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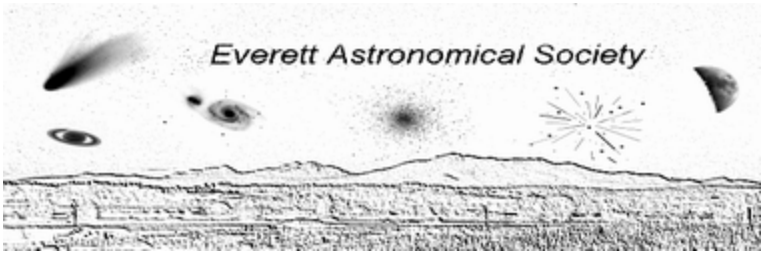

The Stargazer

May 2008

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		(change 'at' to @ to send email)	http://everettastro.org

EAS BUSINESS…

NEXT EAS MEETING – SATURDAY MAY 24TH AT 7:00 PM AT AURORA ASTRO PRODUCTS STORE AT SILVER LAKE.

★★ Saturday May 24th 7:00 pm MEETING ★★
The presentation will be from Kristine Washburn on 'A Beginners Guide to Primordial Black Holes'. The meeting will be the Aurora Astro Products store in Silver Lake. There will be some refreshments. (It may be helpful for some folks to bring a folding chair to the meeting.) We have the layout a bit, to improve seating, based on the larger crowds we have had at the last few meetings.

Map/Directions to Aurora Astro Products store location - http://www.skyvalleyscopes.com/aurora_astro_products_silver_lak.htm

Silver Lake Plaza, 11419 19th AVE. SE, Everett, WA 98208

If you are traveling northbound on I-5:

Take exit #186/128th St. and go east - to the right on 128th St. continue until you come to Murphy's Corner/Intersection with Highway 527/19th Ave SE/Old Bothell-Everett Highway (all one in the same) and turn left/north. Follow until you see Silver Lake Plaza (red brick construction) on your right with the lake is on your left.

If you are traveling southbound on I-5:

Take exit 187/Everett Mall Way and at the top of the exit's hill turn right following signs for Highway 527. At the light turn right following the signs for Highway 527. Then stay on Highway 527/19th Ave SE/Old Bothell-Everett Highway until you have Silver Lake on your right and the Silver Lake Plaza on your left. You may also continue down I-5 until exit 186 and turn left onto 128th then follow previous directions. If you have a problem you can always call (425) 337-4384

★ STAR PARTY INFO ★

Next EAS Star Party: Saturday June 7th at Ron Tam's home.

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 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@verizon.net) but I don't check my email daily. They can email me for directions if they never have been out here."* Listed below are proposed dates for **planned EAS star parties** at my [Ron Tam's] place, depending upon the weather, of course. Call Ron about spur-of-the-moment observing.

Upcoming tentative EAS star party schedule: (also see the regional star parties listed in the 'Astro Calendar for 2008') , Jun 7, Jul 5, Aug 23, Sep 20, Oct 4, Nov 1.

Please also join the EAS mail list, and send mail to the mail list *everett_astronomy@topica.com* 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 Jim Bielaga at (425) 337-4384 for info or check the EAS website.) Members contact Jim Bielaga for scope borrowing.

DARK MOON PERIODS THIS YEAR

New Moon	1st Qtr	3rd Qtr	EAS Star Party at Ron's
Jan 8th	Jan 15th	Jan 29th	--
Feb 6th	Feb 13th	Feb 28th	--
Mar 7th	Mar 14th	Mar 29th	**Sat Mar 08, Sat Mar 29**
Apr 5th	Apr 12th	Apr 28th	**Saturday April 05**
May 5th	May 11th	May 27th	**Saturday May 03**
Jun 3rd	Jun 10th	Jun 26th	**Saturday Jun 07**
Jul 2nd	Jul 9th	Jul 25th	**Saturday Jul 05**
Aug 1st, 30th	Aug 8th	Aug 23rd	**Saturday Aug 23**
Sep 29th	Sep 7th	Sep 21st	**Saturday Sep 20**
Oct 28th	Oct 7th	Oct 21st	**Saturday Oct 04**
Nov 27th	Nov 5th	Nov 19th	**Saturday Nov 01**
Dec 27th	Dec 5th	Dec 19th	--

Other Western US Star Parties This Season…

Rooster Rock OR State Park 2008 RCA Star parties - 22 miles east of Portland on I-84 (east of Sandy River) at exit 25.
Jun 14 - Summer Solstice Celebration at Rooster Rock

Jul 12 - Luna Viewing at Rooster Rock
Aug 11 - Perseid Meteor Shower Watch at Rooster Rock
Sep 06 - Autumnal Equinox Celebration at Rooster Rock
(503) 797-4610. http://www.omsi.edu/visit/planetarium/starparties.cfm

May 23-26 - 40th annual RTMC Astronomy Expo 2008, Riverside, CA **-** http://www.rtmcastronomyexpo.org/

May 24-26 - Fire in the Sky – Rocket launch and Star party – Mansfield, WA - http://www.fireinthesky.org/FITS2008.htm Tacoma Astronomical Society http://www.tas-online.org/calendar.php

Jun 01-08 - Texas Star Party (TSP) 2008- Prude Ranch, Fort Davis, TX - http://www.texasstarparty.org/

Jun 05-07 – CANCELLED - ~~Goldendale 2008 NWRAL "First Light" - Skyview Acres - Goldendale WA http://klickitatstarparty.net/~~

(tbd) - **Mt. St. Helens Star Party** - near Mt. St. Helens Visitors Center

Jun 6-7, Jul 4-5, and Aug 1-2 - Stars Over Yellowstone star parties - Madison Campground Amphitheater, http://smasweb.org/

Jun 21-28 - 2008 Grand Canyon Star Party (GCSP) - On the South Rim - http://www.tucsonastronomy.org/gcsp.html

Jun 30-Jul 07 - Shingletown Star Party 2008 - Shingletown, Mt. Shasta, CA http://www.shingletownstarparty.org/

Jul 02-06 - Golden State Star Party - Frosty Acres Ranch, Adin, (northern, near Mt. Shasta) CA http://goldenstatestarparty.blogspot.com/

Jul 02-06 - The Rocky Mountain Star Stare (RMSS) 2008 - Pike Nat Forest, Colorado Springs, CO http://www.rmss.org/

Jul 31- Aug 02 – Table Mt. Star Party (TMSP) 2008 - Ellensburg WA http://www.tmspa.com/

Jul 31-Aug 02 2008 - 18th Annual Weekend Under the Stars - Foxpark WY - http://home.bresnan.net/~curranm/wuts.html

Aug 01-03 – RCA Trout Lake Star Party 2008 – Trout Lake WA http://www.rca-omsi.org/TroutLake2008.pdf

Aug 01-02 - Lava Hot Springs Star Party, Lava Hot Springs ID http://ifastro.org/web/index.php

Aug 02-10 - Mt. Kobau Star Party 2008 - Mt. Kobau, near Osoyoos BC http://www.mksp.ca/

Aug 06-10 - Mt Bachelor Star Party (MBSP) 2008 - Mt. Bachelor (Bend) OR http://www.mbsp.org/

Aug 29-31 - RASCals Star Party 2008 - Victoria Fish & Game Assoc - Holker Place, Malahat, (Near Victoria) BC, CA http://victoria.rasc.ca/events/StarParty/

Aug 25-31 – Oregon Star Party 2008 (OSP) - Ochocco NF http://www.oregonstarparty.org/

Aug 25-31 (Labor Day)– SAS Brooks Memorial Park Star Party 2008 – SR 97 near Goldendale http://www.seattleastro.org/events.shtml

Aug 30- Sep 07 Merritt Star Quest 2008, Loon Lake Site, near Kelowna BC http://www.merrittastronomical.com/index.html

(tbd) - **Deception Pass Star Party 2008** - Bowman Bay, Deception Pass, WA - http://www.eastsideastro.org/index.htm

Sep 05-07 - Idaho Star Party 2008 - Bruneau Dunes State Park http://www.boiseastro.org/

Sep 24-27 - The Enchanted Skies Star Party 2008 - Socorro NM - http://www.socorro-nm.com/starparty/

Sep 25-28 - OAS Camp Delany Star Party - Sun Lakes SP - http://www.olympicastronomicalsociety.com/Documents/FALLCAMPDELANYSign-UpForm.pdf

Sep 25-28 - Alberta Star Party 2008 – Eccles Ranch Obs., Caroline, Alberta, CA http://calgary.rasc.ca/RASCcalendar.htm#_September

Sep 25-27 - CalStar08 - Lake San Antonio Park CA http://www.sjaa.net/calstar/ - http://www.sjaa.net/

Sep 26-27 - Orion Nebula 2008 Star Party – Table Mt. (Ellensburg) WA http://www.seattleastro.org/orionnebsp.shtml

Oct 30-Nov 02 - Nightfall 2008 - Palm Canyon Resort, Borrego Springs, CA http://www.rtmcastronomyexpo.org/nightfall.htm

(tbd) - **White Sands Star Party** - Alamogordo/White Sands, NM http://www.zianet.com/wssp/

(tbd) **- Blue Mountain Star Party,** Ukiah, OR http://www.tri-cityastronomyclub.org/bluemtn_starparty.htm

(tbd) - **Montana Starwatch**, Great Falls, MT http://smasweb.org/

(tbd) **Craters Star Party** - Craters of the Moon National Monument, ID - http://www.boiseastro.org/

EAS MEMBER NEWS

Astronomy Monopoly, Anyone ?

Jim Bielaga has proposed holding an all-day astronomy monopoly tournament on a future Saturday. If it were held, would you participate? Let Jim know, by calling or emailing him to sign up – if we get enough folks interested, the event can go ahead.

Sidewalk Astronomy

We are looking for volunteers who could do a series of Sidewalk Astronomy sessions this spring and summer, at a local park or public venue. For safety, moral support, and effectiveness, this should be done in teams of at least two people with telescopes. Special events like eclipse or comets especially draw the interest of the public.

School and Community Group Astronomy Outreach

We often have requests for members of the EAS to come and help with an 'astronomy night' event from local schools, scout groups, senior homes, or similar groups. Usually this would be in the form of a star party at their gathering, or perhaps a short slide show or night sky talk. Providing education and support to the community about interest astronomy is one of the main missions of the EAS. Please let club president know if you are interested and available to be on list of volunteers to handle these requests, so that we can say YES when people ask. Recent January cub-scout group visited by Jim Bielaga, Mark Folkerts, Mike Schilling, and Ron Tam for a star party night was a great example of how this can be a rewarding event for all involved.

Possible field Trip to Ritchie Obs. on Bainbridge Island

We are trying to schedule a trip to the Ritchie Observatory. To do this, we need an estimate of how many people would attend. **Please email Mark Folkerts with your interest (or suggestions).**

Attention EAS Members – 10% Discount for all Everett Astronomical Society Members at Aurora Astro Products

"Show your club membership card at Jim Bielaga's new astronomy store 'Aurora Astro Products' and receive a 10% discount on all purchases. This is an exclusive discount to E.A.S. members only.

I am proud to be able to offer this discount to Everett club members, and thanks for the support you have shown me on opening my new store. Also I have made great friends and learned a lot being a club member since 1991.

- Clear Skies, Jim Bielaga"

Members – please look at your EAS membership card to see when your membership dues are payable. If you are more than three months past due, the club will officially assume that you no longer wish to be a member, and remove you from the membership rolls.

Also, those who have subscriptions to Sky and Telescope can now pay their own subscription as long as they are EAS members in good standing. Members will now be able to renew directly via mail or phone and still obtain the club discount. The subscribers may mail in the renewal notices with their payment, or renew via phone at (800) 253-0245. Payment at the time of renewal is required. Once a year, Sky and Telescope will check with the EAS club treasurer to see that the subscribers are still members in good standing to qualify for the discount. New members will continue to subscribe through the club treasurer.

$$ - Financial Health - $$

The club maintains a $750+ balance. We try to keep approximately a $500 balance to allow for contingencies. .

Club Scopes

Scope	Loan Status
10-inch Ward Dobsonian	Available
10-inch Sonotube Dobsonian	Available
8-inch Dobsonian	Available

EAS members: contact VP James Bielaga at (425) 337-4384 or jamesbielaga at aol.com to borrow a scope.

Does Anyone know about the history of the EAS ???

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 (approx 1986 ?)
- Who started the club (Terry Bacon, et. al.)
- When club joined the Astronomical League.

Astro Calendar for 2008

May 2008

May 09 - Astronomy Day Star Party at Harborview Park
May 10 - Astronomy Day at Library and Harborview Park
May 14 - Mercury At Its Greatest Eastern Elongation (22 Degrees)
May 23-26 - RTMC Camp Oakes, CA
May 24 – EAS Meeting 7:00 pm Aurora Astro Products store

June 2008

Jun 07 – EAS monthly suburban star party – Ron Tam's place
Jun 07 - Mercury Inferior Conjunction
Jun 15 - Lyrids meteor shower peak
Jun 20 - Summer Solstice, 20:24 UT
Jun 20 - Pluto Opposition - Mag=13.9
Jun 26 - Bootids meteor shower peak
Jun 21 – EAS Meeting 7:00 pm Aurora Astro Products store
Jun 30 - Jul 07 2008 Shingletown Star Party, Shingletown CA

July 2008

Jul 01 - Mercury At Its Greatest Western Elongation (22 Degrees)
Jul 2-6 – Golden State Star Party – Adin CA (Frosty Acres Ranch)
Jul 04 - Earth At Aphelion (1.017 AU From Sun)
Jul 05 – EAS monthly suburban star party – Ron Tam's place
Jul 09 - Jupiter At Opposition
Jul 26 – EAS Meeting 7:00 pm Aurora Astro Products store
Jul 29 - South Delta-Aquarids meteor shower peak
Jul 31-Aug 02 – Table Mt. Star Party

August 2008

Aug 01-03 – RCA Trout Lake Star Party 2008 – Trout Lake WA
Aug 01 - Total Solar Eclipse, Visible in Canada, Greenland
Aug 01 - Alpha Capricornids meteor Shower Peak
Aug 2-10 – Mt Kobau Star Party – Osoyoos BC
Aug 06 - Southern Iota Aquarids meteor Shower peak
Aug 6-10 - Mt. Bachelor Star Party - near Bend, OR
Aug 12 - Perseids meteor shower peak
Aug 15 - Neptune At Opposition
Aug 16 – EAS Meeting 7:00 pm Aurora Astro Products store
Aug 16 - Partial Lunar Eclipse
Aug 17 - kappa-Cygnids meteor shower peak
Aug 19 11:12a Northern iota-Aquarids meteor shower peak
Aug 23 – EAS monthly suburban star party – Ron Tam's place
Aug 25-31 Oregon Star Party
Aug TBD - Deception Pass Star Party - Bowman Bay, Deception Pass, WA

September 2008

Sep 08 - delta-Aurigids meteor shower peak
Sep 11 - Mercury At Its Greatest Eastern Elongation (27 Degrees)
Sep 13 - Uranus At Opposition
Sep 19 - Piscids meteor shower peak
Sep 20 – EAS Meeting 7:00 pm Aurora Astro Products store
Sep 20 – EAS monthly suburban star party – Ron Tam's place
Sep 22 - Autumnal Equinox (22:16 UT)
Sep 26-28 – Orion Nebula Star Party – Table Mt. WA

October 2008

Oct 04 – EAS monthly suburban star party – Ron Tam's place
Oct 08 - Draconids meteor shower peak
Oct 17 - epsilon-Geminids meteor shower peak
Oct 21 - Orionids Meteor Shower Peak
Oct 25 – EAS Meeting 7:00 pm Aurora Astro Products store
Oct 27 - Asteroid 4 Vesta Closest Approach To Earth (1.539 AU)

November 2008

Nov 01 – EAS monthly suburban star party – Ron Tam's place
Nov 03 - Taurids meteor Shower Peak
Nov 17 - Leonids meteor Shower Peak
Nov 22 – EAS Meeting 7:00 pm Aurora Astro Products store

December 2008

Dec 01 - Conjunction of Moon, Venus, and Jupiter (3 Degree Triangle)

Dec 01 - Moon Occults Venus
Dec 13 - Geminids meteor shower peak
Dec 21 - Winter Solstice, 12:04 UT
Dec 22 - Ursids meteor shower peak
Dec 29 - Moon Occults Jupiter

UW Astronomy Speakers Colloquium Schedule

Astronomy Department weekly colloquium meets Thursdays at 4:00 pm in PAB A102 - the classroom part of the Physics/Astronomy Building complex. http://www.astro.washington.edu/pages/colloquium.html

On The Airwaves - KSER 90.7 - 'It's Over Your Head'

"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 Membership Benefits & Information

EAS Benefits -
Membership in the **Everett Astronomical Society** (EAS) includes invitations to all of the club meetings and star parties, plus the monthly newsletter, ***The Stargazer.*** Currently, a 10% discount is also being offered to EAS members for purchases at Aurora Astro Products in Everett

Magazine Discounts –
In addition you will be able subscribe to ***Sky and Telescope*** for $7 off the normal subscription rate, contact the treasurer (Carol Gore) for more information. http://everettastro.org/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 Carol Gore will renew your *Sky and Telescope* subscription for you. **Astronomy** magazine offers a similar opportunity to club members.)

Membership in the Astronomical League -
EAS is a member of the **Astronomical League** and you will receive the Astronomical League's quarterly newsletter magazine, ***The Reflector***.

EAS Club Telescope Borrowing -
Being a member also allows you the use of the club's telescopes, including an award winning 10 inch Dobsonian mount reflector, a second 10" dob, or and 8" Dobsonian. Contact Jim Bielaga (425) 337-4384 to borrow a telescope.

10% Discount on Purchases at 'Aurora Astro Products' in Everett -
EAS members are currently offered a 10% discount for all purchases of any telescopes, accessories, or other items at Aurora Astro Products, when they show their EAS membership card.

EAS Library -
Membership will give you access to all the material in the lending library. The library, which is maintained by Mike Locke, consists of VCR tapes, DVDs, many books, magazines, and software titles. 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 lockemi at comcast.net, to borrow or donate any materials. See list here: http://everettastro.org/eas_library.htm

Joining or Renewing with the EAS -
EAS dues are $25 / year per family. Funds obtained from membership dues allows the EAS to publish the Stargazer newsletter, pay Astronomical League dues, pay insurance, host a web site, and maintain our library. If it has been a year since you paid your dues, please re-subscribe to keep the club financially solvent, and to continue to receive membership benefits. http://everettastro.org/application.htm

Send your annual dues renewals to the
Everett Astronomical Society
P.O. Box 12746, Everett, WA 98206.

OBSERVER'S INFORMATION…

Lunar Facts

May 19	Full Moon
May 27	Last Quarter Moon
Jun 03	New Moon
Jun 09	First Quarter Moon
Jun 17	Full Moon
Jun 26	Last Quarter Moon
Jul 03	New Moon
Jul 10	First Quarter Moon
Jul 18	Full Moon
Jul 25	Last Quarter Moon
Aug 01	New Moon
Aug 08	First 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*	*Sets*	*Con*	*Diam.*	*Mag*
Sun	***05:21 am***	***20:52***	***Tau***	***30'***	***-27.5***
Mercury	**06:20 am**	**22:20**	**Tau**	**10"**	**+2.0**
Venus	05:14 am	20:26	Tau	10"	-3.9
Mars	10:06 am	**01:20 am**	**Can**	**5"**	**+1.4**
Jupiter	**00:15 am**	**08:55 am**	**Sag**	**44"**	**-2.5**
Saturn	**12:18**	**02:18 am**	**Leo**	**18"**	**+0.6**
Uranus	02:46 am	14:17	Aqr	3"	+5.9
Neptune	**01:45 am**	**11:46 am**	**Cap**	**2"**	**+7.9**
Pluto	**22:13**	**07:47 am**	**Sag**	**--**	**+13.9**

(times are in local time for Everett PDT)

Observing Jupiter's Moons – Java tool
http://skytonight.com/observing/objects/javascript/jupiter

Transit times for Jupiter's Great Red Spot in 2008
http://skytonight.com/observing/objects/planets/3304091.html

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 – **Heavens Above**:
http://www.heavens-above.com/PassSummary.asp?lat=47.979&lng=-122.201&alt=0&loc=Everett&TZ=PST&satid=25544

CONSTELLATIONS OF THE MONTH – SCORPIUS

SCORPIUS (The Scorpion): With a midnight culmination date of June 3rd, Scorpius is well-placed for spring and summer viewing. This zodiacal constellation contains the asterism of the "Fish Hook", and, of course, the entire constellation itself is one of the few that truly does, (and obviously), resemble what its name describes. Indeed, Lambda Scorpii (or Shaula) is a bright blue 1st magnitude subgiant at the tip of the tail of Scorpius, looking very much like it is ready to strike, just as an agitated scorpion. Scorpius borders on the constellations of Ara, Corona Australis, Libra, Lupus, Norma, Ophiuchus, and Sagittarius. Scorpius ranks 10th in overall brightness among the constellations, and 33rd in size; it takes up almost 497 square degrees of the entire sky (1.204%). It contains two known meteor showers: the Alpha Scorpiids (May 3) and the Chi Scorpiids (June 5), and 4 well-known Messier objects. Scorpius is completely visible from latitudes South of + 44 degrees, and completely invisible from latitudes North of + 82 degrees. It has 62 stars greater than magnitude 5.5, and its central point is at RA=16h49m, Dec.= -27 degrees. The solar conjunction date of Scorpius is December 4th.

Antares (Alpha Scorpii) (or "Rival of Mars," because Antares was frequently seen near Mars along the zodiac, and often "rivaled" it in color and brilliance) is in a beautiful area of the sky, which contains several globulars and double stars, as well as nearby reflection nebulosity. Antares was one of the four Royal Stars of the ancient Persians (the others were Aldebaran, Regulus, and Fomalhaut). Antares is an M1 ruddy-colored supergiant of magnitude 0.9. It is about 700 times larger than the Sun, but is only about 15 times more massive than it because of its low density; it is about 600 million miles across.

Scorpius has four well-known Messier objects: M4 (globular cluster), M6 (open cluster), M7 (open cluster), and M80 (globular cluster).

M4, very near to Antares, contains about 10,000 known stars down to about 19th magnitude, and many more dimmer than that. Its combined magnitude is approximately 7.4, and some of its stars appear to form a central "bar". M4 is at a distance of 1.8 kiloparsecs, making it one of the closest globular clusters to the solar system.

M7 is one of the brightest open star clusters in all the sky, and contains about 130 stars, more than half of which are brighter than 10th magnitude. M7 lies about 4 degrees northeast of Shaula. The very faint and distant globular cluster NGC-6453 lies within the same field as M7, appearing as an 11th magnitude spot of coarse nebulosity. M7 lies at about 273 parsecs away, and is estimated to be about 260 million years old.

About 3.5 degrees northwest of M7 lies M6, another open cluster, sometimes referred to as the "Butterfly Cluster" because of its arrangement of wing-like strings of stars of similar luminosity. M6 also contains about 130 stars, and shines at approximately magnitude 4.6, and is about twice as far away (450 parsecs) as M7. M80 is an eighth magnitude globular, and contains the nova T-Scorpii. Scorpius X-1, in Scorpius near the star v Scorpii, was the first discovered cosmic X-ray source, and remains the brightest of all non-transient cosmic X-ray sources in the sky. It is a close binary star, with one of the stars a probable high density neutron star. As gas which envelopes around this binary system streams towards the intense gravitational and magnetic fields near the neutron component, it accelerates to near the speed of light, resulting in X-ray emission known as synchrotron radiation.

There is at least one well-known legend associated with the constellation of Scorpius. In Greek mythology, the legend of Scorpius is closely tied with the legend of Orion. As Orion became more and more famous and more and more proficient as a hunter, he also became more and more insensitive to the plight of the animals he was killing. He did not hunt and kill for necessity, and became very unfeeling about the life of the animals that he was hunting. Artemis, goddess of hunting, was not appreciative of his insensitivity, and sent the Giant Scorpion (Scorpius) to attack him. Scorpius stung him, and as he was about to die, Ophiuchus (the Serpent Bearer) gave Orion an antidote which saved his life. Realizing his insensitivity to animals, he repented, and was permanently placed in the heavens with Scorpius, the stinger of which had taught him that "all life is precious". In China, Scorpius was called the "Azure Dragon".

YOUNG ASTRONOMER'S CORNER

As our Sun ages and after it reaches the "Red Giant" stage, what happens next?

Most stars at this point will move back and forth from the red giant stage to the main sequence several times, in a process not completely understood. What is understood is that the star becomes a "pulsating variable star" during this process, expanding and contracting, and brightening and fading periodically. Red supergiants are the largest group of pulsators, and range from 100 days to 2 years varying between brightest and faintest. Mira, in the constellation Cetus, is a famous example.

Cepheid variables, large yellow-colored stars, vary light output in periods of one to fifty days, and are very important stars for measuring distances too far to be measured by other means. The period of the light variation of Cepheid variables is proportional to their light output, or luminosity; this relationship is used to measure absolute magnitude. When using this data and the apparent magnitude, the distance to these stars (as well as the star groups or galaxies that they belong to) can be found. These Cepheids can be used to measure distances out to about 10 million light years. Polaris, our "North Star" is the nearest Cepheid variable to us.

RR Lyrae stars are the second most common variables, and vary in light output very quickly, (less than a day); these stars are used to measure distances to the star clusters that they are a part of, generally out to about 600,000 light years. Pulsating variables are also known as intrinsic variables, because their pulsations happen from internal processes within the dying star itself, not external to it (such as the fading due to being eclipsed by another star). What happens after this pulsating variable stage in a "dying" star's life? Tune in next month for the next stage in this continuing story!!

ASTRONOMY & TELESCOPE LINGO

Astronomy "Lingo": TRUMPLER'S CLASSIFICATION: A classification method, based on appearance, for open (galactic) star clusters. This system, developed by Swiss-American astronomer Robert Trumpler, uses three cluster appearance criteria: concentration of stars towards the cluster center; range in brightness of all the member stars; and the total number of stars within the cluster. Trumpler also found a relationship between these appearance criteria and galactic cluster diameter.

Astronomy "Lingo": STAR ATLAS: A collection of maps for a particular region of the sky, or the entire sky, showing relative star positions, as well as positions of other sky objects, down to a

certain limiting magnitude. Some contain prints of photographic plates. Examples include Sky Atlas 2000, Uranometria, and the Palomar Sky Survey.

Telescope "Lingo": SPACE TELESCOPE SCIENCE INSTITUTE (STScI): A research institute in Maryland that defines and controls the observing program of the Hubble Space Telescope, and collects incoming HST data for participating scientists. It is operated by a consortium of American Universities under contract to NASA.

Telescope "Lingo": DECLINATION AXIS: The axis at right angles to the polar axis about which an equatorially-mounted telescope is turned, allowing adjustments in declination to be made. As a result, the optical axis follows a specific hour circle across the sky.

ASTRONOMY "FUN FACTS"

★★ Have you ever seen a Sci-Fi movie or television show, where perhaps in the background or out the spaceship window, a nice spiral galaxy was seen to be slowly rotating for visual effect??? In fact, if such a spiral galaxy were the size of our own Milky Way and were rotating fast enough for a human to visually detect its rotation, its outer sections would be spinning at the unattainable velocity of 33 billion times the speed of light!!!! This would truly be science fiction!!!

★★ While the Milky Way Galaxy rotates, the Earth is revolving on its own axis, and it takes the Earth one year to revolve around the Sun. It takes the Milky Way Galaxy 230 million years to make one complete revolution. One galactic year thus equals 230 million Earth years, so our Galaxy is about 52 galactic years, or 12 billion Earth years, old. In another 3 billion years, our Galaxy will reach the retirement age of 65 galactic years (i.e., 65 complete revolutions) of age!!!

★★ If a fairly large neutron star (approximately 12 miles in diameter) were located within the Sun's core, it would actually not disrupt the Sun, but rather stabilize it and lengthen its life. Because the neutron star would generate stabilizing gravitational energy, the Sun would live far longer than its estimated remaining 5 billion years: it would in fact live for well over another 3 trillion years!!!!

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. Four dark planetary rings were discovered during the Voyager 2 fly-by in 1989.

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.

Neptune has 13 known (and IAU named) 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).

"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 this column, and is not intended to imply that there is optical mirror symmetry between the two objects.

Study Item: OBSERVATORY: A structure or complex built primarily for astronomical observation. Today’s modern and major observatories often have far more than only visual capabilities. They are often outfitted with optical, radio and/or infrared equipment, and in the largest observatories, there is often associated instrumentation so that spectrographic, photometric, and similar measurements can be accomplished. Most major observatories are situated at sites that have minimal impact from light and air pollution, as well as minimized atmospheric disturbances. Many world-class observatories are situated in mountainous areas or on volcanic islands where the atmosphere is thin and water vapor absorption effects are minimized. Radio observatories are less hampered by the restrictions listed above, but still need to be located in areas where they can be isolated from radio and electrical interference.

Representative Northern Hemisphere Item: **McDonald Observatory.** An observatory affiliated with the University of Texas on Mount Locke near Fort Davis, Texas, located at 2081 meters. This observatory has 2.7-meter (1969) and 2.1-meter (1939) reflecting telescopes; the 2.1-meter (the Otto Struve telescope) has recently been modernized for infrared astronomy. The Hobby-Eberly Telescope (HET) was commissioned in 1997 on the mountain, and is used mainly for spectrographic surveys. The HET has an 11-meter spherical segmented f/1.3 mirror on an azimulthal mounting, permanently tipped at an angle of 35 degrees to the zenith. A mobile secondary reflects images onto the primary, and as a result, 70% of the sky visible from Mount Locke can be surveyed.

Representative Southern Hemisphere Item:: **Mount Stromlo and Siding Springs Observatories**. Two optical observatories owned and operated by the Australian National University in Canberra. They are located on Mount Stromlo near Canberra (at 770 meters) and on Siding Spring Mountain (1150 meters) in the Warrumbungle Mountain Range in New South Wales (NSW). The primary instrument on Mount Stromlo is a 1.9-meter reflector (1953), and on Siding Spring there is a 2.3-meter altazimuth reflector (1984), along with some smaller reflecting telescopes. Importantly, Siding Spring is also the home of the separate Anglo-Australian Observatory (AAO), which contains the 3.9-meter Anglo-Australian Telescope and the 1.2-meter UK Schmidt Telescope.

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

100 METEORITE EXPLOSIONS ON THE MOON

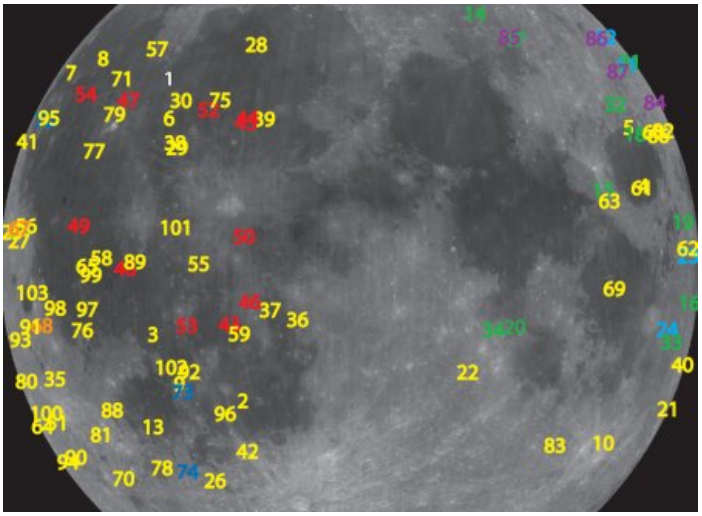
Not so long ago, anyone claiming to see flashes of light on the Moon would be viewed with deep suspicion by professional astronomers. Such reports were filed under "L" … for lunatic.

Not anymore. Over the past two and a half years, astronomers have observed the Moon flashing at them not just once but one hundred times. "*They're explosions caused by meteoroids hitting the Moon*," explains Bill Cooke, head of NASA's Meteoroid Environment Office. "*A typical blast is about as powerful as a few hundred pounds of TNT and can be photographed easily using a backyard telescope*." As an example, he offers A video was made of an impact that occurred near crater Gauss on January 4, 2008. The impactor was a tiny fragment of extinct comet 2003 EH1. Every year in early January, the Earth-Moon system passes through a stream of debris from that comet, producing the well-known Quadrantid meteor shower. Here on Earth, Quadrantids disintegrate as flashes of light in the atmosphere; on the airless Moon they hit the ground and explode.

"*We started our monitoring program in late 2005 after NASA announced plans to return astronauts to the Moon*," says team leader Rob Suggs of the MSFC. If people were going to be walking around up there, "*it seemed like a good idea to measure how often the Moon was getting hit*." "*Almost immediately, we detected a flash*." That first detection—"*I'll never forget it*," he says--came on Nov. 7, 2005, when a piece of Comet Encke about the size of a baseball hit Mare Imbrium. The resulting explosion produced a 7th magnitude flash, too dim for the naked eye but an easy target for the team's 10-inch telescope.

A common question, says Cooke, is "*how can something explode on the Moon? There's no oxygen up there*." These explosions don't require oxygen or combustion. Meteoroids hit the moon with tremendous kinetic energy, traveling 30,000 mph or faster. "*At that speed, even a pebble can blast a crater several feet wide. The impact heats up rocks and soil on the lunar surface hot enough to glow like molten lava--hence the flash*."

During meteor showers such as the Quadrantids or Perseids, when the Moon passes through dense streams of cometary debris, the rate of lunar flashes can go as high as one per hour. Impacts subside when the Moon exits the stream, but curiously the rate never goes to zero. "*Even when no meteor shower is active, we still see flashes*," says Cooke.



Above: A map of the 100 explosions observed since late 2005. A complete list with lunar coordinates is available at http://www.nasa.gov/centers/marshall/news/lunar/

These "off-shower" impacts come from a vast swarm of natural space junk littering the inner solar system. Bits of stray comet dust and chips off old asteroids pepper the Moon in small but ultimately significant numbers. Earth gets hit, too, which is why on any given night you can stand under a dark sky and see a few meteors per hour glide overhead—no meteor shower required. Over the course of a year, these random or "sporadic" impacts outnumber impacts from organized meteor showers by a ratio of approximately 2:1. "*That's an important finding*," says Suggs. "*It means there's no time of year when the Moon is impact-free*."

Fortunately, says Cooke, astronauts are in little danger. "*The odds of a direct hit are negligible. If, however, we start building big lunar outposts with lots of surface area, we'll have to carefully consider these statistics and bear in mind the odds of a structure getting hit*."

Secondary impacts are the greater concern. When meteoroids strike the Moon, debris goes flying in all directions. A single meteoroid produces a spray consisting of thousands of "secondary" particles all traveling at bullet-like velocities. This could be a problem because, while the odds of a direct hit are low, the odds of a secondary hit may be significantly greater. "*Secondary particles smaller than a millimeter could pierce a spacesuit*," notes Cooke. At present, no one knows how far and wide secondary particles travel. To get a handle on the problem, Cooke, Suggs and colleagues are shooting artificial meteoroids at simulated moon dust and measuring the spray. This work is being done at the Vertical Gun Range at NASA Ames Research Center in Mountain View, CA.

Meanwhile, back at the observatory, the team has upgraded their original 10-inch (25 cm) telescope to a pair of telescopes, one 14-inch (36 cm) and one 20-inch (51 cm), located at the Marshall Space Flight Center in Alabama. They've also established a new observing site in Georgia with a 14-inch telescope. Multiple telescopes allow double- and triple-checking of faint flashes and improve the statistical underpinnings of the survey. "*The Moon is still flashing*," says Suggs. Indeed, during the writing of this story, three more impacts were detected.

HISTORY OF A SUPER SOLAR FLARE

At 11:18 AM on the cloudless morning of Thursday, September 1, 1859, 33-year-old Richard Carrington—widely acknowledged to be one of England's foremost solar astronomers—was in his well-appointed private observatory. Just as usual on every sunny day, his telescope was projecting an 11-inch-wide image of the sun on a screen, and Carrington skillfully drew the sunspots he saw.

On that morning, he was capturing the likeness of an enormous group of sunspots. Suddenly, before his eyes, two brilliant beads of blinding white light appeared over the sunspots, intensified rapidly, and became kidney-shaped. Realizing that he was witnessing something unprecedented and "*being somewhat flurried by the surprise*," Carrington later wrote, "*I hastily ran to call someone to witness the exhibition with me. On returning within 60 seconds, I was mortified to find that it was already much changed and enfeebled*." He and his witness watched the white spots contract to mere pinpoints and disappear. It was 11:23 AM. Only five minutes had passed.

Just before dawn the next day, skies all over planet Earth erupted in red, green, and purple auroras so brilliant that newspapers could be read as easily as in daylight. Indeed, stunning auroras pulsated even at near tropical latitudes over Cuba, the Bahamas, Jamaica, El Salvador, and Hawaii. Even more disconcerting, telegraph systems worldwide went haywire. Spark discharges shocked telegraph operators and set the telegraph paper on fire. Even when telegraphers disconnected the batteries powering the lines, aurora-induced electric currents in the wires still allowed messages to be transmitted.

"*What Carrington saw was a white-light solar flare—a magnetic explosion on the sun*," explains David Hathaway, solar physics team lead at Marshall Space Flight Center. Now we know that solar flares happen frequently, especially during solar sunspot maximum. Most betray their existence by releasing X-rays (recorded by X-ray telescopes in space) and radio noise (recorded by radio telescopes in space and on Earth). In Carrington's day, however, there were no X-ray satellites or radio telescopes. No one knew flares existed until that September morning when one super-flare produced enough light to rival the brightness of the sun itself. "*It's rare that one can actually see the brightening of the solar surface*," says Hathaway. "*It takes a lot of energy to heat up the surface of the sun*!"

A modern solar flare was recorded Dec. 5, 2006, by the X-ray Imager onboard NOAA's GOES-13 satellite. The flare was so intense, it actually damaged the instrument that took the picture. Researchers believe Carrington's flare was much more energetic than that one. The explosion produced not only a surge of visible light but also a mammoth cloud of charged particles and detached magnetic loops—a "CME"—and hurled that cloud directly toward Earth. The next morning when the CME arrived, it crashed into Earth's magnetic field, causing the global bubble of magnetism that surrounds our planet to shake and quiver. Researchers call this a "geomagnetic storm." Rapidly moving fields induced enormous electric currents that surged through telegraph lines and disrupted communications.

"*More than 35 years ago, I began drawing the attention of the space physics community to the 1859 flare and its impact on telecommunications*," says Louis J. Lanzerotti, current editor of the journal Space Weather. He became aware of the effects of solar geomagnetic storms on terrestrial communications when a huge solar flare on August 4, 1972, knocked out long-distance telephone communication across Illinois. That event, in fact, caused AT&T to redesign its power system for transatlantic cables. A similar flare on March 13, 1989, provoked geomagnetic storms that disrupted electric power transmission from the Hydro Québec generating station in Canada, blacking out most of the province and plunging 6 million people into darkness for 9 hours; aurora-induced power surges even melted power transformers in New Jersey. In December 2005, X-rays from another solar storm disrupted satellite-to-ground communications and Global Positioning System (GPS) navigation signals for about 10 minutes. That may not sound like much, but as Lanzerotti noted, "*I would not have wanted to be on a commercial airplane being guided in for a landing by GPS or on a ship being docked by GPS during that 10 minutes*."

Another Carrington-class flare would dwarf these events. Fortunately, says Hathaway, they appear to be rare: "*In the 160-year record of geomagnetic storms, the Carrington event is the biggest*." It's possible to delve back even farther in time by examining arctic ice. "*Energetic particles leave a record in nitrates in ice cores*," he explains. "*Here again the Carrington event sticks out as the biggest in 500 years and nearly twice as big as the runner-up*." These statistics suggest that Carrington flares are once in a half-millennium events. The statistics are far from solid, however, and Hathaway cautions that we don't understand flares well enough to rule out a repeat in our lifetime.

And what then? Lanzerotti points out that as electronic technologies have become more sophisticated and more embedded into everyday life, they have also become more vulnerable to solar activity. On Earth, power lines and long-distance telephone cables might be affected by auroral currents, as happened in 1989. Radar, cell phone communications, and GPS receivers could be disrupted by solar radio noise. Experts who have studied the question say there is little to be done to protect satellites from a Carrington-class flare. In fact, a recent paper estimates potential damage to the 900-plus satellites currently in orbit could cost between $30 billion and $70 billion. The best solution, they say: have a pipeline of comsats ready for launch.

Humans in space would be in peril, too. Spacewalking astronauts might have only minutes after the first flash of light to find shelter from energetic solar particles following close on the heels of those

initial photons. Their spacecraft would probably have adequate shielding; the key would be getting inside in time.

No wonder NASA and other space agencies around the world have made the study and prediction of flares a priority. Right now a fleet of spacecraft is monitoring the sun, gathering data on flares big and small that may eventually reveal what triggers the explosions. SOHO, Hinode, STEREO, ACE and others are already in orbit while new spacecraft such as the Solar Dynamics Observatory are readying for launch. Research won't prevent another Carrington flare, but it may make the "flurry of surprise" a thing of the past.

SATELLITE PINS DOWN TIMER IN STELLAR TICKING TIME BOMB

Using observations from Rossi X-ray Timing Explorer (RXTE), an international team of astronomers has discovered a timing mechanism that allows them to predict exactly when a superdense star will unleash incredibly powerful explosions. "*We found a clock that ticks slower and slower, and when it slows down too much, boom! The bomb explodes*," says lead author Diego Altamirano.

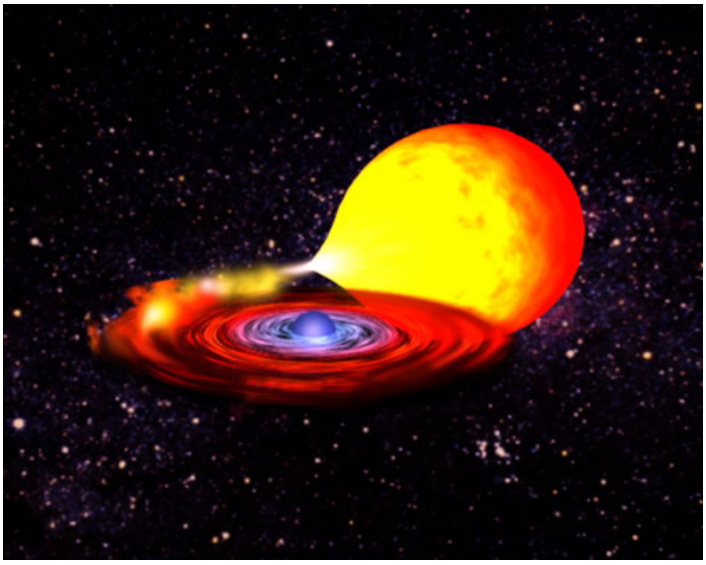
The bursts occur on a neutron star, which is the collapsed remnant of a massive star that exploded in a supernova. The neutron star belongs to a binary system that can be described as a ticking time bomb. Hydrogen and helium gas from a companion star spirals onto the neutron star, slowly accumulating on its surface until it heats up to a critical temperature. Suddenly, the hydrogen and helium begin to fuse uncontrollably into heavier elements, igniting a thermonuclear flame that quickly spreads around the entire star. The resulting explosion appears as a bright flash of X-rays. These bursts, which can occur several times per day from the same neutron star, release more energy in just 10 to 100 seconds than our Sun radiates in an entire week. Put another way, the energy is equivalent to 100 fifteen-megaton hydrogen bombs exploding simultaneously over each postage-stamp-size patch of the neutron star's surface.

Scientists have observed thousands of these X-ray bursts from about 80 different neutron stars. But until now, they had no way to predict when they would occur. The key to this discovery is RXTE, which makes extremely precise timing measurements of rapidly flickering X-ray-emitting objects. As gas gradually builds up on the neutron star's surface, hydrogen and helium atoms sometimes fuse into heavier elements in a stable and almost perfectly repetitive fashion. This mode of fusion produces a nearly regular X-ray signal known as a quasi-periodic oscillation, or QPO for short. Theory predicts that the frequency of the cycle should be about 0.009 cycles per second (9 Millihertz, or one cycle every two minutes). This is very close to the QPO frequency in 4U 1636-53 measured by Altamirano and his colleagues using extensive RXTE observations.

But the team also found that the QPO frequency decreased over time from about 12 Millihertz to 8 Millihertz. In a paper published recently in Astrophysical Journal Letters, the authors demonstrate that every time the QPO frequency slowed down to about 8 Millihertz (one cycle per 125 seconds), the neutron star in 4U 1636-53 let loose a powerful X-ray burst.

"*We are able to predict when these explosions are happening. We have a clock that tells us when the bomb will explode*!" says Altamirano. "*We do not yet know if this sequence of events means the oscillations cause the explosion, or if they are just telling us the time has come for an outburst. Further observations from RXTE will be essential to figure this out*," adds coauthor Michiel van der Klis.

The same group is now studying more than 50 other neutron stars to see if it can identify similar behavior. The 4U 1636-53 system is located about 20,000 light-years away right near the border between the southern constellations of Ara and Norma.



"*It's an exciting discovery*," says astrophysicist Tod Strohmayer. "*The QPO frequencies are related to the mass and size of the neutron star, so we may be able to use them to pin down the masses of some neutron stars. It gives us a new tool to study these fascinating objects*."

http://www.nasa.gov/centers/goddard/news/topstory/2008/timing_mechanism.html

PLANET FINDER CATCHES COMET HOLMES

Last October, astronomers all over the world were astounded when the normally very faint Comet Holmes erupted in the largest outburst for more than a century. Astronomer Dr. Henry Hsieh described how a UK telescope was in the right place at the right time to capture the first images of this once-in-a-lifetime event.

The SuperWASP-North facility on the island of La Palma was built by scientists to discover planets around other stars. The 8 cameras that make up the system operate robotically, automatically scanning large areas of the sky each night. By coincidence, at 2339 GMT on the evening of 24 October 2007, it was pointing towards Comet 17P Holmes. "*By the time SuperWASP spotted the comet, it had already brightened by a factor of 1000*," explains Dr. Hsieh. "*But this was still almost 3 hours before anyone else noticed it*." (That honor belongs to amateur astronomer Juan Antonio Henriquez Santana who saw the eruption from Tenerife). Over the next 2 hours the comet continued brightening, until SuperWASP could no longer accurately measure it -- it was too bright for the cameras!

Comets are bodies orbiting the Sun composed of frozen gases and microscopic solid particles in a small solid nucleus. When they come close to the Sun, they heat up and some of the icy material turns to gas, producing characteristic tails. But during this outburst, Comet Holmes released a large amount of its material all at once. Two days after the eruption began, sunlight reflecting from the ejected material had made the comet one million times brighter than it was originally making it easily visible to observers across the northern hemisphere.

Dr. Hsieh comments: "*Over the next few weeks, SuperWASP continued to observe Comet Holmes as the cloud of dust and gas*

surrounding the 3-km diameter nucleus of the comet steadily expanded. By 31st October, the cloud was already 900,000 km across or more than twice the distance from the Earth to the Moon. "Using our SuperWASP observations, we measured the speed of expansion of the outer edge of this cloud to be over 1500 km per hour and by 17 November measured the size of the cloud to be more than 2 million km across -- much larger than the Sun." Two weeks after the outburst, SuperWASP captured an added bonus -- the faint and delicate tail of the comet composed of the gas released from the nucleus. As astronomers watched over the next few weeks, this tail gradually faded and moved away from the comet. Although many images were gathered by astronomers around the world, the precise cause of the outburst is still a mystery. All they know right now is that it happened once before -- in 1892 -- and may well happen again. http://star.pst.qub.ac.uk/~hhh/holmes/

DISCOVERY OF NEW TYPE OF PULSATING WHITE DWARF STAR

Astronomers Michael H. Montgomery and Kurtis A. Williams, along with graduate student Steven DeGennaro, have predicted and confirmed the existence of a new type of variable star with the help of the 2.1-meter Otto Struve Telescope at McDonald Observatory. Called a "*pulsating carbon white dwarf*," this is the first new class of variable white dwarf star discovered in more than 25 years. Because the overwhelming majority of stars in the universe -- including the Sun -- will end their lives as white dwarfs, studying the pulsations (i.e., variations in light output) of these newly discovered examples gives astronomers a window on an important endpoint in the lives of most stars.

A white dwarf star is the leftover remnant of a Sun-like star that has burned all of the nuclear fuel in its core. It is extremely dense, packing half to 1.5 times the Sun's mass into a volume about the size of Earth. Until recently, there have been two main types of white dwarfs known: those that have an outer layer of hydrogen (about 80 percent), and about those with an outer layer of helium (about 20 percent), whose hydrogen shells have somehow been stripped away.

Last year, astronomers Patrick Dufour and James Liebert discovered a third type of white dwarf star, still more rare. For reasons that are not understood, these "hot carbon white dwarfs" have had both their hydrogen and helium shells stripped off, leaving their carbon layer exposed. Astronomers suspect these could be among the most massive white dwarfs of all, and are the remnants of stars slightly too small to end their lives in a supernova explosion.

After these new carbon white dwarfs were announced, Montgomery calculated that pulsations in these stars were possible. Pulsating stars are of interest to astronomers because the changes in their light output can reveal what goes on in their interiors -- similar to the way geologists study seismic waves from earthquakes to understand what goes on in Earth's interior. In fact, this type of star-study is called "asteroseismology."

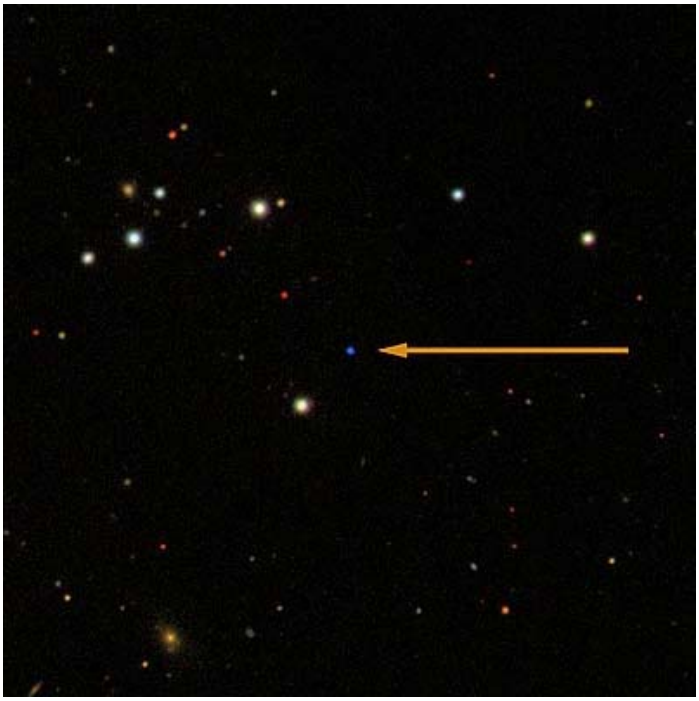
So, Montgomery and Williams' team began a systematic study of carbon white dwarfs with the Struve Telescope at McDonald Observatory, looking for pulsators. DeGennaro discovered that a star about 800 light-years away in the constellation Ursa Major, called SDSS J142625.71+575218.3, fits the bill. Its light intensity varies regularly by nearly two percent about every eight minutes. "*The discovery that one of these stars is pulsating is remarkably important*," said astronomer Michael Briley. "*This will allow us to probe the white dwarf's interior, which in turn should help us solve the riddle of where the carbon white dwarfs come from and what happens to their hydrogen and helium*."

The star lies about ten degrees east northeast of Mizar, the middle star in the handle of the Big Dipper. This white dwarf has about the same mass as our Sun, but its diameter is smaller than Earth's. The star has a temperature of 35,000 degrees Fahrenheit (19,500 C), and is only 1/600th as bright as the Sun.

None of the other stars in their sample were found to pulsate. Given the masses and temperatures of the stars in their sample, SDSS J142625.71+575218.3 is the only one expected to pulsate based on Montgomery's calculations.

The astronomers speculate that the pulsations are caused by changes in the star's carbon outer envelope as the star cools down from its formation as a hot white dwarf. The ionized carbon atoms in the star's outer layers return to a neutral state, triggering the pulsations.

There is a chance that the star's variations might have another cause. Further study is needed, the astronomers say. Either way, studying these stars will shed light on the unknown process that strips away their surface layers of hydrogen and helium to lay bare their carbon interiors.



The star SDSS J142625.71+575218.3 is the first pulsating carbon white dwarf.

65-MILLION-YEAR-OLD ASTEROID IMPACT TRIGGERED A GLOBAL HAIL OF CARBON BEADS

The asteroid presumed to have wiped out the dinosaurs struck the Earth with such force that carbon deep in the Earth's crust liquefied, rocketed skyward, and formed tiny airborne beads that blanketed the planet, say scientists from the U.S., U.K., Italy, and New Zealand. The beads, known to geologists as carbon cenospheres, cannot be formed through the combustion of plant matter, contradicting a hypothesis that the cenospheres are the charred remains of an Earth on fire. If confirmed, the discovery suggests environmental circumstances accompanying the 65-million-year-old extinction event were slightly less dramatic than previously thought. "*Carbon embedded in the rocks was vaporized by the impact, eventually forming new carbon structures in the atmosphere*," said geologist Simon Brassell, study coauthor and former adviser to the paper's lead author,

Mark Harvey. Carbon cenospheres are tiny, carbon-rich particles that form when coal and heavy fuel are heated intensely. Scientists have now learned that cenospheres can form in the wake of asteroid impacts, too.

The carbon cenospheres were deposited 65 million years ago next to a thin layer of the element iridium -- an element more likely to be found in Solar System asteroids than in the Earth's crust. The iridium-laden dust is believed to be the shattered remains of the 200-km-wide asteroid's impact. Like the iridium layer, the carbon cenospheres are apparently common. They've been found in Canada, Spain, Denmark and New Zealand. But the cenospheres' origin presented a double mystery. The cenospheres had been known to geologists only as a sign of modern times -- they form during the intense combustion of coal and crude oil. Equally baffling, there were no power plants burning coal or crude oil 65 million years ago, and natural burial processes affecting organic matter from even older ages -- such as coals from the 300-million-year-old Carboniferous Period -- had simply not been cooked long or hot enough. "*Carbon cenospheres are a classic indicator of industrial activity*," Harvey said. "*The first appearance of the carbon cenospheres defines the onset of the industrial revolution*." The scientists concluded the cenospheres could have been created by a new process, the violent pulverization of the Earth's carbon-rich crust.

Geologists do believe the Earth burned in spots as molten rock and super-hot ash fell out of the sky and onto flammable plant matter. But the charcoal-ized products of these fires only appear in some places on Earth, and are more often found near the asteroid impact site of Chicxulub Crater, just west of Mexico's Yucatan Peninsula. Some geologists had thought all carbon particles resulting from the impact was ash from global scale forest fires, but the present research strongly contradicts that assumption. The scientists examined rock samples from eight marine locations in New Zealand, Italy, Denmark and Spain. They also examined carbon-rich particles from five non-marine locations in the U.S. and Canada. Following chemical and microscopic analysis, the researchers concluded the particles were carbon cenospheres, similar to the ones produced by industrial combustion. The scientists also found that the farther the sample site was from the Chicxulub Crater, the smaller the cenospheres tended to be. That observation is consistent with the expectation that particles were produced by the asteroid impact, since once the particles are ejected, heavier particles should fall back to Earth sooner (and travel shorter distances) than lighter particles.

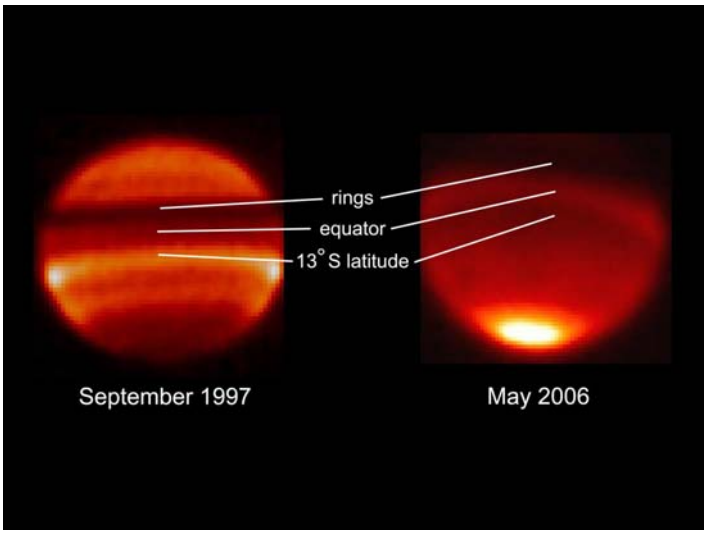
Last, the scientists estimated the total mass of carbon cenospheres ejected by the asteroid collision, assuming a global distribution, to be perhaps as much as 900 quadrillion kilograms. Whether or not the carbon cenospheres are truly ubiquitous, however, needs further corroboration. "*There are still clues to unravel about the events occurring around the time of the impact*," Brassell said. "*And there are aspects of the Earth's natural carbon cycle that we didn't previously consider*." Harvey is interested in the unique properties of the cenospheres themselves. "*Perhaps we can generate and study carbon cenospheres to better understand them*," he said. "*We also need to look for the cenospheres in other parts of the world and also around the time of other extinction events*." http://newsinfo.iu.edu/asset/page/normal/4887.html

SATURN DOES THE WAVE IN UPPER ATMOSPHERE

Two decades of scrutinizing Saturn are finally paying off, as scientists have discovered a wave pattern, or oscillation, in Saturn's atmosphere only visible from Earth every 15 years. The discovery of the wave pattern is the result of a 22-year campaign observing Saturn from Earth (the longest study of temperature outside Earth ever recorded), and the Cassini spacecraft's observations of temperature changes in the giant planet's atmosphere over time. The Cassini infrared results indicate that Saturn's wave pattern is similar to a pattern found in Earth's upper atmosphere. The earthly oscillation takes about two years. A similar pattern on Jupiter takes more than four Earth years. The new Saturn findings add a common link to the three planets.

Just as scientists have been studying climate changes in Earth's atmosphere for long periods of time, scientists have been studying changes in Saturn's atmosphere. Glenn Orton says patience is the key to studying changes over the course of a Saturnian year, the equivalent of about 30 Earth years. "*You could only make this discovery by observing Saturn over a long period of time*," said Orton, lead author of the ground-based study. "*It's like putting together 22 years worth of puzzle pieces, collected by a hugely rewarding collaboration of students and scientists from around the world on various telescopes*."

The wave pattern is called an atmospheric oscillation. It ripples back and forth within Saturn's upper atmosphere. In this region, temperatures switch from one altitude to the next in a candy cane-like, striped, hot-cold pattern. These varying temperatures force the wind in the region to keep changing direction from east to west, jumping back and forth. As a result, the entire region oscillates like a wave. A "snapshot" of the hot-cold temperature patterns in Saturn's atmosphere was captured by the Cassini Composite Infrared Spectrometer. Along with Earth-based data, the "snapshot" also uncovered other interesting phenomena. Among them: the temperature at Saturn's equator switches from hot to cold, and temperatures on either side of the equator switch from cold to hot every Saturn half-year.



Mike Flasar, co-author of the Cassini paper, and principal investigator for Cassini's Composite Infrared Spectrometer, said that Cassini helped define this oscillation in combination with the ground observation campaign. "*It's this great synergy of using ground-based data over time, and then getting up close and personal with the oscillation in Saturn's atmosphere through Cassini*," said Flasar. "*Without Cassini, we might never have seen the structure of the oscillation in detail*." Cassini scientists hope to find out why this phenomenon on Saturn changes with the seasons, and why the temperature switchover happens when the sun is directly over Saturn's equator. http://www.jpl.nasa.gov/news/features.cfm?feature=1686

THE ANTENNAE GALAXIES FOUND TO BE CLOSER TO US

New research on the Antennae Galaxies using the Advanced Camera for Surveys onboard the Hubble Space Telescope shows that this proto-typical pair of interacting galaxies is in fact much closer to us than previously thought -- at 45 million light-years instead of 65 million light-years. The Antennae Galaxies are among the closest known merging galaxies. The merging pair of galaxies, NGC 4038 and NGC 4039, began interacting a few hundred million years ago, creating one of the most impressive sights in the night sky. They are considered by scientists as the archetypal merging galaxy system and are used as a standard against which to validate theories about galaxy evolution.

A group of scientists led by Ivo Saviane has used Hubble to observe individual stars spawned by the colossal cosmic collision in the Antennae Galaxies. They reached an interesting and surprising conclusion. By measuring the colors and brightnesses of red giant stars in the system, the scientists found that the Antennae Galaxies are much closer to us than previously thought: residing at a distance of 45 million light-years instead of the previous best estimate of 65 million light-years.

The team targeted a region in the relatively quiescent outer regions in the southern tidal tail, away from the active central regions. This tail consists of material thrown from the main galaxies as they collided. The scientists needed to observe regions with older red giant stars to derive an accurate distance. Red giants are known to reach a standard brightness, which can then be used to infer their distance from the difference between the intrinsic and observed brightness. The method is known as the tip of the red giant branch (TRGB).

The proximity of the Antennae system means it is the best-studied galaxy merger in the sky, with a wealth of observational data to be compared to the predictions of theoretical models. Saviane says: "*All aspiring models for galaxy evolution must be able to account for the observed features of the Antennae Galaxies, just as respectable stellar models must be able to match the observed properties of the Sun. Accurate models require the correct merger parameters, and of these, the distance is the most essential*".

The previous estimated distance to the Antennae Galaxies was about 65 million light-years although values as high as 100 million light years have been used. Our Sun is only eight light-minutes away from us, so the Antennae Galaxies may seem rather distant, but if we consider that we already know of galaxies that are more than ten thousand million light-years away, the two Antennae Galaxies are really our neighbors.

The previous larger distance required astronomers to invoke some quite exceptional physical characteristics to account for the spectacular system: very high star-formation rates, supermassive star clusters, ultraluminous X-ray sources etc. The new smaller distance makes the Antennae Galaxies less extreme in terms of the physics needed to explain the observed phenomena. For instance, with the smaller distance its infrared radiation is now that expected of a "standard" early merging event rather than that of an ultraluminous infrared galaxy. The size of the star clusters formed as a consequence of the Antennae merger now agree with those of clusters created in other mergers instead of being 1.5 times as large.

The Antennae Galaxies are named for the two long tails of stars, gas and dust that resemble the antennae of an insect. These "antennae" are a physical result of the collision between the two galaxies. Studying their properties gives us a preview of what may happen when our Milky Way galaxy collides with the neighboring Andromeda galaxy in several thousand million years. Although galaxy mergers today are not common, it is believed that in the past they were an important channel of galaxy evolution. Therefore understanding the physics of galaxy mergers is a very important task for astrophysicists. The Antennae are located in the constellation of Corvus, the Crow.

WORLDWIDE TELESCOPE BRINGS SPACE EXPLORATION TO EARTH

A new service, free of charge from Microsoft, lets students and lifelong learners tour the night sky using high-resolution images from the worlds best land- and space-based telescopes. The final frontier got a bit closer as Microsoft officially launched the public beta of its WorldWide Telescope, which is now available at http://www.worldwidetelescope.org WorldWide Telescope is a rich Web application that brings together imagery from the best ground- and space-based observatories across the world to allow people to easily explore the night sky through their computers. WorldWide Telescope has been eagerly anticipated by the astronomical and educational communities as a compelling astronomical resource for students and lifelong learners, and as a way to make science fun for children.

"*The WorldWide Telescope is a powerful tool for science and education that makes it possible for everyone to explore the universe*," said Bill Gates, chairman of Microsoft. "*By combining terabytes of incredible imagery and data with easy-to-use software for viewing and moving through all that information, the WorldWide Telescope opens the door to new ways to see and experience the wonders of space. Our hope is that it will inspire young people to explore astronomy and science, and help researchers in their quest to better understand the universe*."

The application itself is a blend of software and Web 2.0 services created with the Microsoft high-performance Visual Experience Engine, which allows seamless panning and zooming around the heavens with rich image environments. WorldWide Telescope stitches together terabytes of high-resolution images of celestial bodies and displays them in a way that relates to their actual position in the sky. People can freely browse through the solar system, galaxy and beyond, or take advantage of a growing number of guided tours of the sky hosted by astronomers and educators at major universities and planetariums. The service goes well beyond the simple browsing of images. Users can choose which telescope they want to look through, including the Hubble Space Telescope, Chandra X-Ray Observatory, the Spitzer Space Telescope, and others. They can view the locations of planets in the night sky -- in the past, present or future. They can view the universe through different wavelengths of light to reveal hidden structures in other parts of the galaxy. Taken as a whole, the application provides a top-to-bottom view of the science of astronomy. The NASA "Great Observatories" have contributed images to the WorldWide Telescope. These include not only images that contain X-ray data but also others that are multi-wavelength composites of different types of radiation, and provided video and narration for tours on galaxies and supernovas and their remnants. "*Users can see the X-ray view of the sky, zoom into bright radiation clouds, and then cross-fade into the visible light view and discover the cloud remnants of a supernova explosion from a thousand years ago*," said Roy Gould, a researcher at the Harvard-Smithsonian Center for Astrophysics. "I believe this new creation from Microsoft will have a profound impact on the way we view the universe."

Microsoft Research has formed close ties with members of the academic, education and scientific communities to make WorldWide Telescope a reality. NASA, along with other organizations coordinated with Microsoft Research to provide the

imagery, provide feedback on the application from a scientific point of view, and help turn WorldWide Telescope into a rich learning application.

Microsoft's mission to make the universe accessible to everyone was begun years ago by the renowned late Microsoft Senior Researcher Jim Gray. WorldWide Telescope is built on top of Gray's pioneering development of large-scale, high-performance online databases including SkyServer, and his contributions to the Sloan Digital Sky Survey, a project to map a large part of the Northern sky outside of the galaxy. Microsoft Research is releasing WorldWide Telescope as a service free of charge to the astronomy and education communities as a tribute to Gray with the hope that it will inspire and empower kids of all ages to explore and understand the universe in an unprecedented way.

Microsoft Research was founded in 1991, and is dedicated to conducting both basic and applied research in computer science and software engineering. Its goals are to enhance the user experience on computing devices, reduce the cost of writing and maintaining software, and invent novel computing technologies. Researchers focus on more than 55 areas of computing and collaborate with leading academic, government and industry researchers to advance the state of the art in such areas as graphics, speech recognition, user-interface research, natural language processing, programming tools and methodologies, operating systems and networking, and the mathematical sciences. Microsoft Research currently employs more than 800 people in six labs located in Redmond, WA.; Cambridge, MA.; Silicon Valley, CA.; Cambridge, England; Beijing, China; and Bangalore, India. Microsoft Research collaborates openly with colleges and universities worldwide to enhance the teaching and learning experience, inspire technological innovation, and broadly advance the field of computer science. http://www.research.microsoft.com

WANDERING POLES LEFT SCARS ON EUROPA

Curved features on Jupiter's moon Europa may indicate that its poles have wandered by almost 90 deg, report scientists. Such an extreme shift suggests the existence of an internal liquid ocean beneath the icy crust, which could help build the case for Europa as possible habitat for extraterrestrial life. The research team, which included Isamu Matsuyama and colleagues Paul Schenk and Francis Nimmo, used images from the Voyager, Galileo, and New Horizons spacecraft to map several large arc-shaped depressions that extend more than 500 kilometers across Europa's surface. With a radius of about 1500 kilometers, Europa is slightly smaller than the Earth's moon. By comparing the pattern of the depressions with fractures that would result from stresses caused by a shift in Europa's rotational axis, the researchers determined that the axis had shifted by approximately 80 deg. The previous axis of rotation is now located about 10 deg from the present equator.

The drastic shift in Europa's rotational axis was likely a result of the build-up of thick ice at the poles. "*A spinning body is most stable with its mass farthest from its spin axis*," says Matsuyama. "*On Europa, variations in the thickness of its outer shell caused a mass imbalance, so the rotation axis reoriented to a new stable state*." Such a change is called "true polar wander" as opposed to apparent polar wander caused by plate tectonics. There is evidence for true polar wander on Earth, and also on Mars and on Saturn's moon Enceladus. "*Our study adds Europa to this list*," says Matsuyama. "*It suggests that planetary bodies might be more prone to reorientation than we thought*." The study also has implications for liquid water inside Europa. Scientists have hypothesized that Europa has an extensive subsurface ocean based on spacecraft photos that revealed its fractured, icy surface. The ocean beneath the crust would be kept liquid by heat generated by tidal forces from Jupiter's gravity. The presence of heat and water may make life possible, even though the subsurface ocean is cut off from solar energy. "*The large reorientation on Europa required to explain the circular depressions implies that its outer ice shell is decoupled from the core by a liquid layer*," says Matsuyama. "*Therefore, our study provides an independent test for the presence of an interior liquid layer."*

DISCOVERY OF MOST RECENT SUPERNOVA IN OUR GALAXY

The most recent supernova in our galaxy has been discovered by tracking the rapid expansion of its remains. This result, using Chandra X-ray Observatory and the National Radio Astronomy Observatory's Very Large Array, will help improve our understanding of how often supernovae explode in the Milky Way galaxy. The supernova explosion occurred about 140 years ago, making it the most recent in the Milky Way. Previously, the last known supernova in our galaxy occurred around 1680, an estimate based on the expansion of its remnant, Cassiopeia A.

Finding such a recent, obscured supernova is a first step in making a better estimate of how often the stellar explosions occur. This is important because supernovae heat and redistribute large amounts of gas, and pump heavy elements out into their surroundings. They can trigger the formation of new stars as part of a cycle of stellar death and rebirth. The explosion also can leave behind, in addition to the expanding remnant, a central neutron star or black hole. The recent supernova explosion was not seen with optical telescopes because it occurred close to the center of the galaxy and is embedded in a dense field of gas and dust. This made the object about a trillion times fainter, in optical light, than an unobscured supernova. However, the remnant it caused can be seen by X-ray and radio telescopes. "*We can see some supernova explosions with optical telescopes across half of the universe, but when they're in this murk we can miss them in our own cosmic backyard*," said Stephen Reynolds, who led the Chandra study. "*Fortunately, the expanding gas cloud from the explosion shines brightly in radio waves and X-rays for thousands of years. X-ray and radio telescopes can see through all that obscuration and show us what we've been missing*."

Astronomers regularly observe supernovae in other galaxies like ours. Based on those observations, researchers estimate about three explode every century in the Milky Way. "*If the supernova rate estimates are correct, there should be the remnants of about 10 supernova explosions that are younger than Cassiopeia A*," said David Green, who led the Very Large Array study. "*It's great to finally track one of them down*." The tracking of this object began in 1985, when astronomers, led by Green, used the Very Large Array to identify the remnant of a supernova explosion near the center of our galaxy. Based on its small size, it was thought to have resulted from a supernova that exploded about 400 to 1000 years ago. Twenty-two years later, Chandra observations revealed the remnant had expanded by a surprisingly large amount, about 16 percent, since 1985. This indicates the supernova remnant is much younger than previously thought. That young age was confirmed in recent weeks when the Very Large Array made new radio observations. This comparison of data pinpoints the age of the remnant at 140 years - possibly less if it has been slowing down - making it the youngest on record in the Milky Way. Besides being the record holder for youngest supernova, the object is of considerable interest for other reasons.

The high expansion velocities and extreme particle energies that have been generated are unprecedented and should stimulate deeper studies of the object with Chandra and the Very Large Array. "*No other object in the galaxy has properties like this*," Reynolds said. "*This find is extremely important for learning more about how some stars explode and what happens in the aftermath*." http://www.nasa.gov/chandra

MRO Satellite Finds Interior of Mars is Colder

New observations from Mars Reconnaissance Orbiter indicate that the crust and upper mantle of Mars are stiffer and colder than previously thought. The findings suggest any liquid water that might exist below the planet's surface and any possible organisms living in that water, would be located deeper than scientists had suspected. "*We found that the rocky surface of Mars is not bending under the load of the north polar ice cap*," said Roger Phillips, the lead author of a new report appearing in the online version of Science. "*This implies that the planet's interior is more rigid, and thus colder, than we thought before*." The discovery was made using the Shallow Radar (SHARAD) instrument on the Orbiter, which has provided the most detailed pictures to date of the interior layers of ice, sand and dust that make up the north polar cap on Mars. The radar images reveal long, continuous layers stretching up to 600 miles or about one-fifth the length of the United States. "*In our first glimpses inside the polar ice using the radar on Mars Reconnaissance Orbiter, we can clearly see stacks of icy material that trace the history of Mars' climate*," said Jeffrey Plaut. Plaut is a science team member and a co-author of the paper. "*Radar has opened up a new avenue for studying Mars' past."*

The radar pictures show a smooth, flat border between the ice cap and the rocky Martian crust. On Earth, the weight of a similar stack of ice would cause the planet's surface to sag. The fact that the Martian surface is not bending means that its strong outer shell, or lithosphere, a combination of its crust and upper mantle, must be very thick and cold. "*The lithosphere of a planet is the rigid part. On Earth, the lithosphere is the part that breaks during an earthquake*," said Suzanne Smrekar, deputy project scientist for Mars Reconnaissance Orbiter. "*The ability of the radar to see through the ice cap and determine that there is no bending of the lithosphere gives us a good idea of present day temperatures inside Mars for the first time*." Temperatures in the outer portion of a rocky planet like Mars increase with depth toward the interior. The thicker the lithosphere, the more gradually the temperatures increase. The discovery of a thicker Martian lithosphere therefore implies that any liquid water lurking in aquifers below the surface would have to be deeper than previously calculated, where temperatures are warmer. Scientists speculate that any life on Mars associated with deep aquifers also would have to be buried deeper in the interior.

The radar pictures also reveal four zones of finely spaced layers of ice and dust separated by thick layers of nearly pure ice. Scientists think this pattern of thick ice-free layers represents cycles of climate change on Mars on a time scale of roughly one million years. Such climate changes are caused by variations in the tilt of the planet's rotational axis and in the eccentricity of its orbit around the sun. The observations support the idea that the north polar ice cap is geologically active and relatively young, at about 4 million years. On May 25, Phoenix Mars Lander is scheduled to touch down not far from the north polar ice cap. It will further investigate the history of water on Mars, and is expected to get the first up close look at ice on the Red Planet. http://www.nasa.gov/mro

Weird Stellar Pulsar Pair Puzzles Scientists

Astronomers have discovered a speedy spinning pulsar in an elongated orbit around an apparent Sun-like star, a combination never seen before, and one that has them puzzled about how the strange system developed. "*Our ideas about how the fastest-spinning pulsars are produced do not predict either the kind of orbit or the type of companion star this one has*," said David Champion of the Australia Telescope National Facility. "*We have to come up with some new scenarios to explain this weird pair*," he added. Astronomers first detected the pulsar, called J1903+0327, as part of a long-term survey using the National Science Foundation's Arecibo radio telescope in Puerto Rico. They made the discovery in 2006 doing data analysis at McGill University, where Champion worked at the time. They followed up the discovery with detailed studies using the Arecibo telescope, the Robert C. Byrd Green Bank Telescope (GBT) in West Virginia, the Westerbork radio telescope in the Netherlands, and the Gemini North optical telescope in Hawaii.

The pulsar, a city-sized superdense stellar corpse left over after a massive star exploded as a supernova, is spinning on its axis 465 times every second. Nearly 21,000 light-years from Earth, it is in a highly-elongated orbit that takes it around its companion star once every 95 days. An infrared image made with the Gemini North telescope in Hawaii shows a Sun-like star at the pulsar's position. If this is an orbital companion to the pulsar, it is unlike any companions of other rapidly rotating pulsars. The pulsar, a neutron star, also is unusually massive for its type. "*This combination of properties is unprecedented. Not only does it require us to figure out how this system was produced, but the large mass may help us understand how matter behaves at extremely high densities*," said Scott Ransom.

Pulsars are neutron stars whose strong magnetic fields channel lighthouse-like beams of light and radio waves that whirl around as the star spins. Typical pulsars spin a few times a second, but some, like PSR J1903+0327, are much faster, rotating hundreds of times a second. They are called millisecond pulsars. Astronomers think most millisecond pulsars are sped up by material falling onto them from a companion star. This requires the pulsar to be in a tight orbit around its companion that becomes more and more circular with time. The orbits of some millisecond pulsars are the most perfect circles in the Universe, so the elongated orbit of the new pulsar is a mystery. "*What we have found is a millisecond pulsar that is in the wrong kind of orbit around what appears to be the wrong kind of star*," Champion

said. "*Now we have to figure out how this strange system was produced*."

The scientists are considering three possibilities. The first, that the pulsar simply was born spinning quickly, seems unlikely to them. Another possibility, they say, is that the pulsar was formed in a tight group of stars known as a globular cluster, where it had a companion that spun it up. Later, a close encounter with another star in the cluster stripped it of its companion and flung it out of the cluster. For several reasons, including the fact that they don't see a nearby cluster from which it could have come, they don't like that explanation either. A third scenario says the pulsar may be part of a triple, not a double, star system. In this case, the pulsar's 95-day orbit is around a neutron star or white dwarf, not the Sun-like star seen in the infrared image. The Sun-like star would then be in a more-distant orbit around the pulsar and its close companion. "*We've found about 50 pulsars in binary systems. We may now have found our first pulsar in a stellar triple system*," Ransom said.

The research team is busy trying to get their answers. They will study the star in the infrared image further to confirm the indications that it is similar to our Sun and that it actually is a companion to the pulsar. Additional radio observations will study the pulsar's orbit and seek to measure its motion in space. "*This is a fascinating object that has a lot to teach us about physics. It's going to be exciting to peel away the mystery of how this thing came to be*," Champion said. Meanwhile the survey with Arecibo goes on. Other, more conventional millisecond pulsars have been found, but it is almost certain that there will be more surprises, said Jim Cordes, chair of the consortium that is doing the survey. The large volume of data for the survey is archived at the Cornell Center for Advanced Computing, and is then processed using computer clusters at several consortium-member sites around the world. http://www.nrao.edu/pr/2008/strangepulsar/graphics.shtml

SWIFT X-RAY SATELLITE FIRST TO CATCH SUPERNOVA IN ACT OF EXPLODING

Thanks to a fortuitous observation with the Swift satellite, astronomers for the first time have caught a star in the act of exploding. Astronomers have previously observed thousands of stellar explosions, known as supernovae, but they have always seen them after the fireworks were well underway. "*For years we have dreamed of seeing a star just as it was exploding, but actually finding one is a once in a lifetime event*," says team leader Alicia Soderberg. Now for the first time, astronomers have actually seen what happens when a star goes supernova , seeing the star blow up, in real time! The burst only lasted 5 minutes before it faded away. "*This newly born supernova is going to be the Rosetta stone of supernova studies for years to come*."

A typical supernova occurs when the core of a massive star runs out of nuclear fuel and collapses under its own gravity to form an ultradense object known as a neutron star. The newborn neutron star compresses and then rebounds, triggering a shock wave that plows through the star's gaseous outer layers and blows the star to smithereens. Astronomers thought for nearly four decades that this shock "break-out" will produce bright X-ray emission lasting a few minutes. But until this discovery, astronomers have never observed this signal. Instead, they have observed supernovae brightening days or weeks later, when the expanding shell of debris is energized by the decay of radioactive elements forged in the explosion. "*Seeing the shock break-out in X-rays can give a direct view of the exploding star in the last minutes of its life and also provide a signpost to which astronomers can quickly point their telescopes to watch the explosion unfold*," says Edo Berger. Soderberg's discovery of the first shock breakout can be attributed to luck and Swift's unique design. On January 9, 2008, Soderberg and Berger were using Swift to observe a supernova known as SN 2007uy in the spiral galaxy NGC 2770, located 90 million light-years from Earth in the constellation Lynx. At 9:33 a.m. EST they spotted an extremely bright 5-minute X-ray outburst in NGC 2770. They quickly recognized that the X-rays were coming from another location in the same galaxy. In a paper appearing in the May 22 Nature, Soderberg and 38 colleagues show that the energy and pattern of the X-ray outburst is consistent with a shock wave bursting through the surface of the progenitor star. This marks the birth of the supernova now known as SN 2008D.

Although astronomers were lucky that Swift was observing NGC

2770 just at the moment when SN 2008D's shock wave was blowing up the star, Swift is well equipped to study such an event because of its multiple instruments observing in gamma rays, X-rays, and ultraviolet light. "*It was a gift of nature for Swift to be observing that patch of sky when the supernova exploded. But thanks to Swift's flexibility, we have been able to trace its evolution in detail every day since*," says Swift lead scientist Neil Gehrels.

Due to the significance of the X-ray outburst, Soderberg immediately mounted an international observing campaign to study SN 2008D. Observations were made with major telescopes such as the Hubble, Chandra X-ray Observatory, the Very Large Array in New Mexico, the Gemini North telescope and the Keck I telescope in Hawaii, the 200-inch and 60-inch telescopes at the Palomar Observatory in California, and the 3.5-meter telescope at the Apache Point Observatory in New Mexico. The combined observations helped Soderberg and her colleagues pin down the energy of the initial X-ray outburst, which will help theorists better understand supernovae. The observations also show that SN 2008D is an ordinary Type Ibc supernova, which occurs when a massive, compact star explodes. Significantly, radio and X-ray observations found no evidence that a jet played a role in the explosion, ruling out a rare type of stellar explosion known as a gamma-ray burst. "*This was a typical supernova*," says Swift team member Stefan Immler. "*The significance is not the explosion itself, but the fact that we were able to see the star blow up in real time, which gives us unprecedented insight into the explosion process*."
http://www.nasa.gov/centers/goddard/news/topstory/2008/swift_supernova.html http://www.nasa.gov/mission_pages/swift/main/index.html

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 at least two weeks prior to the next upcoming scheduled EAS meeting.

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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In May's StarGazer:

**** ASTRO CALENDAR - UPCOMING ASTRONOMY EVENTS FOR 2008
**** OBSERVER'S INFORMATION - SUN, MOON, AND PLANET VISIBILITY
**** STAR PARTY CALENDAR FOR 2008
**** CONSTELLATIONS OF THE MONTH – SCORPIUS
**** YOUNG ASTRONOMER'S CORNER
**** ASTRONOMY & TELESCOPE LINGO
**** ASTRONOMY "FUN FACTS"
**** MIRROR IMAGES
**** HISTORY OF A SUPER SOLAR FLARE
**** PLANET FINDER CATCHES COMET HOLMES
**** 100 METEORITE EXPLOSIONS ON THE MOON
**** DISCOVERY OF NEW TYPE OF PULSATING WHITE DWARF STAR
**** 65-MILLION-YEAR-OLD ASTEROID IMPACT TRIGGERED A GLOBAL HAIL OF CARBON BEADS
**** SATURN DOES THE WAVE IN UPPER ATMOSPHERE
**** THE ANTENNAE GALAXIES FOUND TO BE CLOSER TO US
**** WORLDWIDE TELESCOPE BRINGS SPACE EXPLORATION TO EARTH
**** WANDERING POLES LEFT SCARS ON EUROPA
**** DISCOVERY OF MOST RECENT SUPERNOVA IN OUR GALAXY
**** MRO SATELLITE FINDS INTERIOR OF MARS IS COLDER
**** WEIRD STELLAR - PULSAR PAIR PUZZLES SCIENTISTS
**** SWIFT X-RAY SATELLITE FIRST TO CATCH SUPERNOVA IN ACT OF EXPLODING

The next EAS Meeting is 7:00 P.M. Saturday May 24th at the 'Aurora Astro Products' store location at Silver Lake.