500 images from the spacecraft's three imaging cameras taken during the encounter. *"We are looking at everything from the last moments of the impactor to the final look-back images taken hours later, and everything in between,"* added A'Hearn. *"Watching the last moments of the impactor's life is remarkable. We can pick up such fine surface detail that objects that are only four meters in diameter can be made out. That is nearly a factor of 10 better than any previous comet mission."*

The final moments of the impactor's life are important, because they set the stage for all subsequent scientific findings. Knowing the location and angle the impactor slammed into the comet's surface is the best place to start. Engineers have established the impactor took two not unexpected coma particle hits prior to impact. The impacts slewed the spacecraft's camera for a few moments before the attitude control system could get it back on

track. The penetrator hit at an approximately 25 degree oblique angle relative to the comet's surface. That's when the fireworks began. The fireball of vaporized impactor and comet material shot skyward. It expanded rapidly above the impact site at approximately 3.1 miles per second, and the crater was just beginning to form. Scientists are still analyzing the data to determine the exact size of the crater. Scientists say the crater was at the large end of original expectations, which was from 50 to 250 meters.

Expectations for Deep Impact's flyby spacecraft were exceeded during its close brush with the comet. The craft is more than 2.2 million miles from Tempel 1 and opening the distance at approximately 23,000 mph. The flyby spacecraft is undergoing a thorough checkout, and all systems appear to be in excellent operating condition.

The Deep Impact mission was implemented to provide a glimpse beneath the surface of a comet, where material from the solar system's formation remains relatively unchanged. Mission scientists hoped the project would answer basic questions about the formation of the solar system by providing an in-depth picture of the nature and composition of comets. For information about Deep Impact on the Internet, visit: <http://www.nasa.gov/deepimpact>

MANITOBA METEORITE HUNTER SCORES AGAIN

Meteorite "magnet" becomes first Canadian to discover two separate space rocks and may have located possible meteorite dumping ground in Manitoba. A new meteorite identified by the Prairie Meteorite Search is posing a mystery about why so many meteorites have been found in eastern Manitoba, and has set a new Canadian record for the man behind the latest out-of-this-world find.

Winnipeg-based rock hound Derek Erstelle has become the first person in Canada to discover two separate meteorites after he uncovered a previously-overlooked meteorite while sifting through some of the unusual rocks he has collected over the years. After finding two fragments of an iron meteorite in the fall of 2002 near Bernic Lake, in eastern Manitoba, Erstelle decided to dig out a similar-looking specimen he discovered about 40-kilometers away near Pinawa in 1998 or 1999. Tests conducted by U of C planetary scientist Dr. Alan Hildebrand and Lakehead University's Dr. Stephen Kissin confirmed that the Pinawa specimen is a rock from outer space and originated from a different source than the Bernic Lake specimens. *"I was inspired to look through my stored rocks for this other rock that I had found before the Bernic Lake specimens,"* said Erstelle, who is an experienced rock collector. *"I'm just out there knocking dust off the rocks when I'm out hunting."*

The Pinawa meteorite is the 7th meteorite to be recovered in Manitoba, and is the 4th Manitoba "find" to be identified by the Prairie Meteorite Search. Meteorites are broadly classified as being either "falls" corresponding to meteorites that were seen to fall to Earth, and "finds" which correspond to meteorites found serendipitously, but with unknown fall dates. The meteorite weighs approximately 2.5 kg and is the 65th meteorite to be recovered in Canada.

Hildebrand calls the discovery very surprising. The extraordinary thing is that two different meteorites could be found only 40 kilometers apart in forested land, where it is much more difficult to find them than on farm or pasture land. Also, the two meteorites are more weathered than is typical for Canadian iron meteorites. *"The meteorite looked much like the two Bernic Lake meteorites so, although they were found about 40-kilometers*

apart, I still expected them to be related. We have the makings of a puzzle here." Hildebrand said. The discovery of more than one meteorite in the same area may be evidence that many meteorites were deposited in eastern Manitoba when glaciers retreated from Western Canada at the end of the last Ice Age.

"The area where Derek found these meteorites is where two lobes of the Laurentide ice sheet met about 11,500 years ago," Hildebrand said. "He may have located a meteorite stranding surface where hundreds or thousands of meteorites were concentrated by glacial flow and were dumped in a small area when the ice melted." Hildebrand said this theory can be tested by determining how long the Bernic Lake and Pinawa meteorites have been on Earth, and by searching for more meteorites in the region near Pinawa.

Tom Weedmark, a UofC geology student, is the Prairie Meteorite Searcher for the summer of 2005. This field campaign locates meteorites by encouraging prairie residents to have rocks identified that they suspect may be meteorites. The project consists of local publicity and visits by Tom to prairie towns to show meteorite specimens and to identify possible meteorites. He will be looking in northern Alberta for the rest of July before heading east to Saskatchewan and Manitoba during August. "The continued success of the search indicates that many more prairie residents have meteorites that haven't yet been studied," Weedmark says. "I hope that we can make this Centennial year a record year for meteorite recovery in Canada."

DEEP IMPACT: DURING AND AFTER IMPACT

Astronomers using the Palomar Observatory's 200-inch Hale Telescope have been amazed by comet Tempel 1's behavior during and after its collision with the Deep Impact space probe.

In the minutes just after the impact the comet was seen to increase its near-infrared brightness nearly fivefold. As the event progressed astronomers at Palomar were able to distinguish jets of material venting from the comet's nucleus that have persisted for days.

Early results from the data, in images taken just minutes after impact, showed a possible plume of dust and gas extending outward some 320 km (200 miles) from the comet's center, roughly coinciding with the site of the probe's final demise.

This apparent dust plume has persisted for several nights, allowing astronomers to watch the comet's slow rotation. The night after impact the plume was on the far side of the comet, but was visible again the next evening as the comet's rotation brought it back into view. Two days after impact, the plume was seen again, this time extending about 200 km (124 miles) from the comet's center. According to Bidushi Bhattacharya of the Spitzer Science Center, "This could be indicative of an outburst of gas and dust still taking place near the region of the impact." "We are very excited by these results. It is a fabulous time to be studying comets," says James Bauer of JPL. "It will be interesting to see how long the effects of the impact persist," he adds.

The images of the comet, obtained by Bauer and Bhattacharya, were sharper than those from most ground-based telescopes because they used a technique known as adaptive optics. Adaptive optics allows astronomers to correct for the blurring of images caused by Earth's turbulent atmosphere, giving them a view that often surpasses those of smaller telescopes based in space. Using the adaptive-optics technique to improve an astronomer's view is generally only possible when a bright star is located near the object they want to study. On the night of impact there was no bright star close enough to the comet to use.

Mitchell Troy, the adaptive-optics group lead and Palomar adaptive-optics task manager at JPL, worked with his team to make adaptive optics corrections anyway. "We were able to deploy a new sensor that was 25 times more sensitive than our normal sensor. This new sensor allowed us to correct for some of the atmosphere's distortions and significantly improve the view of the comet," says Troy. This improved view allowed astronomers to see the dust and ejected material moving out from the comet's surface immediately following the impact event and again days later.

Earth-based observations from telescopes like the 200-inch at Palomar give astronomers an important perspective on how the comet is reacting to the impact, a perspective that cannot be achieved from the front-row seat of a fly-by spacecraft. Astronomers on the ground have the luxury of long-term observations that may continue to show changes in the comet for weeks to come. Images are available at: <http://www.astro.caltech.edu/palomarnew/deepimpact.html>

CHANDRA FINDS LONG-SOUGHT LINK TO ORIGIN OF MILLISECOND PULSARS

The peculiar cosmic object known as 47 Tuc W (denoted by arrow in the X-ray image) is a double star system consisting of a normal star and a neutron star that makes a complete rotation every 2.35 milliseconds. Blink your eye and a superdense star the size of Manhattan Island will have rotated 25 or more times!

New Chandra observations give the best information yet on why such neutron stars, called millisecond pulsars, are rotating so fast. The key, as in real estate, is location, location, location - in this case the crowded confines of the globular star cluster 47 Tucanae, where stars are less than a tenth of a light year apart. Almost two dozen millisecond pulsars are located there. This large sample is a bonanza for astronomers seeking to test theories for the origin of millisecond pulsars, and increases the chances that they will find a critical transitional object such as 47 Tuc W.

47 Tuc W stands out from the crowd because it produces more high-energy X-rays than the others. This anomaly points to a different origin of the X-rays, namely a shock wave due to a collision between matter flowing from a companion star and particles racing away from the pulsar at near the speed of light. Regular variations in the optical and X-ray light corresponding to the 3.2-hour orbital period of the stars support this interpretation. A team of astronomers from the Harvard-Smithsonian Center for Astrophysics pointed out that the X-ray signature and variability of the light from 47 Tuc W are nearly identical to those observed from an X-ray binary source known as J1808. They suggest that these similarities between a known millisecond pulsar and a known X-ray binary provide the long-sought link between these types of objects. In theory, the first step toward producing a millisecond pulsar is the formation of a neutron star when a massive star goes supernova. If the neutron star is in a globular cluster, it will perform an erratic dance around the center of the cluster, picking up a companion star which it may later swap for another. As on a crowded dance floor, the congestion in a globular cluster can cause the neutron star to move closer to its companion, or to swap partners to form an even tighter pair. When the pairing becomes close enough, the neutron star begins to pull matter away from its partner. As matter falls onto the neutron star, it gives off X-rays. An X-ray binary system has been formed, and the neutron star has made the crucial second step toward becoming a millisecond pulsar. The matter falling onto the neutron star slowly spins it up, in the same way that a child's carousel can be spun up by pushing it every time it comes

around. After 10 to 100 million years of pushing, the neutron star is rotating once every few milliseconds. Finally, due to the rapid rotation of the neutron star, or the evolution of the companion, the infall of matter stops, the X-ray emission declines, and the neutron star emerges as a radio-emitting millisecond pulsar. It is likely that the companion star in 47 Tuc W - a normal star with a mass greater than about an eighth that of the Sun - is a new partner, rather than the companion that spun up the pulsar. The new partner, acquired fairly recently in an exchange that ejected the previous companion, is trying to dump on the already spun-up pulsar, creating the observed shock wave. In contrast, the X-ray binary J1808 is not in a globular cluster, and is very likely making do with its original companion, which has been depleted to a brown dwarf size with a mass less than 5% that of the Sun. Most astronomers accept the binary spin-up scenario for creating millisecond pulsars because they have observed neutron stars speeding up in X-ray binary systems, and almost all radio millisecond pulsars are observed to be in binary systems. Until now, definitive proof has been lacking, because very little is known about transitional objects between the second and final steps. That is why 47 Tuc W is hot. It links a millisecond pulsar with many of the properties of an X-ray binary, to J1808, an X-ray binary that behaves in many ways like a millisecond pulsar, thus providing a strong chain of evidence to support the theory.

THE 2005 PERSEID METEOR SHOWER

http://science.nasa.gov/headlines/y2005/22jul_perseids2005.htm

Mars joins the Perseid meteor shower for a beautiful display on August 12th. Got a calendar? Circle this date: Friday, August 12th. Next to the circle write "before sunrise" and "Meteors!" Attach all of the above to your refrigerator in plain view so you won't miss the 2005 Perseid meteor shower. The Perseids come every year, beginning in late July and stretching into August. Sky watchers outdoors at the right time can see colorful fireballs, occasional outbursts and, almost always, long hours of gracefully streaking meteors. Among the many nights of the shower, there is always one night that is best. This year: August 12th. The source of the shower is Comet Swift-Tuttle. Although the comet is nowhere near Earth, the comet's wide tail does intersect Earth's orbit. We glide through it every year in July and August. Tiny bits of comet dust hit Earth's atmosphere traveling 132,000 mph. At that speed, even a tiny smidgen of dust makes a vivid streak of light--a meteor--when it disintegrates. The shower is most intense when Earth is in the dustiest part of the tail.

Perseid meteors fly out of the constellation Perseus, hence their name. The best time to watch is during the hours before sunrise when Perseus is high in the sky: sky map <images/perseids2005/skymap_no-rth.gif>. Between 2 a.m. and dawn on August 12th, if you get away from city lights, you could see hundreds of meteors. Scouts, this is a good time to go camping! Really, it could hardly be better. The Perseids come on a warm summer night. (Note: This is a northern hemisphere shower.) Other familiar meteor showers like the Leonids of November require a parka to enjoy. All you need for Perseids are light pajamas. And there's a bonus: Mars. In the constellation Aries, right beside Perseus, Mars is shining like a bright red star. Step outside before sunrise, look east, and you'll find you have a hard time taking your eyes off Mars. There's something bewitching about it, maybe the red color or perhaps the fact that it doesn't twinkle like a true star. It's steady. You stare at Mars and it stares right back.

Earth and Mars are converging for a close encounter on October 30th. Consider August 12th a preview. Mars already outshines

every star in the night sky, and it's getting brighter every night. If you like August, you'll love October.

And you will like August. Picture this: It's four in the morning. The sky is dark. The breeze is pleasant. Mars is beaming down from the east while meteors flit across the sky. Maybe you should go circle the calendar again.

SCIENTISTS DISCOVER TENTH PLANET

A planet larger than Pluto has been discovered in the outlying regions of the solar system. The planet was discovered using the Samuel Oschin Telescope at Palomar Observatory near San Diego. The discovery was announced today by planetary scientist Dr. Mike Brown of Caltech. The planet is a typical member of the Kuiper belt, but its sheer size in relation to the nine known planets means that it can only be classified as a planet, Brown said. Currently about 97 times further from the sun than the Earth, the planet is the farthest-known object in the solar system, and the third brightest of the Kuiper belt objects.

"It will be visible with a telescope over the next six months and is currently almost directly overhead in the early-morning eastern sky, in the constellation Cetus," said Brown, who made the discovery with colleagues Chad Trujillo and David Rabinowitz on January 8. Brown, Trujillo and Rabinowitz first photographed the new planet with the 48-inch Samuel Oschin Telescope on October 31, 2003. However, the object was so far away that its motion was not detected until they reanalyzed the data in January of this year. In the last seven months, the scientists have been studying the planet to better estimate its size and its motions. *"It's definitely bigger than Pluto,"* said Brown, who is a professor of planetary astronomy. Scientists can infer the size of a solar system object by its brightness, just as one can infer the size of a faraway light bulb if one knows its wattage. The reflectance of the planet is not yet known. Scientists can not yet tell how much light from the sun is reflected away, but the amount of light the planet reflects puts a lower limit on its size. *"Even if it reflected 100 percent of the light reaching it, it would still be as big as Pluto,"* says Brown. *"I'd say it's probably one and a half times the size of Pluto, but we're not sure yet of the final size."* *"We are 100 percent confident that this is the first object bigger than Pluto ever found in the outer solar system,"* Brown added. The size of the planet is limited by observations using NASA's Spitzer Space Telescope, which has already proved its mettle in studying the heat of dim, faint, faraway objects such as the Kuiper-belt bodies. Because Spitzer is unable to detect the new planet, the overall diameter must be less than 2,000 miles, said Brown. A name for the new planet has been proposed by the discoverers to the International Astronomical Union, and they are awaiting the decision of this body before announcing the name. For more information visit: http://www.nasa.gov/home/hqnews/2005/jul/HQ_05209_10th_Planet.html <http://www.nasa.gov/vision/universe/solarsystem/newplanet-072905-imag...>

DUST-ENSHROUDED STAR LOOKS SIMILAR TO SUN, MAY HAVE WITNESSED 'COSMIC CATASTROPHE'

Astronomers report tremendous quantities of warm dusty debris surrounding a star with luminosity and mass similar to the sun's, but located 300 light-years from Earth. The extraordinary nature of the dust indicates a violent history of cosmic collisions between asteroids and comets, or perhaps even between planets. *"What is so amazing is that the amount of dust around this star is approximately 1 million times greater than the dust around the sun,"* said Eric Becklin a co-author of the paper. *"It's*

likely there was a cosmic catastrophe, and a time of heavy bombardment, where large asteroids collided in the last few thousand years or less. It's incredible what must be going on."

Unlike hundreds of other stars with dust, where the dust is far from the star - equivalent to beyond the orbit of Pluto - this dust is orbiting in close to the star, where Earth-like planets are most likely to be, said Inseok Song, lead author of the paper. Was Song surprised to see so much dust so near to the star, which is known as BD+20 307, and is in the constellation Aries? "Definitely," he said. "I expected to find a much weaker excess because dust close to the star can't survive long." "The amount of warm dust near BD+20 307 is so unprecedented I wouldn't be surprised if it was the result of a massive collision between planet-size objects, for example, a collision like the one which many scientists believe formed Earth's moon," said Benjamin Zuckerman, co-author of the paper. "According to this model, the early Earth was struck by a Mars-size object that generated an immense fountain of hot magma, some of which condensed to form the moon. But if even a small percentage of this magma escaped into orbit around the sun, it could have led to a condition such as we now witness at BD+20 307." "This looks similar to our own solar system, and may well lead to a greater understanding of how our solar system formed," said Becklin, who is chief scientist for NASA's Stratospheric Observatory for Infrared Astronomy project. "It is very likely there are planets orbiting this star." The team of astronomers used the 10-meter Keck I and the Gemini North telescopes on Mauna Kea in Hawaii to measure the heat radiation coming from the dust.

Very young stars, 10 million years old or younger, may have this much dust around them, but the evidence presented in Nature points to an age of at least a few hundred million years for BD+20 307. For stars that are hundreds of million years old, "this is the dustiest star, far and away," Zuckerman said. Typically, small dust particles get pushed away by radiation or wind, and larger dust particles often get destroyed in collisions or clump together to form larger objects. "For 98 percent of the stars that have dust around them that have been found, the dust is far beyond the terrestrial planet region and wouldn't tell us anything about Earth," Zuckerman said. "Not more than 1 percent of stars of this age exhibit this kind of warm dust close to the star; the dust is radiating at about room temperature." "The dust we see is similar in composition to dust in the solar system, but has been pulverized into tiny particles," said Alycia Weinberger. "The Earth may have received lots of similar material in its first 600 million years, during a time when the inner solar system was bombarded by asteroids, comets and other debris."

"There are very few systems like this one that any astronomer has seen, just a tiny handful; you can count the examples on one hand," Zuckerman said. "My interpretation is that our solar system may be quite unusual. I expect this star to be studied over and over again. Many stars closer to Earth with an age comparable to that of our solar system during the era of heavy bombardment have been studied carefully and do not show this pattern." "Since the early '80s," Song said, "many astronomers have eagerly searched for an analogy to our solar system's asteroidal belt at other stars. Our finding is a bona fide example of dust at the exo-asteroidal zone and it is chilling to see dust at the Earth-sun separation around a young solar analog - like seeing our own sun back in time." <http://www.newsroom.ucla.edu/page.asp?RelNum=6304>

CASSINI FINDS RECENT & UNUSUAL GEOLOGY ON ENCELADUS

The Cassini spacecraft has obtained new detailed images of the south polar region of Saturn's moon Enceladus. The data reveal

distinctive geological features and the most youthful terrain seen on the moon. These findings point to a very complex evolutionary history for Saturn's brightest, whitest satellite. Cassini's July 14 flyby brought it within 109 miles of the surface of the icy moon. The close encounter revealed a landscape near the South Pole almost entirely free of impact craters. The area is also littered with house-sized ice boulders carved by tectonic patterns unique to Enceladus. These features set the region apart from the rest of the moon. As white as fresh snow, Enceladus has the most reflective surface in the solar system. Previous Cassini flybys revealed Enceladus, in contrast to Saturn's other icy moons, has lightly cratered regions, fractured plains and wrinkled terrain. The new findings add to the story of a body that has undergone multiple episodes of geologic activity spanning a considerable portion of its lifetime. The moon's southern most latitudes have likely seen the most recent activity. These same latitudes may also bear the scars of a shift in the moon's spin rate. If true, this speculation may help scientists understand why Enceladus has a tortured-looking surface, with pervasive crisscrossing faults, folds and ridges. The most remarkable images show ice blocks, about 33 to 328 feet across in a region that is unusual in its lack of the very fine-grained frost that seems to cover the rest of Enceladus. "A landscape littered with building-sized blocks was not expected," said Dr. Peter Thomas, an imaging-team member. "The minimal cover of finer material and the preservation of small, crossing fracture patterns in the surrounding areas indicate that this region is young compared to the rest of Enceladus."

False color composites of this region, created from the most recent images, show the largest exposures of coarse-grained ice fractures seen anywhere on the satellite, which also supports the notion of a young surface at southern latitudes. Some of the latest images may hint at the answer. The images revealed additional examples of a distinctive "Y-shaped" tectonic feature on Enceladus. In this unusual element, parallel ridges and valleys appear to systematically fold and deform around the south polar terrains. "These tectonic features define a boundary that isolates the young, south polar terrains from older terrains on Enceladus," noted Dr. Paul Helfenstein. "Their placement and orientation may tell us a very interesting story about the way the rotation of Enceladus has evolved over time and what might have provided the energy to power the geologic activity that has wracked this moon."

The apparent absence of sizable impact craters also suggests the South Pole is younger than other terrain on Enceladus. These indications of youth are of great interest to scientists who have long suspected Enceladus as one possible source of material for Saturn's extensive and diffuse E ring, which coincides with the moon's orbit. Young terrain requires a means to generate the heat needed to modify the surface. Other Cassini instrument teams are working to understand data about temperature, composition, particles and magnetic field. Together with image interpretation, these data can create a more complete picture. These Cassini images are available on the Web at: <http://www.nasa.gov/cassini>

CASSINI CONFIRMS A DYNAMIC ATMOSPHERE AT SATURN'S MOON ENCELADUS

The latest close flyby of Saturn's icy moon Enceladus by NASA's Cassini spacecraft confirms that the moon has a significant, extended and dynamic atmosphere. The flyby, on 14th July 2005, was Cassini's lowest altitude flyby of any object to date, a mere 173 kilometers (108 miles) above the surface of Enceladus. The 500 km diameter moon Enceladus is a very bright icy moon at a distance of 4 Saturn radii away from Saturn.

It has long been associated with the formation of the E ring, Saturn's outermost ring. The first two more distant flybys of Enceladus on February 17th at an altitude of 1,167 kilometers (725 miles), and on March 9th, 500 kilometers (310 miles) above Enceladus' surface had shown draping or bending of the magnetic field around the moon, revealing that Enceladus was acting as a large obstacle to the flow of plasma and magnetic field from Saturn by its extended asymmetric atmosphere. The recent close flyby confirms and extends the observations from the two more distant flybys which took place earlier this year. Although no other instruments on the Cassini spacecraft had detected evidence of this atmosphere on the first two flybys, on the basis of the magnetometer [MAG] instrument observations alone a decision was made to modify the spacecraft trajectory for the 14th July encounter to fly much closer to the surface of Enceladus.

Professor Michele Dougherty, Principal Investigator on the Magnetometer instrument, says: "*These latest observations are very exciting, they confirm the existence of an atmosphere which we predicted from the distant earlier flybys and they will also allow us to gain a much better understanding of the processes taking place which are producing this very exotic atmosphere*". Observations from numerous instruments now confirm what MAG was able to see from a great distance. Not only is the magnetic field even more strongly bent around the atmospheric obstacle connected to the moon but the other instruments also detected the presence of the atmosphere. The magnetic data also suggests that the atmosphere is not symmetric and may be arising from a comet-like jet from the southern hemisphere. Also the spacecraft passed right through the electric current carrying region associated with the atmospheric interaction.

LOWELL OBSERVATORY REACHES MILESTONE IN CONSTRUCTION OF DISCOVERY CHANNEL TELESCOPE

Lowell Observatory broke ground on the new 4.2-meter Discovery Channel Telescope. With a phase-one cost of \$35 million, the telescope will be the fifth largest telescope in the continental United States and one of the most sophisticated ground-based telescopes of its size. The groundbreaking is a major milestone on the path towards a new astronomical research era for the 111-year-old Lowell Observatory, and presents unique, far-reaching programming and educational opportunities for media industry leader and telescope sponsor, Discovery Communications. The telescope site is located north of the U.S. Forest Service Happy Jack Ranger Station, Coconino National Forest. The agency issued the special use permit to build in this location. Forest Service officials took part in a groundbreaking ceremony along with Lowell Observatory supporters, astronomers, and Discovery executives.

"*Today's groundbreaking is one more important step towards the realization of a dream that began just over a decade ago when Lowell Observatory celebrated its centennial year,*" said Bob Millis, Director, Lowell Observatory. "*With this new telescope, Lowell astronomers will be equipped to continue cutting-edge research well into our institution's second century and, through the magnificent programming capabilities of our partner, Discovery Communications, we will see the results of that research brought into living rooms and classrooms around the world,*" said Millis. Expected to be fully operational by 2010, the telescope will enable Lowell astronomers to enter new research areas and conduct many existing programs much more efficiently. Among the telescope's numerous scientific objectives, the search for near-Earth asteroids, Kuiper Belt Objects, and planets orbiting other stars, will be substantially advanced. The

telescope will make it possible to identify potentially life-threatening near-Earth asteroids much sooner than the technology currently available. Similar results are expected in the search for Kuiper Belt Objects, of which just over 1,000 have been identified and can range in size from that of large asteroids to objects potentially comparable in size to the planet Pluto. The Kuiper Belt, the first objects of which were discovered in 1992, is a sun-centered swarm of orbiting icy bodies extending from Neptune to as yet unknown distances.

The 4.2-meter telescope ultimately will have a significantly wider field of view than any currently existing telescope of its size, giving it the unprecedented ability to survey the sky at nearly eight times the capacity of the largest existing survey telescope. In this wide-field mode, the DCT's ability to perform deep imaging surveys of the night sky will be unmatched. This versatile telescope can be quickly converted to its alternative optical configuration, allowing it, unlike other pure survey telescopes, to be highly effective during bright phases of the moon. Once operational, the DCT also will have real-time capability, allowing the images acquired by the telescope to be simultaneously broadcast to people around the world.

Currently, the design of the telescope's major optical and mechanical components is being refined. The 14-foot-diameter primary mirror blank will be completed in September by Corning, Inc., Canton, New York. The access road to the Happy Jack site has been completed, and construction of the building for the telescope will begin in late summer. The camera that Lowell will design and build for the 4.2-meter telescope will have 40 2K by 4K charge-coupled devices capable of acquiring enormous amounts of data from each exposure and has a two degree field of view. Lowell Observatory, founded in 1894 in Flagstaff, was the first astronomical observatory in Arizona. The first evidence of the expansion of the universe was discovered at Lowell in 1912-1917. The planet Pluto was discovered there in 1930. Today, Lowell's 18 astronomers pursue a broad range of astronomical research using both ground-based and space-based telescopes.

COMPACT MYSTERY OBJECT PRODUCING HIGH-ENERGY RADIATION

The High Energy Stereoscopic System (H.E.S.S.) team of international astrophysicists reports the discovery of another new type of very high energy (VHE) gamma ray source. Gamma-rays are produced in extreme cosmic particle accelerators such as supernova explosions and provide a unique view of the high energy processes at work in the Milky Way. VHE gamma-ray astronomy is still a young field and H.E.S.S. is conducting the first sensitive survey at this energy range, finding previously unknown sources. The object that is producing the high energy radiation is thought to be a 'microquasar'. These objects consist of two stars in orbit around each other. One star is an ordinary star, but the other has used up all its nuclear fuel, leaving behind a compact corpse. Depending on the mass of the star that produced it, this compact object is either a neutron star or a black hole, but either way its strong gravitational pull draws in matter from its companion star. This matter spirals down towards the neutron star or the black hole, in a similar way to water spiraling down a plughole. However, sometimes the compact object receives more matter than it can cope with. The material is then squirted away from the system in a jet of matter moving at speeds close to that of light, resulting in a microquasar. Only a few such objects are known to exist in our galaxy and one of them, an object called LS5039, has now been detected by the H.E.S.S. team. In fact, the real nature LS5039 is something of a

mystery. It is not clear what the compact object is. Some of the characteristics suggest it is a neutron star, some that it is a black hole. Not only that, but the jet isn't much of a jet; although it is moving at about 20% of the speed of light, which might seem a lot, in the context of these objects it's actually quite slow. Nor is it clear how the gamma rays are being produced. As Dr. Guillaume Dubus points out "*We really shouldn't have detected this object. Very high energy gamma rays emitted close to the companion star are more likely to be absorbed, creating a matter/antimatter cascade, than escape from the system.*"

Dr Paula Chadwick adds "*It's very exciting to have added another class of object to the growing catalogue of gamma ray sources. It's an intriguing object -- it will take more observations to work out what is going on in there.*" The H.E.S.S. array is ideal for finding new VHE gamma ray objects; because its wide field of view (ten times the diameter of the Moon) means that it can survey the sky and discover previously unknown sources. The results were obtained using the High Energy Stereoscopic System (H.E.S.S.) telescopes in Namibia, in South-West Africa. This system of four 13 m diameter telescopes is currently the most sensitive detector of VHE gamma-rays -- radiation that is a million, million times more energetic than the visible light. These high energy gamma rays are quite rare even for relatively strong sources; only about one gamma ray per month hits a square meter at the top of the Earth's atmosphere. Also, since they are absorbed in the atmosphere, a direct detection of a significant number of the rare gamma rays would require a satellite of huge size. The H.E.S.S. telescopes employ a trick -- they use the atmosphere as detector medium. When gamma rays are absorbed in the air, they emit short flashes of blue light, named Cherenkov light, lasting a few billionths of a second. This light is collected by the H.E.S.S. telescopes with large mirrors and extremely sensitive cameras and can be used to create images of astronomical objects as they appear in gamma-rays.

The H.E.S.S. telescopes represent several years of construction effort by an international team of more than 100 scientists and engineers, who have been building a system of four telescopes in the Khomas Highland region of Namibia, to study very-high-energy gamma rays from cosmic particle accelerators. The telescopes, known as Cherenkov telescopes, image the light created when high-energy cosmic gamma rays are absorbed in the atmosphere, and have opened a new energy domain for astronomy. The telescopes each feature mirrors of area 107 square meters, and are equipped with highly sensitive and very fast 960-pixel light detectors in the focal planes. Construction of the telescope system started in 2001; the fourth telescope was commissioned in December 2003. Observations were being made even while the system was being built, first using a single telescope, then with two and three telescopes. While only the complete four-telescope system provides the full performance, the first telescope alone was already superior to any of the instruments operated previously in the southern hemisphere. <http://www.mpi-hd.mpg.de/hfm/HESS/public/PressRelease/PressRelease.html>

SCIENCE TEAM CATCHES RARE OCCULTATION LIGHT SHOW

On a clear summer night, the stars aligned for MIT researchers watching and waiting for one small light in the heavens to be extinguished, just briefly. Thanks to a feat of both astronomical and terrestrial alignment, a group of scientists from MIT and Williams College succeeded in observing distant Pluto's tiny moon, Charon, hide a star. Such an event had been seen only once before, by a single telescope 25 years ago, and then not

nearly as well. The consortium spotted it with four telescopes in Chile on the night of July 10-11.

The team expects to use data from this observation to assess whether Charon has an atmosphere, to measure its radius and to determine how round it is. Team leader James L. Elliot headed the group at the Clay Telescope at Las Campanas Observatory in Chile. "*We have been waiting many years for this opportunity. Watching Charon approach the star and then snuff it out was spectacular,*" said Elliot. Jay M. Pasachoff, a team leader, said, "*It's amazing that people in our group could get in the right place at the right time to line up a tiny body 4 billion miles away. It's quite a reward for so many people who worked so hard to arrange and integrate the equipment and to get the observations.*" With the Clay Telescope's 6.5-meter mirror (more than 21 feet across, the size of a large room) the researchers were able to observe changes throughout the event, which lasted less than a minute. While their electronic cameras sensitively recorded data, the light of the faint star was seen to dim and then, some seconds later, brighten. This kind of disappearance of a celestial body behind a closer, apparently larger one is known as an occultation. Studying how the light dimmed and brightened will let the consortium look for signs that Charon has an atmosphere. It has very little mass and thus little gravity to hold in an atmosphere, but it is so cold (being some 40 times farther from the sun than the Earth) that some gases could be held in place by the small amount of Charon's gravity.

Other telescopes around Chile used by the consortium included the 8-meter (more than 26 feet across) Gemini South on Cerro Pachon, the 2.5-meter (more than 8 feet across) DuPont Telescope at Las Campanas Observatory and the 0.8-meter (almost 3 feet across) telescope at the Cerro Armazones Observatory of Chile's Catholic University of the North near Cerro Paranal. The team had searched for a distribution of telescopes along a north-south line in Chile since the predictions of the starlight shadow of Charon were uncertain by several hundred kilometers. Since the star that was hidden is so far away, it casts a shadow of Charon that is the same size as Charon itself, about 1,200 kilometers in diameter. To see the event, the distant star, Charon and the telescopes in Chile had to be perfectly aligned. All of these telescopes had clear views of the event. Teams from the Observatory of Paris at Meudon and from the Southwest Research Institute in Boulder, Colo., also observed the occultation. A video showing the star dimming as Charon passes in front of it and then brightening again is posted on the Web at <http://occult.mit.edu/research/occultations/Charon/C313.2/C313O ccMovi>

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.

JULY DEEP-SKY OBSERVING LIST – IN ORDER OF BEST TIME FOR VIEWING

Class	Primary ID	Alt ID	Con	Ap. RA	Ap. Dec	Mag	Size	SBr
Gal	NGC 4494	PGC 41441	Com	12h31m40.0s	+25°44'51"	10.7	4.5'x 4.3'	23
Gal	NGC 4565	PGC 42038	Com	12h36m37.1s	+25°57'35"	10.6	14.8'x 2.1'	23
Gal	NGC 4559	PGC 42002	Com	12h36m13.7s	+27°55'57"	10.5	12.0'x 4.2'	23
Gal	NGC 4725	PGC 43451	Com	12h50m42.6s	+25°28'25"	10.1	11.0'x 7.2'	24
Gal	NGC 4214	PGC 39225	CVn	12h15m55.3s	+36°18'04"	10.2	8.9'x 7.1'	23
Gal	NGC 2403	PGC 21396	Cam	07h37m19.7s	+65°35'31"	8.9	23.4'x 12.3'	24
Gal	NGC 4631	Arp 281	CVn	12h42m23.6s	+32°30'51"	9.7	14.8'x 2.6'	22
Gal	NGC 4490	Arp 269	CVn	12h30m52.4s	+41°36'52"	10.6	6.3'x 2.7'	22
Gal	NGC 4449	PGC 40973	CVn	12h28m26.7s	+44°03'59"	10.1	5.6'x 3.7'	22
Gal	NGC 4157	PGC 38795	UMa	12h11m20.3s	+50°27'24"	12.1	6.6'x 1.1'	23
Gal	NGC 5005	PGC 45749	CVn	13h11m11.4s	+37°01'58"	10.7	5.8'x 2.6'	22
Gal	NGC 5033	PGC 45948	CVn	13h13m42.7s	+36°34'05"	10.7	10.2'x 3.9'	23
Glob	NGC 5466		Boo	14h05m42.0s	+28°30'41"	9.2	9.0'	
Gal	NGC 4605	PGC 42408	UMa	12h40m14.8s	+61°35'00"	10.9	6.0'x 2.5'	23
PNe	Blue Racquetball	NGC 6572	Oph	18h12m23.5s	+06°51'16"	9	11"	14
Open	NGC 6633	OCL 90	Oph	18h28m01.3s	+06°34'07"	5.6	27.0'	
PNe	NGC 6210	PN G043.1+37.7	Her	16h44m44.2s	+23°47'26"	9.3	16"	15
Gal	NGC 6503	PGC 60921	Dra	17h49m26.3s	+70°08'39"	10.8	6.9'x 2.5'	23
PNe	Cat's Eye	NGC 6543	Dra	17h58m36.0s	+66°38'02"	8.8	20"	15
Glob	NGC 6712		Sct	18h53m23.2s	-08°41'57"	8.1	9.8'	
Open	NGC 6819	OCL 155	Cyg	19h41m31.6s	+40°11'51"	9.5	5.0'	
PNe	Blinking Planetary	NGC 6826	Cyg	19h44m58.8s	+50°32'17"	9.8	25"	17
Neb	Crescent	NGC 6888	Cyg	20h13m01.5s	+38°19'58"	10	20.0'	
Open	NGC 6939	OCL 217	Cep	20h31m32.8s	+60°39'16"	10.1	7.0'	
Gal	NGC 772	Arp 78	Ari	01h59m37.2s	+19°02'06"	11.2	7.1'x 4.0'	24
Gal	NGC 1023	Arp 135	Per	02h40m44.2s	+39°05'07"	10.2	7.9'x 3.5'	22
PNe	Saturn Nebula	NGC 7009	Aqr	21h04m30.1s	-11°20'29"	8.3	29"	15
Gal	NGC 891	PGC 9031	And	02h22m53.3s	+42°22'11"	10.8	14.1'x 3.1'	24
Gal	NGC 185	PGC 2329	Cas	00h39m15.9s	+48°21'54"	10.1	14.1'x 12.0'	24
PNe	NGC 40	PN G120.0+09.8	Cep	00h13m19.7s	+72°32'55"	10.7	48"	19
PNe	Blue Snowball	NGC 7662	And	23h26m10.6s	+42°33'48"	9.2	17"	15
Neb	Bubble	NGC 7635	Cas	23h20m27.5s	+61°12'37"	11	15.0'	
Gal	NGC 7331	PGC 69327	Peg	22h37m20.4s	+34°26'37"	10.3	10.7'x 4.3'	23
Open	NGC 6940	OCL 141	Vul	20h34m50.8s	+28°19'28"	7.2	31.0'	
Neb	Veil/Cirrus	NGC 6992	Cyg	20h56m38.9s	+31°44'13"	7	60.0'	
Gal	NGC 6946	Arp 29	Cyg	20h35m01.7s	+60°10'18"	9.7	11.5'x 10.0'	24
PNe	NGC 7027	PN G084.9-03.4	Cyg	21h07m15.4s	+42°15'26"	10.4	14"	16
Neb	North American	NGC 7000	Cyg	21h02m01.3s	+44°13'14"	4	120.0'	
Open	NGC 1931	OCL 441	Aur	05h31m45.4s	+34°15'31"	10.1	1.0'	
PNe	NGC 246	PN G118.8-74.7	Cet	00h47m20.6s	-11°50'21"	8	4.1'	20
PNe	Crystal Ball	NGC 1514	Tau	04h09m36.9s	+30°47'27"	10	2.2'	20
Open	h Perseus	NGC 869	Per	02h19m24.5s	+57°10'09"	4.3	29.0'	
Open	NGC 663	OCL 333	Cas	01h46m25.4s	+61°16'28"	6.4	16.0'	
Open	Lobster/E.T.	NGC 457	Cas	01h19m24.2s	+58°21'18"	5.1	13.0'	
Open	NGC 281	IC 1590	Cas	00h53m09.7s	+56°38'54"	7.4	4.0'	
Open	NGC 7789	OCL 269	Cas	23h57m19.2s	+56°45'21"	7.5	15.0'	

The Star Gazer
P.O. Box 12746
Everett, WA 98206

In July's Stargazer:

- **** **OBSERVER'S INFORMATION**
- **** **ASTRO CALENDAR**
- **** **CONSTELLATIONS OF THE MONTH:**
- **** **ASTRONOMY FUN FACTS**
- **** **YOUNG ASTRONOMER'S CORNER**
- **** **ASTRONOMY AND TELESCOPE LINGO**
- **** **DEEP IMPACT TELLS A TALE OF THE COMET**
- **** **MANITOBA METEORITE HUNTER SCORES AGAIN**
- **** **DEEP IMPACT: DURING AND AFTER IMPACT**
- **** **CHANDRA FINDS LONG-SOUGHT LINK TO ORIGIN OF MILLISECOND PULSARS**
- **** **THE 2005 PERSEID METEOR SHOWER**
- **** **SCIENTISTS DISCOVER TENTH PLANET**
- **** **DUST-ENSHROUDED STAR SIMILAR TO SUN, MAY HAVE WITNESSED 'COSMIC CATASTROPHE'**
- **** **CASSINI CONFIRMS A DYNAMIC ATMOSPHERE AT SATURN'S MOON ENCELADUS**
- **** **LOWELL OBSERVATORY MILESTONE IN CONSTRUCTION OF DISCOVERY CHANNEL TELESCOPE**
- **** **COMPACT MYSTERY OBJECT PRODUCING HIGH-ENERGY RADIATION**
- **** **SCIENCE TEAM CATCHES RARE OCCULTATION LIGHT SHOW**
- **** **JULY DEEP-SKY OBSERVING LIST**

**The next EAS Meeting is 3:00 P.M. SUNDAY, July 31st
at the Everett Public Library Auditorium.**