

The Stargazer

July 2008

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The Stargazer
P.O. Box 12746
Everett, WA 98206

See EAS website at:

<http://everettastro.org>

EAS BUSINESS...

NEXT EAS MEETING – SATURDAY JULY 26TH AT 7:00 PM AT AURORA ASTRO PRODUCTS STORE AT SILVER LAKE.

★★ Saturday July 26th 7:00 pm MEETING ★★
 The July 26th speaker will be Henny J.G.L.M. Lamers, currently visiting the University of Washington, who will be giving a talk entitled "When galaxies collide".

Prof. Henny J.G.L.M. Lamers - *Astronomical Institute, Utrecht University, The Netherlands*

Galaxies are huge concentrations of stars, gas and dust. The smallest galaxies have diameters of a few thousand light-years, and the largest galaxies of hundred thousand light-years. Galaxies often occur in clusters containing tens to thousands of members. They move with speeds of several hundred km/s with respect to one another. Our own galaxy is part of the "local group" which contains a few dozen members.

Due to the large sizes of the galaxies and their clustering properties collisions and near-collisions occur frequently. It appears that galaxy-galaxy interactions seem to be more rule than exception. Our own galaxy experienced several close encounters and has "cannibalized" several smaller galaxies. We can detect the remnants of these encounters.

The Hubble Space Telescope has observed many colliding or interacting galaxies. The strong gravitational interaction results in a scala of fascinating features: bridges, tails, spiral arms, usually accompanied by bursts of star formation.

We will show a number spectacular images of (nearly)-colliding and merging galaxies and explain the main features and

properties. Movies with numerical simulations help us to understand the physical processes and the history of collisions. We will then zoom into one particular interacting galaxy system: "the Whirlpool system" as an example to show a galaxy reacts to a close encounter."

(It may be helpful for some folks to bring a folding chair to the meeting.) We have changed the layout 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 August 1st 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') 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	1 st Qtr	3 rd Qtr	EAS Star Party at Ron's
Jan 8 th	Jan 15 th	Jan 29 th	--
Feb 6 th	Feb 13 th	Feb 28 th	--
Mar 7 th	Mar 14 th	Mar 29 th	Sat Mar 08, Sat Mar 29
Apr 5 th	Apr 12 th	Apr 28 th	Saturday April 05
May 5 th	May 11 th	May 27 th	Saturday May 03
Jun 3 rd	Jun 10 th	Jun 26 th	Saturday Jun 07
Jul 2 nd	Jul 9 th	Jul 25 th	Saturday Jul 05
Aug 1 st , 30 th	Aug 8 th	Aug 23 rd	Saturday Aug 23
Sep 29 th	Sep 7 th	Sep 21 st	Saturday Sep 20
Oct 28 th	Oct 7 th	Oct 21 st	Saturday Oct 04
Nov 27 th	Nov 5 th	Nov 19 th	Saturday Nov 01
Dec 27 th	Dec 5 th	Dec 19 th	--

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.

Aug 11 - Perseid Meteor Shower Watch at Rooster Rock

Sep 06 - Autumnal Equinox Celebration at Rooster Rock (503) 797-4610. <http://www.oms.edu/visit/planetarium/starparties.cfm>

Jul 4-5, and Aug 1-2 - Stars Over Yellowstone star parties - Madison Campground Amphitheater, <http://smasweb.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-oms.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

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.

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

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:

Mon, Thu, Fri – 9:00 am to 6:00 pm
Tues/Weds – Noon to 8:00 pm
Sat – 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

10-INCH WARD DOBSONIAN
10-INCH SONOTUBE DOBSONIAN
8-INCH DOBSONIAN

LOAN STATUS

AVAILABLE
AVAILABLE
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. NWRAL 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

July 2008

Jul 01 - Mercury At Its Greatest Western Elongation (22 Degrees)
Jul 04 - Earth At Aphelion (1.017 AU From Sun)
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 to 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

Jul 25	Last Quarter Moon
Aug 01	New Moon
Aug 08	First Quarter Moon
Aug 16	Full Moon
Aug 23	Last Quarter Moon
Aug 30	New Moon
Sep 07	First Quarter Moon
Sep 15	Full Moon
Sep 22	Last Quarter Moon
Sep 29	New Moon
Oct 07	First Quarter Moon
Oct 14	Full Moon

Digital Lunar Orbiter Photographic Atlas of the Moon

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

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

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

UP IN THE SKY -- THE PLANETS

Object	Rises	Sets	Con	Diam.	Mag
Sun	04:36 am	19:54	Can	30'	-27.5
Mercury	03:54 am	19:40	Gem	05"	-1.7
Venus	05:39 am	20:35	Can	10"	-3.9
Mars	08:28 am	21:37	Leo	04"	+1.7
Jupiter	18:54	03:26 am	Sag	47"	-2.7
Saturn	07:48 am	21:27	Leo	16"	+0.8
Uranus	21:46	09:22 am	Aqr	04"	+5.8
Neptune	20:46	06:46 am	Cap	02"	+7.8
Pluto	17:12	02:44 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 - DELPHINUS

DELPHINUS: (The Dolphin or Porpoise). With a midnight culmination date of July 31st, Delphinus (abbreviated Del) is best viewed from August through September, and is thus well placed for summer viewing in the Northern Hemisphere. It contains the asterism known as "Job's Coffin", but has no associated Messier objects or meteor showers. Bordering

constellations include Aquarius, Aquila, Equuleus, Pegasus, Sagitta, and Vulpecula. Delphinus ranks 61st in overall brightness among the constellations (overall brightness is calculated by dividing the number of visible stars in a constellation by the size of the constellation in square degrees, and then multiplying that number by 100). Delphinus ranks 69th in size, taking up only 188.54 square degrees (0.457% of the sky; note: this square degree factor would be the denominator in the above equation: the smaller the denominator the larger the result – in this case, overall brightness). The number of visible stars (stars brighter than magnitude 5.5) in this relatively small constellation is 11.

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

Some interesting facts about Delphinus:

The common names of Alpha Delphinus (Sualocin) and Beta Delphinus (Rotanev) spelled backwards give the names of Nicolaus Venator, the assistant to the astronomer Giuseppe Piazzi. Both the early Greeks and Romans saw the outline of a dolphin in Delphinus. In Greek mythology, Delphinus rescued the poet Arion from sailors who planned to kill him, and brought the poet ashore at Tarentum. In appreciation, Poseidon permanently set the dolphin among the stars. Objects of note in this constellation include Gamma Delphini. This “star” is actually a double star: the primary is magnitude +4.5, and the secondary is fifth magnitude; they are separated by 10.1 arc seconds. NGC 6891 is a magnitude +10.5 planetary: it has a strong bluish tint, and appears very rounded in an eight-inch scope. NGC 6905 is also a planetary nebula, about 40 arc seconds in diameter. If you have the opportunity for summer observing, try to either observe this area of the sky naked eye, or do a gentle binocular sweep of the beautiful areas surrounding the Milky Way, including the constellation of the “Dolphin”.

YOUNG ASTRONOMER’S CORNER

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

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

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

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

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

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

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

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

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

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

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

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

NOTE: This column will resume talking about stellar evolution - after the “Red Giant” stage of a star’s life - later this summer.

ASTRONOMY & TELESCOPE LINGO

Astronomy lingo: NECTARIS BASIN: A large multi-ringed basin located on the southeastern nearside of Earth's Moon. It was flooded with lava to produce Mare Nectaris after the basin's initial formation about 3.9 billion years ago.

Telescope lingo: SEPARATION: The angular distance (expressed in arc seconds ("')) between each component of a visual binary or optical double star. Separation is measured using a filar micrometer placed in the eyepiece of a telescope.

ASTRONOMY "FUN FACTS" & PLANETARY FOCUS

★★ *Due to the summer vacation and observing season, these columns are taking a break and will return in time for the August newsletter.*

"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 is first defined below, and then a representative object from each hemisphere is described. ["MIRROR" IMAGES" is strictly the name of this column, and is not intended to imply that there is optical mirror symmetry between the two representative objects.]

CLASS OF OBJECT: X-RAY BINARY: The most prevalent type of luminous galactic X-ray source. These systems involve a close binary system in which gas either flows (via the inner Lagrangian point) or discharges (from a strong stellar wind) from a normal (nondegenerate) star on to a more compact companion associate star. For the most luminous X-ray binaries, this companion is probably a neutron star or black hole; for less luminous sources, the associate star is probably a white dwarf. Gravitational energy activates these X-ray binary sources, with both luminosity and temperature proportional to the mass to radius ratio of the accreting (e.g. black hole, neutron star, or white dwarf) star. There are two main types of X-ray binaries: high-mass and low-mass. In high-mass binaries, the nondegenerate star (a star NOT composed primarily of degenerate matter such as electrons and neutrons stripped from atoms during gravitational collapse) is an early spectral type (O, B, or A) giant or supergiant; in low-mass binaries, the nondegenerate star is a middle or late main-sequence star with a mass approximately equal to that of our own Sun. Several X-ray binaries contain a pulsating X-ray source (which may be a magnetized, rotating neutron star), and the most luminous among them (such as Scorpius X-1 and Cygnus X-3) are also very strong variable radio sources which also sometimes emit radio flares.

REPRESENTATIVE NORTHERN HEMISPHERE ITEM: HERCULES X-1: A low-mass X-ray binary star in the constellation of Hercules (the low-mass optical companion (HZ Her) is of variable spectral type from A/F to B due to X-ray heating). Hercules X-1 exhibits regular (every 1.24 seconds) X-ray pulsations, binary companion star eclipses every 1.75 days, and longer-period modulations (35-day cycles) of X-ray intensity. Hercules X-1 was the first X-ray binary to be optically identified. The mass and rapid pulsations of the X-ray component suggest that it is a rotating neutron star; it is thus often referred to as an X-ray pulsar.

REPRESENTATIVE SOUTHERN HEMISPHERE ITEM: CENTAURUS X-3: The first X-ray binary to be discovered; it is located in the constellation Centaurus. It is a high-mass X-ray binary (the optical companion is a 13th magnitude spectral type O-6.5 supergiant), with regular X-ray eclipses observed every 2.09 days, with rapid pulsations of the X-ray source (a 4.8 second period), related to the rotation of a magnetized neutron star. Centaurus X-3 is thus also known as an X-ray pulsar.

ASTRONOMICAL NOTES -- ON & OFF THE WEB...**SPACECRAFT REVEAL LARGEST CRATER IN SOLAR SYSTEM**

New analysis of Mars' terrain using spacecraft observations reveals what appears to be by far the largest impact crater ever found in the solar system. Mars Reconnaissance Orbiter and Mars Global Surveyor have provided detailed information about the elevations and gravity of the Red Planet's northern and southern hemispheres. A new study using this information may solve one of the biggest remaining mysteries in the solar system: why does Mars have two strikingly different kinds of terrain in its northern and southern hemispheres? The huge crater is creating intense scientific interest.

The mystery of the two-faced nature of Mars has perplexed scientists since the first comprehensive images of the surface were beamed home by spacecraft in the 1970s. The main hypotheses have been an ancient impact or some internal process related to the planet's molten subsurface layers. The impact idea, proposed in 1984, fell into disfavor because the basin's shape didn't seem to fit the expected round shape for a crater.

The newer data is convincing some experts who doubted the impact scenario. "*We haven't proved the giant-impact hypothesis, but I think we've shifted the tide,*" said Jeffrey Andrews-Hanna, a postdoctoral researcher.

A giant northern basin that covers about 40 percent of Mars' surface, sometimes called the Borealis basin, is the remains of a colossal impact early in the solar system's formation, the new analysis suggests. At 5,300 miles across, it is about four times wider than the next-biggest impact basin known, the Hellas basin on southern Mars. An accompanying report calculates that the impacting object that produced the Borealis basin must have been about 1,200 miles across. That's larger than Pluto.

"*This is an impressive result that has implications not only for the evolution of early Mars, but also for early Earth's formation,*" said Michael Meyer, the Mars chief scientist at NASA.

This northern-hemisphere basin on Mars is one of the smoothest surfaces found in the solar system. The southern hemisphere is high, rough, heavily cratered terrain, which ranges from 2.5 to 5 miles higher in elevation than the basin floor.

Other giant impact basins have been discovered that are elliptical rather than circular. But it took a complex analysis of the Martian surface from two Mars orbiters to reveal the clear elliptical shape of Borealis basin, which is consistent with being an impact crater.

One complicating factor in revealing the elliptical shape of the basin was that after the time of the impact, which must have been at least 3.9 billion years ago, giant volcanoes formed along one part of the basin rim and created a huge region of high, rough terrain that obscures the basin's outlines. It took a combination of gravity data, which tend to reveal underlying structure, with data on current surface elevations to reconstruct a map of Mars elevations as they existed before the volcanoes erupted.

"In addition to the elliptical boundary of the basin, there are signs of a possible second, outer ring - a typical characteristic of large impact basins," Banerdt said.

Giant Impact Explains Mars Dichotomy -- Aharonson

The surface landscape of Mars, divided into lowlands in the north and highlands in the south, has long perplexed planetary scientists. Was it sculpted by several small impacts, via mantle convection in the planet's interior, or by one giant impact? Now scientists have shown through computer modeling that the 'Mars dichotomy', as the divided terrain has been termed, can indeed be explained by one giant impact early in the planet's history.

"The dichotomy is arguably the oldest feature on Mars," notes Oded Aharonson, associate professor of planetary science at Caltech and an author of the computer study. The feature arose more than four billion years ago, before the rest of the planet's complex geologic history was superimposed.

Scientists had previously discounted the idea that a single, giant impactor could have created the lower elevations and thinner crust of Mars's northern region, says Margarita Marinova, a graduate student lead author of the study, which appears June 26 in the journal *Nature*. This special issue of the journal features a trio of papers on the Mars dichotomy. The study comes at a time of renewed interest in the ancient crustal feature on Mars, Aharonson notes. In this issue of *Nature*, Jeffrey Andrews-Hanna, Maria Zuber and Bruce Banerdt examine the gravitational and topographic signature of the dichotomy with information from the Mars orbiters. Another accompanying report by Francis Nimmo, explores the expected consequences of mega-impacts.

For one thing, Marinova explains, it was thought that a single impact would leave a circular footprint, but the outline of the northern lowlands region is elliptical. There is also a distinct lack of a crater rim: topography increases smoothly from the lowlands to the highlands without a lip of concentrated material in between, as is the case in small craters. Finally, it was believed that a giant impactor would obliterate the record of its own occurrence by melting a large fraction of the planet and forming a magma ocean.

"We set out to show that it's possible to make a big hole without melting the majority of the surface of Mars," Aharonson says. The team modeled a range of projectile parameters that could yield a cavity the size and ellipticity of the Mars lowlands without melting the whole planet or making a crater rim.

After cranking 500 simulations combining various energies, velocities, and impact angles through the Beowulf-class computer cluster CITerra, the researchers narrowed in on a "sweet spot" -- a range of single-impact parameters that would make exactly the type of crater found on Mars. Although a large impact had been suggested (and discounted) in the past, Aharonson says, computers weren't fast enough to run the models. "The ability to search for parameters that allow an impact compatible with observations is enabled by the dedicated machine at Caltech," he adds.

The favored simulation conditions outlined by the sweet spot suggest an impact energy of around 10^{29} joules, which is equivalent to 100 billion gigatons of TNT. The impactor would have hit Mars at an angle between 30 and 60 degrees while traveling at 6 to 10 kilometers per second. By combining these factors, Marinova calculated that the projectile was roughly 1,600 to 2,700 kilometers across.

Estimates of the energy of the Mars impact place it squarely between the impact that is thought to have led to the extinction of

dinosaurs on Earth 65 million years ago and the one believed to have extruded our planet's moon four billion years ago.

Indeed, the timing of formation of our moon and the Mars dichotomy is not coincidental, Marinova notes. "This size range of impacts only occurred early in solar system history," she says. The results of this study are also applicable to understanding large impact events on other heavenly bodies, like the Aitken Basin on the moon and the Caloris Basin on Mercury.

Evidence of massive asteroid impact on Mars supported by computer simulations -- Nimmo.

The dramatic differences between the northern and southern hemispheres of Mars have puzzled scientists for 30 years. One of the proposed explanations -- a massive asteroid impact -- now has strong support from computer simulations carried out by two groups of researchers.

"It's a very old idea, but nobody had done the numerical calculations to see what would happen when a big asteroid hits Mars," said Francis Nimmo, associate professor of Earth and planetary sciences, and first author of one of the papers.

Nimmo's group found that such an impact could indeed produce the observed differences between the Martian hemispheres. The other study used a different approach and reached the same conclusion. Nimmo's paper also suggests testable predictions about the consequences of the impact.

The so-called hemispheric dichotomy was first observed by Viking missions to Mars in the 1970s. The Viking spacecraft revealed that the two halves of the planet look very different, with relatively young, low-lying plains in the north and relatively old, cratered highlands in the south. Some 20 years later, the Mars Global Surveyor mission showed that the crust of the planet is much thicker in the south and also revealed magnetic anomalies present in the southern hemisphere and not in the north.

"Two main explanations have been proposed for the hemispheric dichotomy -- either some kind of internal process that changed one half of the planet, or a big impact hitting one side of it," Nimmo said. "The impact would have to be big enough to blast the crust off half of the planet, but not so big that it melts everything. We showed that you really can form the dichotomy that way."

The quantitative model used by Nimmo's group calculated the effects of an impact in two dimensions. Asphaug's group used a different model to calculate impacts in three dimensions, but with lower resolution (i.e., less detail in the simulation).

"The two approaches are very complementary; putting them together gives you a complete picture," Nimmo said. "The two-dimensional model provides high resolution, but you can only look at vertical impacts. The three-dimensional model allows nonvertical impacts, but the resolution is lower so you can't track what happens to the crust."

Most planetary impacts are not head-on, Asphaug said. His group found a set of impact conditions that result in a hemispheric dichotomy matching the observations. Those conditions include an impactor about one-half to two-thirds the size of the Moon, striking at an angle of 30 to 60 degrees.

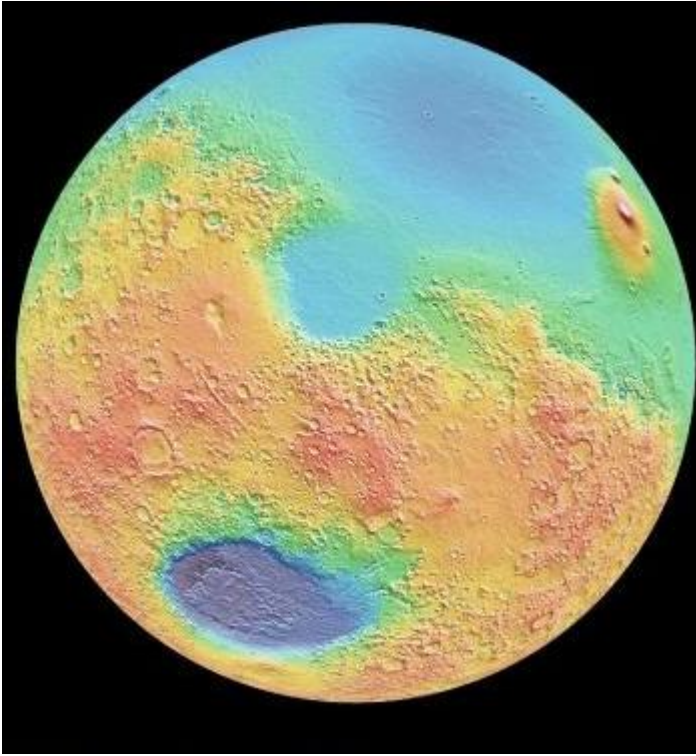
"This is how planets finish their business of formation," Asphaug said. "They collide with other bodies of comparable size in gargantuan collisions. The last of those big collisions defines the planet."

According to Nimmo's analysis, shock waves from the impact would travel through the planet and disrupt the crust on the other

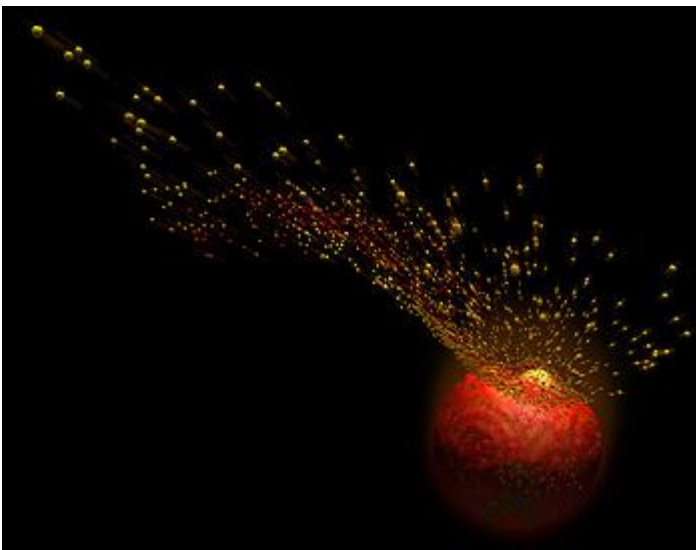
side, causing changes in the magnetic field recorded there. The predicted changes are consistent with observations of magnetic anomalies in the southern hemisphere, he said.

http://www.ucsc.edu/news_events/img/2008/06/mars-349.jpg

The northern hemisphere of Mars is low (blue) and smooth, while the southern hemisphere is high (red) and heavily cratered.



In addition, new crust that formed in the northern lowlands would be derived from deep mantle rock melted by the impact and should have significantly different characteristics from the southern hemisphere crust. Certain Martian meteorites may have originated from the northern crust, Nimmo said. The study also suggests that the impact occurred around the same time as the impact on Earth that created the Moon.



http://www.ucsc.edu/news_events/img/2008/06/impact-349.jpg

This image from a computer simulation shows the type of impact that could have created the Mars hemispheric dichotomy.

CHEMICAL CLUES POINT TO DUSTY ORIGIN FOR EARTH-LIKE PLANETS

Higher than expected levels of sodium found in a 4.6 billion-year-old meteorite suggest that the dust clouds from which the building blocks of the Earth and neighboring planets formed were much denser than previously supposed.

Conel Alexander and Fred Ciesla, with colleagues Jeffrey Grossman and Denton Ebel, analyzed the sodium content of grains in objects called "chondrules" from the Semarkona meteorite, which fell in India in 1940. The Semarkona meteorite, like all other chondrule-bearing meteorites (known as chondrites), dates from the early stages of the solar system's formation. Unlike most others, however, its constituents have been relatively unaltered by heat and chemical changes over the more than four billion years since its origin, making it an important window into the early history of the solar system.

Chondrules, which make up 20 to 80% of the volume of chondrites, are round, roughly millimeter-sized objects made of glass and crystals. Chondrules are thought to have formed by flash heating of dust in the primordial solar system. From the types of minerals found in chondrules, scientists have determined that they formed at temperatures of up to nearly 2,000 C (3600 F). The source of this high heat, which would have affected vast areas of dust, is unknown. The heat would also be expected to have boiled off many of the volatile chemical elements, such as sodium, leaving the chondrules depleted in these elements.

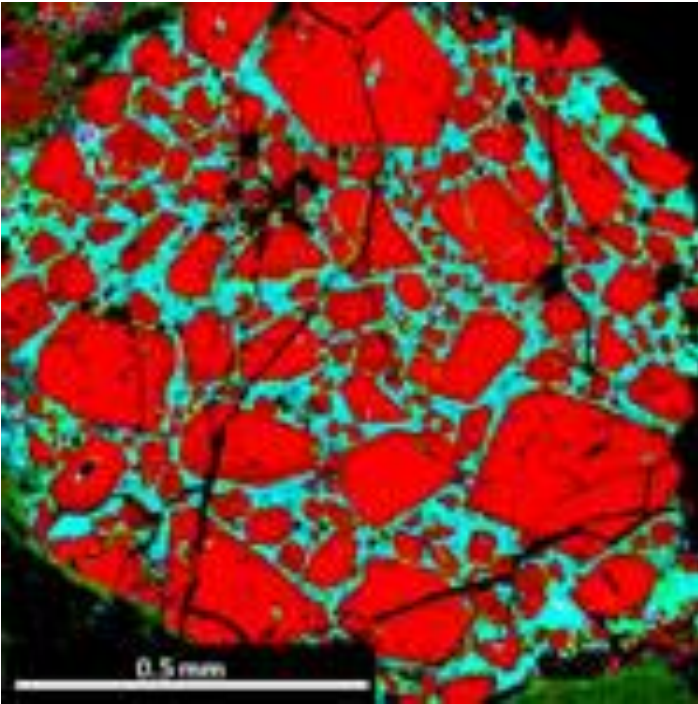
But the chemical analyses by the research team found that the Semarkona chondrules had surprisingly high sodium abundances when they formed, indicating that sodium was not driven off. Rather, it remained at nearly constant levels during chondrule formation.

"Chondrules formed as molten droplets produced by what was probably one of the most energetic processes that operated in the early solar system," says Alexander. "You would expect all the sodium to evaporate and be lost from the chondrules under such conditions. Instead, the sodium was retained. The chondrules stayed as effectively closed systems throughout the heating and melting."

The researchers determined that in order for the molten droplets that formed the chondrules to remain as closed systems and retain constant levels of sodium, the initial dust cloud must have been far denser than previously supposed. *"If the droplets were crowded close enough together, then the sodium vapor in the spaces in between would reach a saturation point," says Alexander, "and that would prevent further evaporation."*

To achieve this condition, the density of dust in the chondrule-forming regions of the early solar system must have been at least about 10 grams per cubic meter, and possibly much more. This is at least 100 times the densities considered by previous models of chondrule formation, which had assumed at most densities of only about 0.1 grams per cubic meter, and normally considerably less. At densities of 10 grams per cubic meter or more, regions only a few thousand kilometers across, small by astronomical standards, could collapse under their own gravity to make objects that would be 10s of kilometers across.

False color micrograph of a chondrule from the Semarkona meteorite. Red indicates olivine crystals, blue and green are glass. High-density dust prevented sodium in the glass from evaporating during chondrule formation, despite high temperatures. Scale bar = 0.5 mm.



<http://www.ciw.edu/sites/www.ciw.edu/files/news/1ac91edbig.jpg>

"What's notable about this result is that it raises the possibility that the formation of chondrules in these high-density regions was linked to the formation of kilometer-sized objects called planetesimals, which were the first stage in building Earth-like planets," says Alexander. "It will also help narrow down the possibilities for the cause of the heating that produced the chondrules, as well as the sizes of the regions where they formed. Heating chondrules to their peak temperatures and then quickly cooling them down when they are present at such high densities is a significant challenge for any mechanism proposed to explain chondrule origin. These tiny objects still have a lot to tell us about how our solar system took shape."

100 YEARS OF SPACE ROCK: THE TUNGUSKA IMPACT

<http://www.jpl.nasa.gov/news/features.cfm?feature=1769>

At around 7:17 on the morning of June 30, 1908, a man based at the trading post at Vanavara in Siberia is sitting on his front porch. In a moment, 40 miles from the center of an immense blast of unknown origin, he will be hurled from his chair and the heat will be so intense he will feel as though his shirt is on fire.



The man at the trading post, and others in a largely uninhabited region of Siberia, near the Podkamennaya Tunguska River, are to be accidental eyewitnesses to cosmological history.

"If you want to start a conversation with anyone in the asteroid business all you have to say is Tunguska," said Don Yeomans, manager of the Near-Earth Object Office at NASA. "It is the only entry of a large meteoroid we have in the modern era with first-hand accounts."

While the impact occurred in '08, the first scientific expedition to the area would have to wait for 19 years. In 1921, Leonid Kulik, the chief curator for the meteorite collection of the St. Petersburg museum led an expedition to Tunguska. But the harsh conditions of the Siberian outback thwarted his team's attempt to reach the area of the blast. In 1927, a new expedition, again lead by Kulik, reached its goal.

"At first, the locals were reluctant to tell Kulik about the event," said Yeomans. "They believed the blast was a visitation by the god Ogdy, who had cursed the area by smashing trees and killing animals."

While testimonials may have at first been difficult to obtain, there was plenty of evidence lying around. Eight hundred square miles of remote forest had been ripped asunder. Eighty million trees were on their sides, lying in a radial pattern.

"Those trees acted as markers, pointing directly away from the blast's epicenter," said Yeomans. "Later, when the team arrived at ground zero, they found the trees there standing upright -- but their limbs and bark had been stripped away. They looked like a forest of telephone poles."

Such debranching requires fast moving shock waves that break off a tree's branches before the branches can transfer the impact momentum to the tree's stem. Thirty seven years after the Tunguska blast, branchless trees would be found at the site of another massive explosion -- Hiroshima, Japan. Kulik's expeditions (he traveled to Tunguska on three separate occasions) did finally get some of the locals to talk. One was the man based at the Vanara trading post who witnessed the heat blast as he was launched a few yards. His account:

"Suddenly in the north sky...the sky was split in two, and high above the forest the whole northern part of the sky appeared covered with fire...At that moment there was a bang in the sky and a mighty crash...The crash was followed by a noise like stones falling from the sky, or of guns firing. The earth trembled."

The massive explosion packed a wallop. The resulting seismic shockwave registered with sensitive barometers as far away as England. Dense clouds formed over the region at high altitudes which reflected sunlight from beyond the horizon. Night skies glowed, and reports came in that people who lived as far away as Asia could read newspapers outdoors as late as midnight. Locally, hundreds of reindeer, the livelihood of local herders, were killed, but there was no direct evidence that any person perished in the blast.

"A century later some still debate the cause and come up with different scenarios that could have caused the explosion," said Yeomans. "But the generally agreed upon theory is that on the morning of June 30, 1908, a large space rock, about 120 feet across, entered the atmosphere of Siberia and then detonated in the sky."

It is estimated the asteroid entered Earth's atmosphere traveling at a speed of about 33,500 miles per hour. During its quick plunge, the 220-million-pound space rock heated the air surrounding it to 44,500 degrees Fahrenheit. At 7:17 a.m. (local Siberia time), at a height of about 28,000 feet, the combination of pressure and heat caused the asteroid to fragment and annihilate itself, producing a fireball and releasing energy equivalent to about 185 Hiroshima bombs.

"That is why there is no impact crater," said Yeomans. "The great majority of the asteroid is consumed in the explosion."

Yeomans and his colleagues at JPL's Near-Earth Object Office are tasked with plotting the orbits of present-day comets and asteroids that cross Earth's path, and could be potentially hazardous to our planet.

Yeomans estimates that, on average, a Tunguska-sized asteroid will enter Earth's atmosphere once every 300 years. On this 100th anniversary of the Tunguska event, does that mean we have 200 years of largely meteor-free skies?

"Not necessarily," said Yeomans. "The 300 years between Tunguska-sized events is an average based on our best science. I think about Tunguska all the time from a scientific point of view, but the thought of another Tunguska does not keep me up at night."

EXPLODING ASTEROID THEORY STRENGTHENED BY NEW EVIDENCE FOUND IN OHIO AND INDIANA

Was the course of life on the planet altered 12,900 years ago by a giant comet exploding over Canada? New evidence found by Ken Tankersley and colleagues suggests the answer is affirmative. Geological evidence found in Ohio and Indiana recently is strengthening the case to attribute what happened 12,900 years ago in North America -- when the end of the last Ice Age unexpectedly turned into a phase of extinction for animals and humans -- to a cataclysmic comet or asteroid explosion over top of Canada.

A comet/asteroid theory advanced by geophysicist Allen West in the past two years says that an object from space exploded just above the earth's surface at that time over modern-day Canada, sparking a massive shock wave and heat-generating event that set large parts of the northern hemisphere ablaze, setting the stage for the extinctions.

Now Ken Tankersley, working in conjunction with Allen West and Nelson R. Schaffer, has verified evidence from sites in Ohio and Indiana -- including, locally, Hamilton and Clermont counties in Ohio and Brown County in Indiana -- that offers the strongest support yet for the exploding comet/asteroid theory.

Samples of diamonds, gold and silver that have been found in the region have been conclusively sourced through X-ray diffractometry in the lab of Warren Huff back to the diamond fields region of Canada.

The only plausible scenario available now for explaining their presence this far south is the kind of cataclysmic explosive event described by West's theory. "We believe this is the strongest evidence yet indicating a comet impact in that time period," says Tankersley.

Ironically, Tankersley had gone into the field with West believing he might be able to disprove West's theory. Tankersley was familiar through years of work in this area with the diamonds, gold and silver deposits, which at one point could be found in such abundance in this region that the Hopewell Indians who lived here about 2,000 years ago engaged in trade in these items.

Prevailing thought said that these deposits, which are found at a soil depth consistent with the time frame of the comet/asteroid event, had been brought south from the Great Lakes region by glaciers.

"My smoking gun to disprove (West) was going to be the gold, silver and diamonds," Tankersley says. "But what I didn't know at

that point was a conclusion he had reached that he had not yet made public -- that the likely point of impact for the comet wasn't just anywhere over Canada, but located over Canada's diamond-bearing fields. Instead of becoming the basis for rejecting his hypothesis, these items became the very best evidence to support it."

Additional sourcing work is being done at the sites looking for iridium, micro-meteorites and nano-diamonds that bear the markers of the diamond-field region, which also should have been blasted by the impact into this region.

Much of the work is being done in Sheriden Cave in north-central Ohio's Wyandot County, a rich repository of material dating back to the Ice Age.

Tankersley first came into contact with West and Schaffer when they were invited guests for an interdisciplinary colloquia this spring. West presented on his theory that a large comet or asteroid, believed to be more than a mile in diameter, exploded just above the earth at a time when the last Ice Age appeared to be drawing to a close.

The timing attached to this theory of about 12,900 years ago is consistent with the known disappearances in North America of the woolly mammoth population and the first distinct human society to inhabit the continent, known as the Clovis civilization. At that time, climatic history suggests the Ice Age should have been drawing to a close, but a rapid change known as the Younger Dryas event, instead ushered in another 1,300 years of glacial conditions. A cataclysmic explosion consistent with West's theory would have the potential to create the kind of atmospheric turmoil necessary to produce such conditions.

"The kind of evidence we are finding does suggest that climate change at the end of the last Ice Age was the result of a catastrophic event," Tankersley says.

Currently, Tankersley can be seen in a new documentary airing on the National Geographic channel. The film "Asteroids" is part of that network's "Naked Science" series.

The new discoveries made working with West and Schaffer will be incorporated into two more specials that Tankersley is currently involved with -- one for the PBS series "Nova" and a second for the History Channel that will be filming Tankersley and his students in the field this summer. Another documentary, this one being produced by the Discovery Channel and the British public television network Channel 4, will also be following Tankersley and his students later this summer.

As more data continues to be compiled, Tankersley, West and Schaffer will be publishing about this newest twist in the search to explain the history of our planet and its climate. Climate change is a favorite topic for Tankersley. "The ultimate importance of this kind of work is showing that we can't control everything," he says. "Our planet has been hit by asteroids many times throughout its history, and when that happens, it does produce climate change."

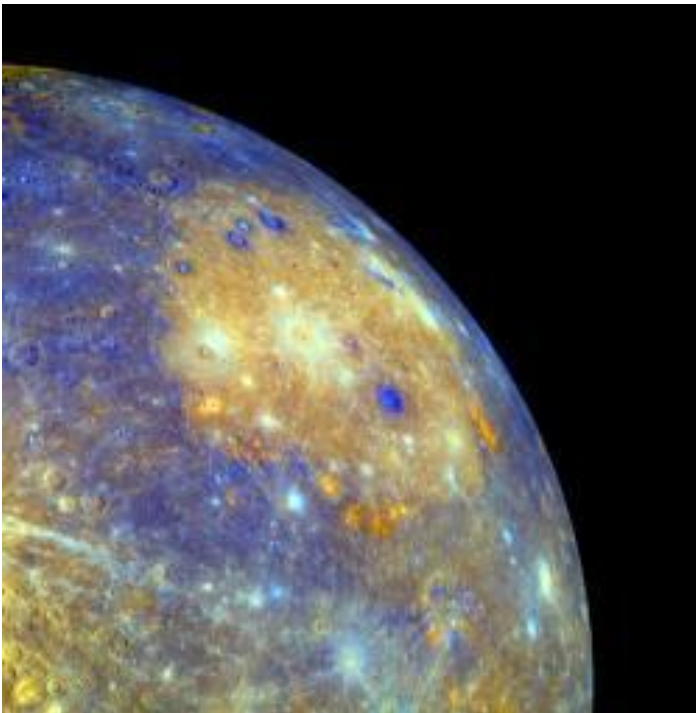
NEW DISCOVERIES FROM MERCURY

Scientists have argued about the origins of Mercury's smooth plains and the source of its magnetic field for more than 30 years. Now, analyses of data from the January 2008 flyby of the planet by the Mercury Surface, Space Environment, Geochemistry and Ranging (MESSENGER) spacecraft have shown that volcanoes were involved in plains formation and suggest that its magnetic field is actively produced in the planet's core.

Scientists additionally took their first look at the chemical composition of the planet's surface. The tiny craft probed the

composition of Mercury's thin atmosphere, sampled charged particles (ions) near the planet, and demonstrated new links between both sets of observations and materials on Mercury's surface. The results are reported in a series of 11 papers published in a special section of Science magazine July 4.

The controversy over the origin of Mercury's smooth plains began with the 1972 Apollo 16 moon mission, which suggested that some lunar plains came from material that was ejected by large impacts and then formed smooth "ponds." When Mariner 10 imaged similar formations on Mercury in 1975, some scientists believed that the same processes were at work. Others thought Mercury's plains material came from erupted lavas, but the absence of volcanic vents or other volcanic features in images from that mission prevented a consensus.



Six of the papers in Science report on analyses of the planet's surface through its reflectance and color variation, surface chemistry, high-resolution imaging at different wavelengths, and altitude measurements. The researchers found evidence of volcanic vents along the margins of the Caloris basin, one of the solar system's youngest impact basins. They also found that Caloris has a much more complicated geologic history than previously believed.

The first altitude measurements from any spacecraft at Mercury also found that craters on the planet are about a factor of two shallower than those on Earth's moon. The measurements also show a complex geologic history for Mercury.

Mercury's core makes up at least 60 percent of its mass, a figure twice as large as any other known terrestrial planet. The flyby revealed that the magnetic field, originating in the outer core and powered by core cooling, drives very dynamic and complex interactions

Remarking on the importance of the core to surface geological structures, Principal Investigator Sean Solomon said, "The dominant tectonic landforms on Mercury, including areas imaged for the first time by MESSENGER, are features called lobate scarps, huge cliffs that mark the tops of crustal faults that formed

during the contraction of the surrounding area. They tell us how important the cooling core has been to the evolution of the surface. After the end of the period of heavy bombardment, cooling of the planet's core not only fueled the magnetic dynamo, it also led to contraction of the entire planet. And the data from the flyby indicate that the total contraction is a least one-third greater than we previously thought."

The flyby also made the first-ever observations of the ionized particles in Mercury's unique exosphere. The exosphere is an ultrathin atmosphere in which the molecules are so far apart they are more likely to collide with the surface than with each other. The planet's highly elliptical orbit, its slow rotation and particle interactions with the magnetosphere, interplanetary medium and solar wind result in strong seasonal and day-night differences in the way particles behave. http://www.nasa.gov/messenger/http://messenger.jhuapl.edu/mer_flyby1.html

STUDY PUTS SOLAR SPIN ON ASTEROIDS, THEIR MOONS & EARTH IMPACTS

Asteroids with moons, which scientists call binary asteroids, are common in the solar system. A longstanding question has been how the majority of such moons are formed. A trio of astronomers from Maryland and France say the surprising answer is sunlight, which can increase or decrease the spin rate of an asteroid.

Derek Richardson, his former student Kevin Walsh, and co-author Patrick Michel outline a model showing that when solar energy "spins up" a "rubble pile" asteroid to a sufficiently fast rate, material is slung off from around the asteroid's equator. This process also exposes fresh material at the poles of the asteroid.

If the spun off bits of asteroid rubble shed sufficient excess motion through collisions with each other, then the material coalesces into a satellite that continues to orbit its parent. Because the team's model closely matches observations from binary asteroids, it neatly fills in missing pieces to a solar system puzzle. And, it could have much more down-to-earth implications as well. The model gives information on the shapes and structure of near-Earth binary asteroids that could be vital should such a pair need to be deflected away from a collision course with Earth.

Finally, the authors say, these findings suggest that a sample return mission to such a binary asteroid could bring back exposed pristine material from the poles of the parent asteroid, providing a chance to probe the internal composition of an asteroid without having to dig into it.

Solar Spin Power

It's estimated that about 15 per cent of near-Earth and main-belt asteroids with diameters less than 10 kilometers have satellite. Scientists have determined that these small binary asteroid pairs were not formed at the beginning of the solar system, indicating that some process still at work must have created them. "It was at first thought the moons in these asteroid pairs probably formed through collisions and/or close encounters with planets," said Richardson. "However, it was found that these mechanisms could not account for the large number of binary asteroids present among near-Earth and inner main belt asteroids."

Recent studies have outlined a thermal process -- known as the YORP effect after the scientists (Yarkovsky, O'Keefe, Radzievskii, Paddack) who identified it -- by which sunlight can speed up or slow down an asteroid's spin. Widespread evidence of this mechanism can be seen in the notable abundance of

both fast and slow rotators among [near-Earth asteroids] and small main belt asteroids, Walsh, Richardson and Michel write in the Nature paper.

The trio modeled different types of 'rubble pile' asteroids -- chunks of rock held together by gravity. This work is the first to show how the slow spinup of such asteroids leads over millions of years to mass loss that can form binaries. *"Our model almost exactly matches the observations of our test case, binary asteroid KW4, which was imaged incredibly well by the Arecibo radio telescope in Puerto Rico,"* Walsh said.

Asteroid Deep Impacts

"Based on our findings, the YORP effect appears to be the key to the origin of a large fraction of observed binaries," said Michel. *"The implications are that binary asteroids are preferentially formed from aggregate objects [rubble piles], which agrees with the idea that such asteroids are quite porous. The porous nature of these asteroids has strong implications for defensive strategies if faced with an impact risk to Earth from such objects, because the energy required to deflect an asteroid depends sensitively on its internal structure,"* he said.

Doublet craters formed by the nearly simultaneous impact of objects of comparable size can be found in a number of places on Earth, suggesting that binary asteroids have hit our planet in the past. Similar doublet craters also can be found on other planets. The authors say that their current findings also suggest that a space mission to a binary asteroid could bring back material that might shed new light on the solar system's early history.

The oldest material in an asteroid should lie underneath its surface, explained Richardson, and the process of spinning off this surface material from the primary asteroid body to form its moon, or secondary body, should uncover the deeper older material. *"Thus a mission to collect and return a sample from the primary body of such a binary asteroid could give us information about the older, more pristine material inside an asteroid, just as the University of Maryland-led Deep Impact mission gave us information about the more pristine material inside a comet,"* Richardson said. Michel added, "Bringing back pristine material is the goal of our proposed Marco Polo mission.

Movie1 <http://www.astro.umd.edu/%7Ekwalsh/BinaryFormation.mpg>
Watch an animated model of the spin-up and binary formation from two views, on the left is an overhead view. The right pane of the movie looks at the equator of the primary body, which is also the plane in which the asteroid's satellite is formed.

Movie2 http://echo.jpl.nasa.gov/%7Eostro/kw4_2001_060830.S3M.320.mov
Animation of the KW4 system as viewed from Earth during May/June 2001 (with the actual star background and simulated solar illumination).

SPACECRAFT SHOWS DIVERSE WET ENVIRONMENTS ON ANCIENT MARS

Two studies based on data from Mars Reconnaissance Orbiter have revealed that the Red Planet once hosted vast lakes, flowing rivers and a variety of other wet environments that had the potential to support life. One study shows that vast regions of the ancient highlands of Mars, which cover about half the planet, contain clay minerals, which can form only in the presence of water. Volcanic lavas buried the clay-rich regions during subsequent, drier periods of the planet's history, but impact craters later exposed them at thousands of locations across

Mars. The data for the study derives from images taken by the Compact Reconnaissance Imaging Spectrometer for Mars, or CRISM, and other instruments on the orbiter.

"The big surprise from these new results is how pervasive and long-lasting Mars' water was, and how diverse the wet environments were," said Scott Murchie, CRISM principal investigator.

The clay-like minerals, called phyllosilicates, preserve a record of the interaction of water with rocks dating back to what is called the Noachian period of Mars' history, approximately 4.6 billion to 3.8 billion years ago. This period corresponds to the earliest years of the solar system, when Earth, the moon and Mars sustained a cosmic bombardment by comets and asteroids. Rocks of this age have largely been destroyed on Earth by plate tectonics. They are preserved on the moon, but were never exposed to liquid water. The phyllosilicate-containing rocks on Mars preserve a unique record of liquid water environments possibly suitable for life in the early solar system.

"The minerals present in Mars' ancient crust show a variety of wet environments," said John Mustard, a member of the CRISM team, and lead author of the study. *"In most locations the rocks are lightly altered by liquid water, but in a few locations they have been so altered that a great deal of water must have flushed through the rocks and soil. This is really exciting because we're finding dozens of sites where future missions can land to understand if Mars was ever habitable and if so, to look for signs of past life."*

Another study finds that the wet conditions on Mars persisted for a long time. Thousands to millions of years after the clays formed, a system of river channels eroded them out of the highlands and concentrated them in a delta where the river emptied into a crater lake slightly larger than California's Lake Tahoe, approximately 25 miles in diameter.

"The distribution of clays inside the ancient lakebed shows that standing water must have persisted for thousands of years," says Bethany Ehlmann, another member of the CRISM team. Ehlmann is lead author of the study of an ancient lake within a northern-Mars impact basin called Jezero Crater. *"Clays are wonderful at trapping and preserving organic matter, so if life ever existed in this region, there's a chance of its chemistry being preserved in the delta."*

CRISM's high spatial and spectral resolutions are better than any previous spectrometer sent to Mars and reveal variations in the types and composition of the phyllosilicate minerals. By combining data from CRISM and the orbiter's Context Imager and High Resolution Imaging Science Experiment, the team identified three principal classes of water-related minerals dating to the early Noachian period. The classes are aluminum-phyllosilicates, hydrated silica or opal, and the more common and widespread iron/magnesium-phyllosilicates. The variations in the minerals suggest that different processes, or different types of watery environments, created them.

"Our whole team is turning our findings into a list of sites where future missions could land to look for organic chemistry and perhaps determine whether life ever existed on Mars," said Murchie.

A NEW WAY TO WEIGH GIANT BLACK HOLES

How do you weigh the biggest black holes in the universe? One answer now comes from a completely new and independent

technique that astronomers have developed using data from Chandra X-ray Observatory.

By measuring a peak in the temperature of hot gas in the center of the giant elliptical galaxy NGC 4649, scientists have determined the mass of the galaxy's supermassive black hole. The method, applied for the first time, gives results that are consistent with a traditional technique.

Astronomers have been seeking out different, independent ways of precisely weighing the largest supermassive black holes, that is, those that are billions of times more massive than the Sun. Until now, only methods based on observations of the motions of stars or of gas in a disk near such large black holes had been used.

"This is tremendously important work since black holes can be elusive, and there are only a couple of ways to weigh them accurately," said Philip Humphrey of the University of California at Irvine, who led the study. *"It's reassuring that two very different ways to measure the mass of a big black hole give such similar answers."*

NGC 4649 is now one of only a handful of galaxies for which the mass of a supermassive black hole has been measured with two different methods. In addition, this new X-ray technique confirms that the supermassive black hole in NGC 4649 is one of the largest in the local universe with a mass about 3.4 billion times that of the Sun, about a thousand times bigger than the black hole at the center of our galaxy.

The new technique takes advantage of the gravitational influence the black hole has on the hot gas near the center of the galaxy. As gas slowly settles towards the black hole, it gets compressed and heated. This causes a peak in the temperature of the gas right near the center of the galaxy. The more massive the black hole, the bigger the temperature peak detected by Chandra.

This effect was predicted by two of the co-authors -- Fabrizio Brighenti and William Mathews -- almost 10 years ago, but this is the first time it has been seen and used.

"It was wonderful to finally see convincing evidence of the effects of the huge black hole that we expected," said Brighenti. *"We were thrilled that our new technique worked just as well as the more traditional approach for weighing the black hole."*

The black hole in NGC 4649 is in a state where it does not appear to be rapidly pulling in material towards its event horizon or generating copious amounts of light as it grows. So, the presence and mass of the central black hole has to be studied more indirectly by tracking its effects on stars and gas surrounding it. This technique is well suited to black holes in this condition.

"Monster black holes like this one power spectacular light shows in the distant, early universe, but not in the local universe," said Humphrey. *"So, we can't wait to apply our new method to other nearby galaxies harboring such inconspicuous black holes."*
<http://chandra.harvard.edu/photo/2008/ngc4649/>
<http://www.jpl.nasa.gov/news/news.cfm?release=2008-136>

THREE RED SPOTS MIX IT UP ON JUPITER

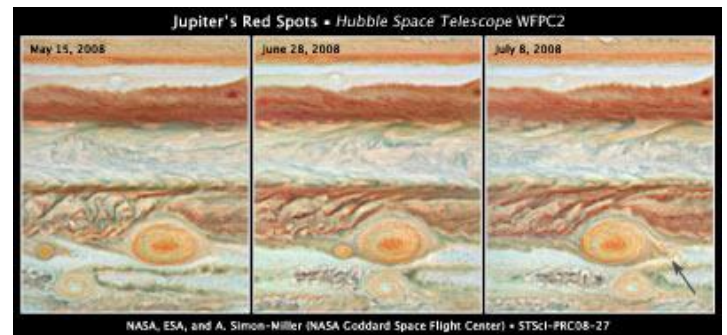
A new sequence of Hubble Space Telescope images offers an unprecedented view of a planetary game of Pac-Man among three red spots clustered together in Jupiter's atmosphere. The images were taken by the Wide Field and Planetary Camera 2.

The time series shows the passage of the "Red Spot Jr." in a band of clouds below (south) of the Great Red Spot. "Red Spot Jr." first appeared on Jupiter in early 2006 when a previously white storm turned red. This is the second time, since turning red, it has skirted past its big brother apparently unscathed.

But this is not the fate of "baby red spot," which is in the same latitudinal band as the Great Red Spot. This new red spot first appeared earlier this year. The baby red spot gets ever closer to the Great Red Spot in this picture sequence until it is caught up in its anticyclonic spin. In the final image, the baby spot is deformed and pale in color and has been spun to the right (east) of the Great Red Spot. Amateur astronomers' observations confirm that this pale spot is the migrating baby spot.

The prediction is that the baby spot will now get pulled back into the Great Red Spot "Cuisinart" and disappear for good. This is one possible mechanism that has powered and sustained the Great Red Spot for at least 150 years.

These three natural-color Jupiter images were made from data acquired on May 15, June 28 and July 8, 2008, by Wide Field Planetary Camera 2. Each one covers 58 degrees of Jovian "latitude" and 70 degrees of "longitude" (centered on 5 degrees South latitude and 110, 121 and 121 degrees West longitude, respectively).



<http://hubblesite.org/news/2008/27> .

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.

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In July'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 - DELPHINUS**
- **** **YOUNG ASTRONOMER'S CORNER**
- **** **ASTRONOMY "FUN FACTS"**
- **** **MIRROR IMAGES**
- **** **ASTRONOMY & TELESCOPE LINGO**
- **** **SPACECRAFT REVEAL LARGEST CRATER IN SOLAR SYSTEM**
- **** **CHEMICAL CLUES POINT TO DUSTY ORIGIN FOR EARTH-LIKE PLANETS**
- **** **100 YEARS OF SPACE ROCK: THE TUNGUSKA IMPACT**
- **** **EXPLODING ASTEROID THEORY STRENGTHENED BY NEW EVIDENCE FOUND IN OHIO AND INDIANA**
- **** **NEW DISCOVERIES FROM MERCURY**
- **** **STUDY PUTS SOLAR SPIN ON ASTEROIDS, THEIR MOONS & EARTH IMPACTS**
- **** **SPACECRAFT SHOWS DIVERSE WET ENVIRONMENTS ON ANCIENT MARS**
- **** **A NEW WAY TO WEIGH GIANT BLACK HOLES**
- **** **THREE RED SPOTS MIX IT UP ON JUPITER**

The next EAS Meeting is 7:00 P.M. Saturday July 26th at the 'Aurora Astro Products' store location at Silver Lake.