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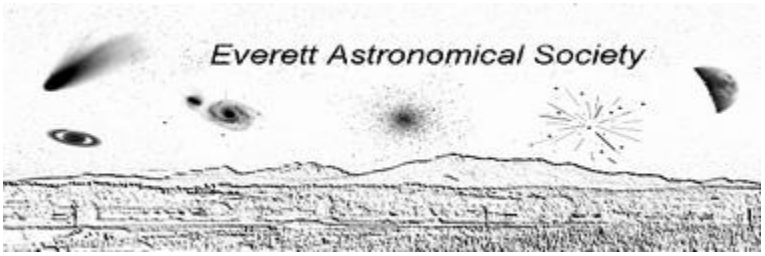

The Stargazer

November 2008

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Newsletter co-editor: Bill O'Neil	(774) 253-0747	wonastrn at netway.com	
Web assistance: Cody Gibson	(425) 348-1608	sircody01 at comcast.net	*See EAS website at:*
		(change 'at' to @ to send email)	http://everettastro.org

EAS BUSINESS…

NEXT EAS MEETING – SATURDAY NOV 22ND 7 PM AT AURORA ASTRO PRODUCTS STORE AT SILVER LAKE.

★★ Saturday November 22nd 7:00 pm MEETING ★★
This month's program is "Secrets Of The Sun" describing many aspects of what we understand about how the Sun works, its phenomenon, and how they affect us on Earth, including fusion in the core, magnetic affects on its surface (such as sunspots, solar flares, prominences, and coronal mass ejections). The lifecycle from the formation of the Sun and solar system to its final stages. Includes descriptions by leading astronomers, and striking images and graphics. From 'The Universe' series.

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

Pat Lewis – Longtime EAS active member Pat Lewis has passed away, on November 17th. A memorial service will be held on December 3rd at 2:00 pm, at University Presbyterian Church, at 4540 15th Ave NE, in Seattle, just north of the UW. She was 89. Pat made many contributions to local astronomy, including writing and recording many episodes of 'It's over your head' radio show on KSER for a number of years. She was also involved with the Seattle Astronomical Society. She will be greatly missed.

★ STAR PARTY INFO ★

Next EAS Star Party: None planned until spring.

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.

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

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	--

EAS MEMBER NEWS

**** NOMINATIONS / VOLUNTEERS NEEDED FOR EAS OFFICES ****

The EAS continues to exist due to the willingness of members of the club to volunteer and contribute to the club. Thank you very much to those (some below) who are or have been actively volunteering and helping keep the club going. Some of the people in the current roles have been doing so for a long time, so others in the club need to step up and make a contribution, as we cannot ask the same people to keep doing the same jobs year after year. Without new volunteers, the club suffers. There are people have been part of the club for many years, and have yet to volunteer to help out in a formal role. If you have not volunteered for a role in supporting the club, you need to consider doing so. It is not difficult, it does not require special skills, it can be fun and rewarding, and the vitality of the EAS depends on it ! I urge you in the strongest possible way to please volunteer and find a way to help. Please bring a name of volunteer or nomination to the November EAS meeting.

Offices and Volunteer Roles in the EAS:

President: (current incumbent **Mark Folkerts**) – Run the monthly EAS meetings, and introduce speakers, call EAS board meetings.

Vice-President: (current incumbent **James Bielaga**) – Run EAS meetings if president is absent. Also store/maintain, and loan out the club telescopes.

Treasurer: (current incumbent, **Carol Gore**) – Collect club dues, pay club expenses, maintain club checking account bookkeeping, pickup and respond to mail sent to club.

Librarian: (current incumbent, **Mike Locke**) – Maintain the collections of books, tapes, videos, and software that has been donated to the club, and make available to members.

Stargazer Newsletter Editor(s): (current incumbents **Mark Folkerts** and **Bill O'Neil**) – gather events and news and write articles to publish monthly newsletter.

Webmaster: (current incumbent, **Cody Gibson**) – design, update and support EAS website presence.

ALCOR: (current incumbent **Joanne Green**) – Coordinate with the Astronomical League about EAS club membership info, announce AL ballots, review AL observing awards and distribute awards to members.

Programs chairperson: (currently **vacant**, acting incumbent, **Mark Folkerts**) – Contact potential speakers and schedule them to come and speak to the EAS, send them directions and thank them for their contribution. Identify videos or other programs.

Publicity / Astronomy-Day coordinator: (current incumbent **David Brodeur**) – Make reservations for venue (library), notify websites about EAS astronomy day events, create press releases and notify news organizations about EAS events, and promote new membership growth in the EAS.

Star Party Host / coordinator: (currently **Ron Tam**) – Graciously offering the opportunity to members to view the sky from their darker suburban/rural property location.

Outreach chairperson: (currently **vacant**) - Coordinate requests from public for EAS member volunteers to conduct star parties or presentations at visits to schools, senior centers, scout meetings, etc.

Sidewalk astronomy committee: (currently **vacant**). – Plan and conduct urban/suburban sidewalk astronomy events to allow passers-by to experience astronomy. Needs 2-3 people for each event, and to schedule events.

Secretary: (currently **vacant**) – Keep notes and photos of EAS meetings and events and speaker presentations, and publish them in the StarGazer newsletter, and send info to Night Sky Network.

Other volunteers? Find a way to help and contribute. Come up with a new idea to promote the EAS and astronomy in your community. Come to Astronomy Day or a star party and share your interest in the sky…

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. A star party night can be a rewarding event for all involved. **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. <<

Aurora Astro Products
"*Your Northern Light in the Astronomy Business*"
Over 37 product dealerships, and growing

11419 19th Avenue SE #A102
Everett, WA 98208
www.auroraastro.com
425-337-4384
425-337-4758 fax

New hours:
Monday, Thursday, Friday – 9:00 am to 6:00 pm
Tuesday/Wednesday – Noon to 8:00 pm
Saturday – 10:00 am to 5:00 pm

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 2008-2009

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 – EAS Holiday Dinner Mtg – Alfy's on Broadway – 7:00 pm
Dec 13 - Geminids meteor shower peak
Dec 21 - Winter Solstice, 12:04 UT
Dec 22 - Ursids meteor shower peak
Dec 29 - Moon Occults Jupiter

January 2009

Jan 01 - International Year of Astronomy 2009
Jan 03 - Quadrantids Meteor Shower Peak
Jan 04 - Earth At Perihelion (0.983 AU From Sun)
Jan 14 - Stardust, Earth Flyby
Jan 14 - Venus At Its Greatest Eastern Elongation (47 Degrees)
Jan 26 - Annular Solar Eclipse
Jan 26 - Chinese New Year

February 2009

Feb 09 - Penumbral Lunar Eclipse
Feb 17 - 50th Anniversary (1959), Vanguard 2 Launch
Feb 28 - 50th Anniversary (1959), Discoverer 1 Launch

March 2009

Mar 08 - Daylight Saving - Set Clock Ahead 1 Hour (United States)
Mar 08 - Saturn At Opposition
Mar 20 - Vernal Equinox, 11:44 UT
:

April 2009

Apr 02 - 50th Anniversary (1959), Selection Of Mercury 7Astronauts
Apr 12 - Easter Sunday
Apr 22 - Lyrids Meteor Shower Peak
Apr 29-May 03 - Astronomy Week

May 2009

May 02 - Astronomy Day
May 05 - Eta Aquarids Meteor Shower Peak

June 2009

Jun 05 - Venus At Its Greatest Western Elongation (46 Degrees)
Jun 21 - Summer Solstice, 05:45 UTC
Jun 23 - Pluto At Opposition

July 2009

Jul 04 - Earth At Aphelion (1.017 AU From Sun)
Jul 07 - Penumbral Lunar Eclipse
Jul 20 - 40th Anniversary (1969), 1st Man On The Moon (Apollo 11)
Jul 22 - Total Solar Eclipse
Jul 29 - South Delta-Aquarids Meteor Shower Peak

August 2009

Aug 01 - Alpha Capricornids Meteor Shower Peak
Aug 06 - Penumbral Lunar Eclipse
Aug 06 - Southern Iota Aquarids Meteor Shower Peak
Aug 12 - Perseids Meteor Shower Peak
Aug 17 - Neptune At Opposition
Aug 24 - Mercury At Its Greatest Eastern Elongation (27 Degrees)
Aug 25 - Northern Iota Aquarids Meteor Shower Peak

September 2009

Sep 04 - Saturn's Rings Edge-on From Earth
Sep 17 - Uranus At Opposition
Sep 22 - Autumnal Equinox (21:18 UT)

October 2009

Oct 09 - Draconids Meteor Shower Peak
Oct 21 - Orionids Meteor Shower Peak

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 five-minute segment is broadcast **every Wednesday morning at approximately 8:20 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.celestialnorth.org/radio/index.php and podcasts at http://www.celestialnorth.org/radio/index.php

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

Nov 19	Last Quarter Moon
Nov 27	New Moon
Dec 05	First Quarter Moon
Dec 12	Full Moon
Dec 19	Last Quarter Moon
Dec 27	New Moon
Jan 04	First Quarter Moon
Jan 11	Full Moon
Jan 18	Last Quarter Moon
Jan 26	New Moon
Feb 02	First Quarter Moon
Feb 09	Full Moon

Digital Lunar Orbiter Photographic Atlas of the Moon

The Lunar and Planetary Institute has created a digital version of the Lunar Orbiter Photographic Atlas of the Moon, and Consolidated Lunar Atlas available online at:
http://www.lpi.usra.edu/research/cla/menu.html
http://www.lpi.usra.edu/research/lunar_orbiter

UP IN THE SKY -- THE PLANETS (AND PLUTO)

Object	*Rises*	*Sets*	*Con*	*Diam.*	*Mag*
Sun	***07:25 am***	***16:25***	***Lib***	***30'***	***-27.5***
Mercury	07:19 am	16:17	Lib	06"	-1.2
Venus	**10:54 am**	**18:55**	**Sag**	**16"**	**-4.1**
Mars	07:49 am	16:33	Sco	04"	+1.4
Jupiter	**11:12 am**	**19:47**	**Sag**	**37"**	**-2.0**
Saturn	**01:02 am**	**13:56**	**Leo**	**16"**	**+1.1**
Uranus	**13:40**	**01:03am**	**Aqr**	**04"**	**+5.8**
Neptune	**12:40**	**22:32**	**Cap**	**02"**	**+7.9**
Pluto	**09:18am**	**18:41**	**Sag**	**--**	**+14.0**

(times listed 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 - PHOENIX

LEO (The Lion). One of the 48 "original" constellations. The possessive form of this famous constellation is known as Leonis. Asterisms associated with Leo include The Sickle, The Spring Triangle, and The Diamond (of Virgo). Constellations bordering

on Leo (and the directions from Leo) include Cancer(W), Coma Berenices (E), Crater(S), Hydra(S), Leo Minor(N), Sextans (S and W), Ursa Major(N), and Virgo(S and E). The overall brightness (the number of visible stars per unit area = # of visible stars in constellation/size of constellation in square degrees x 100) of Leo is 5.491 (ranking Leo 70th in brightness among the constellations). The central point of Leo is located at RA=10h37m, and Dec. = +13.5 degrees. The size of Leo is 946.96 square degrees (2.296% of the sky), making Leo the 12th largest constellation in area.

Messier objects included within its borders are M65 (spiral galaxy – NGC 3623), M66 (spiral galaxy – NGC 3627), M95 (spiral galaxy – NGC 3351), M96 (spiral galaxy – NGC 3368), and M105 (elliptical galaxy – NGC 3379). Meteor showers (and peaks) associated with Leo are the delta Leonids (Feb. 26), the sigma Leonids (April 17), and the famous Leonids (Nov. 17). The midnight culmination date is March 1st, making Leo a wonderful Spring constellation for observing. The solar conjunction date is August 31st. There are 52 visible stars brighter than magnitude 5.5; some of the famous named stars in Leo include Regulus, Denebola, Algieba, Adhafera, and Chort. Regulus is one of the four Royal Stars of the ancient Persians (the other three are Aldebaran (Taurus), Antares (Scorpius), and Fomalhaut (Piscis Austrinus). Among the nearest stars to our solar system include Wolf 359 (the 4th nearest star), AD Leo (the 37th nearest star), and Ross 104 (the 79th nearest). Wolf 359 has an apparent magnitude of 13.5; an absolute magnitude of 16.5; a parallax (arcsec) of 0.429; and is at a distance of 7.6 light years. Leo is completely visible from latitudes +84 degrees to -57 degrees, and portions of it are visible worldwide.

The Leonid meteor shower (peak Nov. 17th) is unusually active every 33 years. Fantastic and well-known displays were noted in 1799, 1833, 1866, and 1966, with meteors in the tens of thousands reported per hour on these occasions. This year, a last quarter moon will be visible, which may interfere with some of the fainter meteors which might be visible, but the Leonids are always worth checking out if the night is clear.

GEMINI (The Twins), as this winter constellation is also known, borders on the constellations of Auriga, Cancer, Canis Minor, Lynx, Monoceros, Orion, and Taurus, and ranks 26th in overall brightness among the constellations, containing 47 stars brighter than magnitude 5.5. Its central point is located at RA=7h,1m and Dec.= +22.5 degrees. It is completely visible from latitudes North of –55 degrees, and completely invisible from latitudes South of –80 degrees; this constellation ranks 30th in overall size. Gemini's most famous bright stars are Castor (Alpha) and Pollux (Beta), better known as "The Twins". Gemini has two associated meteor showers: the Epsilon Geminids (19 Oct.), and the Geminids (14 Dec.), and one Messier object: the open cluster M35 (NGC 2168).

Two of the planet "discoveries" took place within this constellation. In 1781 William Herschel found the planet Uranus near Eta Geminorum; in the first half of this century (1930), Clyde Tombaugh (working at Flagstaff's Lowell Observatory), discovered Pluto near Delta Geminorum. Castor, appearing as one star to the naked eye, is officially designated as a triple star, but is in reality six stars, each of the three having a companion. Studies indicate that star systems containing more than six stars will more rapidly become unstable and separate. Gemini's midnight culmination date is January 5th, so try to enjoy the beauty of this constellation, and its beautiful and interesting neighbors, on the next clear night.

TAURUS (The Bull), as this late fall and winter constellation is also known, borders on the constellations of Aries, Auriga, Cetus, Eridanus, Gemini, Orion, and Perseus, and ranks 12th in overall brightness among the constellations, containing 98 stars brighter than magnitude 5.5. Associated asterisms involving Taurus include The Heavenly G, The Hyades, The Pleiades, The V, The Winter Octagon, and the Winter Oval. Its central point is located at RA=4h,39m and Dec.= +15.5 degrees. It is completely visible from latitudes North of –59 degrees, and portions of it are visible worldwide; this constellation ranks 17th in overall size, and takes up 797.25 square degrees (or 1.933% of the sky).

Some of Taurus's most famous bright stars are Aldebaran, Merope, Alcyone, Electra, Pleione, Sterope, and Nath and El Nath. Taurus has three associated meteor showers: the Daytime Beta Taurids (29 June); the S. Taurids (3 November) and the N. Taurids (13 November); this wonderful constellation also contains two Messier objects: M1 (the Crab Nebula) and M-45 (the Pleiades). Aldebaran is one of the four Royal Stars of the ancient Persians. The star Beta Tauri was once shared by both the constellations of Auriga and Taurus; before the 20th century, star catalogs frequently listed this star as gamma Aurigae. Ever since the Belgian astronomer Delporte's standards for constellation boundaries were adopted, this star has been officially part of Taurus. M-45 (the Pleiades or "Seven Sisters") is the brightest open cluster in the sky. It is also one of the few members of Messier's list which does not possess a corresponding NGC number (probably because it is too bright); indeed, some cataloguers down through history had listed the Pleiades as a separate and distinct constellation. About one degree north of Zeta Tauri lies M-1 (the Crab Nebula, which received its name from Lord Rosse in the mid-19th century when he noticed that its broad filaments resembled a crab's pincers. The Crab Nebula is a gaseous remnant of a supernova which first became visible in 1054, and is the brightest supernova remnant in the sky. It is within this beautiful constellation that the Italian astronomer Piazzi discovered the first asteroid, Ceres, on New Year's Day, 1801. Taurus has a midnight culmination date of November 30th (and a solar conjunction date of June 2): try to enjoy the beauty of this wonderful constellation, and its interesting neighbors, on the next clear fall or winter night.

YOUNG ASTRONOMER'S CORNER, ASTRONOMY AND TELESCOPE "LINGO", AND ASTRONOMY "FUN FACTS"

These three columns published last month, and will return again to the Stargazer in the very near future.

PLANETARY FOCUS

Planetary Focus last published in September, and will return in the near future.

"MIRROR IMAGES"

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

CLASS OF OBJECT: CLUSTER OF GALAXIES (or GALAXY CLUSTER): This is a grouping of galaxies, which may contain as much as a few thousand member galaxies. The majority of galaxies appear to occur in clusters or in smaller groups such as doublets or triplets. The Local Group (of which the Milky Way is a

member), is a smaller, irregular galaxy cluster; irregular clusters may be large or small, but tend to contain more variable types of galaxies as members (e.g., barred spirals, ellipticals, regular spirals). The larger, denser clusters tend to have more uniform membership amongst their hundreds or thousands of members (for example, most members of the group may be elliptical galaxies, rather than a more variable mix). Adjacent galaxy clusters are grouped into larger superclusters. Rich galaxy clusters are those with higher concentrations of galaxies in their centers; the Abell Catalogue lists many of this latter type, and the Coma and Perseus clusters are examples. The mass required to keep the galaxies in rich clusters gravitationally bound is about 10 times greater than the mass actually observed. The large amount of hot gas that galaxy clusters have been shown to contain is not sufficient to explain this "missing mass". In irregularly shaped clusters, the gas is associated with individual galaxies, but in regular galaxy clusters, this gas has been shown to form more of a large common pool between the galaxies; this "regular cluster" gas then is more enriched as a result of cluster member interactions, and tends to be more metallic as a result.

Hot, intracluster gas loses energy via X-ray radiation; gas in the cluster core is most dense. Cooling gas flows inward towards the center of the cluster to maintain the pressure required to support the mass of the outer hot atmosphere; this forms a cooling flow. Cooling flows have been detected from X-ray spectra in 70-90% of all larger galaxy clusters; these cooling flows can deposit up to several hundred solar masses per year towards the center of the cluster. A significant portion of this flow will be deposited to the centrally located cD galaxy, which are the most massive galaxies yet detected. Recent studies show that galaxy clusters are a relatively recent phenomenon, evolving from the merging of smaller clusters to form the rich clusters observed today. More distant galaxy clusters show a greater proportion of blue galaxies; this color is due to star formation (initiated either by ram pressure stripping of galaxies in merging subclusters, or by interactions between galaxies on the periphery of the cluster).

REPRESENTATIVE NORTHERN HEMISPHERE OBJECT: Virgo Cluster: A giant irregular galaxy cluster lying near the North Galactic Pole in the constellation of Virgo. With a distance of approximately 15 megaparsecs, it is the nearest large cluster to earth. About 2,500 galaxies have been observed in this cluster, and about 75% are spirals; the remaining members are mostly ellipticals. One of this cluster's brightest members (the giant elliptical M-87), is a radio source and an X-ray source, and the X-ray halo around this galaxy is contributing about 10 solar masses per year to the slight cooling flow. Another large member of the group (M-86), is, (in addition to being an X-ray source as well), exhibiting this X-ray source as a 'plume' directed away from the center of the galaxy; this is as a result of the gas being stripped away from the galaxy by ram pressure as it descends into the cluster proper. The Virgo cluster is the center of the Local Supercluster, which itself exerts a considerable gravitational influence on the Local Group of galaxies, of which the Milky Way is a member.

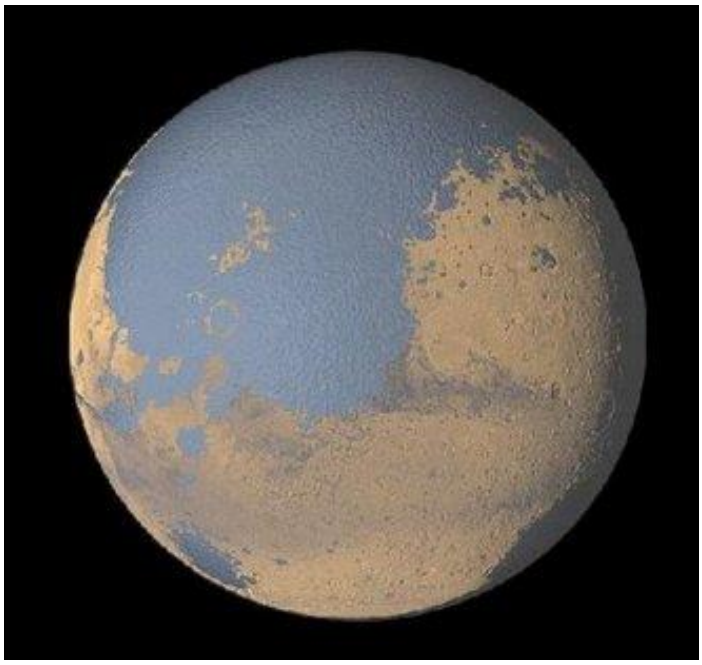
REPRESENTATIVE SOUTHERN HEMISPHERE OBJECT: Fornax Cluster: This cluster in the constellation of the same name contains 18 bright galaxies and at least 10 fainter ones; these are all compressed into an area of about a 6-degree diameter circle, and most members lie between 20 and 25 megaparsecs away from Earth. NGC-1380 is at the center of the cluster, and is a lenticular shaped galaxy. There are several other member galaxies within the one degree field of this central cluster galaxy: it is possible to see nine galaxies total with NGC-1380 centered. There are still other galaxies just outside this immediate area. About one degree southwest of this main cluster is NGC-1365, also known as the "Great Barred Spiral of Fornax". NGC-1365 shines at magnitude 9.5, and measures 9.8' x 5.5'; it is one of the brightest galaxies in the area, and the spiral arms and bar structure are visible in backyard telescopes.

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

SOLAR WIND RIPS UP MARTIAN ATMOSPHERE

Researchers have found new evidence that the atmosphere of Mars is being stripped away by solar wind. It's not a gently continuous erosion, but rather a ripping process in which chunks of Martian air detach themselves from the planet and tumble into deep space. This surprising mechanism could help solve a longstanding mystery about the Red Planet. "*It helps explain why Mars has so little air*," says David Brain, who presented the findings at the 2008 Huntsville Plasma Workshop.

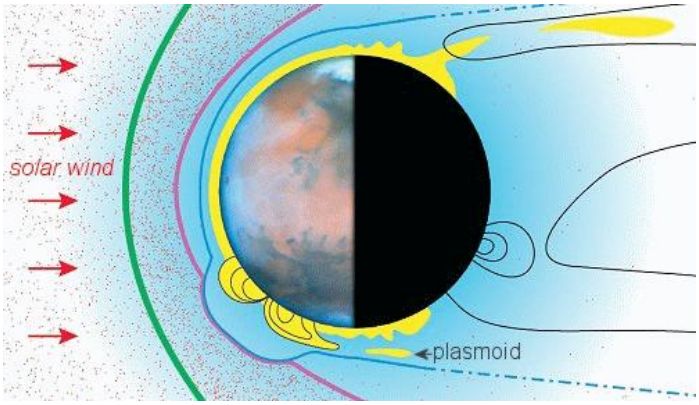
Billions of years ago, Mars had a lot more air than it does today. (Note: Martian "air" is primarily carbon dioxide, not the nitrogen-oxygen mix we breathe on Earth.) Ancient martian lake-beds and river channels tell the tale of a planet covered by abundant water and wrapped in an atmosphere thick enough to prevent that water from evaporating into space. Some researchers believe the atmosphere of Mars was once as thick as Earth's. Today, however, all those lakes and rivers are dry and the atmospheric pressure on Mars is only 1% that of Earth at sea-level. A cup of water placed almost anywhere on the Martian surface would quickly and violently boil away—a result of the super-low air pressure.



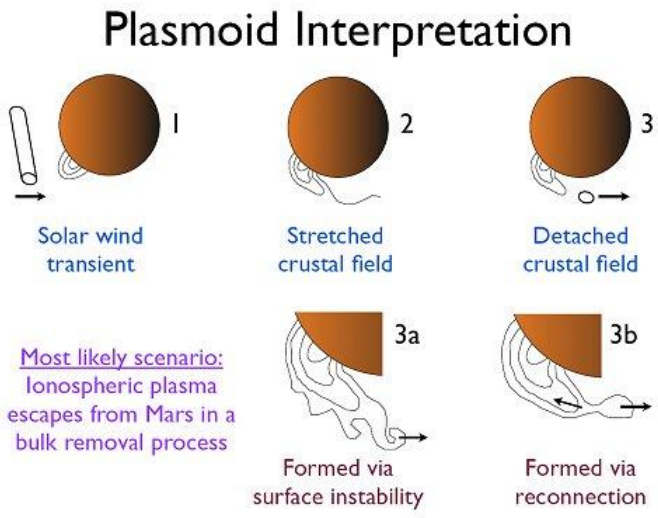
An artist's concept of ancient Mars with abundant air and water.

So where did the air go? Researchers entertain several possibilities: An asteroid hitting Mars long ago might have blown away a portion of the planet's atmosphere in a single violent upheaval. Or the loss might have been slow and gradual, the result of billions of years of relentless "sand-blasting" by solar wind particles. Or both mechanisms could be at work. Brain has uncovered a new possibility--a daily ripping process intermediate between the great cataclysm and slow erosion models. The evidence comes from NASA's now-retired Mars Global Surveyor (MGS) spacecraft.

In 1998, MGS discovered that Mars has a very strange magnetic field. Instead of a global bubble, like Earth's, the Martian field is in the form of magnetic umbrellas that sprout out of the ground and reach beyond the top of Mars' atmosphere. These umbrellas number in the dozens and they cover about 40% of the planet's surface, mainly in the southern hemisphere. For years, researchers thought the umbrellas protected the Martian atmosphere, shielding pockets of air beneath them from erosion by the solar wind. Surprisingly, Brain finds that the opposite can be true as well: "*The umbrellas are where coherent chunks of air are torn away*."



Solar wind blowing against Mars tears atmosphere-filled plasmoids from the tops of magnetic umbrellas. Credit: Graphic artist Steve Bartlett.



Addressing his colleagues at the Workshop, he described how he made the discovery just a few months ago: Brain was scrolling through archival data from Global Surveyor's particles and fields sensors. "*We have measurements from 25,000 orbits*," he says. During one of those orbits, MGS passed through the top of a magnetic umbrella. Brain noticed that the umbrella's magnetic field had linked up with the magnetic field in the solar wind. Physicists call this "magnetic reconnection." What happened next is not 100% certain, but Global Surveyor's readings are consistent with the following scenario: "*The joined fields wrapped themselves around a packet of gas at the top of the Martian atmosphere, forming a magnetic capsule a thousand kilometers wide with ionized air trapped inside*," says Brain. "*Solar wind pressure caused the capsule to 'pinch off' and it blew away, taking its cargo of air with it*." Brain has since found a dozen more examples. The magnetic capsules or "plasmoids" tend to blow over the south pole of Mars, mainly because most of the umbrellas are located in Mars' southern hemisphere.

Dave Brain presented this slide at the 2008 Huntsville Plasma Workshop to explain in cartoon fashion how plasmoids carry air away from Mars.

Brain isn't ready to declare the mystery solved. "*We're still not sure how often the plasmoids form or how much gas each one contains*." The problem is, Mars Global Surveyor wasn't designed to study the phenomenon. The spacecraft was only equipped to sense electrons, not the heavier ions which would make up the bulk of any trapped gas. "*Ions and electrons don't always behave the same way*," he cautions. Also, MGS sampled the umbrellas at fixed altitudes and at the same local time each day. "*We need to sample many altitudes and times of day to truly understand these dynamic events."*In short, he told the audience, "*we need more data*." Brain is pinning his hopes on a new NASA mission named MAVEN. Short for "Mars Atmosphere and Volatile Evolution," MAVEN is an upper atmosphere orbiter currently approved for launch to Mars in 2013. The probe is specifically designed to study atmospheric erosion. MAVEN will be able to detect electrons, ions and neutral atoms; it will be able to measure both magnetic and electric fields; it will travel around Mars in an elliptical orbit, piercing magnetic umbrellas at different altitudes, angles, and times of day; and it will explore regions both near and far from the umbrellas, giving researchers the complete picture they need.If magnetized chunks of air are truly being torn free, MAVEN will see it happening and measure the atmospheric loss rate. "*Personally, I think this mechanism is important*," says Brain, "*but MAVEN may yet prove me wrong*." Meanwhile, the Mystery of the Missing Martian Air is shaping up to be a ripping good yarn.

MYSTERIOUS SOURCE OF HIGH-ENERGY COSMIC RADIATION DISCOVERED

Scientists announced Wednesday the discovery of a previously unidentified nearby source of high-energy cosmic rays. The finding was made with a balloon-borne instrument high over Antarctica.

Researchers from the Advanced Thin Ionization Calorimeter (ATIC) collaboration, published the results in the Nov. 20 issue of the journal Nature. The new results show an unexpected surplus of cosmic ray electrons at very high energy -- 300-800 billion electron volts -- that must come from a previously unidentified source or from the annihilation of very exotic theoretical particles used to explain dark matter.

"*This electron excess cannot be explained by the standard model of cosmic ray origin*," said John P. Wefel, ATIC project principal investigator. "*There must be another source relatively near us that is producing these additional particles*."

According to the research, this source would need to be within about 3,000 light years of the sun. It could be an exotic object such as a pulsar, mini-quasar, supernova remnant or an intermediate mass black hole. "*Cosmic ray electrons lose energy during their journey through the galaxy*," said Jim Adams, ATIC research lead. "*These losses increase with the energy of the electrons. At the energies measured by our instrument, these energy losses suppress the flow of particles from distant sources, which helps nearby sources stand out*."

The scientists point out, however, that there are few such objects close to our solar system. "*These results may be the first indication of a very interesting object near our solar system waiting to be studied by other instruments*," Wefel said.

An alternative explanation is that the surplus of high energy electrons might result from the annihilation of very exotic particles put forward to explain dark matter. In recent decades, scientists have learned that the kind of material making up the universe around us only accounts for about five percent of its mass composition. Close to 70 percent of the universe is composed of dark energy (so called because its nature is unknown). The remaining 25 percent of the mass acts gravitationally just like regular matter, but does little else, so it is normally not visible.

The nature of dark matter is not understood, but several theories that describe how gravity works at very small, quantum distances predict exotic particles that could be good dark matter candidates.

"*The annihilation of these exotic particles with each other would produce normal particles such as electrons, positrons, protons and antiprotons that can be observed by scientists*," said Eun-Suk Seo, ATIC lead.

The 4,300-pound ATIC experiment was designed to be carried to an altitude of about 124,000 feet above Antarctica using a helium-filled balloon about as large as the interior of the New Orleans Superdome. The goal was to study cosmic rays that otherwise would be absorbed into the atmosphere. For information on NASA's scientific balloon program, visit: http://sites.wff.nasa.gov/code820/

SPACECRAFT DETECTS BURIED GLACIERS ON MARS

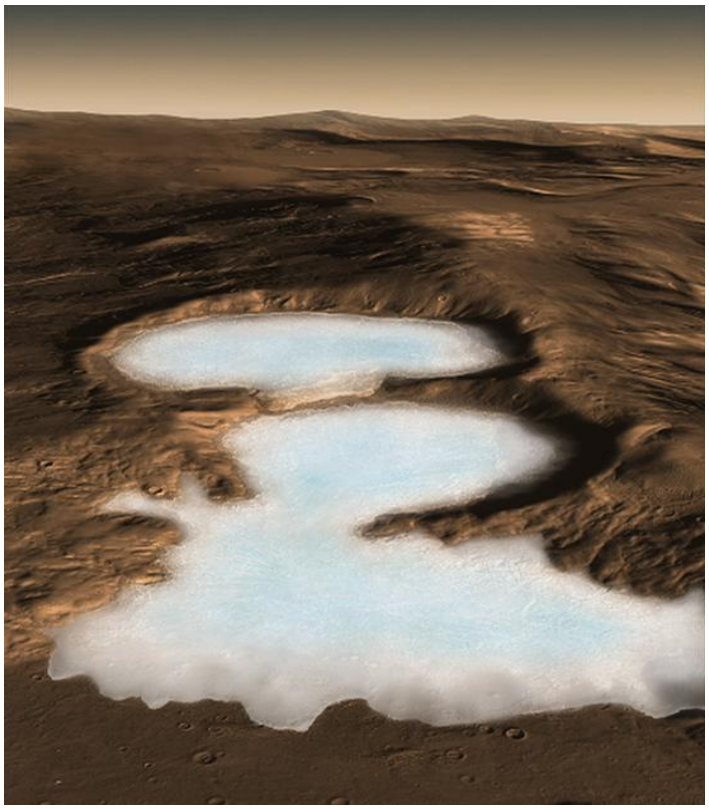
Mars Reconnaissance Orbiter has revealed vast Martian glaciers of water ice under protective blankets of rocky debris at much lower latitudes than any ice previously identified on the Red Planet. Scientists analyzed data from the spacecraft's ground-penetrating radar and report that buried glaciers extend for dozens of miles from the edges of mountains or cliffs. A layer of rocky debris blanketing the ice may have preserved the underground glaciers as remnants from an ice sheet that covered middle latitudes during a past ice age. This discovery is similar to massive ice glaciers that have been detected under rocky coverings in Antarctica.

"*Altogether, these glaciers almost certainly represent the largest reservoir of water ice on Mars that is not in the polar caps*," said John W. Holt, who is lead author of the report. "*Just one of the features we examined is three times larger than the city of Los Angeles and up to half a mile thick. And there are many more. In addition to their scientific value, they could be a source of water to support future exploration of Mars*."

Scientists have been puzzled by what are known as aprons -- gently sloping areas containing rocky deposits at the bases of taller geographical features -- since Viking orbiters first observed them on the Martian surface in the1970s. One theory has been that the aprons are flows of rocky debris lubricated by a small amount ice. Now, the shallow radar instrument on the Mars Reconnaissance Orbiter has provided scientists an answer to this Martian puzzle. "*These results are the smoking gun pointing to the presence of large amounts of water ice at these latitudes*," said Ali Safaeinili, a shallow radar instruments team member.

Radar echoes received by the spacecraft indicated radio waves pass through the aprons and reflect off a deeper surface below without significant loss in strength. That is expected if the apron areas are composed of thick ice under a relatively thin covering. The radar does not detect reflections from the interior of these deposits as would occur if they contained significant rock debris. The apparent velocity of radio waves passing through the apron is consistent with a composition of water ice. Scientists developed the shallow radar instrument for the orbiter to examine these mid-latitude geographical features and layered deposits at the Martian poles. The Italian Space Agency provided the instrument.

"*We developed the instrument so it could operate on this kind of terrain*," said Roberto Seu, leader of the instrument science team. "*It is now a priority to observe other examples of these aprons to determine whether they are also ice*."



Holt and 11 co-authors report the buried glaciers lie in the Hellas Basin region of Mars' southern hemisphere. The radar also has detected similar-appearing aprons extending from cliffs in the northern hemisphere.

"*There's an even larger volume of water ice in the northern deposits*," said JPL geologist Jeffrey J. Plaut, who will be publishing results about these deposits. "*The fact these features are in the same latitude bands, about 35 to 60 degrees in both hemispheres, points to a climate-driven mechanism for explaining how they got there*."

The rocky debris blanket topping the glaciers apparently has protected the ice from vaporizing, which would happen if it were exposed to the atmosphere at these latitudes.

"*A key question is, how did the ice get there in the first place*?" said James W. Head. "*The tilt of Mars' spin axis sometimes gets much greater than it is now. Climate modeling tells us ice sheets could cover mid-latitude regions of Mars during those high-tilt periods. The buried glaciers make sense as preserved fragments from an ice age millions of years ago. On Earth, such buried glacial ice in Antarctica preserves the record of traces of ancient organisms and past climate history*." http://www.nasa.gov/mro

SITE LIST NARROWS FOR NEXT MARS LANDING

Four intriguing places on Mars have risen to the final round as NASA selects a landing site for its next Mars mission, the Mars Science Laboratory. The agency had a wider range of possible landing sites to choose from than for any previous mission, thanks to the Mars Science Laboratory's advanced technologies,

and the highly capable orbiters helping this mission identify scientifically compelling places to explore. Mars Science Laboratory project leaders chose the four this month, after seeking input from international Mars experts and from engineers working on the landing system and rover capabilities.

The sites, alphabetically, are: Eberswalde, where an ancient river deposited a delta in a possible lake; Gale, with a mountain of stacked layers including clays and sulfates; Holden, a crater containing alluvial fans, flood deposits, possible lake beds and clay-rich deposits; and Mawrth, which shows exposed layers containing at least two types of clay.

"*All four of these sites would be great places to use our roving laboratory to study the processes and history of early Martian environments and whether any of these environments were capable of supporting microbial life and its preservation as biosignatures*," said John Grotzinger. He is the project scientist for the Mars Science Laboratory.

The mission's capabilities for landing more precisely than ever before and for generating electricity without reliance on sunshine have made landing sites eligible that would not have been acceptable for past Mars missions. During the past two years, multiple observations of dozens of candidate sites by Mars Reconnaissance Orbiter have augmented data from earlier orbiters for evaluating sites' scientific attractions and engineering risks.

JPL is assembling and testing the Mars Science Laboratory spacecraft for launch in fall 2009. Paring the landing-site list to four finalists allows the team to focus further on evaluating the sites and planning the navigation. The mission plan calls for the rover to spend a full Mars year (23 months) examining the environment with a diverse payload of tools.

After evaluating additional Mars orbiter observations of the four sites, NASA will hold a fourth science workshop about the candidates in the spring and plans to choose a final site next summer. Three previous landing-site science workshops for Mars Science Laboratory, in 2006, 2007 and two months ago, drew participation of more than 100 Mars scientists and presentations about more than 30 sites. The four sites rated highest by participants in the latest workshop were the same ones chosen by mission leaders after a subsequent round of safety evaluations and analysis of terrain for rover driving. One site, Gale, had been a favorite of scientists considering 2004 landing sites for Spirit and Opportunity rovers, but was ruled out as too hazardous for the capabilities of those spacecraft.

"*Landing on Mars always is a risky balance between science and engineering. The safest sites are flat, but the spectacular geology is generally where there are ups and downs, such as hills and canyons. That's why we have engineered this spacecraft to make more sites qualify as safe*," said Michael Watkins, mission manager for the Mars Science Laboratory. "*This will be the first spacecraft that can adjust its course as it descends through the Martian atmosphere, responding to variability in the atmosphere. This ability to land in much smaller areas than previous missions, plus capabilities to land at higher elevations and drive farther, allows us consider more places the scientists want to explore*."

For their Mars landings in 2004, Spirit and Opportunity needed safe target areas about 70 kilometers (about 40 miles) long. Mars Science Laboratory is designed to hit a target area roughly 20 kilometers (12 miles) in diameter. Also, a new "skycrane" technology to lower the rover on a tether for the final touchdown can accommodate more slope than the airbag method used for Spirit and Opportunity. In addition, a radioisotope power supply, like that used by Mars Viking landers in the 1970s, will enable year-round operation farther from the equator than the solar power systems of more recent missions.

Gale is near the equator, Eberswalde and Holden are farther south, and Mawrth is in the north.

As a clay-bearing site where a river once flowed into a lake, Eberswalde Crater offers a chance to use knowledge that oil industry geologists have accumulated about locations of the most promising parts of a delta to look for any concentrations of carbon chemistry that is crucial to life.

The mountain inside Gale Crater could provide a route for the rover to drive up a 5-kilometer (3-mile) sequence of layers, studying a transition from environments that produced clay deposits near the bottom to later environments that produced sulfate deposits partway up.

Running water once carved gullies and deposited sediments as alluvial fans and catastrophic flood deposits in Holden Crater, a site that may also present the chance to evaluate layers deposited in a lake. Exploration of key features within this target area would require drives to the edge of a broad valley, and then down into the valley.

Mawrth Valley is an apparent flood channel near the edge of vast Martian highlands. It holds different types of clays in clearly layered context, offering an opportunity for studying the changes in wet conditions that produced or altered the clays. The clay signatures are stronger than at the other sites, and this is the only one of the four for which the science target is within the landing area, not nearby.

ESA Closes In On the Origin of Mars' Larger Moon

European space scientists are getting closer to unravelling the origin of Mars'larger moon, Phobos. Thanks to a series of close encounters by ESA's Mars Express spacecraft, the moon looks almost certain to be a "rubble pile", rather than a single solid object. However, mysteries remain about where the rubble came from.

Unlike Earth, with its single large moon, Mars plays host to two small moons. The larger one is Phobos, an irregularly sized lump of space rock measuring just 27 km x 22 km x 19 km.

During the Summer, Mars Express made a series of close passes to Phobos. It captured images at almost all fly-bys with the High Resolution Stereo Camera (HRSC). A team led by Gerhard Neukum, is now using these and previously collected data to construct a more accurate 3D model of Phobos, so that its volume can be determined with more precision.

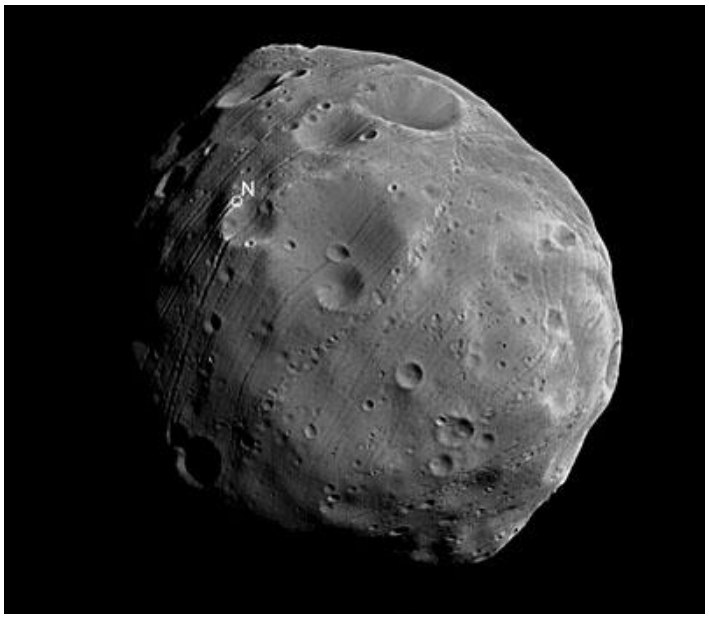
In addition, during one of the nearest fly-bys, the Mars Express Radio Science (MaRS) Experiment team led by Martin Patzold, , carefully monitored the spacecraft's radio signals. They recorded the changes in frequency brought about by Phobos' gravity pulling Mars Express. This data is being used by Tom Andert, and Pascal Rosenblatt, both members of the MaRS team, to calculate the precise mass of the martian moon.

Putting the mass and volume data together, the teams will be able to calculate the density. Eventually, this will be a new important clue to how the moon formed.

Previously, radio tracking from the Soviet Phobos 88 mission and from the spacecraft orbiting Mars in the past decades had provided the most accurate mass. "*We can be ten times more precise in our frequency shift measurements today*," says Rosenblatt.

The team's current mass estimate for Phobos is 1.072x1016 kg, or about one billionth the mass of the Earth. Preliminary density calculations suggest that it is just 1.85 grams per cubic centimetre. This is lower than the density of the martian surface rocks, which are 2.7-3.3 grams per cubic centimetre, but very similar to that of some asteroids. The particular class of asteroids that share Phobos' density are known as D-class. They are believed to be highly fractured bodies containing giant caverns because they are not solid. Instead, they are a collection of pieces, held together by gravity. Scientists call them rubble piles.

Also, spectroscopic data from Mars Express and previous spacecraft show that Phobos has a similar composition to these asteroids. This suggests that Phobos, and probably its smaller sibling Deimos, are captured asteroids. However, one observation remains difficult to explain in this scenario. Usually captured asteroids are injected into random orbits around the planet that gravitationally tie them, but Phobos orbits above Mars' equator - a very specific case. Scientists do not yet understand how it could do this.



In another scenario, Phobos could have been made of martian rocks that were blasted into space during a large meteorite impact. These pieces have not fallen completely together, thus creating the rubble pile.

So the question remains, where did the original material come from - Mars' surface or the asteroid belt? The MARSIS radar on board Mars Express has also collected historic data about Phobos' subsurface. This data, together with that from the moon's surface and surroundings gathered by the other Mars Express instruments, will also help put constraints on the origin. It's clear though that the whole truth will only be known when samples of the moon are brought back to Earth for analysis in laboratories.

This exciting possibility might soon become reality because the Russians will attempt to do this with the Phobos-Grunt mission, to be launched next year. To land on Phobos, they will require the precise knowledge of the mass as measured by the MaRS Experiment in order to navigate correctly, and are also making use of the HRSC images to select the landing site. http://www.esa.int/SPECIALS/Mars_Express/SEMAKVSG7MF_mg_1.html

Between 23 July and 15 September 2008 Mars Express performed a series of eight fly-bys of the martian moon Phobos, at distances ranging between 4500 and 93 km from the centre of the moon, conducting some of the most detailed investigations of the Moon to date. In observing Phobos, Mars Express benefits from its highly elliptical orbit which takes it from a closest Mars approach of 270 km above the surface up to a maximum of 10 000 km from the planet's centre, crossing the 9 400 km orbit of the moon. Like our Moon, Phobos always shows the same side to the planet, so it is only by flying outside the orbit that it becomes possible to observe the far side. The other spacecraft presently orbiting Mars do so at much lower altitudes, and therefore only see the planet-facing side of the moon.

The High-Resolution Stereo Camera (HRSC) collected pictures of the moon's surface with the highest resolution possible, in color and in 3-D, and provided images of areas never glimpsed before. By September, also the Super Resolution (SRC) Camera, part of the HRSC experiment, collected plenty of images. During the second fly-by, all efforts were concentrated on accurately determining the mass of the moon using the MaRS experiment.

The Visible and Infrared Mineralogical Mapping Spectrometer, OMEGA, the Planetary Fourier Spectrometer, PFS, and the Ultraviolet and Infrared Atmospheric Spectrometer, SPICAM, gathered details on the surface composition, geochemistry and temperature of Phobos.

The MARSIS radar collected information on the topography of the moon's surface and on the structure of its interior. The Energetic neutral atoms analyser, ASPERA studied the environment around Phobos, in particular the plasma that surrounds the moon and also the interaction of the moon with the solar wind. http://www.esa.int/SPECIALS/Mars_Express/SEM8MUSG7MF_0.html

MRO Orbiter Reveals Details of a Wetter Mars

Mars Reconnaissance Orbiter has observed a new category of minerals spread across large regions of Mars. This discovery suggests that liquid water remained on the planet's surface a billion years later than scientists believed, and it played an important role in shaping the planet's surface and possibly hosting life.

Researchers examining data from the orbiter's Compact Reconnaissance Imaging Spectrometer for Mars have found evidence of hydrated silica, commonly known as opal. The hydrated, or water-containing, mineral deposits are telltale signs of where and when water was present on ancient Mars. "*This is an exciting discovery because it extends the time range for liquid water on Mars, and the places where it might have supported life*," said Scott Murchie, the spectrometer's principal investigator. "*The identification of opaline silica tells us that water may have existed as recently as 2 billion years ago*."

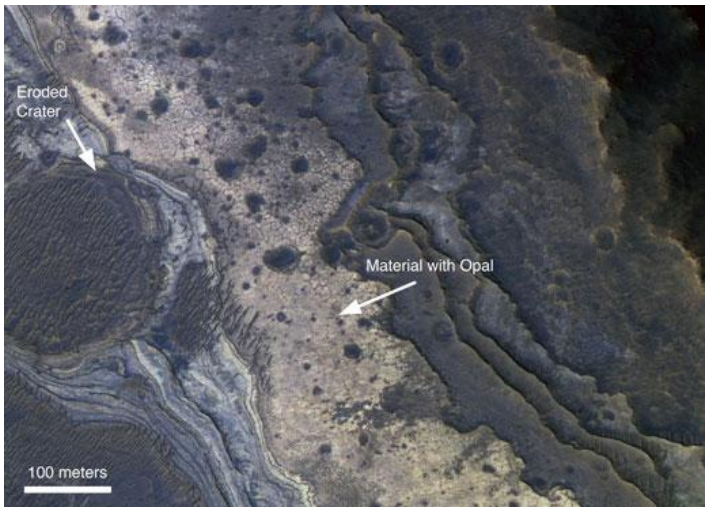
Until now, only two major groups of hydrated minerals, phyllosilicates and hydrated sulfates, had been observed by spacecraft orbiting Mars. Clay-like phyllosilicates formed more than 3.5 billion years ago where igneous rock came into long-term contact with water. During the next several hundred million years, until approximately 3 billion years ago, hydrated sulfates formed from the evaporation of salty and sometimes acidic water.

The newly discovered opaline silicates are the youngest of the three types of hydrated minerals. They formed where liquid water altered materials created by volcanic activity or meteorite impact on the Martian surface. One such location noted by scientists is the large Martian canyon system called Valles Marineris.

"*We see numerous outcrops of opal-like minerals, commonly in thin layers extending for very long distances around the rim of*

Valles Marineris and sometimes within the canyon system itself," said Ralph Milliken.

Milliken is lead author of an article in the November issue of "Geology" that describes the identification of opaline silica. The study reveals that the minerals, which also were recently found in Gusev Crater by Mars rover Spirit, are widespread and occur in relatively young terrains.



In some locations, the orbiter's spectrometer observed opaline silica with iron sulfate minerals, either in or around dry river channels. This indicates the acidic water remained on the Martian surface for an extended period of time. Milliken and his colleagues believe that in these areas, low-temperature acidic water was involved in forming the opal. In areas where there is no clear evidence that the water was acidic, deposits may have formed under a wide range of conditions.

"*What's important is that the longer liquid water existed on Mars, the longer the window during which Mars may have supported life*," says Milliken. "*The opaline silica deposits would be good places to explore to assess the potential for habitability on Mars, especially in these younger terrains*."

The spectrometer collects 544 colors, or wavelengths, of reflected sunlight to detect minerals on the surface of Mars. Its highest resolution is about 20 times sharper than any previous look at the planet in near-infrared wavelengths. For more about the Mars Reconnaissance Orbiter, visit: http://www.nasa.gov/mro

STRANGE MARTIAN LANDFORMS ARE PALEO CLIMATE CLUES AND ROVER SAND TRAPS

One of the most fun and fascinating aspects of space exploration is discovering geological processes and terrain different from those found on our home planet, says Matt Balme, who is leading a team that's decoding Martian mystery landscapes known as Transverse Aeolian Ridges or TARs.

Balme, a research scientist with the Planetary Science Institute, says TARs have no exact analog on Earth. These fields of rippled sand, found over large swaths of Mars, are smaller than the planet's gigantic dunes but larger than the sand ripple fields found on Earth.

Wind-driven particles form TARs. They're called "Aeolian Ridges" because planetary scientists refer to phenomena involving air movement as "Aeolian processes". The ridges assume many shapes, such as simple ripples, forked ripples, snake-like sinuous waves, barchan-like (crescent-shaped) forms or complex, overlapping networks. TARs are worth studying because they are an intriguing scientific mystery, hold clues to past and present climate processes, and because they're death to rovers, says Balme.

In 2005, Opportunity rover bogged down for six weeks with its wheels firmly mired in what Balme believes was a small TAR. So it's important to know where TARs are located to avoid landing among them on future rover missions, he said.

Balme and his colleagues have conducted a pole-to-pole planet survey of more than 10,000 images taken by the Mars Orbiter Camera, which is flying aboard the Mars Global Surveyor spacecraft. They found that TARs - Are more common in the southern hemisphere than in the northern. - Are found in an equatorial belt between 30 degrees north and 30 degrees south latitude. - Exist in two distinct environments: near layered terrain or adjacent to Large Dark Dunes (LLDs). Those adjacent to dunes have formed recently, while those near layered terrain are millions of years old. - Are abundant in the Meridiani Planum region and in southern-latitude craters.

The Opportunity rover's TAR encounter provided additional data, showing that at least that TAR was composed of an outer layer of granule-sized material ranging from about 2mm to 5 mm in diameter, Balme said. Beneath this was a mixed mass of fine and coarse particles.

TARs need two things to form, Balme explained: a supply of sediment and strong winds. The sediment requirement helps explain why they're found near dunes and layered terrain and why they're confined to a central belt around the planet, Balme said.

Both dunes and layered terrain (which could have been formed by ancient sand dunes, ocean or lake deposits, or layers of volcanic ash) provide the raw material. Steep slopes also can provide additional particles for TAR formation as they erode. The lack of steep slopes and other sources of coarse and fine material in the middle to far north and south latitudes may explain the absence of TARs in those areas, he said. The TARs near layered terrain are generally several million years old and inactive, while the ones near LLDs are young and may still be actively forming and moving. "*My theory is that the very young TARs are found near the Large Dark Dunes, which are also very young, because the sand blowing off the dunes provides the energy needed to form TARs*," Balme said. "*Meanwhile you have areas near layered landforms that used to have active sediment transport, but no longer. This shows a dynamic environment that has changed, and we might be able to use TARs as paleo markers to help decipher ancient climates*."

Current Martian circulation models don't provide much evidence that wind patterns and atmospheric densities on Mars were significantly different in the past than from what they are today. "*But I think the geology we are seeing suggests that there might have been different patterns and densities*," Balme said. "*The observations we're getting now from Mars Global Surveyor and the HiRISE camera (flying aboard the Mars Reconnaissance Orbiter) are giving us really good data to drive the models*."

Although Blame and his team have discovered much about TARs, they still don't know what materials compose the various TAR fields or why they're seeing these large features on Mars but not on Earth. "*Over the next couple of years we should be seeing many more images from HiRISE that can give us more information, for example, about the heights versus spacing and whether TARs have more in common with dunes or the ripple fields found on Earth*," Balme said. "*And they could provide insights into present and past climate patterns as we learn more*

about them and use that data to help drive general circulation models."

HiRISE images of the same areas of the planet taken over long time intervals also might show small movements within some of the TAR fields, indicating which ones are still active and possibly demonstrating how they form, Blame said.

This image shows Transverse Aeolian Ridges, known as TARs, near the Schiaparelli Crater in the equatorial region of Mars. The image (PSP_008758_1720) was taken by the HiRISE camera flying aboard the Mars the Reconnaissance Orbiter, and covers an area about 750 meters wide. The colors are stretched to enhance contrast between the light-toned TARs and the darker, browner substrate. The TARs seem to have a dominant southwest-to-northeast trend, suggesting that they formed from winds that blew from the northwest or southeast. The TARs also have secondary crests perpendicular to the main trend. These could have formed as the TARs began to funnel the winds between themselves as they grew, or they might indicate a secondary wind-pattern approximately perpendicular to the dominant one. These TARs are very young (or at least have been mobile in the very recent past) because there are almost no small impact craters visible on them, in contrast to the substrate where several small craters can be easily be identified.

DUSTY SHOCK WAVES GENERATE PLANET INGREDIENTS

Shock waves around dusty, young stars might be creating the raw materials for planets, according to new observations from Spitzer Space Telescope.

The evidence comes in the form of tiny crystals. Spitzer detected crystals similar in make-up to quartz around young stars just beginning to form planets. The crystals, called cristobalite and tridymite, are known to reside in comets, in volcanic lava flows on Earth, and in some meteorites that land on Earth.

Astronomers already knew that crystallized dust grains stick together to form larger particles, which later lump together to form planets. But they were surprised to find cristobalite and tridymite. What's so special about these particular crystals? They require flash heating events, such as shock waves, to form.

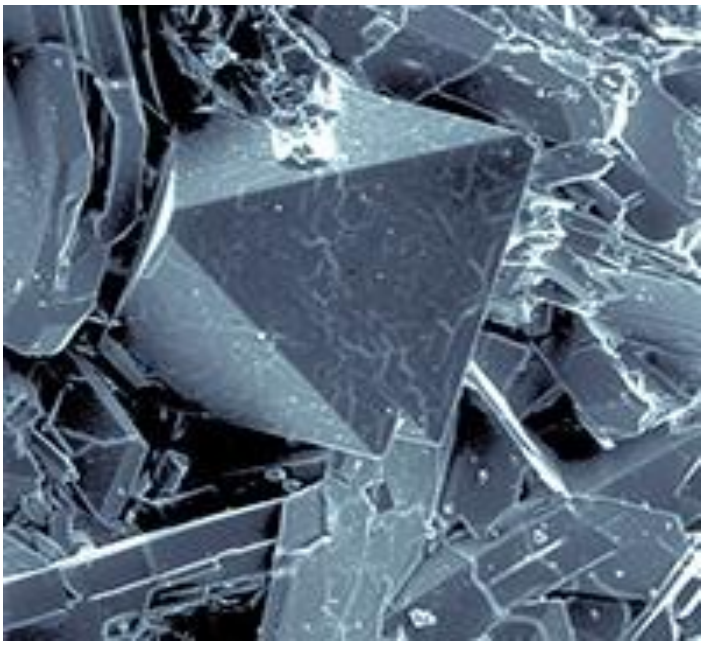
The findings suggest that the same kinds of shock waves that cause sonic booms from speeding jets are responsible for creating the stuff of planets throughout the universe.

"*By studying these other star systems, we can learn about the very beginnings of our own planets 4.6 billion years ago*," said William Forrest. "*Spitzer has given us a better idea of how the raw materials of planets are produced very early on*." Forrest and graduate student Ben Sargent led the research.

Planets are born out of swirling pancake-like disks of dust and gas that surround young stars. They start out as mere grains of dust swimming around in a disk of gas and dust, before lumping together to form full-fledged planets. During the early stages of planet development, the dust grains crystallize and adhere together, while the disk itself starts to settle and flatten. This occurs in the first millions of years of a star's life.

When Forrest and his colleagues used Spitzer to examine five young planet-forming disks about 400 light-years away, they detected the signature of silica crystals. Silica is made of only silicon and oxygen and is the main ingredient in glass. When melted and crystallized, it can make the large hexagonal quartz crystals often sold as mystical tokens. When heated to even higher temperatures, it can also form small crystals like those commonly found around volcanoes.

It is this high-temperature form of silica crystals, specifically cristobalite and tridymite, that Forrest's team found in planet-forming disks around other stars for the first time. "*Cristobalite and tridymite are essentially high-temperature forms of quartz*," said Sargent. "*If you heat quartz crystals, you'll get these compounds*."



In fact, the crystals require temperatures as high as 1,220 Kelvin (about 1,740 degrees Fahrenheit) to form. But young planet-forming disks are only about 100 to 1,000 Kelvin (about minus 280 degrees Fahrenheit to 1,340 Fahrenheit) -- too cold to make the crystals. Because the crystals require heating followed by rapid cooling to form, astronomers theorized that shock waves could be the cause. Shock waves, or supersonic waves of pressure, are thought to be created in planet-forming disks when clouds of gas swirling around at high speeds collide. Some theorists think that shock waves might also accompany the formation of giant planets.

The findings are in agreement with local evidence from our own solar system. Spherical pebbles, called chondrules, found in ancient meteorites that fell to Earth are also thought to have been crystallized by shock waves in our solar system's young planet-forming disk. In addition, Stardust mission found tridymite

minerals in comet Wild 2. http://www.spitzer.caltech.edu/spitzer http://www.nasa.gov/spitzer . http://planetquest.jpl.nasa.gov

CASSINI FINDS MYSTERIOUS NEW AURORA ON SATURN

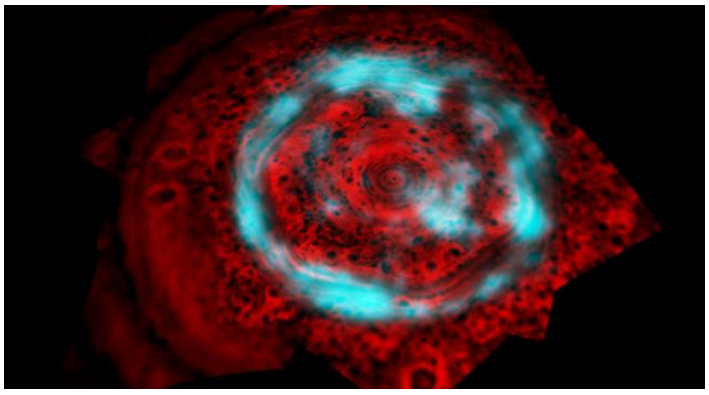
Saturn has its own unique brand of aurora that lights up the polar cap, unlike any other planetary aurora known in our solar system. This odd aurora revealed itself to one of the infrared instruments on Cassini spacecraft.

"*We've never seen an aurora like this elsewhere*," said Tom Stallard, a scientist working with Cassini data. Stallard is lead author of a paper that appears in the Nov. 13 issue of the journal Nature. "*It's not just a ring of auroras like those we've seen at Jupiter or Earth. This aurora covers an enormous area across the pole. Our current ideas on what forms Saturn's aurora predict that this region should be empty, so finding such a bright aurora here is a fantastic surprise*." The new views are available online at: http://www.nasa.gov/cassini and http://saturn.jpl.nasa.gov .

Auroras are caused by charged particles streaming along the magnetic field lines of a planet into its atmosphere. Particles from the sun cause Earth's auroras. Many, but not all, of the auroras at Jupiter and Saturn are caused by particles trapped within the magnetic environments of those planets.

Jupiter's main auroral ring, caused by interactions internal to Jupiter's magnetic environment, is constant in size. Saturn's main aurora, which is caused by the solar wind, changes size dramatically as the wind varies. The newly observed aurora at Saturn, however, doesn't fit into either category.

"*Saturn's unique auroral features are telling us there is something special and unforeseen about this planet's magnetosphere and the way it interacts with the solar wind and the planet's atmosphere*," said Nick Achilleos, Cassini scientist on the Cassini magnetometer team. "*Trying to explain its origin will no doubt lead us to physics which uniquely operates in the environment of Saturn*."



The new infrared aurora appears in a region hidden from Hubble Space Telescope, which has provided views of Saturn's ultraviolet aurora. Cassini observed it when the spacecraft flew near Saturn's polar region. In infrared light, the aurora sometimes fills the region from around 82 degrees north all the way over the pole. This new aurora is also constantly changing, even disappearing within a 45 minute-period. http://www.jpl.nasa.gov/news/news.cfm?release=2008-208

EARLY WARNING OF DANGEROUS ASTEROIDS & COMETS

Silicon chips are at the heart of a new survey telescope that will soon provide a more than fivefold improvement in scientists' ability to detect asteroids and comets that could someday pose a threat to the planet. The prototype telescope installed on Haleakala mountain, Maui, will begin operation this December. It will feature the world's largest and most advanced digital camera. This telescope is the first of four that will be housed together in one dome. The system, called Pan-STARRS (for Panoramic Survey Telescope and Rapid Response System), is being developed at the University of Hawaii's Institute for Astronomy.

"*This is a truly giant instrument*," said astronomer John Tonry, who led the team developing the new 1.4-gigapixel camera. "*We get an image that is 38,000 by 38,000 pixels in size, or about 200 times larger than you get in a high-end consumer digital camera*."

Pan-STARRS, whose cameras cover an area of sky six times the width of the full moon and can detect stars 10 million times fainter than those visible to the naked eye, is also unique in its ability to find moving or variable objects.

The charge-coupled device (CCD) technology is a key enabling technology for the telescope's camera. In the mid-1990s, researchers Barry Burke and Dick Savoye of the Advanced Imaging Technology Group, in collaboration with Tonry, developed the orthogonal-transfer charge-coupled device (OTCCD), a CCD that can shift its pixels to cancel the effects of random image motion. Many consumer digital cameras use a moving lens or chip mount to provide camera-motion compensation and thus reduce blur, but the OTCCD does this electronically at the pixel level and at much higher speeds.

The challenge presented by the Pan-STARRS camera is its exceptionally wide field of view. For wide fields of view, jitter in the stars begins to vary across the image, and an OTCCD with its single shift pattern for all the pixels begins to lose its effectiveness. The solution for Pan-STARRS, proposed by Tonry, was to make an array of 60 small, separate OTCCDs on a single silicon chip. This architecture enabled independent shifts optimized for tracking the varied image motion across a wide scene.

The primary mission of Pan-STARRS is to detect Earth-approaching asteroids and comets that could be dangerous to the planet. When the system becomes fully operational, the entire sky visible from Hawaii (about three-quarters of the total sky) will be photographed at least once a week, and all images will be entered into powerful computers at the Maui High Performance Computer Center. Scientists at the center will analyze the images for changes that could reveal a previously unknown asteroid. They will also combine data from several images to calculate the orbits of asteroids, looking for indications that an asteroid may be on a collision course with Earth.

Pan-STARRS will also be used to catalog 99 percent of stars in the northern hemisphere that have ever been observed by visible light, including stars from nearby galaxies. In addition, the Pan-STARRS survey of the whole sky will present astronomers with the opportunity to discover, and monitor, planets around other stars, as well as rare explosive objects in other galaxies. Detailed information about the Pan-STARRS design and its science applications can be found at http://pan-starrs.ifa.hawaii.edu/public/ . http://web.mit.edu/newsoffice/2008/panstarrs-1117.html

CLOSEST PLANETARY SYSTEM HOSTS TWO ASTEROID BELTS

New observations from Spitzer Space Telescope indicate that the nearest planetary system to our own has two asteroid belts. Our own solar system has just one.

The star at the center of the nearby system, called Epsilon Eridani, is a younger, slightly cooler and fainter version of the sun. Previously, astronomers had uncovered evidence for two possible planets in the system, and for a broad, outer ring of icy comets similar to our own Kuiper Belt.

Now, Spitzer has discovered that the system also has dual asteroid belts. One sits at approximately the same position as the one in our solar system. The second, denser belt, most likely also populated by asteroids, lies between the first belt and the comet ring. The presence of the asteroid belts implies additional planets in the Epsilon Eridani system.

"*This system probably looks a lot like ours did when life first took root on Earth*," said Dana Backman, an astronomer at the SETI Institute,and outreach director for Sofia mission. "*The main difference we know of so far is that it has an additional ring of leftover planet construction material*." Backman is lead author of a paper about the findings.

Image credit: NASA/JPL-Caltech

Asteroid belts are rocky and metallic debris left over from the early stages of planet formation. Their presence around other stars signals that rocky planets like Earth could be orbiting in the system's inner regions, with massive gas planets circling near the belts' rims. In our own solar system, for example, there is evidence that Jupiter, which lies just beyond our asteroid belt, caused the asteroid belt to form long ago by stirring up material that would have otherwise coalesced into a planet. Nowadays, Jupiter helps keep our asteroid belt confined to a ring.

Astronomers have detected stars with signs of multiple belts of material before, but Epsilon Eridani is closer to Earth and more like our sun overall. It is 10 light-years away, slightly less massive than the sun, and roughly 800 million years old, or one-fifth the age of the sun.

Because the star is so close and similar to the sun, it is a popular locale in science fiction. The television series Star Trek and Babylon 5 referenced Epsilon Eridani, and it has been featured in novels by Issac Asimov and Frank Herbert, among others.

The popular star was also one of the first to be searched for signs of advanced alien civilizations using radio telescopes in 1960. At that time, astronomers did not know of the star's young age. Spitzer observed Epsilon Eridani with both of its infrared cameras and its infrared spectrometer. When asteroid and comets collide or evaporate, they release tiny particles of dust that give off heat, which Spitzer can see. "*Because the system is so close to us, Spitzer can really pick out details in the dust, giving us a good look at the system's architecture*," said co-author Karl Stapelfeldt.

The asteroid belts detected by Spitzer orbit at distances of approximately 3 and 20 astronomical units from the star (an astronomical unit is the average distance between Earth and the sun). For reference, our own asteroid belt lies at about 3 astronomical units from the sun, and Uranus is roughly 19 astronomical units away.

One of the two possible planets previously identified around Epsilon Eridani, called Epsilon Eridani b, was discovered in 2000. The planet is thought to orbit at an average distance of 3.4 astronomical units from the star -- just outside the innermost asteroid belt identified by Spitzer. This is the first time that an asteroid belt and a planet beyond our solar system have been found in a similar arrangement as our asteroid belt and Jupiter.

Some researchers had reported that Epsilon Eridani b orbits in an exaggerated ellipse ranging between 1 and 5 astronomical units, but this means the planet would cross, and quickly disrupt, the newfound asteroid belt. Instead, Backman and colleagues argue that this planet must have a more circular orbit that keeps it just outside the belt.

The other candidate planet was first proposed in 1998 to explain lumpiness observed in the star's outer comet ring. It is thought to lie near the inner edge of the ring, which orbits between 35 and 90 astronomical units from Epsilon Eridani.

The intermediate belt detected by Spitzer suggests that a third planet could be responsible for creating and shepherding its material. This planet would orbit at approximately 20 astronomical units and lie between the other two planets. "*Detailed studies of the dust belts in other planetary systems are telling us a great deal about their complex structure*," said Michael Werner, co-author of the study and project scientist for Spitzer. "*It seems that no two planetary systems are alike*."
http://www.jpl.nasa.gov/news/news.cfm?release=2008-197

HUBBLE DIRECTLY OBSERVES A PLANET ORBITING ANOTHER STAR

Hubble Space Telescope has taken the first visible-light snapshot of a planet circling another star. Estimated to be no more than three times Jupiter's mass, the planet, called Fomalhaut b, orbits the bright southern star Fomalhaut, located 25 light-years away in the constellation Piscis Australis, or the "Southern Fish."

Fomalhaut has been a candidate for planet hunting ever since an excess of dust was discovered around the star in the early 1980s by the Infrared Astronomy Satellite.

In 2004, the coronagraph in the High Resolution Camera on Hubble's Advanced Camera for Surveys produced the first-ever resolved visible-light image of the region around Fomalhaut. It clearly showed a ring of protoplanetary debris approximately 21.5

billion miles (34.6 billion kilometers) across and having a sharp inner edge. This large debris disk is similar to the Kuiper Belt, which encircles our solar system and contains a range of icy bodies from dust grains to objects the size of dwarf planets, such as Pluto.

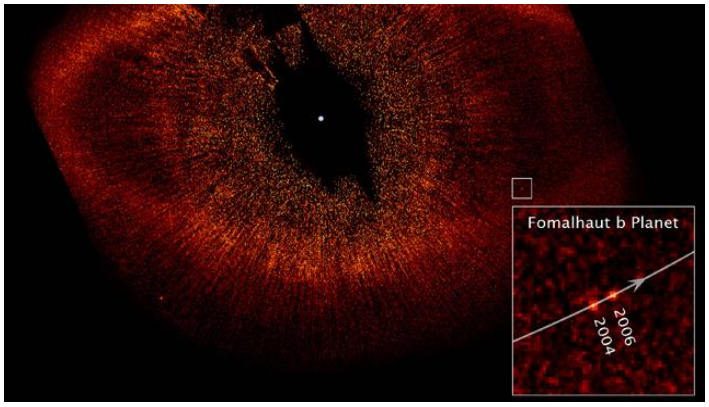
Hubble astronomer Paul Kalas, and team members proposed in 2005 that the ring was being gravitationally modified by a planet lying between the star and the ring's inner edge.

Circumstantial evidence came from Hubble's confirmation that the ring is offset from the center of the star. The sharp inner edge of the ring is also consistent with the presence of a planet that gravitationally "shepherds" ring particles. Independent researchers have subsequently reached similar conclusions.

Now, Hubble has actually photographed a point source of light lying 1.8 billion miles (2.9 billion kilometers) inside the ring's inner edge.

"*Our Hubble observations were incredibly demanding. Fomalhaut b is 1 billion times fainter than the star. We began this program in 2001, and our persistence finally paid off*," Kalas said.

"*Fomalhaut is the gift that keeps on giving. Following the unexpected discovery of its dust ring, we have now found an exoplanet at a location suggested by analysis of the dust ring's shape. The lesson for exoplanet hunters is 'follow the dust*,'" said team member Mark Clampin.



Observations taken 21 months apart by Hubble's Advanced Camera for Surveys' coronagraph show that the object is moving along a path around the star, and is therefore gravitationally bound to it. The planet is 10.7 billion miles (17.2 billion kilometers) from the star, or about 10 times the distance of the planet Saturn from our sun.

The planet 'Fomalhaut b' is brighter than expected for an object of three Jupiter masses. One possibility is that it has a Saturn-like ring of ice and dust reflecting starlight. The ring might eventually coalesce to form moons. The ring's estimated size is comparable to the region around Jupiter and its four largest orbiting satellites.

Kalas and his team first used Hubble to photograph Fomalhaut in 2004, and made the unexpected discovery of its debris disk, which scatters Fomalhaut's starlight. At the time they noted a few bright sources in the image as planet candidates. A follow-up image in 2006 showed that one of the objects is moving through space with Fomalhaut, but changed position relative to the ring since the 2004 exposure. The amount of displacement between the two exposures is exactly as predicted and corresponds to an 872-year-long orbit as calculated from Kepler's laws of planetary motion.

Future observations will attempt to see the planet in infrared light and will look for evidence of water vapor clouds in the atmosphere. This would yield clues to the evolution of a comparatively newborn 100-million-year-old planet. Astrometric measurements of the planet's orbit will provide enough precision to yield an accurate mass.

James Webb Space Telescope, scheduled to launch in 2013, will be able to make coronagraphic observations of Fomalhaut in near- and mid-infrared wavelengths. Webb will be able to hunt for other planets in the system and probe the region interior to the dust ring for structures such as an inner asteroid belt.
http://www.jpl.nasa.gov/news/news.cfm?release=2008-211
http://www.nasa.gov/hubble . http://www.jpl.nasa.gov

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
P.O. Box 12746
Everett, WA 98206

In November's StarGazer:

The next EAS Meeting is 7:00 P.M. Saturday November 22nd at the 'Aurora Astro Products' store location at Silver Lake.