

The Stargazer

February 2010

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

See EAS website at:
<http://everettastro.org>

EAS BUSINESS...

EAS MEETING - SATURDAY FEBRUARY 27TH - 3:00 PM, AT THE *EVERGREEN BRANCH OF EVERETT PUBLIC LIBRARY*

The February club meeting will be on the last weekend of the month, **Saturday the 27th at 3:00 pm** at the ***Evergreen branch*** of the **Everett Public Library** (not the main downtown branch) located at [9512 Evergreen Way](http://9512EvergreenWay). Ph - 425-257-8260 <http://epls.org/ebmap.asp>

The speaker will be amateur astronomer Alan Bédard from the Lynnwood area, talking about his recent experiences getting started doing amateur photometry measurements of the brightness curves of variable stars such as cataclysmic variables, with simple amateur telescopes and low cost astro-cameras like the DSI II, and making an actual contribution to science. He submits his data to groups like the Center for Backyard Astrophysics and the American Association of Variable Star Observers. He also will describe how he came to own a ready-made observatory near Cle Elem and Table Mt to do his observing from. (The previously planned observatory tour this month at Jack Barnes will be moved to March 20th). **Attending members will be eligible for a monthly door prize.**

★ STAR PARTY INFO ★

★ Scheduled EAS Star Parties at Ron Tam's: ★

First star party of season successfully held February 20th !
EAS member Ron Tam has offered a flexible opportunity to EAS members to come to his home north of Snohomish for observing on clear weekend evenings and for EAS starparties. Anyone wishing to do so needs to contact him in advance and confirm available dates, and let him know if plans change. *"Our place is open for star parties any Saturday except weekends of the Full Moon. People can call to get weather conditions or to confirm that there is a star party. Our phone number is (360) 568-5152. They can e-mail me too (tam1951@verizon.net) but I don't check my email daily. They can email me for directions if they never have been out here."* Listed below are proposed dates for **planned EAS star parties** at my [Ron Tam's]

place, depending upon the weather, of course. Call Ron about spur-of-the-moment observing.

Please also join the EAS mail list, and then send mail to the mail list at 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.

Other Western US Star Parties This Season

MARCH -

Mar 12-14 - RCA Messier Marathon Star Party, Kah-Nee-Ta Resort and Casino, Warm Springs, OR - <http://www.rca-omsi.org/sp/kahneeta.htm>

Mar 12-14 - RCA Maupin Dark Sky Star Party, Maupin, OR - <http://www.rca-omsi.org/sp/maupin.htm>

Mar 13 - YVAC Messier Marathon - Big Pines Rec.Site - Yakima River Canyon - 3 mi. N of Roza dam, S of Ellensburg

Mar 20 - International Sidewalk Astronomy Night (ISAN) - <http://www.sidewalkastronomers.us/id220.html>

Mar 27 - OMSI-RCA Vernal Equinox Star Party, Rooster Rock State Park & Stub Stewart State Park, OR http://www.rca-omsi.org/sp/sp_schedule.htm http://www.rca-omsi.org/sp/r_rock.htm

APRIL -

Apr 8-11 Southern New Mexico Star Party - City of Rocks State Park - Silver City, NM, <http://www.astro-npo.org/>

Apr 16-18 - RCA Maupin Dark Sky Star Party, Maupin, OR - <http://www.rca-omsi.org/sp/maupin.htm>

Apr 16 & 17, or 23 & 24 (tba) - EAS Astronomy Day Star Party

MAY -

May 4-5 - Farewell Bend Public Star Party, Farewell Bend State Park, Huntington OR - <http://www.boiseastro.org>

May 9-16 - Texas Star Party (TSP), Prude Ranch, Fort Davis, TX - <http://www.texasstarparty.org/>

May 13-16 - OAS Camp Delany Star Party, Sun Lakes SP - <http://www.olympicastrologicalsociety.org/Documents/Camp%20Delany%20Sign-up%20Form%20Spring%202010.pdf>
<http://www.olympicastrologicalsociety.org>

May 15 - OMSI-RCA Planet Parade Star Party, Rooster Rock State Park & Stub Stewart State Park, OR http://www.rca-omsi.org/sp/sp_schedule.htm

May 15 - RCA Prineville Reservoir Star Party, Prineville, OR - http://www.rca-omsi.org/sp/sp_schedule.htm
<http://www.prinevillereservoirstarparty.org/index.html>

May 14-16 - RCA Maupin Dark Sky Star Party, Maupin, OR - <http://www.rca-omsi.org/sp/maupin.htm>

May 12-16 (Memorial Day) - Annual RTMC Astronomy Expo, Riverside, CA - <http://www.rtmcastronomyexpo.org/>

May 28-31 - Fire in the Sky – Rocket Launch & Star Party, Mansfield, WA - <http://www.fireinthesky.org/> <http://www.tas-online.org/escal/popups/escalEV.php?ev=14759&readFile=0&readSQL=1>
<http://www.tas-online.org/calendar.php>

JUNE -

Jun 05 - OMSI-RCA Summer Solstice Star Party, Rooster Rock State Park & Stub Stewart State Park, OR http://www.rca-omsi.org/sp/r_rock.htm http://www.rca-omsi.org/sp/sp_schedule.htm

Jun 12 – RCA White River Canyon star party, Mt. Hood OR. - <http://www.rca-omsi.org/sp/whiteriver.htm>

Jun 11-12 Craters of the Moon Star Party, Craters of the Moon Nat. Monument, ID - <http://www.boiseastro.org/> Contact <http://mvastro.org>

Jun 5-12 Grand Canyon Star Party (GCSP), On South Rim - <http://www.tucsonastronomy.org/gcsp.html>

Jun 9-13 - The Rocky Mountain Star Stare (RMSS), Pike Nat Forest, Colorado Springs, CO <http://www.rmss.org/>

Jun 17-20 - Bryce Canyon Astronomy Festival, Bryce Canyon Nat. Pk, UT <http://www.nps.gov/bcrca/planyourvisit/astronomyprograms.htm>

Jun 19 Bogus Basin Star Party Bogus Basin

tba - Stars Over Yellowstone Star Parties, Madison Campground Amphitheater - <http://smasweb.org/>

JULY -

Jul 9-11 - Trout Lake Star Party Weekend, Trout Lake WA http://www.rca-omsi.org/sp/sp_schedule.htm <http://www.rca-omsi.org/sp/pix/troutlake.pdf>

Jul 10-14 - Golden State Star Party (GSSP), Frosty Acres Ranch, Adin, CA - <http://www.goldenstatestarparty.org/>

Jul 15-18, - Mt Bachelor Star Party (MBSP), Sunriver (Bend) OR <http://www.mbsp.org/>

Jul 16 - MVAS City of Rocks Star Party - Almo ID - contact <http://mvastro.org>

Jul 16-17 - Ponderosa State Park Public Star Party - Ponderosa State Park, McCall ID <http://www.boiseastro.org/>

Jul 17 - OMSI Lunar Viewing, Rooster Rock & Stub Stewart St. Parks, OR - http://www.rca-omsi.org/sp/sp_schedule.htm

Jul tba - Lava Hot Springs Star Party 2009, Lava Hot Springs ID - <http://ifaastro.org/web/index.php>

AUGUST -

Aug 4-6 - 19th Annual 'Weekend Under the Stars', Foxpark WY - <http://home.bresnan.net/~curranm/wuts.html>

Aug 6-8 - RCA Maupin Dark Sky Star Party, Maupin, OR - <http://www.rca-omsi.org/sp/maupin.htm>

Aug 7 – RCA White River Canyon star party, Mt. Hood OR. - <http://www.rca-omsi.org/sp/whiteriver.htm>

Aug 7-15 - Mt. Kobau Star Party (MKSP), Mt. Kobau, near Osoyoos BC <http://www.mksp.ca/>

Aug 12-15 - Table Mt. Star Party (TMSP), Ellensburg WA <http://www.tmspa.com/>

Aug 11-15 - Oregon Star Party (OSP), Ochocco NF <http://www.oregonstarparty.org/>

Aug 13-15 - Island Star Party (ISP), Victoria Fish & Game Assoc - Holker Place, Metchosin (near Victoria), BC, CA <http://victoria.rasc.ca/events/StarParty/>
<http://www.starfinders.ca/starparty.htm>

Aug 12 - OMSI-RCA Perseid Meteor Shower Star Party, Rooster Rock State Park & Stub Stewart State Park, OR http://www.rca-omsi.org/sp/sp_schedule.htm

tba - Deception Pass Star Party, Bowman Bay, Deception Pass, WA - http://squakmountain.org/deception_pass_star_party.htm
<http://squakmountain.org/events.html#upcoming>

Aug (Labor Day) - SAS Brooks Memorial Park Star Party, SR 97 near Goldendale - <http://www.seattleastro.org/events.shtml>

SEPTEMBER -

Sep 3-5 - RCA Maupin Dark Sky Star Party, Maupin, OR - <http://www.rca-omsi.org/sp/maupin.htm>

Sep 4-11 - Merritt Star Quest - Loon Lake Road - Merritt, BC - <http://www.merrittastronomical.com/>

Sep 9-11 - Orion Nebula 2010 Star Party, Table Mt. (Ellensburg) WA <http://www.seattleastro.org/orionnebbsp.shtml>

Sep 10-12 - Idaho Star Party, Bruneau Dunes State Park - <http://ifaastro.org/web/index.php> (Boise AS) <http://www.boiseastro.org/>

Sep 11-12 - White Sands Star Party, Alamogordo/White Sands, NM - <http://www.zianet.com/wssp/>

Sep 10-12 - RCA Dark Sky Camp Weekend, Camp Hancock, OR - http://www.rca-omsi.org/sp/sp_schedule.htm

tba - CalStar, Lake San Antonio Park CA <http://www.sjaa.net/calstar/> - <http://www.sjaa.net/>

Sep 10-11 - Craters of the Moon Star Party, Craters of the Moon Nat. Monument, ID <http://ifaastro.org/web/index.php>
<http://www.boiseastro.org/>

Sep 11-12 - Alberta Star Party, Starland Recreation Area Campground near Drumheller, Alberta, CA <http://www.astronomycalgary.com/events/info/155>
<http://calgary.rasc.ca/asp2010.htm>

OCTOBER -

Oct 8-11 - OAS Camp Delany Fall Star Party, Sun Lakes SP - <http://www.olympicastronomicalsociety.com/Documents/FALLCAMPD/ELANYSign-UpForm.pdf>

Oct 7-9 - Sun River Star Party, Brothers, OR http://www.rca-omsi.org/sp/sp_schedule.htm

Oct 6-10 - The Enchanted Skies Star Party, Socorro NM - <http://enchantedskies.org/>

(tba) - All Arizona Star Party (near Arizona City, AZ) - <http://www.eastvalleyastronomy.org/aasp.htm>

NOVEMBER -

Nov 4-7 - Nightfall, Palm Canyon Resort, Borrego Springs, CA <http://www.rtmcastronomyexpo.org/nightfall.htm>

Nov tba - Night Under the Stars, Alamo Lake, AZ - <http://azstateparks.com/Parks/ALLA/events.html>

Other Star Parties:

<http://www.cloudynights.com/ubbthreads/showflat.php/Cat/0/Number/2858373/Main/2858366>

2010 ASTRO CALENDAR

February 2010

Feb 14 - Chinese New Year (Year of the Tiger), and Valentine's Day

Feb 20 - EAS Star Party at Ron Tam's

Feb 22 - Asteroid 4 Vesta Closest Approach To Earth (1.411 AU)

Feb 27 – EAS Meeting – 3:00 PM – Evergreen Branch Library

March 2010

Mar 14 - Daylight Savings - Set Clock Ahead 1 Hour (United States)

Mar 12-14 - RCA Messier Marathon Star Party, Kah-Nee-Ta Resort, OR

Mar 12-14 - RCA Maupin Dark Sky Star Party, Maupin, OR

Mar 20 - Vernal Equinox, 17:32 UT - Sun crosses equator, headed north

Mar 20 – EAS Meeting 7:00 pm - Open House at Jack Barnes Observatory

Mar 21 - Saturn at Opposition

April 2010

Apr 04 - Easter Sunday
 Apr 08 - Mercury at Its Greatest Eastern Elongation (19 Degrees)
 Apr 19-25 - Astronomy Week
Apr 10 – EAS Meeting – 3:00 pm Evergreen Branch Library
 Apr 10 - OMSI Astronomical Photometry, Spectroscopy & Astrometry Workshop
 - Portland, OR
 Apr 22 - Lyrids Meteor Shower Peak
 Apr 16-17, -OR- 23-24 – EAS Astronomy Day Star Parties – Harborview Park
Apr 24 – EAS Astronomy Day – Both Everett Library Locations – All Day 9-6

May 2010

May 02 - Asteroid 2 Pallas Occults TYC 2026-01347-1 (11.9 Mag Star)
 May 05 - Eta Aquarids Meteor Shower Peak
 May 07 - Space Day
 May tba – EAS Meeting - location tba
 May 16 - Moon Occults Venus
 May 26 - Mercury At Its Greatest Western Elongation (25 Degrees)

June 2010

Jun 11 - Asteroid 1 Ceres Occults TYC 6845-00708-1 (11.6 Mag Star)
 Jun 12 - New Moon .
 Jun 15 - Asteroid 1 Ceres Closest Approach To Earth (1.825 AU)
 Jun 20 - Asteroid 1 Ceres Occults TYC 6832-00337-1 (11.3 Mag Star)
 Jun tba – EAS Meeting – location tba
 Jun 21 - Summer Solstice, 11:28 UT
 Jun 25 - Pluto at Opposition
 Jun 26 - Partial Lunar Eclipse

July 2010

Jul 06 - Earth At Aphelion (1.017 AU From Sun)
 Jul 11 - Total Solar Eclipse, Visible in South Pacific, Chile
 Jul tba - EAS Meeting
 Jul 29 - South Delta-Aquarids Meteor Shower Peak

August 2010

Aug 01 - Alpha Capricornids Meteor Shower Peak
 Aug 05 - Neil Armstrong's 80th Birthday (1930)
 Aug 06 - Southern Iota Aquarids Meteor Shower Peak
 Aug 07 - Mercury At Its Greatest Eastern Elongation (27 Deg)
 Aug 09 - New Moon
 Aug tba – EAS Meeting – location tba
 Aug 12 - Perseids Meteor Shower Peak
 Aug 20 - Venus at Its Greatest Eastern Elongation (46 Deg)
 Aug 20 - Neptune at Opposition
 Aug 25 - Northern Iota Aquarids Meteor Shower Peak

September 2010

Sep 14 - John Dobson's 95th Birthday (1915)
 Sep 19 - Mercury At Its Greatest Western Elongation (18 Deg)
 Sep 21 - Jupiter at Opposition
 Sep tba – EAS Meeting
 Sep 21 - Uranus at Opposition
 Sep 23 - Autumnal Equinox (03:09 UT)

October 2010

Oct 09 - Draconids Meteor Shower Peak
 Oct 16 – Astronomy Day (Autumn)
 Oct 17 - New Horizons, Halfway to Pluto
 Oct tba – EAS Meeting
 Oct 21 - Orionids Meteor Shower Peak
 Oct 31 - Michael Collins' 80th Birthday (1930)

November 2010

Nov 01 - Daylight Savings - Set Clock Back 1 Hour (USA)
 Nov 03 - Taurids Meteor Shower Peak
 Nov 05 - Moon Occults Venus
 Nov tba – EAS Meeting
 Nov 17 - Leonids Meteor Shower Peak
 Nov 25 - Asteroid 2002 KL3 Near-Venus Flyby (0.03 AU)

December 2010

Dec 06 - Moon Occults Mars
 Dec 13 - Geminids Meteor Shower Peak
 Dec 21 - Total Lunar Eclipse
 Dec tba - EAS Holiday Meeting
 Dec 21 - Winter Solstice, 23:38 UTC
 Dec 22 - Ursids Meteor Shower Peak

OBSERVER'S INFORMATION...**LUNAR FACTS**

Feb 22	First Quarter Moon
Feb 28	Full Moon
Mar 07	Last Quarter Moon
Mar 15	New Moon
Mar 23	First Quarter Moon
Mar 30	Full Moon
Apr 06	Last Quarter Moon
Apr 14	New Moon
Apr 21	First Quarter Moon
Apr 28	Full Moon
May 06	Last Quarter Moon
May 14	New Moon

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

<i>Object</i>	<i>Rises</i>	<i>Sets</i>	<i>Con</i>	<i>Diam.</i>	<i>Mag</i>
<i>Sun</i>	06:56 am	17:50	Aqr	30'	-27.5
Mercury	06:41 am	15:15	Cap	5"	-0.6
Venus	07:27 am	16:47	Aqr	10"	-3.9
Mars	14:00	09:20 am	Can	12"	-0.7
Jupiter	07:05 am	17:51	Aqr	33"	-2.0
Saturn	19:49	08:07 am	Vir	19"	+0.6
Uranus	07:36 am	19:19	Psc	03"	+5.9
Neptune	06:35 am	16:43	Cap	02"	+8.0
Pluto	03:26 am	12:43	Sag	*	+14.1

(times listed are in local time for Everett PST)

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>

'IT'S OVER YOUR HEAD' – ASTRONOMY PODCASTS

Web page with lots of archives and other info is available at <http://www.celestialnorth.org/radio/index.php> and podcasts at <http://www.celestialnorth.org/radio/index.php>

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

EAS MEMBER NEWS**\$\$ - FINANCIAL HEALTH - \$\$**

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

CLUB SCOPES

SCOPE

13-INCH THIN-MIRROR DOB
10-INCH WARD DOBSONIAN
10-INCH SONOTUBE DOBSONIAN
8-INCH DOBSONIAN

LOAN STATUS

FINISHING REHABILITATION
AVAILABLE
AVAILABLE
AVAILABLE

A 25-INCH MIRROR HAS BEEN DONATED TO THE CLUB, AND INVESTIGATION IS UNDER WAY TO DETERMINE WHAT WOULD BE REQUIRED TO TURN IT INTO A LARGE CLUB TELESCOPE. IF YOU HAVE INTEREST OR SKILLS IN MIRROR TESTING OR TELESCOPE MAKING, PLEASE LET US KNOW.

EAS members: contact Ron Tam to borrow a scope for up to 60 days.

OFFICES STILL VACANT FOR 2010 -

President: Schedule & run the club monthly meetings.

Vice president: Run monthly meetings if President is absent, and store/loan club telescopes.

Newsletter Co-editor #2: Contribute columns or articles for the StarGazer on a regular basis.

Publicity chairperson: Contact news media, and e-mail and blog to raise public awareness of EAS activities.

Outreach chairperson: Coordinate requests from public for EAS member volunteers to conduct star parties or presentations at visits to schools, senior centers, scout meetings, etc. 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. A star party night can be a rewarding event for all involved. **Please email Mark Folkerts with your interest (or suggestions).**

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

Other volunteers? Find a way to help and contribute. Come up with a new idea to promote the EAS and astronomy in your community.

EAS MEMBERSHIP BENEFITS & INFORMATION

EAS Benefits - Membership in the Everett Astronomical Society (EAS) includes invitations to all of the club meetings and star parties, and entitles members to the monthly newsletter, *The Stargazer*. Also, a 10% discount is also being offered to EAS members for purchases at Aurora Astro Products in Everett. Only members may vote in EAS elections, or be eligible for EAS drawings.

Magazine Discounts -

In addition you will be able to subscribe to *Sky and Telescope* for \$7 off the normal subscription rate, contact the treasurer (Carol Gore) for more information. <http://everettastro.org/application.htm> (When renewing your subscription to *Sky & Telescope* you should send your S&T renewal form along with a check made out to Everett Astronomical Society to the EAS address. The EAS treasurer Carol Gore will renew your *Sky and Telescope* subscription for you. Astronomy magazine offers a similar opportunity to club members.)

Membership in the Astronomical League -

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

EAS Club Telescope Borrowing -

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

10% Discount on Purchases at 'Aurora Astro Products' in Everett -

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

EAS Library -

Membership will give you access to all the material in the lending library. The library, 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, located at Aurora Astro Products store. We always value any items you would like to donate to this library. You can contact club librarian to borrow or donate any materials. See library items list here: http://everettastro.org/eas_library.htm

Joining or Renewing with the EAS -

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

>> Members – please check 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. <<

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

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.

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

"Mention your EAS club membership at Jim Bielaga's astronomy store 'Aurora Astro Products' and receive a 10% discount on all purchases. This is an exclusive discount to current 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"



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Monday, Thursday, Friday – 9:00 am to 6:00 pm .

Tuesday/Wednesday – Noon to 6:00 pm .

Saturday – 10:00 am to 5:00 pm .

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

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>

[The EAS welcomes newsletter article contributions and submissions of all types from its members.]

In EAS StarGazer - "The Planetarium"
(for late Feb to mid-March)
- By John W Goerger

Well, have you made a decision if astronomy is a "passive science"? Given, it was in a script of a not very good science fiction movie (Jurassic Park III) kind of tells us that those in the story-telling and screen-writing business are not well grounded in the sciences (physical, life and the "soft sciences"). Remember ALIEN 4, where supposedly researchers are able to bring Ripley back to life from just her blood (DNA) and the fully grown Ripley remembers what the ALIENS are all about, how dangerous they are and what her life was like before she had died in ALIENS 3?

There are several science fiction movies and TV shows (NGST) which make the claim that what we all learn while we are alive, or affect a person, is somehow transferred into our genes, even into one's DNA---that is an old view held by a guy named Lamarck (**Jean-Baptiste Lamarck [1744-1829]**). He did push for the concept of **EVOLUTION**, but his understanding as to its mechanisms was all wrong. As an example, say you lose your left foot in an accident, then you and your spouse had a child; Lamarck thought there was a good chance your child would be born without a left foot! Yes, I know kind of silly but this view was being considered science in the early part of the 19th Century. Then comes **Darwin** when he published his book, The Origin of the Species in **1859**, which would spell the end of Lamarckian evolution; for this example say you have a **bunch of rats** and you decide to cut off all their tails (yes that hurts the poor rats). Given Lamarck's viewpoint, eventually the rats without tails would produce baby rats without tails---as you can guess, that did not happen. There were lots of happy baby rats born with tails! The other example is with **Giraffes**; Hundreds of thousands of years ago, most Giraffes had neck-lengths shorter, on average than the neck-lengths of Giraffes today. A Lamarckian would say, the food for the Giraffe for some reason had, (maybe because of climatic conditions, was becoming harder to get to because it was at a higher position on the tree), so the Giraffes would **S-T-R-E-T-C-H** their necks in trying to get to the food that was higher up on the tree, then it use to be. Because they were **S-T-R-E-T-C-H-I-N-G** their necks, eventually the Giraffes necks became longer. You can see right though that "logic"

can't you! First off, with the **Giraffe population** there were a **few Giraffes** whose **neck lengths was longer** than the average. So, it was easy for them to get the food that the short-necked Giraffes could not get to. Since the short-necked Giraffes could not get to the food they would not have the strength to run away from the Tiger, Lion or whatever meat-eating critter decided it wanted Giraffes on its dinner plate.

Also, they had a harder time **fighting off diseases**, but not the **long-neck Giraffes** as they were getting the nutrition, vitamins and other foodstuffs to maintain **good health!** If you are healthy-good looking Giraffe (at least to another Giraffe) you would get a mate or mates and produce more Giraffes with longer necks! Gradually the average length of Giraffes neck-lengths increased along with the number of Giraffes with long necks---genetic drift---**Darwinian Evolution**---**Natural Selection**, not Lamarckian. Yet, writers of books, movies and TV shows still bend toward Lamarckian biology as the root of modern biology when in fact it has been laid on the trash heap of discarded proto-science theories of old.

There are many problems with the Lamarckian System, such as the **various mechanisms** as to how **information** which a living organism **experiences** or **learns** would be transmitted to its DNA. Given Darwin's Natural Selection there is also the discoveries of the Monk, **Mendel** concerning **Genes** which he worked on in the early part of the 1800's (it should be noted that much of his research was destroyed by the Church at the time of his passing-SEE: The Ascent of Man, **Jacob Bronowski**) . As you probably know there isn't any mechanism by which such information is transferred to an organism's **DNA**. However, with natural selection and the understanding of genes clearly was the "nail in the coffin" of the Lamarckian System.

If you were to do a bit of investigating of what astronomy and astronomers were doing, just **two hundred years ago** and farther back, you would discover **Astronomy** was a real exciting and in **some cases a dangerous profession!** When **Jamestown** was **founded in 1608** on the shores of what would become over **172 years later (1780)**, the Eastern United States, **Galileo** was just **aiming his crudely built telescope** toward those celestial objects we know and love so well. Over **two years later**, he presented to the attention of academics his data and drawings of what he had observed and recorded. At the time of Jamestown, the average person living there believed the Earth was the center of our solar system and the Earth did not move but remained fixed while the Sun, Moon, Planets and Stars moved around it!

Harvard University, initially called "**New College**" or "**the college at New Towne**" was incorporated as *The President and Fellows of Harvard College* located in Cambridge Massachusetts and in the **year 1636** was established by the colonial Massachusetts legislature. It wasn't until **1639** that it was renamed **Harvard College** after a John Harvard who gave the college his library of over four hundred books and half of his estate (779 British Pounds). Harvard is the oldest institution in the United States, and has ten separate academic schools as well as the first and oldest corporation in the United States. At the time of its formation one of the few instructors it had was an astronomer!

One of the **core courses** at Harvard was **Astronomy** with an emphasis on **timekeeping-navigation**. Yet, the core of astronomy classes was based on the **Polemic System**, where the Earth was the center of everything and everything revolved about it, as previously stated. However, within **25 years** of the formation of Harvard, the core of astronomy went with the **theories proposed by Galileo**, based on his observations of celestial bodies and research. With this new concept(s) established, methods of timekeeping and navigation were becoming more **exact** and with the discovery of how to determine one's

Longitude, by **John Harrington** who had been a carpenter turned wooden clockmaker. It wasn't until **1773** that **the British Government awarded him** the monies for his creation of what is known as a **Marine Chronometer**. **Starting in 1714** the British Parliament formed a panel consisting of professionals, politicians and Naval Officers to establish a **Board of Latitude** with a **prize of 20,000** (Pounds-money, British money---2 million pounds British monies today) to anyone who could solve the problem of finding Latitude at sea. It is interesting that the **person who solved this problem was not an astronomer**, but then many times in human history one finds that those that are "problem solvers" may not be in that specific field, but are, by definition a "scientist" in the way of their thinking, analyzing the problem(s) at hand, and the methodological approach they took to researching the solution (think of the **Wright Brothers---Bicycle Mechanics** who solved the problem of heavier than air, manned powered flight and built the first aircraft, and flew it).

* * *

In an article in the **July 1976** issue of **ASTRONOMY** it mentions that the reading of the United States of **America's Declaration of Independence**, was read on the steps of a **Transit Observatory** which was being built in the city of **Philadelphia**. During the **American Revolutionary War** against British tyranny of that time, three gentlemen from Harvard University; The College President, the Head Librarian and the Professor of Astronomy, had received permission to cross British lines so they could observe a total solar eclipse which astronomers of that period had predicted. Why, you may wonder was it so important for three Americans to risk their freedom, their lives, to go into British controlled territory to observe **Totality of a Solar Eclipse**. For whatever reason, the British Forces did not have the necessary scientific equipment or personal to examine and study this solar Eclipse. So the Americans set up their equipment and waited, and waited, and waited with baited breath as some reading this have watched and waited for the excitement and awe of seeing the sun slowly "disappear" as the New Moon appeared to "devourer" the Sun (refer to the ancient Chinese that the sun was being eaten by the moon). As the time came close for Totality the three Harvard men, were checking their equipment and calculations and, and---and; something was wrong; the time they had for Totality came and went, yet a sliver of sun still was glaring, no total darkness? What happened?

Understanding the path of a solar eclipse, its' duration, even a partial one, allowed one to check the accuracy of their maps of Earth. If the map a person is using is accurate to determine the path and where totality will be at its maximum, as well as your time-keeping instruments, you would be able to predict the path and when and where totality happens. However, in their case the maps of the period were off---by 4 miles! They were off by a total of 4 miles from where Totality would have been observed.

Previously, I had mentioned the building of a Transit Observatory, which has nothing to do with a transit system for moving people, but rather an observatory building housing a telescope designed for researchers to observe the **"TRANSIT"** of a planet when it comes between us and the sun, and moves across the surface of the sun! By predicting when a planet is going to be in the same plane between the sun and the earth, at what "Latitude and Longitude" with respect to the sun, at what point on the sun will the planet start its transit across the sun and will be moving from that point toward the end point, and the time the transit will end.

For the American Astronomer of the 18th and part of the 19th Century trying to discover and understand the orbital dynamics of planetary orbits about our sun and the moons around those worlds as well as what stars are, what are sunspots and their causes, were not

considered the "proper field of study" of American Astronomers. Navigation was the driving force of and for astronomy during those periods. It was critical to make the most accurate and detailed maps for sailing ships of **commerce** as well as maps for determining ownership of **property** and **national boundaries!**

Then a funny, well maybe not funny to them of **1833** but, to us, an **EVENT** happened in the night sky of the United States that would shake the United States to its scientific core. This meteor storm, called the **Leonids**, had an estimated **300,000 to 600,000 meteors** per hour (many of us today wish we could see that number of meteors per hour) were being seen by people living in the state of Alabama and in other parts of the U.S. This night of "falling stars" startled many; some thinking it was the end of time---Judgment Day (no not from Skynet or TERMINATORS). For the most part cooler heads understood what people and seen and within a few weeks and months a massive Observatory Building Program began within the United States.

* * *

The finest telescope a person (well actually a University or a Government) could own was built by **ZEISS** optics from Europe---a Refractor. Reflectors were around but at the time the refractor was "easier" to construct than those of reflectors. Interesting, from the 1840's and 1850's, a gentleman named **Alvan Clarke** who was constructing miniature wagons and items got interested in the field of optics. Along with his sons he started working on refractor telescopes to where his product was of higher quality and precision than those of ZEISS! The **U.S. Naval Observatory** in the early **1870's** discovered the two moons of Mars, using an Alvan Clarke & Sons **26 inch Refractor** telescope, and the largest operational Refractor built is the **40 inch** which went to the **Yerkes Observatory**.

In the **latter part of the 1800's** a total solar eclipse was predicted to happen over the western US. The US government and Universities organized a major expedition to study it! Would you like to hazard a guess about the accuracy of their maps? The maps were "right on the money" and location for the scientists to study and research this wonderful celestial event! Given some of the "historical "period pieces" films Hollywood has created in past, it makes a person to wonder if perhaps this piece of American History would make for an "Epic Motion Picture".

So, I guess one could conclude from this preceding general look into American History that Astronomy and Astronomers are not "passive" as with almost all the sciences! Many astronomers do work for the government and colleges with some involved with the security of this Nation, but for the most part, many are dedicated to analyzing the data gotten from space probes, material returned from the moon by manned missions, space-based telescopes, and radio telescopes to get a clearer understanding of our solar system, other star systems, our galaxy, galaxies and the Universe. If we could, as humans, establish working settlements of human beings on the moon, on a large asteroid, Mars and O'Neill-style Space Settlements (SEE: [The High Frontier](#)-G. K. O'Neill), perhaps we could once again put some "jazz" into astronomy and show how it directly relates to our civilization; indeed our very existence of being an Advanced Technological Civilization!

The Hubble Space Telescope **imaged an X-pattern of filamentary structures** near the nucleus of a comet-type object on the 26th and 29th of January 2010. It was January 6th that this comet-like object was detected by the Lincoln Near-Earth Asteroid Research (**LINEAR**). The velocity upon collision between two asteroids was estimated at over **11,000 miles per hour**, or 5 times faster than a rifle bullet! The name given to the nucleus at the time the HST imaged the object is called

A/2010 A2 with a **diameter of 480 feet**. The distance at the time HST observed it, the comet-like asteroid was 90 million miles from Earth.

The Obama White House has **cut the CONSTELLATION program** and told NASA to **forget about an American Moon Landing by 2020!** This White House Administration has destroyed NASA's development of a new Heavy Lift Vehicle to replace the soon-to-be-retired Space Shuttles. Without a manned-rated launch vehicle how are we Americans suppose to send out astronauts to the Space Station, Earth Orbit? In previous writings of *The Planetarium* I have written that even though there is in the works, **private launch companies** trying to develop manned launch vehicles, those vehicles are estimated to be at least **5-10 years from now** (does not include sub-orbital flights), assuming they will work and will be on time!

* * *

So, we are to rely on our Russian Partners for a lift for our astronauts to the ISS. What happens if there is a **political falling** out between us and them after this Nation shuts down its Space Shuttle System---then what? All we read and hear are **"pie-in-the-sky"** statements from the current Director and his Deputy about how the U.S will someday have manned missions into the solar system; **with what?** If this really gets under your saddle, write to the White House, NASA, Congress and your Senator demanding an explanation how are we, the United States going to create a Space-Faring Civilization if we have no way of establishing a permanent American Presence beyond our Earth---mining settlements on the moon and beyond! Demand a return of Americans to the lunar surface! Understand the **moon** is not a gold mine; IT IS A **TITANIUM MINE!**

With the launch of STS-130 Space Shuttle **ENDEAVOUR** on February 8th, another major milestone with the completion of Humanity's Outpost to the Cosmos is coming close to completion. With the attachment of the **TRANQUILITY** section and the **CUPOLA**, with its 7 windows, to Tranquility, it will give the researchers inside the ISS a wondrous view of not just of the ISS but of Earth and Space as well. The crew of STS-130 consists of George D. Zamka-Commander, Terry W. Virts Jr.-Pilot, Robert L. Behnken-Mission Specialist, Kathryn P. Hire-Mission Specialist, Nicholas J. M. Patrick-Mission Specialist and Stephen K. Robinson-Mission Specialist. The next space shuttle mission to the ISS was slated for March 18th STS-131, DISCOVERY. However the Discovery move to the VAB (Vehicle Assembly Building) was postponed because of cold weather in Florida. This in turn delays the rollout of the space vehicle to the launch pad. There are specific rules against transporting the space vehicle according to NASA;"when temperatures are below a certain level for extended periods"; the shuttle vehicle thrusters seals could leak under cold temperatures. At the time of writing, NASA's new timetable for launch of STS-131 is April 5, 2010.. After STS-131 there are only three (3) Space Shuttle Missions planned and then the U.S. Government plans to end space shuttle operations!

* * *

With the latter part of February now upon us there are all sorts of cosmic bodies to enjoy watching and entertaining us, when we have a clear sky at night, here in the Pacific Northwest! At sunset, assuming you have a flat horizon, is **Venus** glaring at an apparent magnitude **-3.8** about 4 degrees above the western horizon. By the 28th of February, Venus sets about 55 minutes after sunset. Even into March Venus remains about the same brightness and its diameter is around 10 arc seconds (10").

If you decide to aim a telescope at it, **use very low power** as you will be looking through twice the amount of atmosphere as you would be looking through, if you looked straight up. Because of doubling of the air, Venus will have "color" but this is because of the refracting qualities

of the air and not of the planet or your telescope. Also, there will be quite a bit of **"waviness"** caused by the low altitude of Venus with respect to the ground and again the atmosphere. At present about **98% of the planet is lit**. By mid **March** Venus sets around 30 minutes after sunset and is now 5 degrees above the western horizon. The angular diameter is the same and by **month's end**, it will be about **12 degrees** above the horizon.

The moon is at **First Quarter on the 21st of February**, a waxing gibbous 5 degrees south of Mars on the 25th, and Full on the 28th, the last day of February 2010. In March the moon is **7 degrees to the right of Venus by the 16th**, just a day past New Moon, so see if you can spot a very slender thin lunar crescent (1% lit), on that day. For that observation definitely **use binoculars** for locating It and Venus (that is assuming there won't be any rain clouds around here in the pacific northwest), and the moon will be 6 degrees above the western horizon, about 30 minutes after sunset.

The 'War of the Worlds' planet **Mars**, is really easy to spot in the evening sky, as long as there aren't any stupid rain clouds to prevent us from observing this sapphire colored pinpoint in our evening winter sky. On the 15th of February it had a visual brightness of a **-1.0** but will decrease somewhat to a **-0.2** by the 15th of March. The angular size has decreased some, from a **13.4"** in mid February to a **10.7"**, a bit larger than Venus. Using a 6-inch scope or bigger will still give you lots of features to observe on this planet named after the "god of war".

By **mid March**, **Mars** will have **stopped its apparent westward movement** by the **11th**, with respect to the stars. Very slowly then, it will start to **drift eastward**, again with respect to the stars. In the **early part of March** it will still have a disk size of around **12 arc seconds (12")**, so if it is clear, and no rain, then hurry up and set up your scope and do a telescopic expedition of Mars! Invite the neighbors, you're In-Laws (they already know you are odd when you were dating their offspring and found out the two of you were stargazing though your telescope) and members of EAS! By the middle and latter parts of March you will need at least a larger scope to continue observing Mars--**ENJOY!**

Saturn, our lovely ring-world goes from a **0.7** in February to a bit brighter in March and **rises around 8 P.M.; local** on the last day of February (was rising after 10 P.M., at the beginning of the month). Its angular size is around **44 arc seconds (44")**; this includes the ring structure as well as the planet's diameter. A Full Moon is near it on the 1st of March and itself rises in the east around 8 P.M. local, about two hours after sunset. Chase those stupid clouds always and aim that telescope, you got for a present over the holidays, and gaze away! You will be happy and overjoyed as you observe, what appears to some people as a 3-D like appearance of Saturn, with the distant stars in the background! Jupiter shows up at the end of March and more on it in next month's column of *The Planetarium*! [Shuttle Silhouette](#) - The silhouette of the space shuttle Endeavour from the International Space Station - *Image Credit: NASA.* AD ASTRA! KEEP LOOKING UP!

- *John Goerger*

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

CHANDRA REVEALS SURPRISING ORIGIN OF MOST SN TYPE 1A EXPLOSIONS

New findings from Chandra X-ray Observatory have provided a major advance in understanding a type of supernova critical for studying the dark energy that astronomers think pervades the universe. The results show mergers of two dense stellar remnants are the likely cause of

many of the supernovae that have been used to measure the accelerated expansion of the universe. These supernovae, called Type 1a, serve as cosmic mile markers to measure expansion of the universe because they can be seen at large distances, and they follow a reliable pattern of brightness. However, until now, scientists have been unsure what actually causes the explosions. *"These are such critical objects in understanding the universe,"* said Marat Gilfanov, the lead author of the study. *"It was a major embarrassment that we did not know how they worked. Now we are beginning to understand what lights the fuse of these explosions."*



This composite image of M31 (also known as the Andromeda galaxy) shows X-ray data from Chandra X-ray Observatory in gold, optical data from the Digitized Sky Survey in light blue and infrared data from the Spitzer Space Telescope in red. The Chandra data covers only the central region of M31 as shown in the inset box for the image.

Most scientists agree a Type 1a supernova occurs when a white dwarf star -- a collapsed remnant of an elderly star -- exceeds its weight limit, becomes unstable and explodes. Scientists have identified two main possibilities for pushing the white dwarf over the edge: - two white dwarfs merging, - or accretion, a process in which the white dwarf pulls material from a sun-like companion star until it exceeds its weight limit. ***"Our results suggest the supernovae in the galaxies we studied almost all come from two white dwarfs merging,"*** said co-author Akos Bogdan, ***"This is probably not what many astronomers would expect."***

The difference between these two scenarios may have implications for how these supernovae can be used as "standard candles" -- objects of a known brightness -- to track vast cosmic distances. Because white dwarfs can come in a range of masses, the merger of two could result in explosions that vary somewhat in brightness. Because these two scenarios would generate different amounts of X-ray emission, Gilfanov and Bogdan used Chandra to observe five nearby elliptical galaxies and the central region of the Andromeda galaxy. A Type 1a supernova caused by accreting material produces significant X-ray emission prior to the explosion. A supernova from a merger of two white dwarfs, on the other hand, would create significantly less X-ray emission than the accretion scenario. The scientists found the observed X-ray emission was a factor of 30 to 50 times smaller than expected from the accretion

scenario, effectively ruling it out. This implies that white dwarf mergers dominate in these galaxies. An open question remains whether these white dwarf mergers are the primary catalyst for Type 1a supernovae in spiral galaxies. Further studies are required to know if supernovae in spiral galaxies are caused by mergers or a mixture of the two processes. Another intriguing consequence of this result is that a pair of white dwarfs is relatively hard to spot, even with the best telescopes. *"To many astrophysicists, the merger scenario seemed to be less likely because too few double-white-dwarf systems appeared to exist,"* said Gilfanov. *"Now this path to supernovae will have to be investigated in more detail."*

In addition to the X-rays observed with Chandra, other data critical for this result came from Spitzer Space Telescope and the ground-based, infrared Two Micron All Sky Survey. The infrared brightness of the galaxies allowed the team to estimate how many supernovae should occur. New results show that the M31 Chandra image would be about 40 times brighter than observed if Type 1a supernova in the bulge of this galaxy were triggered by material from a normal star falling onto a white dwarf star. This implies that the merger of two white dwarfs is the main trigger for Type 1a supernovas for the area observed by Chandra. Similar results for five elliptical galaxies were found.

These findings represent a major advance in understanding the origin of Type 1a supernovas, explosions that are used as cosmic mile markers to measure the accelerated expansion of the universe and study dark energy. Most scientists agree that a Type 1a supernova occurs when a white dwarf star -- a collapsed remnant of an elderly star -- exceeds its weight limit, becomes unstable and explodes. However, there is uncertainty about what pushes the white dwarf over the edge, either accretion onto the white dwarf or a merger between two white dwarfs. A Type 1a supernova caused by accreting material produces significant X-ray emission prior to the explosion. A supernova from a merger of two white dwarfs, on the other hand, would create significantly less. The scientists used the difference to decide between these two scenarios by examining the new Chandra data. A third, less likely possibility is that the supernova explosion is triggered, in the accretion scenario, before the white dwarf reaches the expected mass limit. In this case, the detectable X-ray emission could be much lower than assumed for the accretion scenario. However, simulations of such explosions do not show agreement with the observed properties of Type 1a supernovas. <http://chandra.nasa.gov> <http://chandra.harvard.edu>

NEW WISE INFRARED ALL-SKY SURVEY TELESCOPE SENDS FIRST IMAGES

Wide-field Infrared Survey Explorer, or WISE, will scan the entire sky for millions of hidden objects, including asteroids, "failed" stars and powerful galaxies. WISE data will serve as navigation charts for other missions such as Hubble and Spitzer Space Telescopes, pointing them to the most interesting targets WISE finds. To sense the infrared glow of stars and galaxies, the WISE spacecraft cannot give off any detectable infrared light of its own. This is accomplished by chilling the telescope and detectors to ultra-cold temperatures. The coldest of WISE's detectors will operate at less than 8 Kelvin, or minus 445 Fahrenheit. The first sky survey will be complete in six months, followed by a second scan of one-half of the sky lasting three months. The WISE mission ends when the frozen hydrogen that keeps the instrument cold evaporates away, an event expected to occur in October 2010. Preliminary survey images are expected to be released six months later, in April 2011, with the final atlas and catalog coming after another 11 months in March 2012. Selected images began being released to the public in February. A diverse cast of cosmic characters is showcased in the first survey images released. Since WISE began its

scan of the entire sky in infrared light on Jan. 14, the space telescope has beamed back more than a quarter of a million raw, infrared images. Four new, processed pictures illustrate a sampling of the mission's targets -- a wispy comet, a bursting star-forming cloud, the grand Andromeda galaxy and a faraway cluster of hundreds of galaxies. http://www.nasa.gov/mission_pages/WISE/multimedia/images20100216.html .

One image shows the beauty of a comet called Siding Spring. As the comet parades toward the sun, it sheds dust that glows in infrared light visible to WISE. The comet's tail, which stretches about 10 million miles, looks like a streak of red paint. A bright star appears below it in blue.

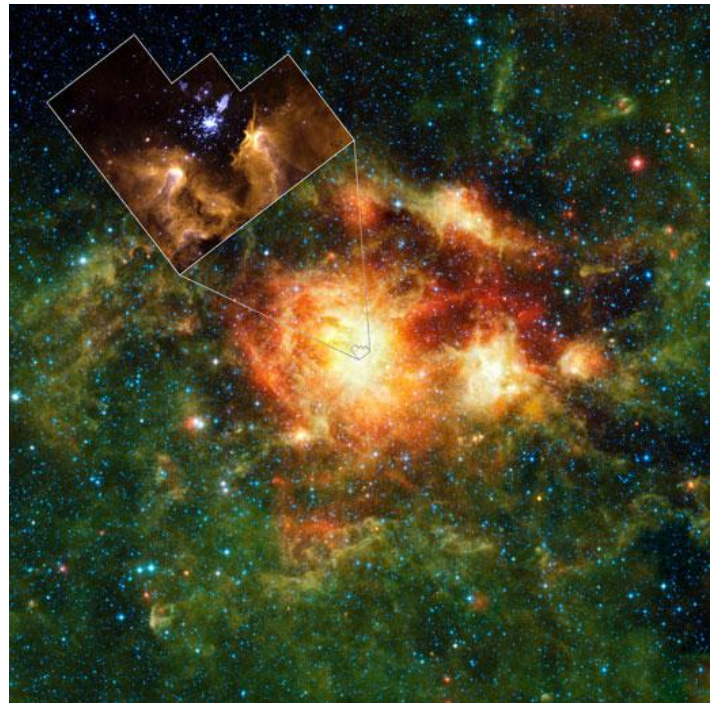


Comet Siding Spring appears to streak across the sky like a superhero in this new infrared image from WISE. The comet, also known as C/2007 Q3, was discovered in 2007 by observers in Australia. The snowball-like mass of ice and dust spent billions of years orbiting in the deep freeze of the Oort Cloud, a spherical cloud of comets surrounding our solar system. At some point, it got knocked out of this orbit and onto a course that brings it closer to the sun. In October 2009, it passed as close as 1.2 astronomical units from Earth and 2.25 astronomical units from the sun (an astronomical unit is the distance between the sun and Earth). Now, the comet is leaving the warmer, more hospitable neighborhood of the solar system and heading back out to chillier parts. In this view, longer wavelengths of infrared light are red and shorter wavelengths are blue. The comet appears red because it is more than ten times colder than the surrounding stars, for example, the bright blue star in the foreground. Colder objects give off more of their light at longer wavelengths. An ice cube, for example, pours out a larger fraction of its light at longer infrared wavelengths than a cup of hot tea emits. A comet like this one can be thought of as a time capsule leftover from the formation of our solar system 4.5 billion years ago. After spending most of its long, lonely life in the darkest, coldest parts of our solar system, it warms up as it approaches the sun. The sunlight causes it to shed ices and dust in a long tail that trails behind it. Comet Siding Spring, having experienced this "spring" awakening, is glowing in infrared light that WISE can see. Once it moves too far from the sun's warmth and light, it will disappear from view for the foreseeable future. Astronomers will use these measurements to learn about the comet's size, composition, reflectivity, and the size and makeup of the dust particles in its coma (the hazy cloud surrounding its nucleus) and its tail. WISE data on this and other comets will help unlock clues that lay within these icy time capsules, teaching us about our solar system's evolution. In this image, 3.4-micron light is colored blue; 4.6-micron light is green; 12-micron light is orange; and 22-micron light is red. It was taken on Jan. 10, 2010. - Image credit: NASA/JPL-Caltech/UCLA

During its survey, the mission is expected to find perhaps dozens of comets, including some that ride along in orbits that take them somewhat close to Earth's path around the sun. WISE will help unravel clues locked inside comets about how our solar system came to be.

Another image shows a bright and choppy star-forming region called NGC 3603, lying 20,000 light-years away in the Carina spiral arm of our Milky Way galaxy. This star-forming factory is churning out batches of new stars, some of which are monstrously massive and hotter than the sun. The hot stars warm the surrounding dust clouds, causing them to glow at infrared wavelengths. The cluster contains some of the most massive stars known.

Winds and radiation from the stars are evaporating and dispersing the cloud material from which they formed, warming the cold dust and gas surrounding the central nebula. Other star-forming clouds in the Milky Way have experienced such eruptions, as evidenced by their pockmarked clouds of expanding cavities and bubbles. Because NGC 3603 is so close, it is an excellent lab for the study of such faraway and momentous events.



This infrared image shows a star-forming cloud teeming with gas, dust and massive newborn stars. The inset reveals the very center of the cloud, a cluster of stars called NGC 3603. It was taken in visible light by HST. WISE, which is surveying the whole sky in infrared light, is particularly sensitive to the warm dust that permeates star-forming clouds like this one. In this way, WISE complements visible-light observations. WISE also complements Hubble and other telescopes by showing the "big picture," providing context for more detailed observations. For example, the WISE picture here is 2,500 times larger than the Hubble inset. While the Hubble view shows the details of the hot young star cluster, the WISE picture shows the effects that this stellar powerhouse has on its neighborhood. This greenish "halo" of warm cloud material is seen best by WISE due to its large field of view and improved sensitivity over past all-sky infrared surveys. These observations provide circumstantial evidence that the massive stars in the center of the cluster triggered the formation of younger stars in the halo, which can be seen as red dots. The dust at the center of the cluster is very hot, producing copious amounts of infrared light, which results in the bright, yellow cores of the nebulosity. Ultimately, this turbulent region will be blasted apart by supernova explosions. In the WISE image, infrared light of 3.4 and 4.6 microns is blue; 12-micron light is green; and 22-micron light is red. - WISE credit: NASA/JPL-Caltech/UCLA - Hubble credit: NASA/STScI/MPIA/Univ. of Heidelberg/Univ. of Illinois at Urbana-Champaign

WISE will see hundreds of similar star-making regions in our galaxy, helping astronomers piece together a picture of how stars are born. The observations also provide an important link to understanding violent episodes of star formation in distant galaxies.

Traveling farther out from our Milky Way, the third new image shows our nearest large neighbor, the Andromeda spiral galaxy. Andromeda is a bit bigger than our Milky Way and about 2.5 million light-years away. The new picture highlights WISE's wide field of view -- it covers an area larger than 100 full moons and even shows other smaller galaxies near Andromeda, all belonging to our "local group" of more than about 50 galaxies. WISE will capture the entire local group.

The fourth WISE picture is even farther out, in a region of hundreds of galaxies all bound together into one family. Called the Fornax cluster, these galaxies are 60 million light-years from Earth. The mission's infrared views reveal both stagnant and active galaxies, providing a census of data on an entire galactic community. "All these pictures tell a story about our dusty origins and destiny," said Peter Eisenhardt, the WISE project scientist.

"WISE sees dusty comets and rocky asteroids tracing the formation and evolution of our solar system. We can map thousands of forming and dying solar systems across our entire galaxy. We can see patterns of star formation across other galaxies, and waves of star-bursting galaxies in clusters millions of light years away." Other mission targets include comets, asteroids and cool stars called brown dwarfs. WISE discovered its first near-Earth asteroid on Jan. 12, and first comet on Jan. 22. The mission will scan the sky one-and-a-half times by October. At that point, the frozen coolant needed to chill its instruments will be depleted. <http://www.nasa.gov/wise> <http://wise.astro.ucla.edu>



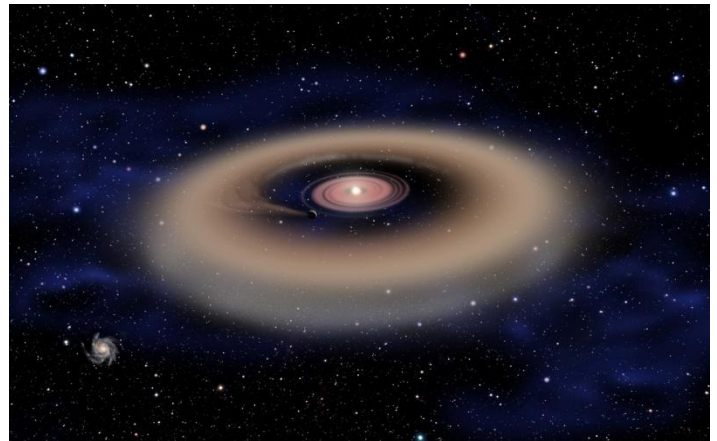
The full Andromeda galaxy, also known as Messier 31 or simply M31, is captured in this image. The mosaic covers an area equivalent to more than 100 full moons, or five degrees across the sky. WISE used all four of its infrared detectors to capture this picture (3.4- and 4.6-micron light is colored blue; 12-micron light is green; and 22-micron light is red). Blue highlights mature stars, while yellow and red show dust heated by newborn, massive stars. Credit: NASA

MASSIVE STARS: GOOD PLANET HUNT TARGETS , BUT BAD SETI TARGETS

Most searches for planets around other stars, also known as exoplanets, focus on Sun-like stars. Those searches have proven successful, turning up more than 400 alien worlds. However, Sun-like stars aren't the only potential homes for planets. New research by astronomers confirms that planet formation is a natural by-product of

star formation, even around stars much heftier than the Sun. "We see evidence of planet formation on fast forward," said Xavier Koenig. Koenig and his colleagues examined the star-forming region named W5, which lies about 6,500 light-years away in the constellation Cassiopeia. They employed Spitzer Space Telescope and the ground-based Two Micron All-Sky Survey (2MASS) to look for infrared evidence of dusty planet-forming disks. They targeted over 500 type A and B stars, which are about two to 15 times as massive as the Sun. Sirius and Vega, not included in this study, are two type A stars easily visible to backyard sky gazers.

The team found that about one-tenth of the stars examined appear to possess dusty disks. Of those, 15 showed signs of central clearing, which suggests that newborn Jupiter-sized planets are sucking up material. "The gravity of a Jupiter-sized object could easily clear the inner disk out to a radius of 10 to 20 astronomical units, which is what we see," said Lori Allen. (An astronomical unit is the average Earth-Sun distance of 93 million miles.)



This artist's conception shows a Jupiter-sized planet forming from a disk of dust and gas surrounding a young, massive star. The planet's gravity has cleared a gap in the disk. Of more than 500 stars examined in the W5 star-forming region, 15 show evidence of central clearing that may be due to forming planets. Credit: David A. Aguilar, CfA

Planet formation around A and B stars is a battle between opposing forces. On one hand, the stars' disks tend to be more massive and contain more of the raw materials to build planets. On the other hand, fierce stellar radiation and winds try to destroy the disks rapidly. The stars in W5 are only about two to five million years old, yet most have already lost the raw materials needed to form planets. This indicates that, at least for type A and B stars, planets must form quickly or not at all. The prospects for hypothetical alien life are disappointing. The habitable zone, or region where liquid water could exist on a rocky surface, is at a greater distance from the star for A and B stars than for sun-like stars due to their greater luminosity. However, that luminosity comes at the price of a short lifetime. A and B stars live for only about 10 - 500 million years before running out of fuel. Life existed on Earth for 3.5 billion years in very simple forms, before the Cambrian explosion led to the diversity of life forms we see today. Planets in W5 around these more massive stars wouldn't have that opportunity. "These stars aren't good targets in the hunt for extraterrestrials," said Koenig, "but they give us a great new way to get a better understanding of planet formation." <http://www.spitzer.caltech.edu/spitzer> <http://www.nasa.gov/spitzer>

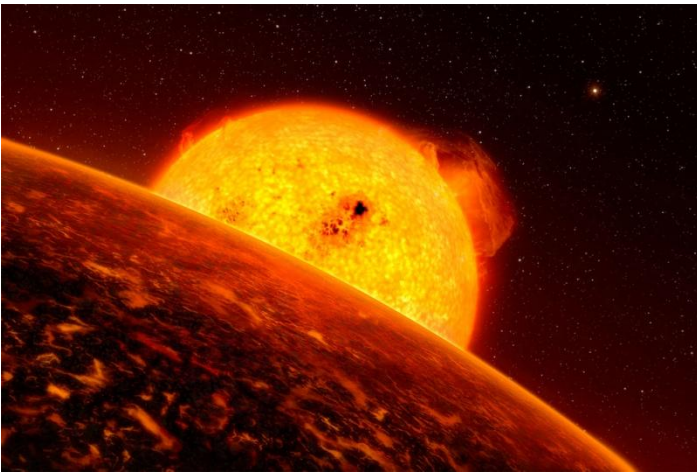
MOST EARTHLIKE EXOPLANET STARTED OUT AS GAS GIANTS

The most earthlike planet yet found around another star may be the rocky remains of a Saturn-sized gas giant, according to research. "The

first planets detected outside our solar system 15 years ago turned out to be enormous gas-giants in very tight orbits around their stars. We call them 'hot Jupiters,' and they weren't what astronomers expected to find," said Brian Jackson. *"Now, we're beginning to see Earth-sized objects in similar orbits. Could there be a connection?"*

Jackson and his colleagues turned to CoRoT-7b, the smallest planet and the most like Earth that astronomers have found to date. Discovered in February 2009 by the Convection, Rotation and Planetary Transits (CoRoT) satellite, a mission led by the French Space Agency, CoRoT-7b takes just 20.4 hours to circle its sun like star, located 480 light-years away in the constellation Monoceros. Astronomers believe the star is about 1.5 billion years old, or about one-third the sun's age.

"CoRoT-7b is almost 60 times closer to its star than Earth, so the star appears almost 360 times larger than the sun does in our sky," Jackson said. As a consequence, the planet's surface experiences extreme heating that may reach 3,600 degrees Fahrenheit on the daylight side. CoRoT-7b's size (70 percent larger than Earth) and mass (4.8 times Earth's) indicate that the world is probably made of rocky materials.



This artist's impression shows sunrise over CoRoT-7b, the smallest-known exoplanet. The world is about 70 percent larger than Earth. The planet may be the rocky remains of a gas giant planet whose atmosphere was evaporated by close proximity to the star. Credit: ESO/L. Calçada

"But with such a high dayside temperature, any rocky surface facing the star must be molten, and the planet cannot retain anything more than a tenuous atmosphere, even one of vaporized rock," Jackson said. He estimates that solar heating may have already cooked off several Earth masses of material from CoRoT-7b.

With the help of computer models that track the planet's mass loss and orbital changes, the researchers have turned back the planet's clock. *"There's a complex interplay between the mass the planet loses and its gravitational pull, which raises tides on the star,"* Jackson explained. Those tides gradually change the planet's orbit, drawing it inward in a process called tidal migration. But closer proximity to the star then increases the mass loss, which in turn slows the rate of orbital change. After accounting for the give-and-take of mass loss and tidal migration, the team finds that CoRoT-7b could have weighed in at 100 Earth masses -- or about the heft of Saturn -- when it first formed. At that time, it orbited 50 percent farther from its star than it does now. The researchers also show that regardless of whether CoRoT-7b started life as a Saturn-like gas giant or as a rocky world, the planet has probably lost many Earth masses of material since its formation. *"You could say that, one way or the other, this planet is disappearing before our eyes,"* Jackson said. He suggests that similar processes likely have influenced many other exoplanets that lie close to their stars. In fact, several

recent studies suggest that many hot Jupiters have undergone similar mass loss and tidal evolution, perhaps leaving behind remnant cores similar to CoRoT-7b. *"CoRoT-7b may be the first in a new class of planet -- evaporated remnant cores,"* Jackson said. *"Studying the coupled processes of mass loss and migration may be crucial to unraveling the origins of the hundreds of hot, earthlike planets space missions like CoRoT and Kepler will soon uncover."*

SUZAKU FINDS "FOSSIL" FIREBALLS FROM SUPERNOVAE

In a supernova remnant known as the Jellyfish Nebula, the Suzaku satellite detected X-rays from fully ionized silicon and sulfur -- an imprint of higher-temperature conditions immediately following the star's explosion. The nebula is about 65 light-years across. Studies of two supernova remnants using the Japan-U.S. Suzaku observatory have revealed never-before-seen embers of the high-temperature fireballs that immediately followed the explosions. Even after thousands of years, gas within these stellar wrecks retain the imprint of temperatures 10,000 times hotter than the sun's surface.



Credit: JAXA/NASA/Suzaku

"This is the first evidence of a new type of supernova remnant -- one that was heated right after the explosion," said Hiroya Yamaguchi. A supernova remnant usually cools quickly due to rapid expansion following the explosion. Then, as it sweeps up tenuous interstellar gas over thousands of years, the remnant gradually heats up again.

Capitalizing on the sensitivity of the Suzaku satellite, a team led by Yamaguchi and Midori Ozawa, a graduate student, detected unusual features in the X-ray spectrum of IC 443, better known to amateur astronomers as the Jellyfish Nebula. The remnant, which lies some 5,000 light-years away in the constellation Gemini, formed about 4,000 years ago. The X-ray emission forms a roughly circular patch in the northern part of the visible nebulosity.

Suzaku's X-ray Imaging Spectrometers (XISs) separate X-rays by energy in much the same way as a prism separates light into a rainbow of colors. This allows astronomers to tease out the types of processes responsible for the radiation. Some of the X-ray emission in the Jellyfish Nebula arises as fast-moving free electrons sweep near the nuclei of atoms. Their mutual attraction deflects the electrons, which then emit X-rays as they change course. The electrons have energies corresponding to a temperature of about 12 million degrees Fahrenheit. Several bumps in the Suzaku spectrum were more puzzling. *"These structures indicate the presence of a large amount of silicon and sulfur atoms from which all electrons have been stripped away,"* Yamaguchi said. These "naked" nuclei produce X-rays as they recapture their lost electrons. But removing all electrons from a silicon atom requires temperatures higher than about 30 million degrees F (17

million C); hotter still for sulfur atoms. "These ions cannot form in the present-day remnant," Yamaguchi explained. "Instead, we're seeing ions created by the enormous temperatures that immediately followed the supernova."

The team suggests that the supernova occurred in a relatively dense environment, perhaps in a cocoon of the star's own making. As a massive star ages, it sheds material in the form of an outflow called a stellar wind and creates a cocoon of gas and dust. When the star explodes, the blast wave traverses the dense cocoon and heats it to temperatures as high as 100 million degrees F, or 10,000 times hotter than the sun's surface. In the supernova remnant W49B, Suzaku found another fossil fireball. It detected X-rays produced when heavily ionized iron atoms recapture an electron. Eventually, the shock wave breaks out into true interstellar space, where the gas density can be as low as a single atom per cubic centimeter -- about the volume of a sugar cube. Once in this low-density environment, the young supernova remnant rapidly expands. The expansion cools the electrons, but it also thins the remnant's gas so much that collisions between particles become rare events. Because an atom may take thousands of years to recapture an electron, the Jellyfish Nebula's hottest ions remain even today, the astronomers reported. "Suzaku sees the Jellyfish's hot heart," Ozawa said.



This view combines infrared images from the ground (red, green) with X-ray data from Chandra X-Ray Observatory (blue). Credit: JAXA/NASA/Suzaku, Tom Bash and John Fox/Adam Block/NOAO/AURA/NSF

The team has already identified another fossil fireball in the supernova remnant known as W49B, which lies 35,000 light-years away in the constellation Aquila. Ozawa, Yamaguchi and colleagues report X-ray emission from iron atoms that are almost completely stripped of electrons. Forming these ions requires temperatures in excess of 55 million degrees F - nearly twice the observed temperature of the remnant's electrons.

Massive Black Hole Implicated in Stellar Destruction

New results from Chandra X-ray Observatory and the Magellan telescopes suggest that a dense stellar remnant has been ripped apart by a black hole a thousand times as massive as the Sun. If confirmed, this discovery would be a cosmic double play: it would be strong evidence for an intermediate mass black hole, which has been a hotly debated topic, and would mark the first time such a black hole has been caught tearing a star apart. This scenario is based on Chandra observations, which revealed an unusually luminous source of X-rays in a dense cluster of old stars, and optical observations that showed a peculiar mix of elements associated with the X-ray emission. Taken together, a case can be made that the X-ray emission is produced by

debris from a disrupted white dwarf star that is heated as it falls towards a massive black hole. The optical emission comes from debris further out that is illuminated by these X-rays.

The intensity of the X-ray emission places the source in the "ultraluminous X-ray source" or ULX category, meaning that it is more luminous than any known stellar X-ray source, but less luminous than the bright X-ray sources (active galactic nuclei) associated with supermassive black holes in the nuclei of galaxies. The nature of ULXs is a mystery, but one suggestion is that some ULXs are black holes with masses between about a hundred and several thousand times that of the Sun, a range intermediate between stellar-mass black holes and supermassive black holes located in the nuclei of galaxies. This ULX is in a globular cluster, a very old and crowded conglomeration of stars. Astronomers have suspected that globular clusters could contain intermediate-mass black holes, but conclusive evidence for this has been elusive.

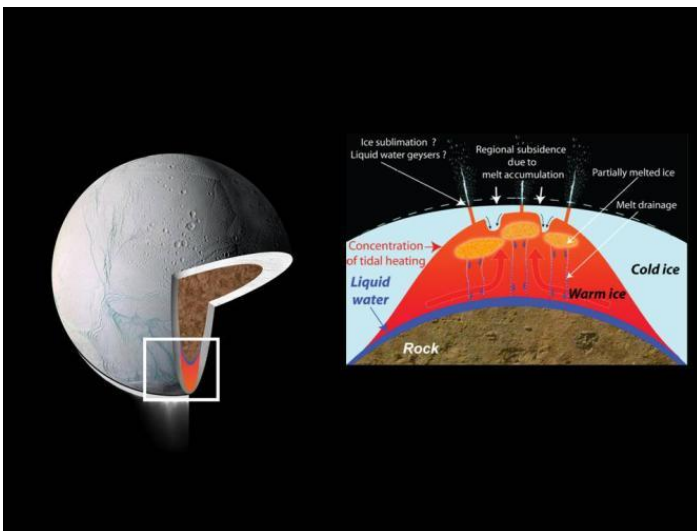


Composite image of a so-called ultraluminous X-ray source, or ULX. Image credit: X-ray: NASA/CXC/UA/J. Irwin et al. Optical: NASA/STScI

"Astronomers have made cases for stars being torn apart by supermassive black holes in the centers of galaxies before, but this is the first good evidence for such an event in a globular cluster," said Jimmy Irwin who led the study. Irwin and his colleagues obtained optical spectra of the object using the Magellan I and II telescopes in Las Campanas, Chile. These data reveal emission from gas rich in oxygen and nitrogen but no hydrogen, a rare set of signals from globular clusters. The physical conditions deduced from the spectra suggest that the gas is orbiting a black hole of at least 1,000 solar masses. The abundant amount of oxygen and absence of hydrogen indicate that the destroyed star was a white dwarf, the end phase of a solar-type star that has burned its hydrogen leaving a high concentration of oxygen. The nitrogen seen in the optical spectrum remains an enigma. "We think these unusual signatures can be explained by a white dwarf that strayed too close to a black hole and was torn apart by the extreme tidal forces," said coauthor Joel Bregman. Theoretical work suggests that the tidal disruption-induced X-ray emission could stay bright for more than a century, but it should fade with time. So far, the team has observed there has been a 35 percent in X-ray emission from 2000 to 2008. The ULX in this study is located in NGC 1399, an elliptical galaxy about 65 million light years from Earth. <http://chandra.harvard.edu>.

CASSINI SHOWS ENCELADUS CRUST IN MOTION

Blobs of warm ice that periodically rise to the surface and churn the icy crust on Saturn's moon Enceladus explain the quirky heat behavior and intriguing surface of the moon's south polar region, according to a new paper using data from Cassini spacecraft. *"Cassini appears to have caught Enceladus in the middle of a burp,"* said Francis Nimmo, a planetary scientist and a co-author of the new paper. *"These tumultuous periods are rare and Cassini happens to have been watching the moon during one of these special epochs."* The south polar region captivates scientists because it hosts the fissures known as "tiger stripes" that spray water vapor and other particles out from the moon. While the latest paper doesn't link the churning and resurfacing directly to the formation of fissures and jets, it does fill in some of the blanks in the region's history. *"This episodic model helps to solve one of the most perplexing mysteries of Enceladus,"* said Bob Pappalardo, Cassini project scientist, of the research done by his colleagues. *"Why is the south polar surface so young? How could this amount of heat be pumped out at the moon's south pole? This idea assembles the pieces of the puzzle."*



These drawings depict explanations for the source of intense heat that has been measured coming from Enceladus' south polar region. These models predict that water could exist in a deep layer as an ocean or sea and also near the surface. Cassini scientists infer that the temperature of the ice in the south polar region must be close to its melting point (shown in red). A layer of liquid water (dark blue) might exist between the ice and the silicate core (brown), allowing the ice to deform independent of the rock, providing even more mechanical energy and more flexing of the icy shell for extreme tidal heating. Tidal heating could also cause friction in faults near the surface, leading to pockets of partially melted ice. Image credit NASA/JPL

About four years ago, Cassini's composite infrared spectrometer instrument detected a heat flow in the south polar region of at least 6 gigawatts, the equivalent of at least a dozen electric power plants. This is at least three times as much heat as an average region of Earth of similar area would produce, despite Enceladus' small size. The region was also later found by Cassini's ion and neutral mass spectrometer instrument to be swiftly expelling argon, which comes from rocks decaying radioactively and has a well-known rate of decay. Calculations told scientists it would be impossible for Enceladus to have continually produced heat and gas at this rate. Tidal movement – the pull and push from Saturn as Enceladus moves around the planet – cannot explain the release of so much energy.

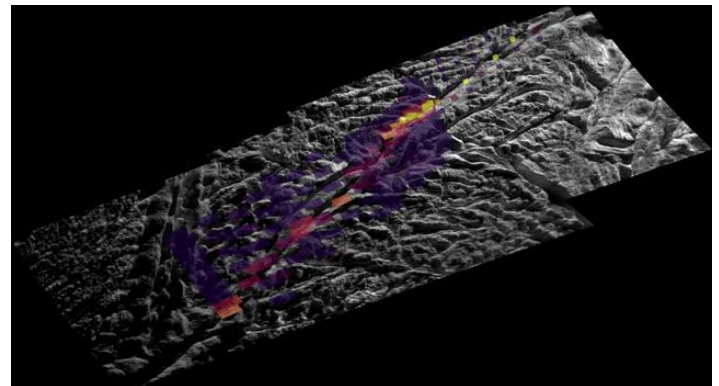
The surface ages of different regions of Enceladus also show great diversity. Heavily cratered plains in the northern part of the moon appear to be as old as 4.2 billion years, while a region near the equator known as Sarandib Planitia is between 170 million and 3.7 billion years

old. The south polar area, however, appears to be less than 100 million years old, possibly as young as 500,000 years.

Craig O'Neill, and Nimmo adapted a model that O'Neill had developed for the convection of Earth's crust. For Enceladus, which has a surface completely covered in cold ice that is fractured by the tug of Saturn's gravitational pull, the scientists stiffened up the crust. They picked a strength somewhere between that of the malleable tectonic plates on Earth and the rigid plates of Venus, which are so strong, it appears they never get sucked down into the interior. Their model showed that heat building up from the interior of Enceladus could be released in episodic bubbles of warm, light ice rising to the surface, akin to the rising blobs of heated wax in a lava lamp. The rise of the warm bubbles would send cold, heavier ice down into the interior. (Warm is, of course, relative. Nimmo said the bubbles are probably just below freezing, which is 273 degrees Kelvin or 32 degrees Fahrenheit, whereas the surface is a frigid 80 degrees Kelvin or -316 degrees Fahrenheit.) The model fits the activity on Enceladus when the churning and resurfacing periods are assumed to last about 10 million years, and the quiet periods, when the surface ice is undisturbed, last about 100 million to two billion years. Their model suggests the active periods have occurred only 1 to 10 percent of the time that Enceladus has existed and have recycled 10 to 40 percent of the surface. The active area around Enceladus's south pole is about 10 percent of its surface.

CASSINI FINDS PLETHORA OF PLUMES, HOTSPOTS AT ENCELADUS

Newly released images from last November's swoop over Saturn's icy moon Enceladus by Cassini spacecraft reveal a forest of new jets spraying from prominent fractures crossing the south polar region and yield the most detailed temperature map to date of one fracture. The new images from the imaging science subsystem and the composite infrared spectrometer teams also include the best 3-D image ever obtained of a "tiger stripe," a fissure that sprays icy particles, water vapor and organic compounds. There are also views of regions not well-mapped previously on Enceladus, including a southern area with crudely circular tectonic patterns. For Cassini's visible-light cameras, the Nov. 21, 2009 flyby provided the last look at Enceladus' south polar surface before that region of the moon goes into 15 years of darkness, and includes the most detailed look yet at the jets. Scientists planned to use this flyby to look for new or smaller jets not visible in previous images. In one mosaic, scientists count more than 30 individual geysers, including more than 20 that had not been seen before. At least one jet spouting prominently in previous images now appears less powerful. *"This last flyby confirms what we suspected,"* said Carolyn Porco, imaging team lead. *"The vigor of individual jets can vary with time, and many jets, large and small, erupt all along the tiger stripes."*

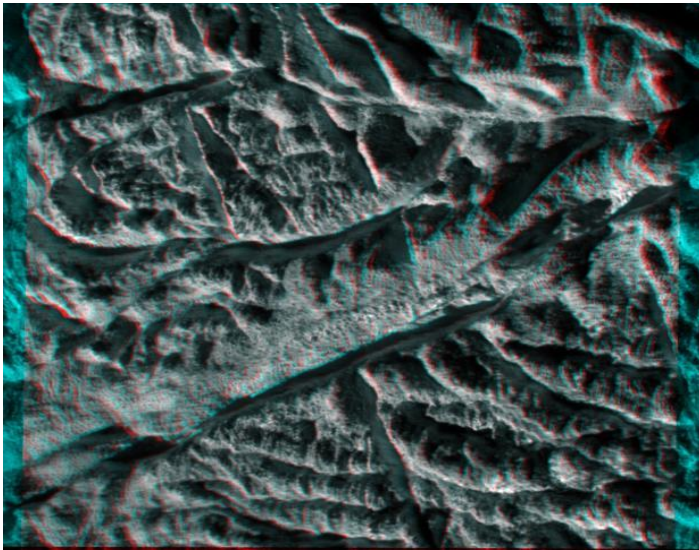


In this unique mosaic image combining high-resolution data from the imaging science subsystem and composite infrared spectrometer aboard Cassini

spacecraft, pockets of heat appear along one of the mysterious fractures in the south polar region of Saturn's moon Enceladus. Image credit: NASA/JPL/GSFC/SWRI/SSI

"Enceladus continues to astound," said Bob Pappalardo, Cassini project scientist. "With each Cassini flyby, we learn more about its extreme activity and what makes this strange moon tick."

A new map that combines heat data with visible-light images shows a 40-kilometer (25-mile) segment of the longest tiger stripe, known as Baghdad Sulcus. The map illustrates the correlation, at the highest resolution yet seen, between the geologically youthful surface fractures and the anomalously warm temperatures that have been recorded in the south polar region. The broad swaths of heat previously detected by the infrared spectrometer appear to be confined to a narrow, intense region no more than a kilometer (half a mile) wide along the fracture.



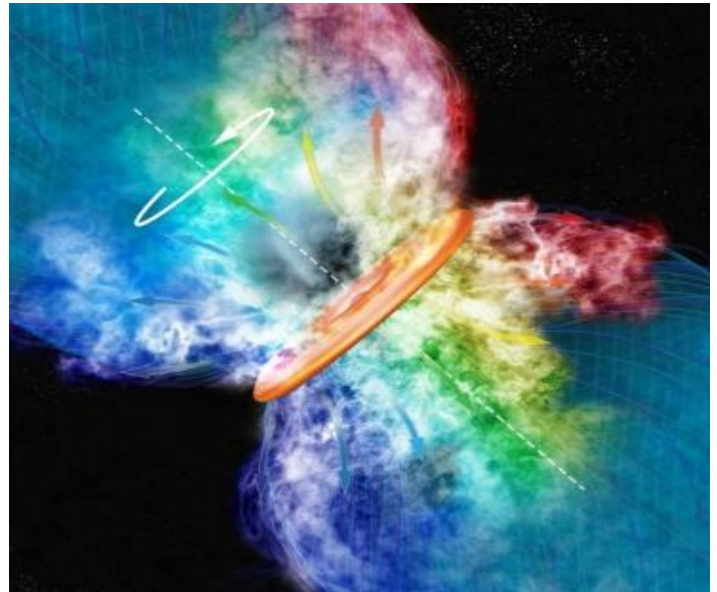
This anaglyph made from images captured by Cassini spacecraft shows a dramatic, 3-D view of one of the deep fractures nicknamed "tiger stripes" on Saturn's moon Enceladus. (put on your Red/Blue glasses) The fractures, which are located near the moon's south pole, spray jets of water ice. Image credit: NASA

In these measurements, peak temperatures along Baghdad Sulcus exceed 180 Kelvin (minus 135 degrees Fahrenheit), and may be higher than 200 Kelvin (minus 100 degrees Fahrenheit). These warm temperatures probably result from heating of the fracture flanks by the warm, upwelling water vapor that propels the ice-particle jets seen by Cassini's cameras. Cassini scientists will be testing this idea by investigating how well the hot spots correspond with the jet sources. "The fractures are chilly by Earth standards, but they're a cozy oasis compared to the numbing 50 Kelvin (-370 Fahrenheit) of their surroundings," said John Spencer, a composite infrared spectrometer team member. "The huge amount of heat pouring out of the tiger stripe fractures may be enough to melt the ice underground. Results like this make Enceladus one of the most exciting places we've found in the solar system." Some of Cassini's scientists infer that the warmer the temperatures are at the surface, the greater the likelihood that jets erupt from liquid. "And if true, this makes Enceladus' organic-rich, liquid sub-surface environment the most accessible extraterrestrial watery zone known in the solar system," Porco said. The Nov. 21 flyby was the eighth targeted encounter with Enceladus. It took the spacecraft to within about 1,600 kilometers (1,000 miles) of the moon's surface, at around 82 degrees south latitude. The full version of this story with accompanying images is at: [http://www.jpl.nasa.gov/news/news.cfm?release=2010-061&cid=release_2010-](http://www.jpl.nasa.gov/news/news.cfm?release=2010-061&cid=release_2010-061)

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<http://www.nasa.gov/cassini> and <http://saturn.jpl.nasa.gov>.

A MASSIVE STAR IS BORN IN ORION

Time-lapse movie shows that massive stars — which may hold clues about the origins of life — form like their smaller siblings. A team of astronomers led by Lynn D. Matthews at the Haystack Observatory has discovered a disk of gas swirling close to a young massive star, which they say offers the first evidence that massive stars form similarly to smaller stars. Because massive stars are believed to be responsible for creating most of the chemical elements in the universe that are critical for the formation of Earth-like planets and life, understanding how they form may help unravel mysteries about the origins of life. Until now, it had been difficult to prove how massive stars form because they are rare, form very quickly and tend to be enshrouded in dense, dusty material, making it hard to observe them. By using the Very Long Baseline Array (VLBA) radio telescope to take images of the wavelengths of light emitted by a massive young star located 1,350 light years away in the Orion constellation, Matthews' team has produced a high-resolution time-lapse movie that reveals a disk rotating around the star, known as Source I (when spoken, "Source Eye"). "It is the first really ironclad confirmation that massive young stars are surrounded by orbiting accretion disks, and the first strong suggestion that these disks launch magnetically driven winds," said astronomy and astrophysics professor Mark Krumholz of the time-lapse movie. For almost 20 years, astronomers have known that low-mass stars form as a result of disk-mediated accretion, or from material formed from a structure rotating around a central body and driven by magnetic winds. But it had been impossible to confirm whether this was true for massive stars, which are eight to 100 times larger than low-mass stars. Without any hard data, theorists proposed many models for how massive stars might form, such as via collisions of smaller stars. "This work should rule out many of them," Krumholz said of Matthews' movie.



Artist's conception of the rotating disk of hot, ionized gas surrounding Orion Source I, blocking the star from our view. A cool wind of gas is driven from the upper and lower surfaces of the disk and is sculpted into an hourglass shape by tangled magnetic field lines. Image: Bill Saxton, National Radio Astronomy Observatory/Associated Universities, Incorporated/National Science Foundation

A network of 10 radio telescope dishes located across North America, the VLBA can be thought of as a virtual telescope 5,000 miles in diameter, according to Matthews. Used as a zoom lens to penetrate

the dusty cloud surrounding the massive star, the VLBA captured images up to 1,000 times sharper than those previously obtained by other telescopes, including Hubble Space Telescope. By assembling 19 individual images of Source I taken by the VLBA at monthly intervals between March 2001 and December 2002, the high-resolution movie reveals thousands of masers, radio emitting gas clouds that can be thought of as naturally occurring lasers, located close to the massive star. According to Matthews, only three massive stars in the entire galaxy are known to have silicon monoxide masers. Because the silicon monoxide masers emit beams of intense radiation that can pierce the dusty material surrounding Source I, the scientists could probe the material close to the star and measure the motions of individual gas clumps. By tracking the gas motions through space, the astronomers discovered the rotating accretion disk comprised of gas clumps orbiting the central star, as well as clumps moving away from it that appear to be caught in an outflowing wind. Such gas outflows help form stars by carrying momentum away from the system.

One interesting implication of the masers near Source I is that some gas particles appear to move away from the massive star along curved trajectories that wrap in a helix shape resembling Twizzlers candy. *"To induce that kind of curvature, our observations seem to suggest, there is some role of magnetic fields during this process,"* Matthews said. To better understand this possible magnetic field, researchers plan to measure the polarization of the light from gas around the star, which will help them quantify its strength and geometry. The group would also like to extend the time span of the movie to several years to see the evolution of the material around the star over longer time scales. *"Full-motion movies are actually quite rare in astronomy,"* Krumholz said. *"With a few exceptions, most processes take place much too slowly for noticeable changes to occur over a human lifetime."*

BORN IN BEAUTY: PROPLYDS IN THE ORION NEBULA

A collection of 30 never-before-released images of embryonic planetary systems in the Orion Nebula are the highlight of the longest single Hubble Telescope project ever dedicated to the topic of star and planet formation. Also known as proplyds, or protoplanetary discs, these modest blobs surrounding baby stars are shedding light on the mechanism behind planet formation. Only the Hubble Space Telescope, with its high resolution and sensitivity, can take such detailed pictures of circumstellar discs at optical wavelengths.



The many proplyds in Orion nebula

Looking like a graceful watercolor painting, the Orion Nebula is one of the most photogenic objects in space and one of the Hubble Space Telescope's favorite targets. As newborn stars emerge from the

nebula's mixture of gas and dust, protoplanetary discs, also known as proplyds, form around them: the centre of the spinning disc heats up and becomes a new star, but remnants around the outskirts of the disc attract other bits of dust and clump together. Proplyds are thought to be young planetary systems in the making. In an ambitious survey of the familiar nebula using Hubble's Advanced Camera for Surveys (ACS), researchers have discovered 42 protoplanetary discs.

Visible to the naked eye, the Orion Nebula has been known since ancient times, but was first described in the early 17th century by the French astronomer Nicolas-Claude Fabri de Peiresc — who is given credit for discovering it. At 1500 light-years away, the nebula, also known as Messier 42, is the closest star-forming region to Earth with stars massive enough to heat up the surrounding gas, setting it ablaze with color, and making the region stand out to stargazers.

Within the awe-inspiring, gaseous folds of Orion, researchers have identified two different types of discs around young and forming stars: those that lie close to the brightest star in the cluster (Theta 1 Orionis C) and those farther away from it. This bright star heats up the gas in nearby discs, causing them to shine brightly. Discs that are farther away do not receive enough energetic radiation from the star to heat up the gas and so they can only be detected as dark silhouettes against the background of the bright nebula, as the dust that surrounds these discs absorbs background visible light. By studying these silhouetted discs, astronomers are better able to characterize the properties of the dust grains that are thought to bind together and possibly form planets like our own. The brighter discs are indicated by a glowing cusp in the excited material and facing the bright star, but which we see at a random orientation within the nebula, so some appear edge on, and others face on, for instance. Other interesting features enhance the look of these captivating objects, such as emerging jets of matter and shock waves. The dramatic shock waves are formed when the stellar wind from the nearby massive star collides with the gas in the nebula, sculpting boomerang shapes or arrows or even, in the case of 181-825, a space jellyfish!

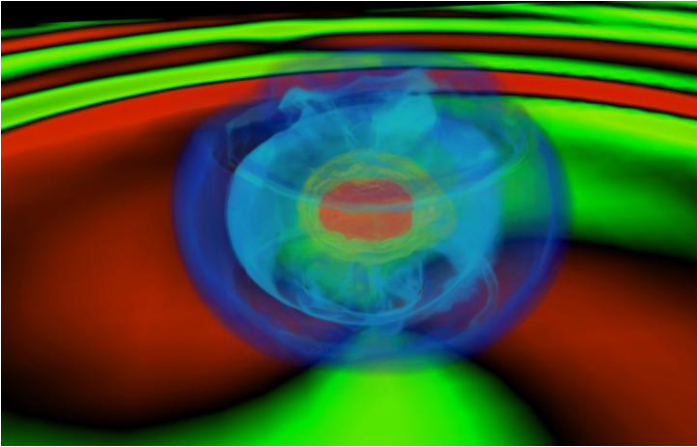
It is relatively rare to see visible images of proplyds, but the high resolution and sensitivity of Hubble and the Orion Nebula's proximity to Earth allow for precise views of these potential planetary systems. This proplyd atlas is the first scientific outcome from the HST Treasury Program on the Orion Nebula. Treasury Programs are carried out to allow scientists to conduct comprehensive studies over longer periods since time on the in-demand Hubble Space Telescope is strictly allocated. High resolution imaging of protoplanetary discs is an example of a science discovery that has led to better technology and is one of the main science cases for the Atacama Large Millimeter/submillimeter Array (ALMA), one of the largest ground-based astronomy projects of the next decade. ALMA will observe the dust at longer wavelengths, in emission (instead of in absorption as we see it at optical wavelengths) with an angular resolution up to 10 times better than that of Hubble.

WHY WON'T THE SUPERNOVA EXPLODE?

A massive old star is about to die a spectacular death. As its nuclear fuel runs out, it begins to collapse under its own tremendous weight. The crushing pressure inside the star skyrockets, triggering new nuclear reactions, setting the stage for a terrifying blast. And then... nothing happens. At least that's what supercomputers have been telling astrophysicists for decades. Many of the best computer models of supernova explosions fail to produce an explosion. Instead, according to the simulations, gravity wins the day and the star simply collapses. Clearly, physicists are missing something. *"We don't really understand how supernovas of massive stars work yet,"* says Fiona Harrison, an

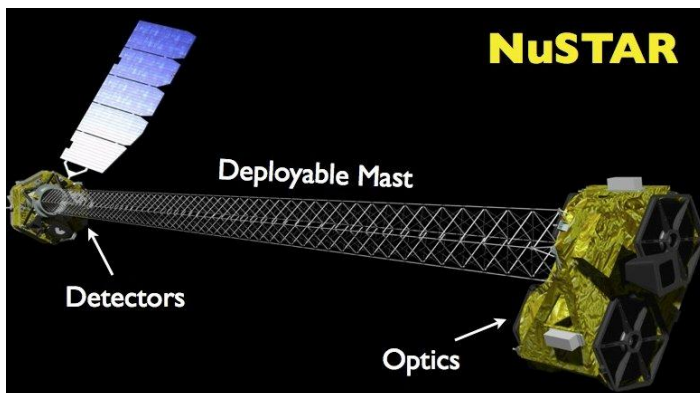
astrophysicist. The death of relatively small stars is better understood, but for larger stars — those with more than about 9 times the mass of our sun — the physics just doesn't add up.

Something must be helping the outward push of radiation and other pressures overcome the inward squeeze of gravity. To figure out what that "something" is, scientists need to examine the inside of a real supernova while it's exploding — not a particularly easy thing to do! But that's exactly what Harrison intends to do with a new space telescope she and her colleagues are developing called the Nuclear Spectroscopic Telescope Array, or NuSTAR. After it launches in 2011 aboard a Pegasus rocket, NuSTAR will give scientists an unprecedented view of high-energy X-rays coming from supernova remnants, black holes, blazars, and other extreme cosmic phenomena.



A supercomputer model of a rapidly-spinning, core-collapse supernova. NuSTAR observations of actual supernova remnants will provide vital data for such models and help explain how massive supernovas manage to explode. Credit: Fiona Harrison/Caltech

NuSTAR will be the first space telescope that can actually focus these high-energy X-rays, producing images roughly 100 times sharper than those possible with previous telescopes. Using NuSTAR, scientists will look for clues to conditions inside the exploding star etched into the pattern of elements spread throughout the nebula that remains after the star explodes.



An artist's concept of NuSTAR. Focusing X-ray optics require long focal lengths--hence the 10-meter deployable mast, which is extended after launch

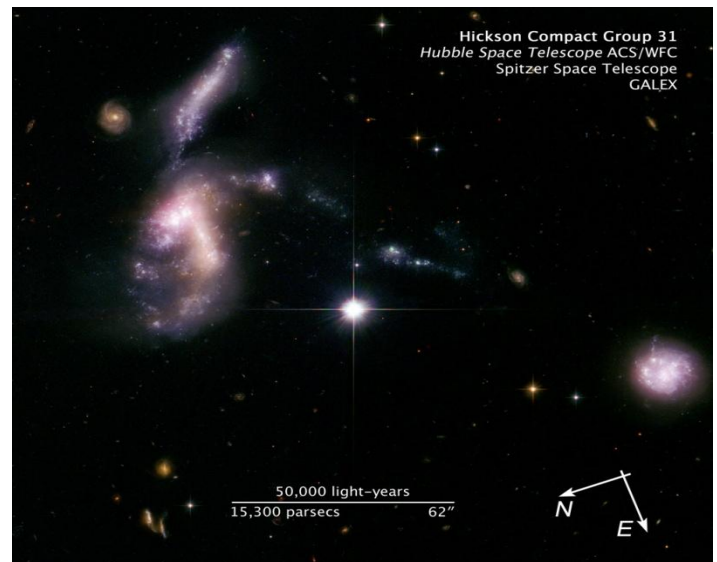
"You don't get the opportunity to watch these explosions very often, ones that are close enough to study in detail," Harrison says. "What we can do is study the remnants. The composition and distribution of the material in the remnants tells you a lot about the explosion." One element in particular is of keen interest: titanium-44. Creating this isotope of titanium through nuclear fusion requires a certain

combination of energy, pressure, and raw materials. Inside the collapsing star, that combination occurs at a depth that's very special. Everything below that depth will succumb to gravity and collapse inward to form a black hole. Everything above that depth will be blown outward in the explosion. Titanium-44 is created right at the cusp. So the pattern of how titanium-44 is spread throughout a nebula can reveal a lot about what happened at that crucial threshold during the explosion. And with that information, scientists might be able to figure out what's wrong with their computer simulations.

JURASSIC SPACE: ANCIENT GALAXIES THAT WAIT TO COME TOGETHER

Imagine finding a living dinosaur in your backyard. Astronomers have found the astronomical equivalent of prehistoric life in our intergalactic backyard: a group of small, ancient galaxies that has waited 10 billion years to come together. These "late bloomers" are on their way to building a large elliptical galaxy. Such encounters between dwarf galaxies are normally seen billions of light-years away and therefore occurred billions of years ago. But these galaxies, members of Hickson Compact Group 31, are relatively nearby, only 166 million light-years away. Hickson Compact Group 31 is one of 100 compact galaxy groups catalogued by Canadian astronomer Paul Hickson. New images of this foursome by Hubble offer a window into the universe's formative years when the buildup of large galaxies from smaller building blocks was common.

Astronomers have known for decades that these dwarf galaxies are gravitationally tugging on each other. Their classical spiral shapes have been stretched like taffy, pulling out long streamers of gas and dust. The brightest object in the Hubble image is actually two colliding galaxies. The entire system is aglow with a firestorm of star birth, triggered when hydrogen gas is compressed by the close encounters between the galaxies and collapses to form stars. The Hubble observations have added important clues to the story of this interacting group, allowing astronomers to determine when the encounter began and to predict a future merger.



"We found the oldest stars in a few ancient globular star clusters that date back to about 10 billion years ago. Therefore, we know the system has been around for a while," says astronomer Sarah Gallagher, leader of the Hubble study. "Most other dwarf galaxies like these interacted billions of years ago, but these galaxies are just coming together for the first time. This encounter has been going on for at most a few hundred million years, the blink of an eye in cosmic history. It is an extremely

rare local example of what we think was a quite common event in the distant universe." Everywhere the astronomers looked in this group they found batches of infant star clusters and regions brimming with star birth. The entire system is rich in hydrogen gas, the stuff of which stars are made. Gallagher and her team used Hubble's Advanced Camera for Surveys to resolve the youngest and brightest of those clusters, which allowed them to calculate the clusters' ages, trace the star-formation history, and determine that the galaxies are undergoing the final stages of galaxy assembly.

The analysis was bolstered by infrared data from Spitzer Space Telescope and ultraviolet observations from the Galaxy Evolution Explorer (GALEX) and Swift satellite. Those data helped the astronomers measure the total amount of star formation in the system. "Hubble has the sharpness to resolve individual star clusters, which allowed us to age-date the clusters," Gallagher adds. Hubble reveals that the brightest clusters, hefty groups each holding at least 100,000 stars, are less than 10 million years old. The stars are feeding off of plenty of gas. A measurement of the gas content shows that very little has been used up — further proof that the "galactic fireworks" seen in the images are a recent event. The group has about five times as much hydrogen gas as our Milky Way Galaxy. "This is a clear example of a group of galaxies on their way toward a merger because there is so much gas that is going to mix everything up," Gallagher says. "The galaxies are relatively small, comparable in size to the Large Magellanic Cloud, a satellite galaxy of our Milky Way. Their velocities, measured from previous studies, show that they are moving very slowly relative to each other, just 134,000 miles an hour (60 kilometers a second). So it's hard to imagine how this system wouldn't wind up as a single elliptical galaxy in another billion years." Adds team member Pat Durrell: "The four small galaxies are extremely close together, within 75,000 light-years of each other — we could fit them all within our Milky Way." Why did the galaxies wait so long to interact? Perhaps, says Gallagher, because the system resides in a lower-density region of the universe, the equivalent of a rural village. Getting together took billions of years longer than it did for galaxies in denser areas.

SPIRIT'S JOURNEY TO THE CENTER OF MARS

Mars rover Spirit has tenaciously swept, scraped, and squeezed secrets from the forbidding surface of Mars for 6 years. Now at an impasse, up to its belly in sand, it has struggled to tilt its solar panels toward the sun and collect just enough power to survive the perilously cold Martian winter. If Spirit can make it through to spring, the feisty robot will prove it's still in the game—by solving the mysteries of the Martian core. Unlocking those secrets will require the guile of a veteran explorer. Like a wily old baseball pitcher who uses knuckle balls to keep winning, the aging Spirit still has a few tricks up its sleeve. It will do its next trick without moving a single mechanical muscle. "In this case, it's a good thing Spirit is immobile," says principal investigator Steve Squires. "We can track its radio signal to determine its motion through space." Mars is rotating around its own axis and orbiting the Sun. With the rover stationary, the radio's only motion will be the motion of Mars. Because the scientists already know the specifics of the red planet's orbit, they'll be able to use Spirit's radio signal to hone in on how the planet spins around its own axis. "Mars wobbles, or precesses, as it spins," says Bruce Banerdt. "We'll measure that wobble by looking at the timing of the radio signal—how long it takes to go back and forth between Spirit's transmitter and our receivers on Earth." "Mars completes an entire wobble only once every 170,000 years," he continues. "So we'll be measuring a very tiny motion—looking at minute changes. But these minuscule numbers speak volumes about Mars' core." Spirit's radio signals will also reveal the precise speed of Mars' wobble. That, in turn,

will help the researchers calculate the planet's moment of inertia, or MOI. The moment of inertia of a spinning object—in this case, a planet—is a number that describes how easy or how hard it is to change the spin. Spin a hard-boiled egg and then spin a raw egg. You'll see a distinct difference in the way they rotate.



Spirit's view of its own predicament. The rover is now parked for the winter with its solar panels tilted only 9 degrees toward the sun. Spirit recorded this fisheye view with its rear hazard-avoidance camera after completing a drive during the 2,169th Martian day, or sol, of Spirit's mission on Mars (Feb. 8, 2010). The drive motor for the right-rear wheel (on the left in this view) stopped working in late 2009, leaving the six-wheeled rover with only four functioning wheels. The top of the image shows the underside of Spirit's solar array. Image Credit: NASA/JPL-Caltech

"The MOI affects the speed at which the axis of Mars wobbles, so the wobble speed indirectly tells us the MOI," says Banerdt. They'll add the MOI to what they already know about Mars—its size and mass. "Combining these three things with our understanding of how iron and rock behave inside a planet will allow us to set limits on the size and density of the Martian core. And the density will tell us what elements must be mixed with iron to make up the core." First, it will help scientists figure out if the core is solid or liquid. There are clues that it was molten at some time in the ancient past. A molten core is a fluid that moves and conducts electricity, so it sets up a powerful magnetic field. Researchers see remnants of that field today but are unsure how much of the core, if any, is still molten. "If Mars' core is solid through and through, the nature of the wobble will be subtly different from the wobble if the core is liquid," says Squires. "This research has implications that reverberate through all kinds of basic questions about the formation of the solar system and its planets. I have to tip my hat to Spirit. It keeps coming up with new tricks."

But first the rover has to survive the long, hard winter. Baseball great Rogers Hornsby summed it up: "People ask me what I do in winter when there's no baseball. I'll tell you what I do. I stare out the window and wait for spring." Make that Martian spring.

FROM THE EDITOR'S TERMINAL

The Stargazer is your newsletter and therefore it should be a cooperative project. Ads, announcements, suggestions, and literary works should be received by the editor at least two weeks prior to the next upcoming scheduled EAS meeting.

If you wish to contribute an article or suggestions to *The Stargazer* please contact Mark Folkerts by email or by telephone (425) 486-9733 or co-editor Bill O'Neil, at (774) 253-0747.

The Star Gazer
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In February's StarGazer:

- **** **ASTRO CALENDAR - UPCOMING ASTRONOMY EVENTS**
- **** **OBSERVER'S INFORMATION - SUN, MOON, AND PLANET VISIBILITY**
- **** **UP IN THE SKY -- THE PLANETS (AND PLUTO)**
- **** **WESTERN USA STAR PARTY SCHEDULE FOR 2010**
- **** **"THE PLANETARIUM" – BY JOHN GOERGER**
- **** **CHANDRA REVEALS SURPRISING ORIGIN OF MOST SN TYPE 1A EXPLOSIONS**
- **** **NEW WISE INFRARED ALL-SKY SURVEY TELESCOPE SENDS FIRST IMAGES**
- **** **MASSIVE STARS: GOOD PLANET HUNT TARGETS , BUT BAD SETI TARGETS**
- **** **MOST EARTHLIKE EXOPLANET STARTED OUT AS GAS GIANTS**
- **** **SUZAKU FINDS "FOSSIL" FIREBALLS FROM SUPERNOVAE**
- **** **MASSIVE BLACK HOLE IMPLICATED IN STELLAR DESTRUCTION**
- **** **CASSINI SHOWS ENCELADUS CRUST IN MOTION**
- **** **CASSINI FINDS PLETHORA OF PLUMES, HOTSPOTS AT ENCELADUS**
- **** **A MASSIVE STAR IS BORN IN ORION**
- **** **BORN IN BEAUTY: PROPLYDS IN THE ORION NEBULA**
- **** **WHY WON'T THE SUPERNOVA EXPLODE?**
- **** **JURASSIC SPACE: ANCIENT GALAXIES THAT WAIT TO COME TOGETHER**
- **** **SPIRIT'S JOURNEY TO THE CENTER OF MARS**

<p>The next EAS Meeting is 3:00 pm, Saturday February 27th * at the Evergreen Branch Library *</p>
