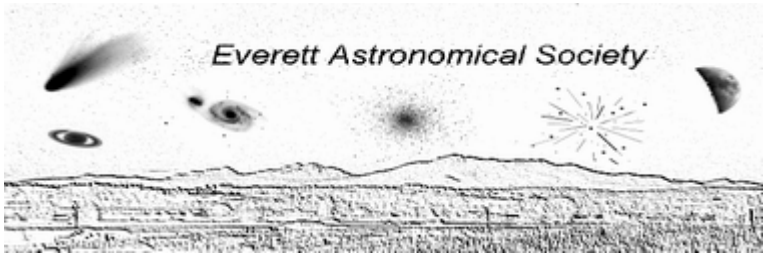
Volume MMVIII. No. 3



The Stargazer

March 2008

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Web assistance: Cody Gibson	(425) 348-1608	sircody01 at comcast.net	*See EAS website at:*
		(change 'at' to @ to send email)	http://members.tripod.com/everett_astronomy

EAS BUSINESS…

NEXT EAS MEETING – SATURDAY MARCH 29TH AT 7:00 PM AT AURORA ASTRO PRODUCTS STORE AT SILVER LAKE. 'ORGANIC MATERIALS IN STARDUST PARTICLES'

★★ Saturday March 29th 7:00 pm MEETING ★★
The presentation will be by Graciela Matrajt from the University of Washington Astronomy department, speaking about "The Organic Materials Found in Stardust Particles". She worked on the team with Dr. Don Brownlee analyzing the first ever material returned to Earth from a comet. (Comet p/Wild2). The meeting will be the Aurora Astro Products store in Silver Lake. There will be some refreshments. (It may be helpful for some folks to bring a folding chair to the meeting.) We are also rearranging the layout a bit, to improve seating, based on the larger crowds we have had the last two 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 ★

"The Spring galaxies can be viewed from my place now. Let's try for a star party this Saturday, May 29th depending on the weather of course. There is a Everett Astro Society meeting Saturday evening too. For those who want to set up at sunset, that will be around 7:30 PM if you are attending the meeting then come after the meeting. Of course that all depends on the weather and cloud cover. We will be having another Star Party the following Saturday and I will send out a reminder next week. - Ron Tam, 16024 51st St SE, Snohomish 98290, (360) 568 5152"

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') Apr 5, May 3, Jun 7, Jul 5, Aug 23, Sep 20, Oct 4, Nov 1.

Please also join the EAS mail list, and send mail to the mail list *everett_astronomy@topica.com* to coordinate spur-of-the-moment observing get-togethers, on nights when the sky clears. We try to hold informal close-in star parties each month during the spring, summer, and fall months on a weekend near the New moon at a member's property or a local park. (call Jim Bielaga at (425) 337-4384 for info or check the EAS website.) Members contact Jim Bielaga for scope borrowing.

On Saturday, March 29, 2008, **Earth Hour** invites people around the world to turn off their lights for one hour – from 8:00pm to 9:00pm in their local time zone. On this day, cities around the world, including Copenhagen, Chicago, Melbourne, Dubai, and Tel Aviv, will hold events to acknowledge their commitment to energy conservation. http://www13.earthhourus.org/

DARK MOON PERIODS THIS YEAR

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

Other Western US Star Parties This Season…

Rooster Rock OR State Park 2008 RCA Star parties - 22 miles east of Portland on I-84 (east of Sandy River) at exit 25.
Apr 12 - Planet Parade at Rooster Rock
May 10 - Astronomy Day at Rooster Rock
Jun 14 - Summer Solstice Celebration at Rooster Rock
Jul 12 - Luna Viewing at Rooster Rock
Aug 11 - Perseid Meteor Shower Watch at Rooster Rock
Sep 06 - Autumnal Equinox Celebration at Rooster Rock
(503) 797-4610. http://www.omsi.edu/visit/planetarium/starparties.cfm

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

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

May 02-05 - OAS Camp Delany Star Party - Sun Lakes SP http://www.olympicastronomicalsociety.com/Documents/SPRING_CAMPDELANY_Sign-UpForm.pdf

May 09/10 – EAS Astronomy Day Star Party - Harborview Park - Everett http://members.tripod.com/everett_astronomy/astronomy_day.htm

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

EAS MEMBER NEWS

Astronomy Monopoly, Anyone ?

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

Sidewalk Astronomy

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

Astronomy Day 2008 volunteers needed – May 9/10

We need EAS volunteers for Astronomy Day activities, to assist with open house at library to talk to people and tell them about the

EAS and amateur astronomy, and/or to help with star party at Harborview Park on Friday May 9th and Saturday May 10th. This could be bringing a scope, a self-running PowerPoint show, some posters, books, software, or photos, or just talking with visitors. You do not need to be an astronomy expert to be a big help – just someone who is willing to share their interest in astronomy. Please contact Mark if you can help out with this.

School and Community Group Astronomy Outreach

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

Possible field Trip to Ritchie Obs. on Bainbridge Island

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

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

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

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

- Clear Skies, Jim Bielaga"

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

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	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.

Unsoeld Seminar Series - Neil deGrasse Tyson in Olympia

Join Dr. Neil deGrasse Tyson - world renowned astrophysicist, bestselling author, and host of the groundbreaking PBS series NOVA scienceNOW – in person for a fascinating journey across the horizons of science, the universe and society. Tuesday, April 29, 2008 at 7:30 p.m. at The Evergreen State College, College Recreation Center (CRC), 2700 Evergreen Parkway, Olympia.

Tickets: Online at www.buyolympia.com/events , by phone at (360) 867-6833 with your Visa or MasterCard, in person at The Evergreen State College Communications Building Box Office (noon to 3p.m. weekdays), the Evergreen Book Store, or Rainy Day Records in downtown Olympia. Prices are $20 for reserved section seating (advance tickets only, not available at the door), $10 for adult general admission ($13 at the door),$5 for student general admission ($8 at the door). Student prices apply to youth under age 16 or high school or college students with valid student ID. Parking is free after 5:00 p.m. Use Parking Lot C for best access to the College Recreation Center.

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

March 2008

Mar 20 - Vernal Equinox, 05:48 UT
Mar 23 - Easter Sunday
Mar 29 – EAS Meeting 7:00 pm Aurora Astro Products store
Mar 29 – EAS monthly suburban star party – Ron Tam's place

April 2008

Apr 05 – EAS monthly suburban star party – Ron Tam's place
Apr 16 - Mercury Superior Conjunction
Apr 22 - Lyrids meteor Shower Peak
Apr 12 – EAS Meeting 7:00 pm Aurora Astro Products store

May 2008

May 02 - Space Day
Apr 05 – EAS monthly suburban star party
May 02-05 - OAS Camp Delaney Star Party - Sun Lakes SP
May 05 - Eta Aquarids meteor Shower Peak
May 09 - Astronomy Day Star Party at Harborview Park
May 10 - Astronomy Day at Library and Harborview Park
May 14 - Mercury At Its Greatest Eastern Elongation (22 Degrees)
May 23-26 - RTMC Camp Oakes, CA
May 24 – EAS Meeting 7:00 pm Aurora Astro Products store

June 2008

Jun 05-07 –2008 NWRAL "First Light" Star Party - Goldendale WA
Jun 07 – EAS monthly suburban star party – Ron Tam's place
Jun 07 - Mercury Inferior Conjunction
Jun 15 - Lyrids meteor shower peak
Jun 16 - Prineville Reservoir Star Party (Prineville, OR)
Jun 20 - Summer Solstice, 20:24 UT
Jun 20 - Pluto Opposition - Mag=13.9
Jun 26 - Bootids meteor shower peak
Jun 21 – EAS Meeting 7:00 pm Aurora Astro Products store
Jun 30 - Jul 07 2008 Shingletown Star Party, Shingletown CA

July 2008

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

August 2008

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

September 2008

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

October 2008

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

November 2008

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

December 2008

Dec 01 - Conjunction of Moon, Venus, and Jupiter (3 Degree Triangle)
Dec 01 - Moon Occults Venus
Dec 13 - Geminids meteor shower peak
Dec 21 - Winter Solstice, 12:04 UT
Dec 22 - Ursids meteor shower peak
Dec 29 - Moon Occults Jupiter

UW Astronomy Speakers Colloquium Schedule

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

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

"Our group of radio script writers now consists of EAS and SAS members Jim Ehrmin, Greg Donohue, and Ted Vosk, who are now regularly writing and helping to produce our **astronomy radio show**, "**It's Over Your Head"** on radio station **KSER, FM 90.7.** The six-minute segment is broadcast **every Wednesday morning at approximately 7:20 A.M.** and gives a weekly look at what's up in the sky over Snohomish County, with other information. If you are a listener to the program, show your support by giving the program director of KSER a call!" Web page with lots of archives and other info is available at http://www.itsoveryourhead.org/

KPLU 88.5 FM National Public Radio has daily broadcasts of "Star Date" by the McDonald Observatory of the University of Texas at Austin, Monday through Friday at about 6:05 pm. The short 2 minute radio show deals with current topics of interest in astronomy. The University of Washington TV broadcasts programs from NASA at 12:00 AM Monday through Friday, 12:30 AM Saturday, and 1:30 AM Sunday on the Channel 27 cable station.

EAS Membership Benefits & Information

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

Magazine Discounts –
In addition you will be able subscribe to ***Sky and Telescope*** for $7 off the normal subscription rate, contact the treasurer (Carol Gore) for more information.
http://members.tripod.com/everett_astronomy/application.htm (**When renewing your subscription to *Sky & Telescope* you should send your S&T renewal form along with a check made out to Everett Astronomical Society to the EAS address.** The EAS treasurer 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://members.tripod.com/everett_astronomy/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://members.tripod.com/everett_astronomy/application.htm

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

OBSERVER'S INFORMATION…

LUNAR FACTS

Mar 29	Last Quarter Moon
Apr 05	New Moon
Apr 11	First Quarter Moon
Apr 19	Full Moon
Apr 27	Last Quarter Moon
May 04	New Moon
May 11	First Quarter Moon
May 19	Full Moon
May 27	Last Quarter Moon
Jun 03	New Moon
Jun 09	First Quarter Moon
Jun 17	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	Mag
Sun	**06:52 am**	**19:35**	**Psc**	**-27.5**
Mercury	06:35 am	18:00	Aqr	+1.3
Venus	06:26 am	17:49	Aqr	-3.9
Mars	11:12 am	**03:32 am**	**Gem**	**+0.8**
Jupiter	**03:26 am**	12:24	**Sag**	**-2.1**
Saturn	**16:01**	**05:59 am**	**Leo**	**+0.3**
Uranus	06:21 am	17:44	Aqr	+5.9
Neptune	**05:23 am**	15:21	Cap	+8.0
Pluto	**03:47 am**	13:15	**Sag**	**+14.0**

(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 – HYDRA

HYDRA: The Water Snake, as this constellation is also known, borders on the constellations of Antlia, Cancer, Canis Minor, Centaurus, Corvus, Crater, Leo, Libra, Monoceros, Puppis, Pyxis, Sextans, and Virgo, and ranks 71st in overall brightness among the constellations, containing, ironically enough, 71 stars brighter than magnitude 5.5. Its central point is located at RA=11h,33m and Dec.= -14 degrees. It is completely visible from latitudes +55 degrees to –83 degrees, with portions visible worldwide. This constellation ranks 1st in overall size; the largest constellation takes up over three percent of the entire sky. One of the most famous stars in the sky is Alphard (alpha Hydra), an orange giant with a K4-III spectral type. Alphard (also known as the "Dragon's Heart" and "Solitary One") has an apparent magnitude of 1.97 (making it the 46th brightest star in the sky), and an absolute magnitude of –0.3; it may also be a minimal variable star, with a magnitude fluctuation of approximately 0.2 noted. This beautiful star is located about 95 light years from our solar system. Hydra has one associated meteor shower: the sigma Hydrids (11 Dec.), and three Messier objects (M-48 (open cluster), M-68 (globular cluster), and M-83 (spiral galaxy).

M-83 is a nearly face-on spiral, and has been called the finest face-on Sc-type spiral in the sky. It has a combined (total) magnitude of 8 (making it one of the 25 brightest galaxies in all the sky as well), and appears photographically to be about 10 X 8 minutes of arc in angular size, with a bright nucleus. Its distance to us is approximately 4.5 megaparsecs, making it also one of the closest spiral galaxies outside our Local Group. M-83 was actually discovered by Lacaille in 1752. This great loose spiral galaxy is on the border with the constellation of Centaurus, and can also be located at about 18 degrees south of the star Spica. The two main arms forming the spiral pattern of M-83 actually form a reverse letter "S"; a third and fainter arm sweeps from the nucleus towards the southwest of the galactic structure. The spiral arms are branded by abundant star clouds, hot giant stars, and bright nebulous areas. The nucleus itself measures about 20" across, and demonstrates an intense emission spectrum. The total luminosity of M-83 is approximately 5 billion times that of our Sun, and the galaxy has a visible diameter of approximately 30,000 light years. Interestingly, at least five supernovae have occurred within the confines of M-83 in the last 70 years or so, making M-83 a very good target for patient supernovae hunters!!

M48 (NGC-2548; open (galactic) cluster) is located near the western border of Hydra, and has often been regarded as one of the "missing" Messier objects, as no such object exists at the actual coordinates (actually 4 degrees North of the present location of M-48) which Messier charted. The total cluster magnitude is listed at 5.5, and its overall angular size is about 40'. M-48 contains about 50 stars: 10th and 11th magnitude stars in the central "chain", and fainter stars down to approximately 13th

magnitude. There are three yellow giants in the cluster, and the remaining stars are A-type main sequence stars. M-48 is located about 1700 light years from our solar system. M-68 (globular cluster), is an ample grouping of stars for larger scopes, but is also a good object in smaller scopes as well. This globular grouping contains well over 100,000 stars, and has a thicker inner mass of stars about 2.0' in diameter; its total diameter is about 9.0' (approximately 100 light-years). The cluster distance has been calculated at about 46,000 light years from Earth, giving a total luminosity of the cluster at about 100,000 times that of the Sun (with a total absolute magnitude of –7.7(and an apparent magnitude of around 8.0)). The integrated spectral type of the cluster has been shown to be A6, and M-68 contains 38 stars known to be variables.

Hydra also contains the star R-Hydrae, a well-known variable star that was the third of all the long-period variables to be discovered (after Omicron Ceti (Mira) and Chi Cygni). R-Hydrae is one of the easiest of the long-period pulsators for amateurs to observe because of its variation: it can reach to magnitude 4 brightness at maximum, but is often very hard to find visually (becoming approximately 250 times fainter) at minimum: one must then know its exact location. Ironically, its maximum luminosity is estimated to be about 250 times that of our own Sun. Similar to Mira, R-Hydrae is an M-class giant star, and is clearly reddish in color. Another well-known Hydra entity is V-Hydrae, a variable star which is often considered the reddest star known. V-Hydrae is a semi-regular red variable: it is actually one of the rare "carbon stars" visible in the skies; carbon stars are low-temperature giant stars with spectra demonstrating carbon compound lines; V-Hydrae has been given a spectral type of N6. Its color has variously been described by noted astronomers down through the years as "brown red" (Copeland, 1876) and "a most magnificent copper red" (Dreyer, 1879). V-Hydrae has a period of approximately 533 days, with an apparent magnitude variation of between 6.5 and fainter than 12 (a difference of about 6 magnitudes (or, again, a variation in light intensity of about 250 times)). Another Hydra variable, U-Hydrae, is somewhat brighter (4.7-6.2), and is almost as red as V-Hydrae. Hydra also contains a well-known planetary nebula – NGC-3242. This planetary is located about 1.8 degrees south of Mu-Hydrae, and appears in small telescopes as a pale blue gently-glowing disc, which measures about 40" x 35", with a bright inner "human eye"-like disc, and an outer halo of greenish-blue nebulosity. NGC-3242 has a central star with a visual magnitude of around 11.4, and the planetary has an overall visual magnitude of approximately 9.0. Much of the illumination of NGC-3242 can be attributed to fluorescence induced by the strong UV radiation of the central hot blue dwarf, a 60,000 degree Kelvin surface temperature star. The planetary's blue-green tint is due to the strong emissions of doubly-ionized oxygen.

Perhaps most well known of all the other phenomena associated with this constellation is the fact that in September 1965, one of the most famous comets of the 20th century was discovered near Alphard. Comet Ikeya-Seki (a sungrazer) was, one month later in October, visible in daylight when only two degrees from the sun!! Hydra has a midnight culmination date of March 15th, so try to get out (in good dark skies and well above any horizon obstructions), and enjoy some of the beauties of this famous and marvelous constellation this late winter and spring.

YOUNG ASTRONOMER'S CORNER

The Young Astronomer's Corner periodically asks some questions that young people may be seeking an answer to. Here are some such questions about astronomy and space exploration:

Q: Why should we build a space station?

A: The simple answer is that if humans are going to explore outer space, we need to know a lot more information about it. Space has no air to breathe and a micro-gravity atmosphere. The space shuttle and space station missions allow astronauts and cosmonauts to conduct many useful experiments in the weightlessness of space; but because shuttle missions are only about 2 weeks in duration, the longer orbiting time for the space station would allow longer time for some important experiments to be conducted. These include the long-term effects of weightlessness on humans, certain medical and laboratory experiments (including crystal, food and plant growth) and the effects of living in close, cramped quarters over long periods of time. By studying issues such as these in space, we can prepare perhaps for a future colony on the Moon and perhaps on another planet, as well as gain a fuller appreciation and knowledge of our life here on Earth.

Q: How long do stars live?

A: When a star is born from a large cloud of gas and dust, its size determines how long it will live. In general, the smaller the star, the longer it will live. Smaller stars with very low mass make helium from hydrogen (also known as fusion) very slowly. These stars tend to be cooler and thus redder in appearance, and burn for trillions (!) of years before they use all of their hydrogen found in the core. Medium sized stars, like our Sun, burn faster however. Because they are larger, there is more pressure from gravity in their cores, which causes nuclear fusion reactions to happen more quickly: they use up their hydrogen fuel more quickly. Stars such as the size of our Sun live for a few billion years. The most massive stars are generally the hottest and most unstable; they 'die' from processes such as a collapse from their own weight to form supernovae, neutron stars, and/or pulsars for example; these largest stars die within 'only' a few million years. In general, when it comes to stars, the bigger you are, the shorter your life.

Q: Could we land a spacecraft on the planet Jupiter?

A: No, because Jupiter has no true "surface" to land on. Additionally, any spacecraft able to make it that far would sink through thicker and thicker "clouds", until the clouds were so thick that the pressure created would crush the spacecraft. The deeper you go inside Jupiter, the greater the crushing pressures.

Q: Which planet has the largest moon?

A: Jupiter. The name of the moon is Ganymede, and it also happens to be the largest moon in the entire solar system. It is 3,166 miles in diameter, and is thus larger than the planets Mercury (2,930 miles diameter) and Pluto (1,380 miles diameter). By comparison, Earth's Moon is 2,086 miles in diameter.

ASTRONOMY & TELESCOPE LINGO

ASTRONOMY "LINGO": Vaca Muerta Meteorite: A rare stony-iron (mesosiderite) meteorite that probably fell about 3,000 years ago. It was found in the Atacama Desert of Chile, and it was easy to spot in the light sand of the desert because of its dark color. It was first found in 1861, and it was a very large meteorite indeed: about 4 tons of an estimated total of 6 tons have been recovered thus far. Vaca Muerta is Spanish for 'dead cow'. The name of Vaca Muerta comes from the fact that an old cattle tail crossed the strewnfield, and many dry skeletons of cows are scattered along the trail. The cattle came from the valleys of Salta and Jujuy, north Argentina, approximately 700 miles distant across the Andes. These cattle were to serve as food for the

miners of Saltpeter fields (Oficinas Salitreras) of the Atacama Desert.

TELESCOPE "LINGO": Field Distortion: An aberration of a mirror or lens in which the image has a distorted shape. This is as a result of non-uniform lateral magnification over the field of view. There are two main types of field distortion: In "pincushion distortion", there is more magnification at the edge of the field, and in "barrel distortion", magnification decreases towards the field edge.

ASTRONOMY "FUN FACTS"

★★ Neptune is about 1 billion miles further away from the Sun than Uranus. This average distance between Uranus and Neptune is almost 11 times the Sun-Earth distance, and almost 290,000 times the distance between New York and London. If a Boeing 747 could be made space-worthy, it would take approximately 1,900 years to fly from Uranus to Neptune, flying at an average speed of 600 miles per hour!!

★★ Before Voyager 2 traveled to the outer planets, the record for deep-space communication was set by Pioneer 5, which communicated (non-image data only) data back to earth from a distance of 22 million miles. Voyager 2, when it visited Uranus in 1986 at a distance of approximately 2 billion miles, improved the communication distance record (with image data as well), by a factor of about 100!!

★★ The Sun radiates more energy in one second than mankind has consumed throughout all of its history. One second of the Sun's energy is 13 million times the mean annual electricity usage in the entire United States!!!

PLANETARY FOCUS - URANUS

Planetary Focus is periodically published in the StarGazer. For the month of March 2008, our guest planet is Uranus, and these are the facts:

Rotation around the Sun: every 84.01 years

Orbit: from 18.31 (closest or 'perihelion') to 20.07 (furthest or 'aphelion') Astronomical Units (AU)*; this is an orbit that varies between approximately 1.7 billion and 1.9 billion miles from the sun. (*Note: One AU equals approximately 93 million miles).

Inclination of Orbit to Ecliptic: 0.8 degrees.

Mean Orbital Velocity: 6.80 km/sec.

Diameter at Equator: 51,400 kilometers (or 32,000 miles).

Mass: 914.5 5. (approximately 14.5 times more massive than earth); (5.9742 x (10 e24 (10 to the 24th power)) kilograms = 1 Earth Mass).

Density: approximately 1.25 times that of water (global density).

Period of Rotation on its own axis: approximately 15 hours, 36 minutes (retrograde axial motion).

Axis tilt: 97.86 degrees.

Number of Satellites (known moons): 27, as well as planetary rings.

Special Notes About Uranus: Uranus is the seventh largest planet in the solar system (one of the gas giants), and the first to be discovered telescopically (William Herschel, 1781). At opposition, it has a mean angular diameter of 3.7 arc seconds, and an overall magnitude of 5.6 (close to the limit of naked eye visualization). In larger terrestrial telescopes, the green-colored disk of Uranus is fairly featureless; this makes visual determination of its period of rotation impossible. The equator of Uranus is tilted by approximately 98 degrees with respect to its orbit; its rotation axis is thus close to its orbital plane. Very exaggerated seasonal changes arise on Uranus as its poles, because of this equator tilt, alternately point towards the sun. The outer layers of Uranus are mainly low-density gaseous hydrogen and helium. Methane and hydrogen in the upper atmosphere condense to form ice crystal clouds, and methane formation at even higher altitudes gives the planet its green coloration. It is believed that Uranus has a rocky core about the size of the earth, composed of primarily iron and silicon. Even though the equatorial areas of Uranus receive very little sunlight (because of the planet's great tilt), equatorial temperatures are almost the same as temperatures found at the sunlit poles: this indicates that the transport of heat throughout the planet is very efficient. Uranus has a magnetosphere and magnetic field approximately the same as that of the earth, except that polarity is opposite to that of the earth.

Auroral activity had been noted on Uranus even before the Voyager probes investigated the planet. Voyager 2 flew by Uranus in 1986, sending back stunning pictures of the green planet, but nevertheless essentially showing a featureless surface. However, faint cloud markings have been noted, and it has been determined that winds on the planet blow in the same direction as the planetary rotation; these faint cloud features are arranged into east-west bands.

Like all the other gas giant planets (Jupiter, Saturn, and Neptune), Uranus has a ring system. Unlike the magnificent rings of Saturn however (see last month's Young Astronomer's Corner), instead of broad and bright, the rings of Uranus are dim and narrow. There are 11 rings total, and most of them are less than 10 kilometers wide, with individual particles averaging about one meter in size. The 15 moons of Uranus are interesting in their own right. All 15 have low surface brightness, and are composed of a mixture of rock and ice, and data hints at the fact the larger moons of Uranus are about 50% hydrogen, 30% rock, and 20% carbon- and nitrogen-based substances. The two largest are Titania and Oberon; other famous moons of Uranus are Ariel, Umbriel, and Miranda. Titania is the largest, and has an icy surface with numerous small craters. It also has some larger impact basins (such as the one named Gertrude, over 200 kilometers (km) in diameter), and a large network of faults, such as the 5 km deep and 1500 km long Messina Chasma. Oberon, the next largest moon of Uranus, is also its outermost one. The surface of Oberon shows some larger craters with bright rays and darker floors or basins associated with them; these darker basins may be due to geologic eruptions of some sort. Oberon also has large, steep-sided mountains, some up to 6 km high. Umbriel and Ariel are the third and fourth largest moons respectively, and Miranda the fifth largest. Miranda is very interesting in that it has a very complex surface structure. Voyager 2 revealed three distinct terrain regions on the moon: enclosed and grooved areas about 200-300 km across; brighter areas with cliffs; and aged cratered plains. Perhaps most interesting about Miranda is that these three distinct appearing regions have led some scientists to speculate that Miranda was shattered by a collision at one point and then reassembled into a single moon again. If you have the opportunity some dark night with minimal light pollution, and you have access to a good telescope, try to find, or get someone to show you, the beautiful greenish "star" that is really our seventh largest planet.

"MIRROR IMAGES"

"MIRROR" IMAGES": This column is intended as a bi-monthly column, and last printed in February; it will return next month (April) with all new content.

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

MANY NEARBY SUN-LIKE STARS MAY FORM ROCKY PLANETS

Astronomers have discovered that terrestrial planets might form around many, if not most, of the nearby sun-like stars in our galaxy. These new results suggest that worlds with potential for life might be more common than we thought. Astronomer Michael Meyer and his colleagues used the Spitzer Space Telescope to determine whether planetary systems like ours are common or rare in our Milky Way galaxy. They found that at least 20 percent, and possibly as many as 60 percent, of stars similar to the sun are candidates for forming rocky planets. The astronomers used Spitzer to survey six sets of stars, grouped depending on their age, with masses comparable to our sun. The sun is about 4.6 billion years old. "*We wanted to study the evolution of the gas and dust around stars similar to the sun and compare the results with what we think the solar system looked like at earlier stages during its evolution*," Meyer said.

The Spitzer telescope does not detect planets directly. Instead it detects dust -- the rubble left over from collisions as planets form -- at a range of infrared wavelengths. The hottest dust is detected at the shortest wavelengths, between 3.6 microns and 8 microns. Cool dust is detected at the longest wavelengths, between 70 microns and 160 microns. Warm dust can be traced at 24-micron wavelengths. Because dust closer to the star is hotter than dust farther from the star, the "warm" dust likely traces material orbiting the star at distances comparable to the distance between Earth and Jupiter. "*We found that about 10 to 20 percent of the stars in each of the four youngest age groups shows 24-micron emission due to dust*," Meyer said. "*But we don't often see warm dust around stars older than 300 million years. The frequency just drops off. That's comparable to the time scales thought to span the formation and dynamical evolution of our own solar system*," he added. "*Theoretical models and meteoritic data suggest that Earth formed over 10 to 50 million years from collisions between smaller bodies*." In a separate study, Thayne Currie and Scott Kenyon and their colleagues also found evidence of dust from terrestrial planet formation around stars from 10 to 30 million years old. "*These observations suggest that whatever led to the formation of Earth could be occurring around many stars between three million and 300 million years old*," Meyer said. Kenyon and Ben Bromley have developed planet formation models that provide a plausible scenario. Their models predict warm dust would be detected at 24-micron wavelengths as small rocky bodies collide and merge. "*Our work suggests that the warm dust Meyer and colleagues detect is a natural outcome of rocky planet formation. We predict a higher frequency of dust emission for the younger stars, just as Spitzer observes*," said Kenyon. The numbers on how many stars form planets are ambiguous because there's more than one way to interpret the Spitzer data, Meyer said. The warm-dust emission that Spitzer observed around 20 percent of the youngest cohort of stars could persist as the stars age. That is, the warm dust generated by collisions around stars three to 10 million years old could carry over and show up as warm dust emission seen around stars in the 10- to 30-million-year-old range and so on. Interpreting the data this way, about one out of five sun-like stars is potentially planet-forming, Meyer said. There's another way to interpret the data. "*An optimistic scenario would suggest that the biggest, most massive disks would undergo the runaway collision process first and assemble their planets quickly. That's what we could be seeing in the youngest stars. Their disks live hard and die young, shining brightly early on, then fading*," Meyer said. "*However, smaller, less massive disks will light up later. Planet formation in this case is delayed because there are fewer particles to collide with each other*." If this is correct and the most massive disks form their planets first and the wimpiest disks take 10 to 100 times longer, then up to 62 percent of the surveyed stars have formed, or may be forming, planets. "*The correct answer probably lies somewhere between the pessimistic case of less than 20 percent and optimistic case of more than 60 percent*," Meyer said. The next critical test of the assertion that terrestrial planets like Earth could be common around stars like the sun will come next year with the launch of the Kepler mission. http://www.spitzer.caltech.edu/spitzer and http://www.nasa.gov/spitzer

SPITZER CATCHES YOUNG STARS IN BABY BLANKET OF DUST

Newborn stars peek out from beneath their natal blanket of dust in this dynamic image of the Rho Ophiuchi dark cloud from the Spitzer Space Telescope. Called "Rho Oph" by astronomers, it's one of the closest star-forming regions to our own solar system. Located near the constellations Scorpius and Ophiuchus, the nebula is about 407 light years away from Earth. Rho Oph is made up of a large main cloud of molecular hydrogen, a key molecule allowing new stars to form out of cold cosmic gas, with two long streamers trailing off in different directions.

Recent studies using the latest X-ray and infrared observations reveal more than 300 young stellar objects within the large central cloud. Their median age is only 300,000 years, very young compared to some of the universe's oldest stars, which are more than 12 billion years old. "*Rho Oph is a favorite region for astronomers studying star formation. Because the stars are so young, we can observe them at a very early evolutionary stage, and because the Ophiuchus molecular cloud is relatively close, we can resolve more detail than in more distant clusters, like Orion*," said Lori Allen, lead investigator of the new observations. This false-color image of Rho Oph's main cloud, Lynds 1688, was created with data from Spitzer's infrared array camera, which has the highest spatial resolution of Spitzer's three imaging instruments, and its multiband imaging photometer, best for detecting cooler materials. The colors in this image reflect the relative temperatures and evolutionary states of the various stars. The youngest stars are surrounded by dusty disks of gas from which they and their potential planetary systems are forming. These young disk systems show up as red in this image. Some of these young stellar objects are surrounded by their own compact nebulae. More evolved stars, which have shed their natal material, are blue. The extended white nebula in the center right of the image is a region of the cloud glowing in infrared light due to the heating of dust by bright young stars near the cloud's right edge. Fainter, multi-hued diffuse emission fills the image. The color of the nebulosity depends on the temperature, composition and size of the dust grains. Most of the stars forming now are

concentrated in a filament of cold, dense gas that shows up as a dark cloud in the lower center and left side of the image against the bright background of the warm dust. http://www.spitzer.caltech.edu/spitzer http://www.nasa.gov/spitzer

SCIENTISTS STUDY "PLUMBING" IN PLUMES OF ENCELADUS

Scientists on the Cassini mission have become out-of-this world "plumbers" as they try to piece together what's happening inside the "pipes" feeding the plumes of Saturn's moon Enceladus. Enceladus is jetting out giant geysers three times the size of the moon, and now scientists are beginning to understand how the ice grains are created and how they might have formed. Knowing the process of how the plume forms and the path the water-ice particles have to travel is giving them an insight into what may be a liquid reservoir or lake lying just beneath the surface. "*Since Cassini discovered the water vapor geysers, we've all wondered where this water vapor and ice are coming from. Is it from an underground water reservoir or are there some other processes at work? Now, after looking at data from multiple instruments, we can say there probably is water beneath the surface of Enceladus*," said Juergen Schmidt, team member on Cassini's Cosmic Dust Analyzer.

The large number of ice particles observed spewing from the geysers and the steady rate at which these particles are produced require high temperatures, close to the melting point of ice, possibly resulting in an internal lake. The lake would be similar to Earth's Lake Vostok, beneath Antarctica, where liquid water exists locked in ice. The ice grains then condense in the vapor evaporating from the water, streaming through cracks in the ice crust to the surface. The presence of liquid water inside Enceladus would have major implications for future astrobiology studies on the possibility of life on bodies in the outer solar system.

Scientists have studied the plume dynamics since 2005, collecting data from several Cassini remote sensing instruments and those that sample particles directly, like the Cosmic Dust Analyzer. They conclude that an internal lake at a temperature of about 273 Kelvin (32 degrees Fahrenheit) is the best way to account for the material jetting out of the geysers. At these warm temperatures, liquid water, ice and water vapor mingle. The vapor escapes to the vacuum of space through cracks in Enceladus' ice crust. When the gas expands, it cools and the ice grains that make up the visible part of the plumes condense from the vapor. Vapor in the plumes is clocked at roughly the same speed as a supersonic jet, about 300 to 500 meters per second, or about 650 to 1,100 miles per hour. However, most of the condensed ice particles fail to reach Enceladus' escape velocity of 240 meters per second (536 miles per hour).

Pinball-like physics account for the slow speed of the particles. Shooting up through crooked cracks in the ice, the particles ricochet off the walls, losing speed, while the water vapor moves unimpeded up the crevasse. The vapor reboosts the frozen particles as they pinball off the walls, carrying them upward. Reaching nozzle-like openings at the surface, the faster-moving water vapor shoots high above Enceladus, becoming entrapped in Saturn's magnetosphere. Most of the particles, which have lost energy through collisions in transit, fail to achieve escape velocity and fall back to Enceladus' surface. Only about 10 percent escape Enceladus and form Saturn's E-ring. "*Our model provides a simple concept to understand how particles form, their speed and how they behave as they make their way out into space. If vapor temperature is too low, then the gas density is too small to push the grains out and we would not see such large amounts of particles*," said Schmidt. "*Therefore, we believe that at the site of evaporation, we must have temperatures near the melting point of water*." Scientists say that particles seen in the plumes are too numerous to have started from processes described in one existing model that requires low temperatures, proposing that gases may be trapped inside ice crystals. Another model suggests that water ice, suddenly exposed to the vacuum of space, sublimes, or boils, directly into vapor without liquefying first. But this would mean there are short bursts of activity, rather than the steady production of particles. The new model of grains condensing in a vent that evaporates from a liquid body is consistent with a steady production of particles, ejected from a localized source. This research provides fundamental knowledge about solar system bodies, in particular those that, like our home planet, are homes to oceans – environments where life might evolve. http://saturn.jpl.nasa.gov and http://www.nasa.gov/cassini

DEEP IMPACT BEGINS HUNT FOR ALIEN WORLDS

The Deep Impact spacecraft is aiming its largest telescope at five stars in a search for alien (exosolar) planets as it enters its extended mission, called Epoxi. Deep Impact made history when the mission team directed an impactor from the spacecraft into comet Tempel 1 on July 4, 2005. NASA recently extended the mission, redirecting the spacecraft for a flyby of comet Hartley 2 on Oct. 11, 2010. As it cruises toward the comet, Deep Impact will observe five nearby stars with "transiting exosolar planets," so named because the planet transits, or passes in front of, its star. The Epoxi team, led by astronomer Michael A'Hearn, directed the spacecraft to begin these observations Jan. 22. The planets were discovered earlier and are giant planets with massive atmospheres, like Jupiter in our solar system. They orbit their stars much closer than Earth does the sun, so they are hot and belong to the class of exosolar planets nicknamed "Hot Jupiters." However, these giant planets may not be alone. If there are other worlds around these stars, they might also transit the star and be discovered by the spacecraft. Deep Impact can even find planets that don't transit, using a timing technique. Gravity from the unseen planets will pull on the transiting planets, altering their orbits and the timing of their transits. "*We're on the hunt for planets down to the size of Earth, orbiting some of our closest neighboring stars*," said Epoxi Deputy Principal Investigator Drake Deming. Epoxi is a combination of the names for the two extended mission components: the exosolar planet observations, called Extrasolar Planet Observations and Characterization (Epoch), and the flyby of comet Hartley 2, called the Deep Impact Extended Investigation (Dixi).

More than 200 exosolar planets have been discovered to date. Most of these are detected indirectly, by the gravitational pull they exert on their parent star. Directly observing exosolar planets by detecting the light reflected from them is very difficult, because a star's brilliance obscures light coming from any planets orbiting it. However, sometimes the orbit of an exosolar world is aligned so that it eclipses its star as seen from Earth. In these rare cases, called transits, light from that planet can be seen directly. "*When the planet appears next to its star, your telescope captures their combined light. When the planet passes behind its star, your telescope only sees light from the star. By subtracting light from just the star from the combined light, you are left with light from the planet*," said Deming, who is leading the search for exosolar worlds with Deep Impact. "*We can analyze this light to discover what the atmospheres of these planets are like*." Deep Impact will also look back to observe Earth in visible and infrared wavelengths, allowing comparisons with future discoveries of Earth-like planets around other stars. http://www.nasa.gov/mission_pages/epoxi/

TITAN'S SURFACE ORGANICS SURPASS OIL ON EARTH

Saturn's orange moon Titan has hundreds of times more liquid hydrocarbons than all the known oil and natural gas reserves on Earth, according to new data from the Cassini spacecraft. The hydrocarbons rain from the sky, collecting in vast deposits that form lakes and dunes. The new findings from the study led by Ralph Lorenz, Cassini radar team member are reported in the Jan. 29 issue of the Geophysical Research Letters. "Titan is just covered in carbon-bearing material -- it's a giant factory of organic chemicals," said Lorenz. "This vast carbon inventory is an important window into the geology and climate history of Titan." At a balmy minus 179 degrees Celsius (minus 290 degrees Fahrenheit), Titan is a far cry from Earth. Instead of water, liquid hydrocarbons in the form of methane and ethane are present on the moon's surface, and tholins probably make up its dunes. The term "tholins" was coined by Carl Sagan in 1979 to describe the complex organic molecules at the heart of prebiotic chemistry.

Cassini has mapped about 20 percent of Titan's surface with radar. Several hundred lakes and seas have been observed, with each of several dozen estimated to contain more hydrocarbon liquid than Earth's oil and gas reserves. The dark dunes that run along the equator contain a volume of organics several hundred times larger than Earth's coal reserves. Proven reserves of natural gas on Earth total 130 billion tons, enough to provide 300 times the amount of energy the entire United States uses annually for residential heating, cooling and lighting. Dozens of Titan's lakes individually have the equivalent of at least this much energy in the form of methane and ethane. "*This global estimate is based mostly on views of the lakes in the northern polar regions. We have assumed the south might be similar, but we really don't yet know how much liquid is there*," said Lorenz. Cassini's radar has observed the south polar region only once, and only two small lakes were visible. Future observations of that area are planned during Cassini's proposed extended mission. Scientists estimated Titan's lake depth by making some general assumptions based on lakes on Earth. They took the average area and depth of lakes on Earth, taking into account the nearby surroundings, like mountains. On Earth, the lake depth is often 10 times less than the height of nearby terrain. "*We also know that some lakes are more than 10 meters or so deep because they appear literally pitch-black to the radar. If they were shallow we'd see the bottom, and we don't*," said Lorenz.

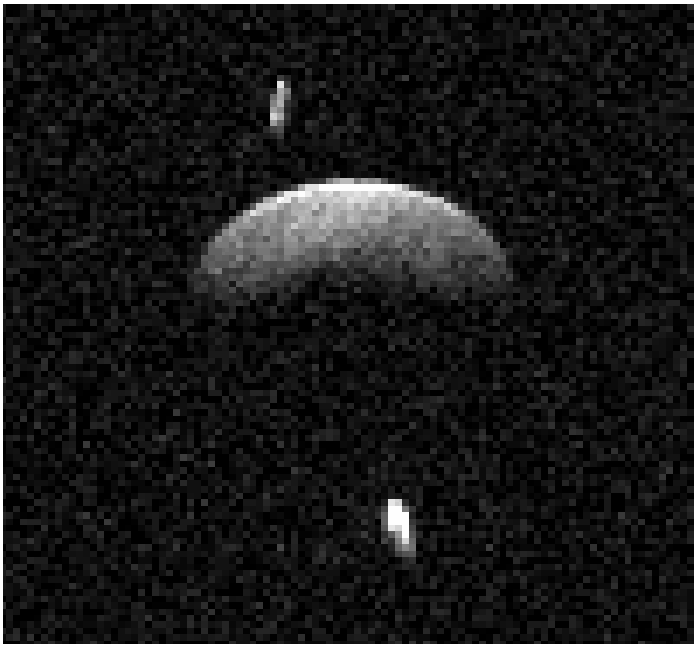
The question of how much liquid is on the surface is an important one because methane is a strong greenhouse gas on Titan as well as on Earth, but there is much more of it on Titan. If all the observed liquid on Titan is methane, it would only last a few million years, because as methane escapes into Titan's atmosphere, it breaks down and escapes into space. If the methane were to run out, Titan could become much colder. Scientists believe that methane might be supplied to the atmosphere by venting from the interior in cryovolcanic eruptions. If so, the amount of methane, and the temperature on Titan, may have fluctuated dramatically in Titan's past. "*We are carbon-based life, and understanding how far along the chain of complexity towards life that chemistry can go in an environment like Titan will be important in understanding the origins of life throughout the universe*," added Lorenz.

A Triple Near-Earth Asteroid – A Mere 7M Miles Away

Once considered just your average single asteroid, 2001 SN263 has now been revealed as the first near-Earth triple asteroid ever found. The asteroid -- with three bodies orbiting each other -- was discovered by astronomers at the sensitive radar telescope at Arecibo Observatory in Puerto Rico. Arecibo astronomer Michael Nolan said he and his colleagues made the discovery when they obtained radar images Feb. 11. The group subsequently took more images to learn that the three objects -- about 7 million miles from Earth -- are rotating around each other. The main, central body is spherical with a diameter of roughly 1.5 miles (2 km), while the larger of the two moons is about half that size. The smallest object is about 1,000 feet across, or about the size of the Arecibo telescope.

Other triple asteroids exist in the asteroid belt (between Mars and Jupiter) and beyond, but this is the first near-Earth system where the actual shapes of objects can be clearly seen. "*This discovery has extremely important implications for ideas about the origins of near-Earth asteroids and the processes responsible for their physical properties*," said Nolan. "*Double, or binary, asteroid systems are known to be fairly common -- about one in six near-Earth asteroids is a binary -- but this is the first near-Earth triple system to be discovered*." The object was first discovered visually Sept. 19, 2001, by the Lincoln Near Earth Asteroid Research (LINEAR) project. The orbits of binary -- and now triple -- asteroid systems unveil the mass and allow astronomers to assess whether they are stable over millennia or have formed very recently. Previous radar investigations of binary near-Earth asteroids have disclosed extraordinary physical and dynamical characteristics.

Nolan said this discovery prompts several important questions: Are the objects orbiting in the same plane? How rapidly are the orbits changing with time? Did the moons form when this asteroid formed in the main asteroid belt, or after it arrived in near-Earth space?



Because of the small sizes and irregularly shaped components, 2001 SN263 should offer unique insights relative to the much larger triple systems in the main asteroid belt, said Nolan. "*Examining the orbits of the moons as we continue to observe 2001 SN263 over the next few weeks may allow us to determine the density of the asteroid and type of material from which it is made*," he said. "*We will also be studying its shape, surface features and regolith [blanketing material] properties*."

Radar observations by the Arecibo Observatory can image a much larger fraction of the population of near-Earth asteroids than spacecraft. For example, Arecibo has discovered more than half of the near-Earth binary asteroid systems discovered since 1999. Continued observations will undoubtedly lead to the discovery of

new classes of objects, such as this triple system. While the Arecibo telescope is capable of these investigations, the future of the radar program and the entire telescope are in considerable doubt due to NSF budget cuts. http://www.news.cornell.edu/stories/Feb08/asteroid.png

DUSTY DISK AT NEARBY STAR MAY HIDE EARTH-LIKE PLANET

A recent survey by a team of Japanese astronomers may have found an Earth-like planet hidden in the dust around a nearby star. Using the Coronagraphic Imager with Adaptive Optics (CIAO) at the Subaru Telescope, researchers recently resolved a circumstellar disk around the young lightweight star FN Tau. The diminutive star is located in a star-forming region toward the Constellation Taurus at a distance 460 light years from Earth. This star is a youthful 100 thousand years old and weighs only one tenth of the Sun.

To ease understanding, a circumstellar disk is a mixture of gas and dust around a newly forming star. The disk accompanies almost most, if not all, sun-like star formation processes, and planets commonly form in this disk. The disk can also be referred to as a protoplanetary disk because the solid particles inside the disk collide and stick together and grow into planetesimals, which then crash into each other eventually accumulating enough mass to be stabilized as planets. In response to this scenario, the study of young stars and their surrounding structures provide details into the formation of planetary systems, and the search for planets outside our solar system motivates much of modern astronomy. Although hundreds have been found through indirect methods, being the first to directly image a planet around a nearby star is one of the primary goals of Subaru. The findings at FN Tau show that Subaru is on the right path toward planet discovery.

The FN Tau researchers pointed the Subaru Telescope toward the tiny star trying to detect lightweight disks. Their study found a thick, compact, and roughly circular protoplanetary disk with a radius 260 times the Earth- Sun distance. The disk is rather featureless, and does not have any anomalies or asymmetries, such as rings, spirals, or arms. The mass of the disk was estimated to be 6% of the central FN Tau star, and, by far, the least massive one directly detected. In result, the discovery is the combination of the most lightweight protoplanetary disk around the least massive star.

One of the questions to come out during the study was what kind of planets can be formed from the disk around FN Tau? To date, astronomers worldwide have found 270 extrasolar planets using the indirect detection method, and all are primarily Jupiter-like giant planets; the least massive exoplanet is still 5 times heavier than Earth. Because it surrounds a smaller star, the disk about FN Tau is believed to more likely contain Earth-like planets. The best-fit model used during this study shows that the lightweight disk around FN Tau could only produce Earth-like planets. The planetary system formation theory also predicted that the disk is able to form planets lighter than the Earth within 30 astronomical units (AU), the distance where we find planets in our Solar System. For the future, astronomers are hopeful of using Subaru's newest technologies for resolving the detailed structure of the disk to analyze the size and composition of the dust, culminating in the first image of a terrestrial planet near FN Tau.

MARS ROVERS SHARPEN QUESTIONS ABOUT LIVABILITY

Like salt used as a preservative, high concentrations of dissolved minerals in the wet, early-Mars environment known from discoveries by the Opportunity rover may have thwarted any microbes from developing or surviving. "*Not all water is fit to drink*," said Andrew Knoll, a member of the rover science team who is a biologist at Harvard. Opportunity spent recent months examining a bright band of rocks around the inner wall of a crater. Scientists previously hypothesized this material might preserve a record of the ground surface from just before the impact that excavated the crater. Inspection suggests that, instead, it was at the top of an underground water table, Squyres reported. Experiments with simulated Martian conditions and computer modeling are helping researchers refine earlier assessments of whether the long-ago conditions in the Meridiani area studied by Opportunity would have been hospitable to microbes. Chances look slimmer. "*At first, we focused on acidity, because the environment would have been very acidic*," Knoll said. "*Now, we also appreciate the high salinity of the water when it left behind the minerals Opportunity found. This tightens the noose on the possibility of life*." Conditions may have been more hospitable earlier, with water less briny, but later conditions at Meridiani and elsewhere on the surface of Mars appear to have been less hospitable, Knoll said. "*Life at the Martian surface would have been very challenging for the last 4 billion years. The best hopes for a story of life on Mars are at environments we haven't studied yet -- older ones, subsurface ones*," he said.

Opportunity and its twin, Spirit, began their fifth year on Mars last month, far surpassing their prime missions of three months. Scientists and engineers recently discussed new observations by the rovers, recent analysis of some earlier discoveries, and perspectives on which lessons from these rovers' successes apply to upcoming missions to Mars. "*The engineering efforts that have enabled the rovers' longevity have tremendously magnified the science return*," said Steve Squyres, principal investigator for the rovers' science payload. "*All of Spirit's most important findings, such as evidence for hot springs or steam vents, came **after** the prime mission*."

The current rovers and orbiters at Mars pursue the agency's "follow the water" theme for Mars exploration. They decipher the roles and fate of water on a planet whose most striking difference from Earth is a scarcity of water. Elachi cited the achievements of Spirit and Opportunity -- "*They have worked 16 times longer than planned, driven 20 times farther than planned, and, most important, found diverse geological records of the effects of water in ancient Martian environments*," he said. "*We must not let these successes lull us into thinking this type of exploration is easy. Fifty years into the Space Age, we are still in the golden age of robotic exploration of our solar system, when each mission is unprecedented in some way as we push the limits of what is possible. Each mission presents new challenges*."

"*Our next missions, Phoenix and Mars Science Laboratory, mark a transition from water to habitability -- assessing whether sites where there's been water have had conditions suited to life*," said Charles Elachi. "*Where conditions were habitable, later missions may look for evidence of life."* The Phoenix lander, on course to reach Mars on May 25, will assess habitability of a shallow subsurface environment of icy soil farther north than any earlier mission has landed. It revives technology from missions launched before Spirit and Opportunity. The following mission, the Mars Science Laboratory rover, will incorporate many lessons from the current rovers, said that project's manager, Richard Cook. "*The next rover will be much bigger to carry the instruments necessary for meeting its goals, but it would be laughable to consider doing Mars Science Laboratory without the experience gained from doing the Mars Exploration Rovers*," he said. The Mars Science Laboratory rover will weigh about four times as much as Spirit or Opportunity. "*There's no way we could use an airbag landing*," said Rob Manning, chief engineer for the future rover. Instead, a

rocket-powered hovering stage will lower it to the surface on a tether. Lessons from Spirit and Opportunity will come into play when it starts driving, though. "*With the current rovers, we've learned we can trust the autonomous navigation technology to a level we never expected, so now we can include that as a capability in our mission design for Mars Science Laboratory*," Manning said.

SATURN'S MINGLING MOONS MAY SHARE A DARK PAST

Despite the incredible diversity of Saturn's icy moons, theirs is a story of great interaction. Some of them are pock-marked, some seemingly dirty, others pristine, one spongy, one two-faced, some still spewing with activity and some seeming to be captured from the far reaches of the solar system. Yet many of them have a common thread -- black "stuff" coating their surfaces.

"*We are beginning to unravel the mysteries of these different and strange moons*," said Rosaly Lopes, Cassini scientist. She coordinated a special section of 14 papers about Saturn's icy moons that appears in the February issue of the journal Icarus. Taken together, the papers bring an idea that Cassini scientist Bonnie Buratti calls "the ecology of the Saturn system" to the forefront. "*Ecology is about your entire environment -- not just one body, but how they all interact*," said Buratti. "*The Saturn system is really interesting, and if you look at the surfaces of the moons, they seem to be altered in ways that aren't intrinsic to them. There seems to be some transport in this system*." Though the details of that transport are not yet clear, mounting evidence suggests that some mechanism has spread the mysterious dark material found on several of the moons from one to another; the material may even have a common cometary origin. Along those lines, several of the new papers focus on similarities between the dark material found on different moons -- on Hyperion and Iapetus, for example, or between Phoebe and Iapetus.

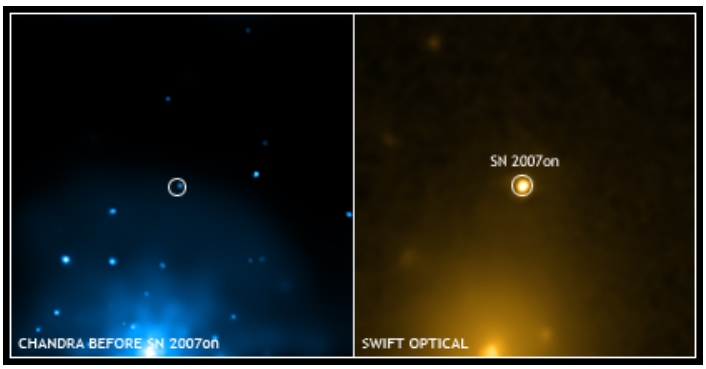
Roger Clark of the USGS goes further, saying, "*We see the same spectral signature on all the moons that have coatings of dark material*." Clark is lead author of one of the new papers, which focuses on Saturn's moon Dione. His team found the dark material there to be extremely fine-grained, making up only a very thin layer on the moon's trailing side. Its distribution and composition, as measured by the Cassini visual and infrared mapping spectrometer, indicate that the dark material is not native to Dione. And scientists see many of the same signatures there that appear on the moons Phoebe, Iapetus, Hyperion and Epimetheus, and also in Saturn's F-ring. As for where this material comes from and what the dark material is, Clark said, "*It's a mystery, which makes it intriguing. We're still trying to find the exact match*." The visual and infrared spectrometer detected unique absorption bands in the dark material within the Saturn system, which scientists have not seen anywhere else in the solar system. "The data keep getting better and better," he said. "*We're ruling things out and figuring out pieces*." So far, the team has identified bound water and, possibly, ammonia in the dark material.

Ongoing geologic activity is another component of Saturn's ecology as some of the moons continue to feed the planet's rings, which in turn affect many of the moons. Clark's team reports tentative evidence to support the hypothesis presented earlier this year that Dione is still geologically active. In one series of observations, the infrared spectrometer detected a cloud of methane and water ice encircling Dione in its orbit within the outer portions of Saturn's E-ring. Of course the big story is the icy plumes spewing from the warm, south polar region of Enceladus. These plumes are believed to be feeding the E-ring. A paper led by Frank Postberg says there are traces of organic compounds or silicate materials within the water ice-dominated E-ring, close to Enceladus. This implies that the moon's rocky core and liquid water are dynamically interacting. The finding could bolster a theory that Dennis Matson and Julie Castillo put forth this year, which said that a warm, organic brew might lie just below Enceladus' surface.

POSSIBLE PROGENITOR OF SUPERNOVA TYPE Ia DETECTED

Using data from Chandra X-ray Observatory, scientists have reported the possible detection of a binary star system that was later destroyed in a supernova explosion. The new method they used provides great future promise for finding the detailed origin of these important cosmic events. Rasmus Voss and Gijs Nelemans searched Chandra images for evidence of a much sought after, but as yet unobserved binary system – one that was about to go supernova. Near the position of a recently detected supernova, they discovered an object in Chandra images taken more than four years before the explosion. The supernova, known as SN 2007on, was identified as a Type Ia supernova. Astronomers generally agree that Type Ia supernovas are produced by the explosion of a white dwarf star in a binary star system. However, the exact configuration and trigger for the explosion is unclear. Is the explosion caused by a collision between two white dwarfs, or because a white dwarf became unstable by pulling too much material off a companion star? Answering such questions is a high priority because Type Ia supernovas are major sources of iron in the Universe. Also, because of their nearly uniform intrinsic brightness, Type Ia supernova are used as important tools by scientists to study the nature of dark energy and other cosmological issues. "*Right now these supernovas are used as black boxes to measure distances and derive the rate of expansion of the universe*," said Nelemans. "*What we're trying to do is look inside the box*."

If the supernova explosion is caused by material being pulled off a companion star onto the white dwarf, fusion of this material on the surface of the star should heat the star and produce a strong source of X-radiation prior to the explosion. Once the supernova explosion occurs, the white dwarf is expected to be completely destroyed and then would be undetectable in X-rays. In the merger scenario, the intensity of X-ray emission prior to the explosion is expected to be much weaker. Based on the detection of a fairly strong X-ray source at approximately the position of SN 2007on 4 years before the explosion, Voss and Nelemans conclude that the data support the scenario where matter is pulled off a companion star. The small number of X-ray sources in the field implies that there is only a small chance of an unrelated source being so close by coincidence. Also, the X-ray source has similar properties to those expected for fusion on a white dwarf, unlike most X-ray sources in the sky.



However, in follow-up studies, Voss, Nelemans and colleagues Gijs Roelofs and Cees Bassa used higher-quality optical images

to better determine the supernova's position. This work, which is not yet published, shows a small, but significant difference in the measured positions of the supernova and the X-ray source, suggesting the source may not be the progenitor.

Follow-up Chandra observations hint that the X-ray object has disappeared, but further observations are needed to finally decide whether the source was the progenitor or not. The team is also applying this new method to other supernovas and has high hopes that they will eventually succeed in identifying the elusive cause of at least some of these explosions. "*We're very excited about opening up a new way of studying supernovas, even though we're not sure that we've seen this particular stellar bomb before it exploded*," said Gijs Roelofs. "*We're very confident that we'll learn a lot more about these important supernovas in the future*." Voss agrees that, even if the X-ray source is not found to be the progenitor of SN 2007on, the hunt is worth the effort. "*Finding the progenitor to one of these Type Ia supernovas is a great chase in astronomy right now*," he said. "*These supernovas are great tools for studying dark energy, but if we knew more about how they form they might become even better tools*." http://chandra.harvard.edu

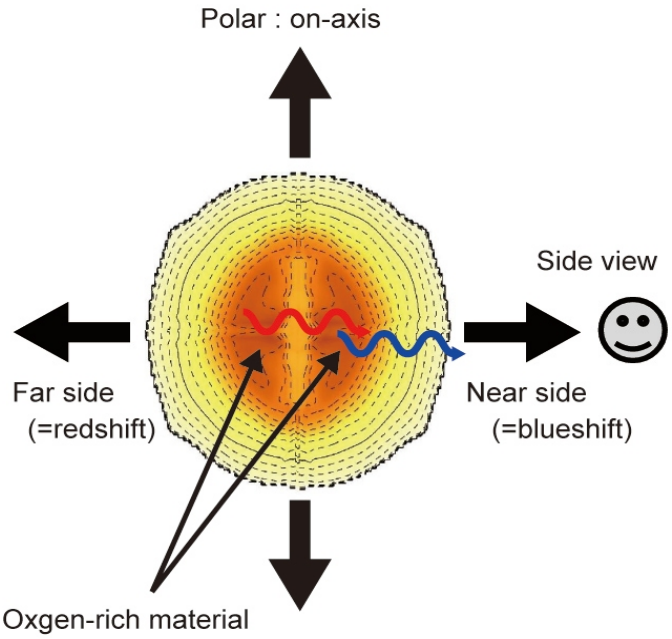
SUPERNOVAE ARE NOT ROUND

An international team has uncovered the shape of core-collapse supernovae. They used the Subaru Telescope to discover that supernovae are not round but rather pencil-like. The result sheds light on actively debated unsolved topics in astrophysics: the explosion mechanisms of supernovae and gamma-ray bursts. Massive stars (more than 10 times the Sun) end their lives with a bang. The massive stars' death is triggered by the gravitational collapse of the inner core. The central region becomes superdense by this collapse, leaving a neutron star or even a black hole. A neutron star is a compact star as massive as the Sun within about 10 km of radius, and a black hole has such a strong gravitational pull that even light cannot escape. As an outcome of the collapse, the energy of the falling matter is somehow transferred to the outer part of the star leading to a supernova explosion. However, there has been a big problem in this theory: astrophysicists have not been successful in understanding the detailed mechanism that turns the collapse into an explosion as we can see in telescopes. In recent years, interesting theories have been proposed to understand the explosion mechanism. The key is to make the collapse not round and the explosion pencil-like, like two cannons placed back to back.

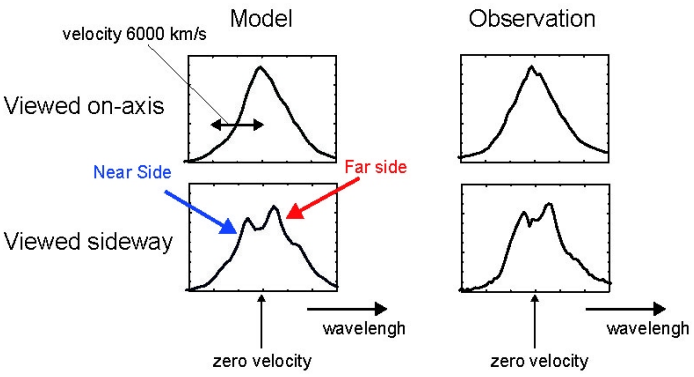
Materials thrown out by the explosion actually keep expanding even years later. If one can see the shape of the expanding materials, it will tell astrophysicists details about the original explosion. However, a supernova explosion gives out such a dense gas that it has been impossible to see what is going on at its core. In addition, most supernovae take place in other galaxies, namely about a few hundred million light years away, and it is impossible to see the image of their shape directly. It has been a great challenge to astrophysicists to observe the shape of very core of a supernova explosion.

Keiichi Maeda and his colleagues had predicted theoretically that a line profile of light emitted by oxygen could tell them the shape of expanding materials. Most importantly, they realized that it is possible to judge whether a supernova is round by studying the color (spectrum) of a supernova at late-times, namely 200 days after the explosion. Then the outer part of the exploded star becomes thin enough so that we can see directly into the expanding core. The light emitted from the expanding oxygen atoms becomes slightly bluer or redder by Doppler effects, depending on if the gas is moving towards or away from us. Studying the small change in color of the light, they proposed to determine the shape of the expanding core.

The research has collected late-time spectra of 15 supernovae using the 8.2 m Subaru telescope and the Very Large Telescope (European Southern Observatory). Even with these largest telescopes, the observation was challenging, because a supernova is extremely faint at such a late phase after 200 days since the explosion. Indeed, such observations had been available only for a few supernovae before the present work and it was not possible to tell if they were special in some way or of garden-variety types.



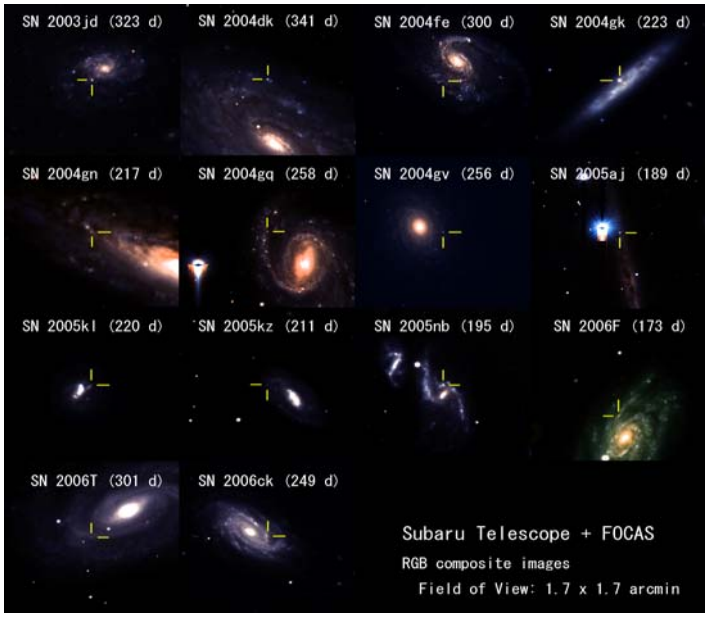
A large sample of observations is essential in their investigation. It is difficult to clearly distinguish the two cases -- a round explosion or a pencil-like explosion viewed from the pointed direction -- for a single object. With ten or more supernovae, however, it becomes possible to derive the detailed, generic shape, because the random orientation relative to the viewing angle from the Earth allows removing the uncertainty by a statistical analysis. They found five supernovae showing a clear signature of a pencil-like explosion viewed from the side, and four supernovae with hints of such a feature. Considering that pencil-like explosion appear round if these are viewed from the pointed direction, the probability of seeing the feature of pencil-like explosion indicates that all supernovae are not round. This is the first observational confirmation that supernovae are in general not round.



Their result supports recent theoretical scenarios of pencil-like supernova explosion, namely by hydrodynamic instability (i.e.,

the vibration of the shock waves), or rotation plus a magnetic field. "*Also important is*," says Maeda, the first author of the paper, "*the finding that the deviation from spherical symmetry looks smaller in usual supernovae than in extreme ones associated with gamma-ray bursts*." He adds, "*And it strongly indicates that the explosion mechanisms of the supernovae linked to gamma-ray bursts and other usual supernovae are intrinsically different*." According to him, the team plans to look into more details of individual theoretical scenarios and compare those with the observations. "*This is even more challenging than the present study, both in theory and observation. But we believe this is within the reach*," says Maeda.

If the explosion is more or less round, the oxygen-rich core of a supernova progenitor star is thrown out as a shell, resulting in a "single-peaked" oxygen emission line when intensity of light is shown as a function of its color. On the other hand, if the explosion is pencil-like (or like canon balls), the oxygen-rich materials are ejected mostly along the equatorial direction as a "doughnut". The oxygen emission line profile is then predicted to be "single-peaked" for an on-axis observer, but "double-peaked" for an observer looking at the supernova sideways. This stems from different Doppler shift -- longer/shorter wavelength detected for materials moving away from/toward the observer.



Images of supernovae at the late-phase observed by the Subaru telescope. A few supernovae were also observed with the Very Large Telescope.

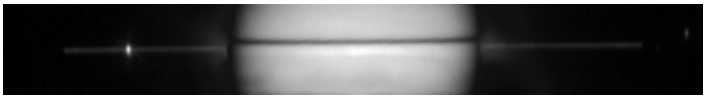
THE VANISHING RINGS OF SATURN

Saturn: jewel of the solar system, taker of breaths, ringed beauty. Even veteran astronomers can't help but gasp when they see her through a small telescope. Saturn's rings are vanishing! Around the world, amateur astronomers have noticed the change; Saturn's wide open rings are rapidly narrowing into a thin line. Efrain Morales Rivera sends these pictures taken through a backyard telescope in Aguadilla, Puerto Rico: "*The rings have narrowed considerably in the last year*," he reports. "*The Cassini division (a dark gap in the rings) is getting hard to see*."

Four hundred years ago, the same phenomenon puzzled Galileo. Peering through a primitive spy glass, he discovered Saturn's rings in 1610 and immediately wrote to his Medici patrons: "*I found another very strange wonder, which I should like to make known to their Highnesses…."* He was dumbfounded, however, when the rings winked out little more than a year later. What happened? The same thing that's happening now: we're experiencing a "ring plane crossing." As Saturn goes around the sun, it periodically turns its rings edge-on to Earth—once every 14-to-15 years. Because the rings are so thin, they can actually disappear when viewed through a small telescope.

In the months ahead, Saturn's rings will become thinner and thinner until, on Sept. 4, 2009, they vanish (while Saturn is behind the Sun as viewed from Earth). When this happened to Galileo in 1612, he briefly abandoned his study of the planet. Big mistake: ring plane crossings are good times to discover new Saturnian moons and faint outer rings. It's also a good time to behold Saturn's curiously blue north pole. In 2005 the Cassini spacecraft flew over Saturn's northern hemisphere and found the skies there as azure as Earth itself. Saturn is a planet of golden clouds, but for some reason clouds at high northern latitudes have cleared, revealing a dome of surprising blue. For years, only Cassini has enjoyed the view from this angle, because from Earth, the blue top of Saturn was hidden behind the rings. No more: "*Now that Saturn's rings are only open 8 degrees, we can finally view its northern hemisphere's beautiful teal blue colored belts and zones, which really did look blue through my 10-inch telescope*," reports Dan Petersen of Racine, Wisconsin, who took this picture http://science.nasa.gov/headlines/y2008/images/saturn/Dan-Petersen1.jpg on Feb. 24, 2008.

Galileo never understood the true nature of Saturn's rings. He didn't know that they were a disk-shaped swarm of orbiting moonlets ranging in size from microscopic dust to tumbling houses. (Scientists still aren't sure, but they may be debris from a shattered moon.) He didn't even know the rings were rings. Through his 17th-century telescope, they looked more like ears or planetary lobes of some kind. Yet, somehow, his intuition guided him to make a correct prediction: "*they'll be back*," or Italian words to that effect. And he was right. Saturn's rings opened up again and scientists resumed their study. In 1659, Christaan Huygens correctly explained the periodic disappearances as ring plane crossings. In 1660, Jean Chapelain argued that Saturn's rings were not solid, but made instead of many small particles independently orbiting Saturn. His correct suggestion was not widely accepted for nearly two hundred years.



Above: Saturn's rings are wide but very thin. Astronomers using the Hubble Space Telescope captured this image of the rings edge-on in 1995. Star-like objects in the ring plane are icy satellites. Almost 27 ring plane crossings later, we still marvel at Saturn. Even with rings diminished, she is still a breathtaking sight through the meanest of telescopes. Indeed, this is a good week to look.

SPRING IS AURORA SEASON

What are the signs of spring? They are as familiar as a blooming Daffodil, a songbird at dawn, a surprising shaft of warmth from the afternoon sun. And, oh yes, don't forget the aurora borealis.

Spring is aurora season. For reasons not fully understood by scientists, the weeks around the vernal equinox are prone to Northern Lights. Canadians walking their dogs after dinner, Scandinavians popping out to the sauna, Alaskan Huskies on the Iditarod trail—all they have to do is look up and behold, green curtains of light dancing across the night sky. Spring has arrived! This is a bit of a puzzle. Auroras are caused by solar activity, but the Sun doesn't know what season it is on Earth. Yet it seemed to know on March 1st when these lights erupted over Tromso, Norway: "*It was a very powerful outburst of Northern Lights*," says photographer Bjorn Jorgensen. "*The ground actually turned green!"*

Such outbursts are called auroral substorms and they have long puzzled space physicists. Often sighted in springtime, "*substorms erupt with little warning and sometimes shocking intensity*," says space physicist Vassilis Angelopoulos. "*They're a big mystery*." Angelopoulos is the Principal Investigator of THEMIS mission--a fleet of five spacecraft launched in Feb. 2007 to study the substorm phenomenon. The Polar spacecraft, which can detect auroras in broad daylight using special UV filters, has also joined the effort. It is a puzzle worthy of many spacecraft. Underlying each display of pretty lights is a potent geomagnetic storm. THEMIS observed one recently with a total energy of five hundred thousand billion (5 x 1014) Joules. "*That's approximately equivalent to the energy of a magnitude 5 earthquake*," says Angelopoulos. Possible side-effects of such storms range from satellite malfunctions to home power outages; telecommunications, air traffic and GPS systems are all vulnerable. "*In a society that relies increasingly on space technology, understanding substorms is vital*."

THEMIS may have found the substorm power supply--and a springtime connection: "*The satellites have detected magnetic 'ropes' connecting Earth's upper atmosphere directly to the Sun*," says Dave Sibeck, project scientist for the mission. "*We believe that solar wind particles flow in along these ropes, providing energy for geomagnetic storms and auroras*." It turns out that rope-like magnetic connections between Sun and Earth are favored in springtime. It's a matter of geometry: As Earth goes around in its orbit, Earth's tilted magnetic poles make different angles with respect to the Sun, tipping back and forth with a one-year cadence. Around the time of the equinox, Earth's magnetic field is best oriented for "connecting-up" with the Sun. But wait, there are two equinoxes, spring and fall, with similar magnetic geometry. Indeed, studies show that fall is aurora season, too. Geomagnetic disturbances are almost twice as likely in spring and fall vs. winter and summer, according to 75 years of historical records analyzed by solar physicist David Hathaway. So, 'tis the season for auroras--and lots of data for THEMIS. Says Sibeck, "*we welcome the spring!"*

A 'NAKED-EYE' GAMMA RAY BURST

A powerful gamma ray burst detected March 19th by the Swift satellite has shattered the record for the most distant object that could be seen with the naked eye. "*It was a whopper*," says Swift principal investigator Neil Gehrels. "*This blows away every gamma ray burst we've seen so far*." Swift's Burst Alert Telescope picked up the burst at 2:12 a.m. EDT on March 19, 2008, and pinpointed the coordinates in the constellation Bootes. Telescopes in space and on the ground quickly moved to observe the afterglow. The burst was named GRB 080319B and registered between 5 and 6 on the visual magnitude scale used by astronomers. (A mag. 6 star is the dimmest visible to the human eye; mag. 5 is almost three times brighter.) Later that evening, the Very Large Telescope in Chile and the Hobby-Eberly Telescope in Texas measured the burst's redshift at 0.94. A redshift is a measure of the distance to an object. A redshift of 0.94 translates into a distance of 7.5 billion light years, meaning the explosion took place 7.5 billion years ago, a time when the universe was less than half its current age and Earth had yet to form. This is more than halfway across the visible universe. "*No other known object or type of explosion could be seen by the naked eye at such an immense distance*," says Swift science team member Stephen Holland of Goddard. "*If someone just happened to be looking at the right place at the right time, they saw the most distant object ever seen by human eyes without optical aid."*

Most gamma ray bursts occur when massive stars run out of nuclear fuel. Their cores collapse to form black holes or neutron stars, releasing an intense burst of high-energy gamma rays and ejecting particle jets that rip through space at nearly the speed of light. When the jets plow into surrounding interstellar clouds, they heat the gas to incandescent visibility. It is this gaseous "afterglow" which was visible to the human eye on March 19th. GRB 080319B's afterglow was 2.5 million times more luminous than the most luminous supernova ever recorded, making it the most intrinsically bright object ever observed by humans in the universe. The most distant previous object that could have been seen by the naked eye is the nearby galaxy M33, a relatively short 2.9 million light-years from Earth.

Analysis of GRB 080319B is just getting underway, so astronomers don't know why this burst and its afterglow were so bright. One possibility is the burst was more energetic than others, perhaps because of the mass, spin, or magnetic field of the progenitor star or its jet. Or perhaps it concentrated its energy in a narrow jet that was aimed directly at Earth. GRB 080319B was one of four bursts that Swift detected on March 19th, a Swift record for one day. Swift science team member Judith Racusin comments, "*coincidentally, the passing of Arthur C. Clarke seems to have set the universe ablaze with gamma ray bursts."* A fitting farewell, indeed.

FROM THE EDITOR'S TERMINAL

The Stargazer is <u>your</u> 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 March's StarGazer:

The next EAS Meeting is 7:00 P.M. Saturday March 29th at the 'Aurora Astro Products' store location at Silver Lake.