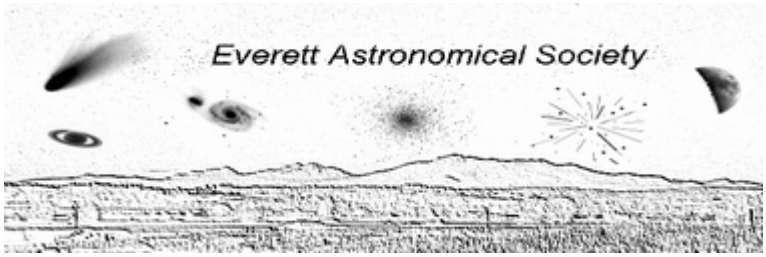
Volume MMVIII. No. 2



The Stargazer

February 2008

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		(change 'at' to @ to send email)	http://members.tripod.com/everett_astronomy

EAS BUSINESS…

NEXT EAS MEETING – SATURDAY FEBRUARY 16TH AT 7:00 PM AT AURORA ASTRO PRODUCTS STORE AT SILVER LAKE.

★★ Saturday February 16th 7:00 pm MEETING ★★

The presentation will be lunar eclipse slides from previous eclipses, and discussion of observing the upcoming Feb 20th eclipse, along with video 'Asteroids Deadly Impact' The meeting will be the Aurora Astro Products store in Silver Lake. There will be some refreshments. (It may be helpful for some folks to bring a folding chair to the meeting.)

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

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

If you are traveling northbound on I-5:
Take exit #186/128th St. and go east - to the right on 128th St. continue until you come to Murphy's Corner/Intersection with Highway 527/19th Ave SE/Old Bothell-Everett Highway (all one in the same) and turn left/north. Follow until you see Silver Lake Plaza (red brick construction) on your right with the lake is on your left.

If you are traveling southbound on I-5:

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

★ STAR PARTY INFO ★

Upcoming EAS star party schedule: (also see the regional star parties listed in the 'Astro Calendar for 2008')

(EAS scheduled star parties are suspended until spring due the cloudy weather.)

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.

Planned events are 'On hold' until spring weather returns in March or so – call Ron about spur-of-the-moment observing.

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

Other Western US Star Parties This Season…

Rooster Rock OR State Park 2008 RCA Star parties - 22 miles east of Portland on I-84 (east of Sandy River) at exit 25.
Mar 15 - Vernal Equinox Celebration at Rooster Rock
Apr 12 - Planet Parade at Rooster Rock
May 10 - Astronomy Day at Rooster Rock
Jun 14 - Summer Solstice Celebration at Rooster Rock
Jul 12 - Luna Viewing at Rooster Rock
Aug 11 - Perseid Meteor Shower Watch at Rooster Rock
Sep 06 - Autumnal Equinox Celebration at Rooster Rock
(503) 797-4610. http://www.omsi.edu/visit/planetarium/starparties.cfm

Mar 28-30 - RCA 2008 Messier Marathon Star Party - Kah-Nee-Ta Resort and Casino, Warm Springs, OR - http://www.rca-omsi.org/kahneeta.htm

Mar 8 - 6pm - OAS Messier Marathon Star Party - SilverRidge Elem. School, Silverdale, WA http://www.olympicastronomicalsociety.com/

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

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

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

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

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

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

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

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

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

Jul 02-06 - Golden State Star Party - Frosty Acres Ranch, Adin, CA http://goldenstatestarparty.blogspot.com/

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$ - FINANCIAL HEALTH - $$

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

CLUB SCOPES

SCOPE	LOAN STATUS
10-INCH WARD DOBSONIAN	AVAILABLE
10-INCH SONOTUBE DOBSONIAN	AVAILABLE
8-INCH DOBSONIAN	AVAILABLE

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

EAS MEMBER NEWS

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

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

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

- Clear Skies, Jim Bielaga"

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

425-337-4384 .
425-337-4758 fax .
New hours: .
Mon, Thu, Fri – 9:00 am to 6:00 pm .
Tues/Weds – Noon to 8:00 pm .
Sat – 10:00 am to 5:00 pm .

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

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

The Northwest Region of the Astronomical League (NWRAL) is putting together a new website and needs the following information from each club of the NWRAL. The EAS is looking for any information from members about the early history. Please contact Mark Folkerts if you have any info that could be of help. NRWAL would like a brief history of the club
- Club established date (approx 1986 ?)
- Who started the club (Terry Bacon, et. al.)
- When club joined the Astronomical League.

ASTRO CALENDAR FOR 2008

February 2008

Feb 07 - Annular Solar Eclipse, Visible in Antarctica
Feb 07 - Chinese New Year
Feb 16 – EAS Meeting 7:00 pm Aurora Astro Products store
Feb 20 - Uranus Ring Plane Crossing
Feb 20 - Total Lunar Eclipse
http://sunearth.gsfc.nasa.gov/eclipse/leplot/leplot2001/le2008feb21t.gif
Feb 24 - Saturn At Opposition
Feb 29 – Leap Day 2008

March 2008

Mar 03 - Mercury At Its Greatest Western Elongation (27 Degrees)
Mar 09 - Daylight Saving - Set Clock Ahead 1 Hour (United States)
Mar 29 – EAS Meeting 7:00 pm Aurora Astro Products store
Mar 20 - Vernal Equinox, 05:48 UT
Mar 23 - Easter Sunday
Mar 28-30 - RCA 2008 Messier Marathon Star Party - Kah-Nee-Ta OR
Mar 29 –

April 2008

Apr 22 - Lyrids Meteor Shower Peak
Apr 12 – EAS Meeting 7:00 pm Aurora Astro Products store

May 2008

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

June 2008

Jun 05-07 –2008 NWRAL "First Light" Star Party - Goldendale WA
Jun 16 - Prineville Reservoir Star Party (Prineville, OR)
Jun 20 - Summer Solstice, 20:24 UT
Jun 20 - Pluto At Opposition
Jun 21 – EAS Meeting 7:00 pm Aurora Astro Products store
Jun 30 - Jul 07 2008 Shingletown Star Party, Shingletown CA

July 2008

Jul 01 - Mercury At Its Greatest Western Elongation (22 Degrees)
Jul 2-6 – Golden State Star Party – Adin CA (Frosty Acres Ranch)
Jul 04 - Earth At Aphelion (1.017 AU From Sun)
Jul 09 - Jupiter At Opposition
Jul 26 – EAS Meeting 7:00 pm Aurora Astro Products store
Jul 29 - South Delta-Aquarids Meteor Shower Peak
Jul 31-Aug 02 – Table Mt. Star Party

August 2008

Aug 01-03 – RCA Trout Lake Star Party 2008 – Trout Lake WA
Aug 01 - Total Solar Eclipse, Visible in Canada, Greenland
Aug 01 - Alpha Capricornids Meteor Shower Peak
Aug 2-10 – Mt Kobau Star Party – Osoyoos BC
Aug 06 - Southern Iota Aquarids Meteor Shower Peak
Aug 6-10 - Mt. Bachelor Star Party - near Bend, OR
Aug 12 - Perseids Meteor Shower Peak
Aug 15 - Neptune At Opposition
Aug 16 – EAS Meeting 7:00 pm Aurora Astro Products store
Aug 16 - Partial Lunar Eclipse
Aug 25-31 Oregon Star Party
Aug TBD - Deception Pass Star Party - Bowman Bay, Deception Pass, WA

September 2008

Sep 11 - Mercury At Its Greatest Eastern Elongation (27 Degrees)
Sep 13 - Uranus At Opposition
Sep 20 – EAS Meeting 7:00 pm Aurora Astro Products store
Sep 22 - Autumnal Equinox (22:16 UT)
Sep 26-28 – Orion Nebula Star Party – Table Mt. WA

October 2008

Oct 21 - Orionids Meteor Shower Peak
Oct 25 – EAS Meeting 7:00 pm Aurora Astro Products store
Oct 27 - Asteroid 4 Vesta Closest Approach To Earth (1.539 AU)

November 2008

Nov 03 - Taurids Meteor Shower Peak
Nov 17 - Leonids Meteor Shower Peak
Nov 22 – EAS Meeting 7:00 pm Aurora Astro Products store

December 2008

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

UW Astronomy Speakers Colloquium Schedule

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

ON THE AIRWAVES - KSER 90.7 - 'IT'S OVER YOUR HEAD'

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

KPLU 88.5 FM National Public Radio has daily broadcasts of "Star Date" by the McDonald Observatory of the University of Texas at Austin,

Monday through Friday at about 6:05 pm. The short 2 minute radio show deals with current topics of interest in astronomy. The University of Washington TV broadcasts programs from NASA at 12:00 AM Monday through Friday, 12:30 AM Saturday, and 1:30 AM Sunday on the Channel 27 cable station.

EAS MEMBERSHIP BENEFITS & INFORMATION

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

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

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

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

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

EAS Library -
Membership will give you access to all the material in the lending library. The library, which is maintained by Mike Locke, consists of VCR tapes, DVDs, many books, magazines, and software titles. The EAS has a library of books, videotapes, and software for members to borrow. We always value any items you would like to donate to this library. You can contact a club officer or **Librarian Mike Locke**, phone (425) 259-5995, email lockemi at comcast.net, to borrow or donate any materials. See list here: http://members.tripod.com/everett_astronomy/eas_library.htm

Joining or Renewing with the EAS -

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

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

OBSERVER'S INFORMATION…

LUNAR FACTS

Feb 14	First Quarter Moon
Feb 20	Full Moon – **TOTAL LUNAR ECLIPSE !!!**
Feb 29	Last Quarter Moon
Mar 07	New Moon
Mar 14	First Quarter Moon
Mar 21	Full Moon
Mar 29	Last Quarter Moon
Apr 06	New Moon
Apr 12	First Quarter Moon
Apr 20	Full Moon
Apr 28	Last Quarter Moon
May 05	New Moon

Digital Lunar Orbiter Photographic Atlas of the Moon

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

UP IN THE SKY -- THE PLANETS

Object	Rises	Sets	Con	Mag
Sun	**07:21 am**	**17:32**	**Cap**	**-27.5**
Mercury	06:17 am	**16:04**	**Cap**	**+1.3**
Venus	**06:01 am**	14:54	**Sag**	**-3.9**
Mars	11:52 am	**04:26 am**	**Tau**	**-1.0**
Jupiter	**05:10 am**	13:39	**Sag**	**-1.9**
Saturn	**18:44**	**07:55 am**	**Leo**	**+0.3**
Uranus	08:05 am	**19:20**	**Aqr**	**+5.9**
Neptune	07:08 am	**17:03**	**Cap**	**+8.0**
Pluto	**03:47 am**	13:15	**Sag**	**+14.0**

(times local time for Everett PST)

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

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

NOAA SUN CALCULATOR

Need to know exactly what time the sun will set on Sept. 26, 2065? Or when it rose in 565 BC? How about the length of daylight a week from Tuesday in Albuquerque, N.M.? Just go to NOAA's solar calculator, now available on the Web. http://www.srrb.noaa.gov/highlights/sunrise/gen.html

INTERNATIONAL SPACE STATION – VISIBLE SEATTLE PASSES

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

CONSTELLATIONS OF THE MONTH – CENTAURUS & MONOCEROS

CENTAURUS: The Centaur, as this constellation is also known, borders on the constellations of Antlia, Carina, Circinus, Crux, Hydra, Lupus, Musca, and Vela, and ranks 25th in overall brightness among the constellations, containing 101 stars brighter than magnitude 5.5. Its central point is located at RA=13h,01m and Dec.= -47.5 degrees. It is completely visible from latitudes South of +25 degrees, and completely invisible from latitudes North of +60 degrees; this constellation ranks 9th in overall size, taking up almost 2.6% of the entire sky. Two of Centaurus's most famous bright stars are Proxima Centauri (alpha Centauri C), and Rigel Kentaurus (alpha Centauri). Centaurus has one associated meteor shower: the alpha Centaurids (8 Feb.), and no Messier objects. Interestingly, the nearest star system to our own is Rigel Kentaurus (generally referred to as Alpha Centauri), at a distance of 4.39 light years. It is a triple star system, the brightest two forming a wonderful telescopic double. The dimmer of the three is actually Proxima Centauri, which lies about 0.1 light years closer than the other two stars, and thus is the closest star to our own sun. The entire triple star system is the third brightest of all

the night-time stars, shining at a magnitude of –0.27. Because of the large proper motion of Alpha Centauri, in about 4,000 years, Alpha and Beta Centauri together will become a beautiful double star. Perhaps most well known of all of the other features of this constellation is the Omega Centauri globular cluster, generally regarded as the finest and most beautiful in all of the sky. Also known as NGC 5139, the total visual magnitude of this cluster is 3.7 and it takes up a diameter of almost ½ degree , but its more southerly declination (-47 degrees) makes it a difficult object at latitudes above 35 degrees North. NGC 5139 has a surprising range of metal content as well as possibly age of its members; it is also an X-ray source. Centaurus has a midnight culmination date of March 30th, so if you are planning on "snow-birding" very far south in the next few months, try to get out and enjoy some of the beauties of this constellation this winter and spring.

MONOCEROS: Monoceros, or the Unicorn, is an interesting constellation which borders on many of our familiar winter star groupings, including Orion, Canis Major and Minor, Gemini, Hydra, Lepus, and Puppis. The constellation's central point is at RA=7h01m, and Dec.=+0.5 degrees; its overall brightness is listed at a magnitude of 7.476, and it contains 36 visible stars brighter than magnitude 5.5. Its midnight culmination date is January 5th, which makes it well placed for winter observing, and the grouping has one associated meteor shower (the Monocerotids), which peak on or about December 10th. This constellation ranks 35th in size, and is completely visible from latitudes +79 degrees to –78 degrees. Monoceros also contains one Messier object, M-50, which is a magnitude 6.3 galactic (open) cluster. Perhaps more famous than the Messier object however, are a trio of objects well known to many astronomers. The first is Plaskett's Star, which is in reality a pair of extremely massive stars, among the most massive pairs yet identified. This duo sits almost directly on the Galactic Equator, and the total mass of the system is more than 100 times that of the sun. Also in Monoceros is "Hubble's Variable Nebula", a fan-shaped reflection nebula which has been seen to undergo changes in brightness, size, and shape, (but no regular period of variability has been found for the nebula). It is illuminated by the star R Monocerotis, a very young infrared-emitting stellar object surrounded by a disk of dust which is ejecting a bi-polar flow; this flow causes the variability in the nebula. Lastly, and most famous of all, is the beautiful emission nebula known as the Rosette. It surrounds an open cluster of stars containing the star 12 Monocerotis, and is an H-II region heated and ionized by this centrally located group of hot young stars. Try to enjoy the beauties of this well-placed constellation during these winter months; your time will be well spent.

YOUNG ASTRONOMER'S CORNER

QUESTION: What Happens to our Sun After the "Pulsating Variable" Stage of its Life?

ANSWER: After the pulsating variable stage, most stars develop a core (center) composed of the element carbon. Smaller stars, like our Sun, and those up to about 1.4 times the mass of the sun, will essentially die a quiet death. Others more massive end with a violent explosion called a supernova. But will the sun's eventual death really be that "quiet"? Of course, we won't be here to observe it, but perhaps other souls from a distant planet (perhaps one that humans had long since colonized) might see the sun's next step in this process. When the sun has depleted all of its available helium, it will become a red giant for the last time. Then the sun will throw off some of its mass, in the form of its outermost hydrogen "envelope" (so to speak), out flying off into space, in a stream of electrically charged particles called the stellar wind. More deep layers of the sun will be thrown off in an expanding shell of gas called a planetary nebula. A planetary nebula is typically about one-half to one light year across. It continues to expand at about 20-30 kilometers per second (up to almost 68,000 miles per hour!!), leaving the core star far behind. A planetary nebula is a form of emission nebula (see "Mirror Images" below), because as the gas shell expands, it is also being ionized (tremendously heated, essentially) by the hot star it left behind, and this causes some gas atoms to be disrupted and to glow and be visible. Planetary nebulae have nothing to do with planets; they were called this because early discoverers saw that they resembled planetary discs, rather than point-like stars. About 1,000 planetary nebula have been recorded, and are generally less then 50,000 years old; much older than that and the expanding shell would be too spread out to be visible.

QUESTION: Could a person travel through a black hole?

ANSWER: No Way!!! Remembering that humans haven't even traveled to another planet yet (!!…our own Moon yes… another planet no!!…..and definitely not to another star system similar to that of the Sun!), any person even near a black hole would be killed by many things even before reaching it!! Within a few hundred miles of a black hole, the very strong gravity forces would rip any living object apart. Very strong X-ray sources from around the black hole would cook you, and the surrounding heat would melt even the strongest and toughest of metals. So then, after a living creature or object was ripped apart, cooked, and liquefied, whatever remained would be slurped into the black hole forever!!! Not a very pretty picture, we're afraid!!!!

ASTRONOMY & TELESCOPE LINGO

ASTRONOMY LINGO: 'RUNAWAY STAR': A young, hot star of spectral type O or early B which has a very high space velocity; the star has probably been flung out from a close binary when its companion exploded as a supernova. Examples include Mu Columbae and AE Aurigae.

TELESCOPE LINGO: 'SPILLOVER': The part of the system noise (i.e., receiver noise; antenna/feeder thermal loss noise; galactic synchrotron emission noise from a radio source; and ground and atmospheric thermal emission noise) of a radio telescope using a dish antenna, that results from pick-up by the feed (i.e., the secondary antenna), from directions that do not intercept the reflecting surface of the dish.

ASTRONOMY "FUN FACTS"

★★ The Moon takes two thousandths of a second longer each year to circle the earth: this is about as long as it takes for a balloon to pop. In the far future, there will be increasingly less moonlight time as a result of this, and its light will be dimmer as well, as the earth's only natural satellite gradually pulls farther away.

★★ The motion of the Sun across Mercury's sky, when the planet is closest to the Sun in its orbit, is strange to say the least. From a site on Caloris Basin (Mercury's largest geographical feature), viewers (who would need protection from broiling temperatures) would see the Sun (also 3x larger than it appears in Earth's sky) first rise in the east. Then it would move very slowly across the sky, slow down and come to a complete halt when almost due south, and then again move westward, finally setting in the west. An interesting detail however of Mercury's Sun cycle is that the entire process of sunrise, sunstop, and sunset would take about 88 Earth days!

★★ The Big Bang singularity at Plank time was the ultimate black hole; infinite temperature and density existed; (Plank time is that time after the big bang where the uncertainty principle of quantum mechanics prevents speculation on times shorter than it). What we are and where we live today emerged from this initial black hole. Some scientists conjecture that our universe began as a black hole in another universe, which began as a black hole in another universe, etc…, etc….!!

★★ The strong nuclear force governs the reactions between nuclear particles. If this force had been more forceful by a few percent during the first moments of the universe, then helium-2, which presently does not exist, would have been created in large quantity. The stars would have been made of helium instead of primarily hydrogen, and would have been very unstable as a result. They would have burned and/or exploded quickly, and the life of our universe would have been very quick indeed.

★★ The interstellar dust in our Galaxy alone is equivalent to the mass of over 450 trillion planet Earths!!

★★ More interstellar dust grains can fit into about 12 cubic inches than there are stars in the entire Milky Way Galaxy (i.e., far more than 100 billion dust grains!).

PLANETARY FOCUS - JUPITER

For the month of February 2008, our guest planet is Jupiter, and these are the facts:

Rotation around the Sun: every 11.86 years

Orbit: from 4.95 (closest or 'perihelion') to 5.46 (furthest or 'aphelion')

Astronomical Units (AU)*; this is an orbit that varies between approximately 460 and 508 million miles from the sun. (*Note: One AU equals approximately 93 million miles).

Inclination of Orbit to Ecliptic: 1.3 degrees.

Mean Orbital Velocity: 13.06 km/sec.

Diameter at Equator: 142,985 kilometers (or 88,865 miles).

Mass: 317.83 (approximately 318 times more massive than earth); (5.9742 x (10 e24 (10 to the 24th power)) kilograms = 1 Earth Mass).

Density: 1.3 times that of water (global density).

Surface Gravity (Earth = 1): 2.54

Period of Rotation on its own axis: approximately 9 hours, 55 minutes.

Axis tilt: 3.12 degrees.

Satellites (moons): 62(!!!), as well as planetary rings.

Special Notes About Jupiter: Jupiter is the largest planet in the solar system. Its rotation period is shorter than that of any other planet (less than 10 hours); this leads to a polar diameter (133,718 kilometers), much shorter than the equatorial diameter. Jupiter's mass is more than twice that of all the other planets combined. A density of only 1.3 times that of water however, suggests that it is mostly composed of the lighter elements of hydrogen and helium. At opposition (approximately every 13 months), Jupiter shines at an apparent magnitude of –2.5, and has an apparent diameter of 47 arc seconds. Among the 62 moons of Jupiter are the four famous Galilean satellites (Io, Europa, Ganymede (the largest moon in the entire solar system), and Callisto), all discovered in 1610 by Galileo (and independently by Simon Marius). These Galilean moons (see below) are bright enough to be seen with binoculars. Although not as famous or readily visible as Saturn's, Jupiter also has a ring system; they were discovered as the Voyager 1 probe moved inside of the orbit of one of the other 12 moons of Jupiter (Amalthea) in 1979. Jupiter has a series of wind-driven bands of light clouds (zones) and dark clouds (belts) that cross the disc of the planet parallel to the equator. Within these belts and zones, irregular streaks and spots are seen, including the Great Red Spot, which has been observed from earth since the 17th century; most of these spots and streaks are far more transitory or temporary, however.

Several probes have flown by and investigated Jupiter's atmosphere and structure. These include Pioneer 10 and 11, the Voyager probes, and the Ulysses, and Galileo probes. Cloud zones and belts predominate below about +/- 45 degrees latitude. The lighter colored zones appear to be comprised of ammonia crystals, and are higher clouds lifted by convection of warmer gases; the darker belts are comprised of lower clouds of descending gas flows, and appear to be comprised of hydrogen, sulphur compounds, ammonium hydrosulphide, and possibly organic compounds formed in photochemical reactions. Jupiter is about 90% hydrogen and 10% helium with lower percentages of methane, water, ammonia, other trace compounds, and "rock" (core). This is similar to the composition of the primordial Solar System Nebula from which the entire solar system was formed. The rapid rotation of Jupiter produces the colorful cloud systems.

Our knowledge of the innermost aspects of Jupiter (and the other gas planets) is very indirect. Jupiter's core is most likely silicate rock and iron, and above this is the vast bulk of the planet in the form of liquid metallic hydrogen. Outside of this is a layer of molecular hydrogen and helium, followed by the outermost hydrogen and helium atmosphere, with traces of other compounds as mentioned above. Liquid metallic hydrogen consists of ionized protons and electrons (like the interior of the Sun but at a far lower temperature). At the temperature and pressure of Jupiter's interior, hydrogen is a liquid, not a gas; it is also an electrical conductor and the source of Jupiter's immense magnetic field; this magnetic field is about 19,000 times stronger than the earth's. Jupiter radiates about twice as much heat as it receives from the sun, indicating an internal reservoir of heat energy left over from its creation. This energy may play a part in Jupiter's dynamic zonal and belted cloud (weather) systems (by contributing to convection and very high winds, for example). This energy flow, the planet's rapid rotation, and a greenhouse effect, help to minimize temperature variations in various regions of the planet. Jupiter also emits radio waves (by several mechanisms), but is not massive enough to undergo nuclear fusion reactions like the sun; Jupiter would have to be about 80 times more massive than it is for this to happen.Briefly, Jupiter's Galilean Moons are very interesting in their own right. Europa (the smallest) is smaller than the earth's moon; it is a smooth moon with an icy crust, which is crisscrossed by streaks and cracks. Callisto is the faintest and outermost of these famous moons, and is heavily rayed and cratered. Callisto is believed to have a thick crust of ice and rock, beneath which is thought to be water; this moon also has several systems of concentric ring mountain formations. Ganymede, the largest moon in the entire solar system, is also the brightest of these four Galilean moons. The main surface features on Ganymede are darker cratered areas, and lighter, geologically younger areas with long parallel grooves (sulci); these two features intermingle, and give Ganymede a very elaborate surface appearance; there are areas of exposed ice and long parallel mountain ridges. Finally, Io (the innermost) has intense volcanic action, and volcanoes have been seen to eject material over very extensive areas on this moon; Io is the most volcanically active body known in the solar system. Io orbits within Jupiter's magnetosphere, and its volcanic activity is thought to result from the heating gained by interaction with

Jovian tidal forces. Erupted material (such as sulphur and hydrogen) escapes into the Jovian magnetosphere and is ionized; it forms a ring or torus centered on Io. This ionized matter may affect several phenomena on Jupiter, including aurorae and radio bursts.

One very famous surface feature of Jupiter should be mentioned: The Great Red Spot. This oval spot is located about 22 degrees south of Jupiter's equator. It is an immense high pressure storm (anticyclone), much colder and higher than surrounding clouds. It has been noted that the Great Red Spot (GRS) rotates in a counterclockwise manner with a rotation period of about six days. The north winds on the spot are blowing to the west; the south winds to the east; these outer perimeter winds can reach velocities of over 250 mph. The GRS has been observed for over 300 years (first observed by Robert Hooke in 1664), with variations in size, brightness, and color. At its greatest observed dimensions, the GRS can be as large as 40,000 by 14,000 kilometers. Color varies from pale pinkish beige to bright red; these color changes have been attributed to chemical changes, such as the conversion of phosphene into red phosphorous. Try to enjoy this beautiful planet when visible anytime, but most especially, as for any superior (outside) planet, at opposition.

"MIRROR IMAGES"

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

CLASS OF OBJECT: EMISSION NEBULA: A region of very hot interstellar dust and gas that shines by its own light. Most of the gas atoms in the nebula are ionized, and the resulting free electrons move around in the nebula. These free electrons interact still further with other ions, causing light and other radiation to be emitted from the emission cloud; the decay of excited atoms also contributes to the emissions. These nebulae contain primarily free electrons and hydrogen ions, with some helium ions as well as other trace elements, including oxygen and carbon. These various nebular constituents interact in three main ways, and, as a result, produce various types of radiation. Firstly, an electron can recombine with an ion (usually hydrogen); this generally leads to the emission of radio, optical, and infrared radiation. Secondly, a free electron can collide with an ion without being captured; energy is transferred to the ion, which becomes excited. These excited ions return to their normal state by emitting light at various, discrete wavelengths. Lastly, free electrons can be decelerated or slowed when they pass by an ion; as a result, energy is radiated away, mainly in the form of radio waves. There are three main types of emission nebulae, and all have very low gas densities. In an H-II emission nebula (ionized hydrogen nebula, such as the Orion nebula), the gas is ionized by UV radiation from nearby very hot young stars, such as O and B stars. In planetary nebulae, such as M-57 (the Ring Nebula), the nebula gas is ionized by UV radiation from a dying star remnant which lies within the nebula, and the nebula itself is comprised of gas released from the dying star. Lastly, in supernova remnants, the gas of the nebula can be ionized by UV synchrotron radiation (electromagnetic radiation resulting from very high-energy electrons which are moving within a magnetic field). In these supernovae remnants, the atoms can also be ionized as a result of collision interactions of the growing, expanding remnant with surrounding gas which it impacts as it expands. Still other ionization mechanisms may be at work, but these are the major ones that are better understood. The dramatic colors of an emission nebula (mostly red and green), are mainly due to excitation and recombination.

REPRESENTATIVE NORTHERN HEMISPHERE OBJECT: Orion Nebula (M42; NGC 1976): Visible to the naked eye as a diffuse luminous patch in Orion's sword, the Orion Nebula is one of the brightest emission nebula in the sky, and is about 400 parsecs distant from earth. It is an H-II system, and is associated with the Orion molecular cloud, itself part of a system of giant molecular clouds in the constellation of Orion. The nebula is centered on a dense stellar cluster known as the Trapezium; the Trapezium contains four prominent hot young stars which ionize the nebula gases, producing both radio and optical radiation. The Trapezium vicinity also contains other stars, protostars, gas, and dust. The four main stars of the Trapezium form the multiple star known as theta Orionis. The total intrinsic brightness (luminosity) of the nebula is equal to about 300,000 times that of the Sun. The Orion Nebula is a source of X-rays as well, and is an area of very active star formation.

REPRESENTATIVE SOUTHERN HEMISPHERE OBJECT: 30 Doradus (NGC 2070): A very large and very luminous emission nebula located in the Large Magellanic Cloud (LMC). It is a grouping of H-II regions involved in relatively very fast and intricate motions. Also known as the Tarantula Nebula, it is the brightest object in the LMC, with an absolute magnitude of –19; it is also the most intense radio source in the LMC. The most luminous object within the Tarantula Nebula has been designated R136 a, b, and c; this grouping is very luminous at both optical and UV wavelengths, and lies near the center of the entire nebula. The brightest component is R136a, and it has been shown to be a strong UV source with a very potent stellar wind. Hubble Space Telescope research has shown R136a to be a notably dense cluster containing at least 12 very massive and young O-type stars, all situated within a region only 0.25 parsecs from end to end.

ASTRONOMICAL NOTES -- ON & OFF THE WEB…

TOTAL LUNAR ECLIPSE - 02.20.2008

On Wednesday evening, February 20th, the full Moon over the Americas will turn a delightful shade of red and possibly turquoise, too. **It's a total lunar eclipse—the last one until Dec. 2010**. The Sun goes down. The Moon comes up. You go out and look at the sky. Observing the eclipse is that easy. **Maximum eclipse, and maximum beauty, occurs at 7:26 pm PST**.

A lunar eclipse happens when the Moon passes through the shadow of Earth. You might expect the Moon to grow even more ashen than usual, but in fact it transforms into an orb of vivid red. Why red? That is the color of Earth's shadow. Consider the following: Most shadows we're familiar with are black or gray; step outside on a sunny day and look at your own. Earth's shadow is different because, unlike you, Earth has an atmosphere. The delicate layer of dusty air surrounding our planet reddens and redirects the light of the sun, filling the dark behind Earth with a sunset-red glow. The exact tint--anything from bright orange to blood red is possible--depends on the unpredictable state of the atmosphere at the time of the eclipse. "*Only the shadow knows*," says astronomer Jack Horkheimer of the Miami Space Transit Planetarium.

Transiting the shadow's core takes about an hour. **The first hints of red appear around 7 pm PST**, heralding a profusion of coppery hues that roll across the Moon's surface enveloping every crater, mountain and moon rock, **only to fade away again after 8 pm PST**. No special filter or telescope is required to see this spectacular event. It is a bright and leisurely display visible from cities and countryside alike.

While you're watching, be alert for another color: turquoise. Observers of several recent lunar eclipses have reported a flash of turquoise bracketing the red of totality. "*The blue and turquoise shades at the edge of Earth's shadow were incredible*," recalls amateur astronomer Eva Seidenfaden. The source of the turquoise is ozone. Eclipse researcher Dr. Richard Keen of the University of Colorado explains: "*During a lunar eclipse, most of the light illuminating the moon passes through the stratosphere where it is reddened by scattering. However, light passing through the upper stratosphere penetrates the ozone layer, which absorbs red light and actually makes the passing light ray bluer*." This can be seen, he says, as a soft blue fringe around the red core of Earth's shadow. **To catch the turquoise on Feb. 20th, he advises, "*look during the first and last minutes of totality*." That would be around 7:01 and 7:51 pm PST**. Blood red, bright orange, gentle turquoise: it's all good. **Mark your calendar in vivid color for the Feb. 20th lunar eclipse**.

STARDUST COMET DUST RESEMBLES ASTEROID MATERIALS

Contrary to expectations for a small icy body, much of the comet dust returned by the Stardust mission formed very close to the young sun and was altered from the solar system's early materials. When the Stardust mission returned to Earth with samples from the comet Wild 2 in 2006, scientists knew the material would provide new clues about the formation of our solar system, but they didn't know exactly how. New research reveals that, in addition to containing material that formed very close to the young sun, the dust from Wild 2 also is missing ingredients that would be expected in comet dust. Surprisingly, the Wild 2 comet sample better resembles a meteorite from the asteroid belt rather than an ancient, unaltered comet.

Comets are expected to contain large amounts of the most primitive material in the solar system, a treasure trove of stardust from other stars and other ancient materials. But in the case of Wild 2, that simply is not the case. By comparing the Stardust samples to Cometary Interplanetary Dust Particles (CP IDPs), the team found that two silicate materials normally found in cometary IDPs, together with other primitive materials including presolar stardust grains from other stars, have not been found in the abundances that might be expected in a Kuiper Belt comet like Wild 2. The high-speed capture of the Stardust particles may be partly responsible; but extra refractory components that formed in the inner solar nebula within a few astronomical units of the sun, indicate that the Stardust material resembles chondritic meteorites from the asteroid belt. "*The material is a lot less primitive and more altered than materials we have gathered through high altitude capture in our own stratosphere from a variety of comets*," said Hope Ishii, lead author of the research. "*As a whole, the samples look more asteroidal than cometary*." Because of its tail formed by vaporizing ices, Wild 2 is, by definition, a comet. "*It's a reminder that we can't make black and white distinctions between asteroids and comets*," Ishii said. "*There is a continuum between them*." The surprising findings contradict researchers' initial expectations for a comet that spent most of its life orbiting in the Kuiper Belt, beyond Neptune. In 1974, Wild 2 had a close encounter with Jupiter that placed it into its current orbit much closer to Earth.

Comets formed beyond the so-called 'frost line' where water and other volatiles existed as ices. Because of their setting far from the sun, they have been viewed as a virtual freezer, preserving the original preliminary ingredients of the solar system's formation 4.6 billion years ago. The Stardust spacecraft traveled a total of seven years to reach Wild 2 and returned to Earth in January 2006 with a cargo of tiny particles for scientist to analyze.

This is one of the first studies to closely compare Stardust particles to CP IDPs. This class of IDPs is believed to contain the most primitive and unaltered fraction of the primordial material from which our planets and other solar system objects formed. They are highly enriched in isotopically anomalous organic and inorganic outer solar nebula materials inherited - through the presolar molecular cloud - from dust produced around other stars. IDPs are gathered in the stratosphere by high altitude airplanes (ER-2s and WB-57s) that are typically more than 50 years old.

The team specifically searched for two silicate materials in Stardust that are believed to be unique to cometary IDPs: amorphous silicates known as 'GEMS' (Glass with Embedded Metal & Sulfides); and sliver-like whiskers of the crystalline silicate Enstatite (a rock-forming mineral). Surprisingly, the team found only a single enstatite whisker in the Stardust samples, and it had the wrong crystallographic orientation - a form typical of terrestrial and asteroidal enstatite. Objects similar to 'GEMS' were found, but Ishii and the team showed they were actually created during the high speed 6-kilometer per second impact of Wild 2 comet dust with the Stardust spacecraft's collector by making similar material in the laboratory.

In analyzing the Stardust material, Ishii's team the SuperSTEM (scanning transmission electron microscope). Ishii said future analyses should focus on larger-grained materials, so-called micro-rocks, which suffered less alteration. "*The material found in primitive objects just wasn't there in the samples*," said John Bradley, another author. "*I think this is science in action. It's really exciting because it's just not what we expected*." "*Wild 2 doesn't look like what we thought all comets should look like*," Ishii said. "*The Stardust mission was a real success because without it, we would never have learned these things about our solar system. The sample return was vital for us to continue to unravel how our solar system formed and evolved*."

Stardust launched in February 1999 and set off on three giant loops around the sun. It began collecting interstellar dust in 2000 and met Wild 2 in January 2004, when the spacecraft was slammed by thousands of comet particles including some the size of BBs that could have compromised the mission. It is the first spacecraft to safely make it back to Earth with cometary dust particles in tow.
https://publicaffairs.llnl.gov/news/news_releases/2008/NR-08-01-05.html

GIANT STORM AT JUPITER UNEARTHS A BURIED PAST

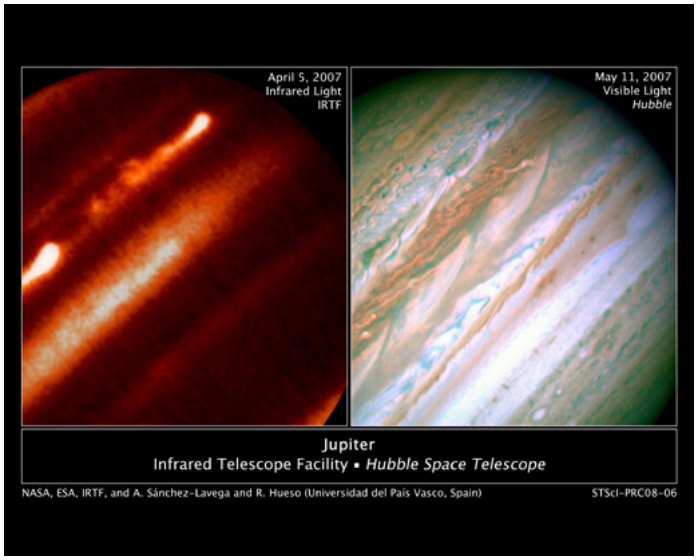
Scientists around the globe have observed an astonishing and rare change in Jupiter's atmosphere -- a huge disturbance churning in the middle northern latitudes of the planet as two giant storms erupted. Jupiter's winds are the strongest at middle northern latitudes, reaching about 600 kilometers per hour (370 miles per hour). Similar phenomena occurred in 1975 and 1990, but this event has never been observed before with high-resolution modern telescopes. The storm eruption was captured in late March 2007 by HST, the IRTF Infrared Telescope Facility on Mauna Kea, and telescopes in the Canary Islands. A network of smaller telescopes around the world also supported these observations. An international team coordinated by Agustin

Sanchez-Lavega monitored the new eruption of cloud activity and its evolution with unprecedented resolution.

"*Fortuitously, we captured the onset of the disturbance with Hubble, while monitoring the planet to support the New Horizons flyby observations of Jupiter in its route to Pluto. We saw the storm grow rapidly since its beginning, from about 400 kilometers [250 miles] to more than 2,000 kilometers [1,245 miles] in size in less than one day*," said Sanchez-Lavega.

The atmosphere of the gaseous giant planet Jupiter is always turbulent. Its circulation is dominated by a pattern of cloud bands alternating with latitude, and by a persistent system of jet streams, both of unknown origin. Changes in the cloud bands are sometimes violent, starting from a localized eruption and followed by the development of a planetary-scale disturbance. The nature of these disturbances and the power source for these jets remains a controversial matter among planetary scientists and meteorologists. The phenomena could be powered by the sun, as is Earth, by the strong internal heat source emanating from Jupiter's interior, or by a combination of both.

According to the analysis, the bright plumes were storm systems triggered in Jupiter's deep water clouds that vigorously moved upward in the atmosphere and injected a fresh mixture of ammonia ice and water about 30 kilometers (20 miles) above the visible clouds. The storms moved in the peak of a jet stream in Jupiter's atmosphere at 600 kilometers per hour (375 miles per hour). They disturbed the jet and formed in their wake a turbulent planetary-scale disturbance containing red cloud particles. "*The infrared images distinguish the plumes from lower-altitude clouds and show that the plumes are lofting ice particles higher than anyplace else on the planet*," said Glenn Orton, second author of the paper.



In spite of the energy deposited and the stirring and turmoil generated by the storms, the jet remained practically unchanged when the disturbance ceased, keeping steady against these storms. Models of the disturbance indicate that the jet stream extends deep in the buried atmosphere of Jupiter, more than 100 kilometers (62 miles) below the cloud tops where most sunlight is absorbed. "*This confirms previous findings by the Galileo probe when it descended through Jupiter's upper atmosphere in December 1995. Although both regions are meteorologically different, all the evidence points to a deep extent for Jupiter's jets and suggest that the internal heat power source plays a significant role in generating the jet*," said Sanchez-Lavega.

A comparison of this disturbance with the two previous events in 1975 and 1990 shows surprising similarities and coincidences, all of which remain unexplained. All three eruptions occurred with a periodic interval of about 15 to 17 years. The plumes always appear in the jet peak; the disturbance erupted with exactly two plumes. Finally, the plumes moved with the same speed of the jet peak in all three events. Understanding this outbreak could be the key to unlocking the mysteries buried in the deep Jovian atmosphere.

Understanding these phenomena is important for Earth's meteorology, where storms are present everywhere and jet streams dominate the atmospheric circulation. In this way, Jupiter represents a natural laboratory where atmospheric scientists study the nature and interplay of the intense jets and severe atmospheric phenomena.
http://www.nasa.gov/topics/solarsystem/features/hubble20080123c.html
http://www.jpl.nasa.gov/news/news.cfm?release=2008-013

LINKED HAWAIIAN TELESCOPES CATCH A NOVA SURPRISE

First results from a new scientific instrument at the Keck Observatory at Mauna Kea, HA, are helping scientists overturn long-standing assumptions about powerful explosions called novae and have produced specific information about one nearby nova. This sophisticated new system, called the Keck Interferometer, combines the observing power of the two 10-meter (33 feet) Keck telescopes into a single mega-telescope. Using the interferometer's "nulling" mode, data were taken by the Keck Interferometer team on a nearby nova called RS Ophiuchi. In "nulling" mode, the Keck Interferometer suppresses the blinding light of a star so researchers can study the surrounding environment. The instrument helps them observe very faint objects near bright sources and produces 10 times more resolving power than a single Keck telescope working alone. It is the only instrument of its kind in operation. The nulling mode was developed to search for dust regions around nearby stars, where planets might be forming, but the bright starlight poses a great challenge. "*Because a star is so much brighter than the dust, something has to block the light, which is what the nuller does*," said Rachel L. Akeson, Keck Interferometer project scientist. "*This technique turns out to be useful for lots of other kinds of objects, including this one, where dust is near a star that just went nova*."

The star in the constellation Ophiuchus went nova at the perfect time for the team, on Feb. 12, 2006. "*We were extremely lucky, because we had astronomers in place at two mountain-top interferometers, Keck in Hawaii and Infrared Optical Telescope Array in Arizona. Within minutes of hearing about the discovery of the nova, we alerted both teams to start observing it that night*," said Wes Traub, a senior research scientist.

The nova system, known as RS Oph consists of a white dwarf and a red giant. The red giant is gradually shedding its massive gaseous outer layers, and the white dwarf is sweeping up much of this wind, growing in mass over time. As the matter builds up on the white dwarf's surface, it eventually reaches a critical temperature that ignites a thermonuclear explosion that causes the system to brighten 600-fold. RS Oph was previously observed blowing its stack in 1898, 1933, 1958, 1967 and 1985, so astronomers were eagerly anticipating the 2006 eruption.

About three-and-a-half days after the nova was detected, the group observed the explosion with the Keck nuller. They set the instrument to cancel the nova's light, allowing them to see the much fainter surrounding material, and then the extremely bright blast zone. The instrument's versatility was key to a surprising

discovery. The nuller saw no dust in the bright zone, presumably because the nova's blast wave vaporized dust particles. But farther from the white dwarf, at distances starting around 20 times the Earth-sun distance, the nuller recorded the spectral chemical signature of silicate dust. The blast wave had not yet reached this zone, so the dust must have pre-dated the explosion. "*This flies in the face of what we expected. Astronomers had previously thought that nova explosions actually create dust*," said Richard Barry, lead author of the paper on the observations. The team thinks the dust is created as the white dwarf plows through the red giant's wind, creating a pinwheel pattern of higher-density regions that is reminiscent of galaxy spiral arms. Inside these arms, atoms become cool enough and dense enough to allow atoms to stick together to form dust particles. The nova's blast wave has since destroyed RS Oph's pinwheel pattern, but it should re-form over the next few years, and future observations by Spitzer Space Telescope could see it. Barry is also coauthor of a paper based on Spitzer observations of RS Oph.

Most studies of RS Oph have relied on spectroscopic models, which have not been able to distinguish various nova components with as much detail as the interferometer. The Keck nuller measured one component of the RS Oph system to an accuracy of just 4 milli-arcseconds, or about the size of a basketball seen 7,500 miles away.
http://www.jpl.nasa.gov/news/news.cfm?release=2008-016

HYPERFAST STAR PROVEN TO BE ALIEN

A young star is speeding away from the Milky Way so fast that astronomers have been puzzled by where it came from; based on its young age it has traveled too far to have come from our galaxy. Now by analyzing its velocity, light intensity, and for the first time its tell-tale elemental composition, Astronomers Alceste Bonanos, Mercedes Lopez-Morales, Ian Hunter and Robert Ryans have determined that it came from our neighboring galaxy, the Large Magellanic Cloud (LMC). The result suggests that it was ejected from that galaxy by a yet-to-be-observed massive black hole.

The star, dubbed HE 0437-5439, is an early-type star and one of ten so-called hypervelocity stars so far found speeding away from the Milky Way. "*But this one is different from the other nine*," commented Lopez-Morales. "*Their type, speed, and age make them consistent with having been ejected from the center of our galaxy, where we know there is a super-massive black hole. This star, discovered in 2005*, initially appeared to have an elemental makeup like our Sun's, suggesting that it, too, came from the center of our galaxy. But that didn't make sense because it would have taken 100 million years to get to its location, and HE 0437-5439 is only 35 million years old*." To explain the enigma, or "paradox of youth," the discoverers proposed that HE 0437-5439 was either a so-called blue straggler -- a relatively young, massive star resulting from the merger of two low-mass stars from the Milky Way, or it originated from the Large Magellanic Cloud. "*We were intrigued by the conundrum and decided to take up the challenge to solve this*," stated Bonanos. "*Stars in the LMC are known to have lower elemental abundances than most stars in our galaxy, so we could determine if its chemistry was more like that galaxy's or our own*."

The team confirmed results of the previous study concerning the mass, age, and speed of the star. It is about nine times the mass of our Sun, about 35 million years old, and it is zooming away from the Milky Way and Large Magellanic Cloud into intergalactic space at 1.6 million miles per hour (2.6 million km/hour).

Although the previous study was able to roughly estimate the star's elemental composition, the measurements were not detailed enough to determine if the elements match stars in our galaxy, or are characteristic of stars from the Large Magellanic Cloud. These astronomers were able to measure the relative abundances of certain elements for the first time in any hypervelocity star. The relative abundance of key elements tells them where a star originated. "*We've ruled out that the star came from the Milky Way*," explained Bonanos. "*The concentration of elements in Large Magellanic Cloud stars are about half those in our Sun. Like evidence from a crime scene, the fingerprints point to an origin in the Large Magellanic Cloud*." Based on the speed of the star's rotation measured by the discoverers, and confirmed by this team, the astronomers believe that the star was originally part of a binary system. The binary could have passed close to a black hole 1,000 the mass of the Sun**. As one star was pulled into the black hole, the other was whipped into frenzy and flung out of the galaxy. "*This is the first observational clue that a massive black hole exists somewhere in the LMC. We look forward to finding out where this black hole might be*," concluded Bonanos.

UNUSUAL SUPERNOVAE MAY REVEAL INTERMEDIATE-MASS BLACK HOLES IN GLOBULAR CLUSTERS

A strange and violent fate awaits a white dwarf star that wanders too close to a moderately massive black hole. According to a new study, the black hole's gravitational pull on the white dwarf would cause tidal forces sufficient to disrupt the stellar remnant and reignite nuclear burning in it, giving rise to a supernova explosion with an unusual appearance. Observations of such supernovae could confirm the existence of intermediate-mass black holes, currently the subject of much debate among astronomers.

"*Our supercomputer simulations show a peculiar supernova that would be a unique signature of an intermediate-mass black hole*," said Enrico Ramirez-Ruiz, an assistant professor of astronomy and astrophysics. Ramirez-Ruiz, and his collaborators -- Stephan Rosswog and William Hix, used detailed computer simulations to follow the entire process of tidal disruption of a white dwarf by a black hole. Their simulations included gas dynamics, gravity, and nuclear physics, requiring weeks of computer time to simulate events that would take place in a fraction of a second.

"*Every star that is not too massive ends up as a white dwarf, so they are very common. We were interested in whether tidal*

disruption can bring this stellar corpse to life again," said Rosswog, the first author of the paper. A white dwarf can explode as a "type Ia" supernova if it accumulates enough mass by siphoning matter away from a companion star. When it reaches a critical mass (about 1.4 times the mass of the Sun), the white dwarf collapses and explodes. Astronomers use these type Ia supernovae as "standard candles" for cosmic distance measurements because their brightness evolves over time in a predictable manner.

The new paper describes a distinctly different mechanism for igniting a white dwarf, in which tidal disruption by a black hole causes drastic compression of the stellar material. The white dwarf is flattened into a pancake shape aligned in the plane of its orbit around the black hole. As each section of the star is squeezed through a point of maximum compression, the extreme pressure causes a sharp increase in temperatures, which triggers explosive burning. The explosion ejects more than half of the debris from the disrupted star, while the rest of the stellar material falls into the black hole. The infalling material forms a luminous accretion disk that emits x-rays and should be detectable by the Chandra X-ray Observatory, the researchers said. "*This is a new mechanism for ignition of a white dwarf that results in a very different type of supernova than the standard type Ia, and it is followed by an x-ray source*," Ramirez-Ruiz said.

He estimated that this type of event would occur about 100 times less frequently than the standard type Ia supernovae, but should be detectable by future surveys designed to observe large numbers of supernovae. The Large Synoptic Survey Telescope (LSST), planned for completion in 2013, is expected to discover hundreds of thousands of type Ia supernovae per year.

"*These exotic creatures will start showing up in the data from the LSST*," Ramirez-Ruiz said. "*We want to predict the light curves so we can look for them in the survey data*."

The mechanism described in the paper requires a black hole that is neither too small nor too big. Such intermediate-mass black holes (500 to 1,000 times the mass of the Sun) may reside in some globular star clusters, but there is much less evidence for their existence than there is for the relatively small stellar black holes (tens of times the mass of the Sun) or for supermassive black holes (a few million times the mass of the Sun), found at the centers of galaxies.

The new paper describes in detail the disruption of a white dwarf with two-tenths the mass of the Sun by a black hole 1,000 times the mass of the Sun. The researchers also found that they can vary the mass of the white dwarf and still get the same outcome -- tidal disruption and ignition of the white dwarf. "*We can ignite the whole mass range of white dwarfs if they get close enough to the black hole,"* Rosswog said.

This series of images shows the interaction of a white dwarf star with a black hole. As it passes the black hole, the white dwarf becomes strongly compressed and heated (top left), triggering an explosion. Most of the stellar mass is ejected into space (the "bubble" in the upper right part of the debris in the top right image), while the rest (the cusp-like part of the image) falls toward the black hole. While the ejected matter expands rapidly, the infalling matter builds a violent, thick accretion disk around the black hole. http://www.ucsc.edu/news_events/img/2008/01/coldens-350.jpg

NEUTRON STARS CAN BE MORE MASSIVE, BLACK HOLES MORE RARE

Neutron stars and black holes aren't all they've been thought to be. In fact, neutron stars can be considerably more massive than previously believed, and it is more difficult to form black holes, according to new research developed by using the Arecibo Observatory in Arecibo, Puerto Rico. Paulo Freire, an astronomer from the observatory, presented the research at the January AAS meeting. In the cosmic continuum of dead, remnant stars, the Arecibo astronomers have increased the mass limit for when neutron stars turn into black holes. "*The matter at the center of a neutron star is highly incompressible. Our new measurements of the mass of neutron stars will help nuclear physicists understand the properties of super-dense matter*," said Freire. "*It also means that to form a black hole, more mass is needed than previously thought. Thus, in our universe, black holes might be more rare and neutron stars slightly more abundant*."

When the cores of massive stars run out of nuclear fuel, their enormous gravitation then causes their collapse then becomes a supernova. The core, typically with a mass 1.4 times larger than that of the sun is compressed into a neutron star. These extreme objects have a radius about 10 to 16 kilometers and a density on the order of a billion tons per cubic centimeter. Freire says that a neutron star is like one single, giant atomic nucleus with about 460,000 times the mass of the Earth.

Astronomers had thought the neutron stars needed a maximum mass between 1.6 and 2.5 suns in order to collapse and become black holes. However, this new research shows that neutron stars remain neutron stars between the mass of 1.9 and up to possibly 2.7 suns.

"*The matter at the center of the neutron stars is the densest in the universe. It is one to two orders of magnitude denser than matter in the atomic nucleus. It is so dense we don't know what it is made out of*," said Freire. "*For that reason, we have at present no idea of how large or how massive neutron stars can be*."

From June 2001 to March 2007, Freire used Arecibo's "L-wide" receiver (sensitive to radio frequencies from 1100 to 1700 MHz) and the Wide-Band Arecibo Pulsar Processors -- a very fast spectrometer on the Arecibo telescope -- to examine a binary pulsar called M5 B, in the globular cluster M5, which is located in the constellation Serpens. Like a lighthouse emits light, a pulsar is a strongly magnetized neutron star that emits large amounts of electromagnetic radiation, usually from its magnetic pole. As in the case of a lighthouse, distant observers perceive a sequence of pulsations, which are caused by the rotation of the pulsar. In the case of M5 B, these radio pulsations arrive at the Earth every 7.95 milliseconds.

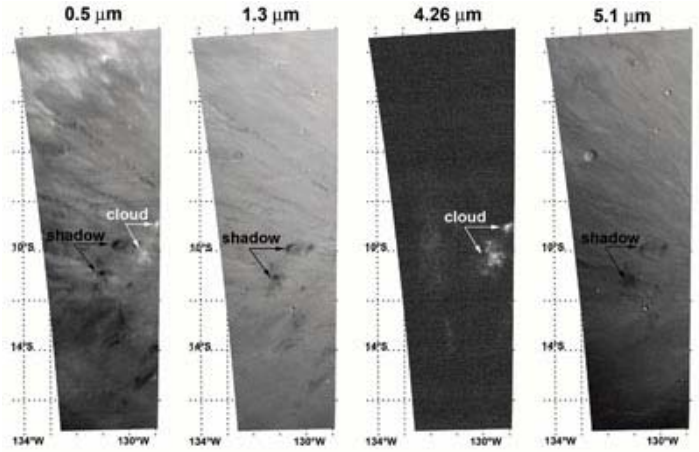
These radio pulsations were scanned by the wide-band spectrometers once every 64 microseconds for 256 spectral channels, and then recorded to a computer disk, with accurate timing information. The precise arrival time of the pulses were then used by the astronomers to accurately measure the orbital motion of M5 B about its companion. This allowed the astronomers to estimate the mass (1.9 solar masses) of the pulsar. http://www.naic.edu/

ICE CLOUDS PUT MARS IN THE SHADE

Until now, Mars has generally been regarded as a desert world, where a visiting astronaut would be surprised to see clouds scudding across the orange sky. However, new results show that the arid planet possesses high-level clouds that are sufficiently dense to cast a shadow on the surface. The results were obtained by the OMEGA Visible and Infrared Mineralogical Mapping Spectrometer instrument on board Mars Express.

Mars is not entirely a haven for Sun worshippers. Clouds of water ice particles do occur, for example on the flanks of the giant Martian volcanoes. There have also been hints of much higher, wispy clouds made up of carbon dioxide (CO_2) ice crystals. This is not too surprising, since the thin Martian atmosphere is mostly made of carbon dioxide, and temperatures on the fourth planet from the Sun often plunge well below the 'freezing point' of carbon dioxide.

Now, a team of scientists has shown that such clouds of dry ice do, indeed, exist. Furthermore, they are sometimes so large and dense that they throw quite dark shadows on the dusty surface. "*This is the first time that carbon dioxide ice clouds on Mars have been imaged and identified from above*," said Franck Montmessin, lead author of the paper. "*This is important because the images tell us not only about their shape, but also their size and density. Previously, we had to rely on indirect information -- for example, from the SPICAM instrument on board Mars Express -- to find out what the clouds are made of. However, it is very difficult to separate the signals coming from the clouds, the atmosphere and the surface*."



Data from the SPICAM Ultraviolet & Infrared Atmospheric Spectrometer indicated that any high altitude clouds are not very thick and made up of much smaller particles, but the CO_2 clouds detected by OMEGA are very different. Not only are they surprisingly high -- more than 80 km above the surface -- but they can be several hundred kilometers across. They are also much thicker than expected. Instead of looking like the wispy ice clouds seen on Earth, they resemble tall convectional clouds that grow as the result of rising columns of warm air.

Even more surprising is the fact that the CO_2 ice clouds are made of quite large particles -- more than a micron (one thousandth of a millimeter) across -- and they are sufficiently dense to noticeably dim the Sun. Normally, particles of this size would not be expected to form in the upper atmosphere or to stay aloft for very long before falling back towards the surface. "*The clouds imaged by OMEGA can reduce the Sun's apparent brightness by up to 40 per cent*," said Montmessin. "*This means that they cast quite a dense shadow and this has a noticeable effect on the local ground temperature. Temperatures in the shadow can be up to 10C cooler than their surroundings, and this in turn modifies the local weather, particularly the winds*."

Since the CO_2 clouds are mostly seen in equatorial regions, the OMEGA team believes that the unexpected shape of the clouds and large size of their ice crystals can be explained by the extreme variations in daily temperature that occur near the equator. "*The cold temperatures at night and relatively high day-time temperatures cause large diurnal waves in the atmosphere*," explained Montmessin. "*This means there is a potential for large-scale convection, particularly as the morning Sun warms the ground*." Bubbles of warm gas rise above the surface and when they reach high levels they become cold enough for CO_2 to condense. This process releases latent heat, which causes the gas and the ice particles to rise even further. What are the particles around which the CO_2 ice condenses? On Earth, cloud droplets form around tiny nuclei -- often particles of dust or salt. On Mars, the answer remains uncertain. One possibility is that Martian dust is carried to high altitudes. Another potential source of condensation nuclei is particles left behind by micrometeorites entering the upper atmosphere. Or the nuclei may simply be tiny crystals of water ice carried aloft on the thermal updrafts.

"*This discovery is important when we come to consider the past climate of Mars*," said Montmessin. "*The planet seems to have been much warmer billions of years ago, and one theory suggests that Mars was then blanketed with CO_2 clouds. We can use our studies of present-day conditions to understand the role that such high level clouds could have played in the global warming of Mars*." http://www.esa.int/esaCP/SEM1DV3MDAF_index_1.html

MILKY WAY GALAXY'S ANTIMATTER CLOUD IS LOPSIDED

The shape of the mysterious cloud of antimatter in the central regions of the Milky Way has been revealed by the orbiting gamma-ray observatory 'Integral'. The unexpectedly lopsided shape is a new clue to the origin of the antimatter. The observations have significantly decreased the chances that the antimatter is coming from the annihilation or decay of astronomical dark matter.

Georg Weidenspointner and an international team of astronomers made the discovery using four-years-worth of data from Integral. The cloud shows up because of the gamma rays it emits when individual particles of antimatter, in this case positrons, encounter electrons, their normal matter counterpart, and annihilate one another. One signature of positron-electron annihilation is gamma rays carrying 511 thousand electron-volts (keV) of energy. There has been a vigorous debate about the origin of these positrons ever since the discovery of the 511 keV emission from the center of the galaxy by gamma-ray detectors flown on balloons during the 1970s.

Some astronomers have suggested that exploding stars could produce the positrons. This is because radioactive nuclear elements are formed in the giant outbursts of energy, and some of these decay by releasing positrons. However, it is unclear whether these positrons can escape from the stellar debris in sufficient quantity to explain the size of the observed cloud.

Other astronomers wondered whether more exotic processes were at work. From earlier results using much less data, the positron cloud seemed to be spherical and centered on the center of the galaxy. Such a shape and position corresponds to the expected distribution of dark matter in the center of our galaxy, so it was suggested that dark matter was annihilating or decaying into pairs of electrons and positrons, which then annihilated to produce the gamma rays.

The trouble with this idea, however, was that the dark matter particles needed to be much less massive than most theories were predicting. The new results give astronomers a valuable new clue and point away from dark matter as the origin of the antimatter. Beyond the galactic center, the cloud is not entirely spherical. Instead it is lopsided with twice as much on one side of the galactic center as the other. Such a distribution is highly unusual because gas in the inner region of the galaxy is relatively evenly distributed. Equally importantly, Integral found evidence

that a population of binary stars is also significantly off-center, corresponding in extent to the cloud of antimatter. That powerfully suggests these objects, known as hard (because they emit at high energies) low mass X-ray binaries, are responsible for a major amount of antimatter. A low mass X-ray binary (LMXB) is a celestial system in which a relatively normal star is being eaten alive by a nearby stellar corpse, either a neutron star or a black hole. The gravitational field of the stellar corpse is so strong that it rips gas from the normal star. As this gas spirals down towards that object, it is heated so much that positron-electron pairs can be spontaneously generated in the intense radiation field, although the 511 keV emission is probably too weak to be detected from individual LMXBs by Integral.

"*Simple estimates suggest that about half and possibly all of the antimatter is coming from the X-ray binaries*," says Weidenspointner. The other half could be coming from a similar process around the galaxy's central black hole and the various exploding stars there. He points out that the lopsided distribution of hard LMXBs is unexpected, as stars are distributed more or less evenly around the galaxy. More investigations are needed to determine whether the observed distribution is real. Integral is currently the only mission that can see both the 511 keV radiation and the hard LMXBs.

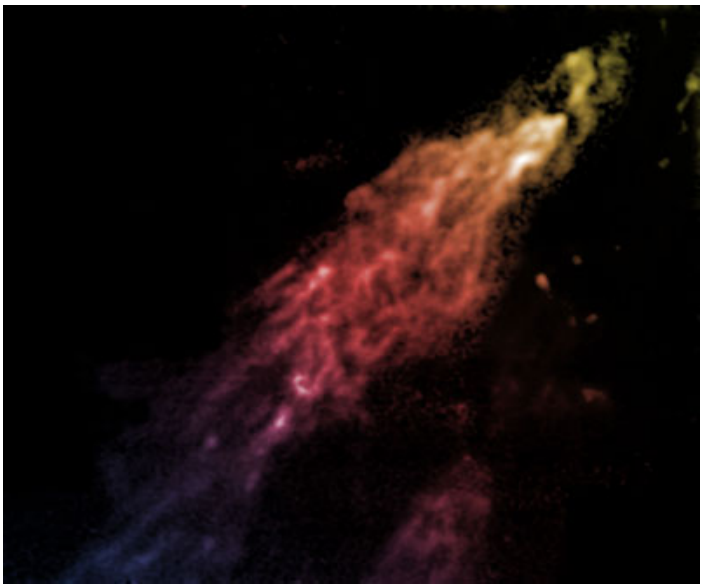
Weidenspointner and colleagues will be watching keenly to see whether it discovers more LMXBs and, if so, where they are located. "*The link between LMXBs and the antimatter is not yet proven but it is a consistent story*," says Weidenspointner. It has real astrophysical importance because it decreases the need for dark matter at the center of our galaxy.

CLOUD SPEEDS TOWARD COLLISION WITH MILKY WAY

A giant cloud of hydrogen gas is speeding toward a collision with our Milky Way Galaxy, and when it hits -- in less than 40 million years -- it may set off a spectacular burst of stellar fireworks. "*The leading edge of this cloud is already interacting with gas from our Galaxy*," said Felix Lockman, of the National Radio Astronomy Observatory (NRAO), leader of a team of astronomers who used the Green Bank Telescope (GBT) to study the object. The cloud, called Smith's Cloud, after the astronomer who discovered it in 1963, contains enough hydrogen to make a million stars like the Sun. Eleven thousand light-years long and 2,500 light-years wide, it is only 8,000 light-years from our Galaxy's disk. It is careening toward our Galaxy at more than 150 miles per second, aimed to strike the Milky Way's disk at an angle of about 45 degrees.

"*This is most likely a gas cloud left over from the formation of the Milky Way or gas stripped from a neighbor galaxy. When it hits, it could set off a tremendous burst of star formation. Many of those stars will be very massive, rushing through their lives quickly and exploding as supernovae. Over a few million years, it'll look like a celestial New Year's celebration, with huge firecrackers going off in that region of the Galaxy*," Lockman said. When Smith's Cloud was first discovered, and for decades after, the available images did not have enough detail to show whether the cloud was part of the Milky Way, something being blown out of the Milky Way, or something falling in.

Lockman and his colleagues used the GBT to make an extremely detailed study of hydrogen in Smith's Cloud. Their observations included nearly 40,000 individual pointings of the giant telescope to cover the cloud with unprecedented sensitivity and resolution. Smith's Cloud is about 15 degrees long in the sky, 30 times the width of the full moon. "*If you could see this cloud with your eyes, it would be a very impressive sight in the night sky*," Lockman said. "*From tip to tail it would cover almost as much sky as the Orion constellation. But as far as we know it is made entirely of gas -- no one has found a single star in it*."



The detailed GBT study dramatically changed the astronomers' understanding of the cloud. Its velocity shows that it is falling into the Milky Way, not leaving it, and the new data show that it is plowing up Milky Way gas before it as it falls. "*Its shape, somewhat similar to that of a comet, indicates that it's already hitting gas in our Galaxy's outskirts*," Lockman said. "*It is also feeling a tidal force from the gravity of the Milky Way and may be in the process of being torn apart. Our Galaxy will get a rain of gas from this cloud, then in about 20 to 40 million years, the cloud's core will smash into the Milky Way's plane*," Lockman explained. The cloud will likely strike a region somewhat farther from the Galactic center than our Solar System and about 90 degrees ahead of us in the Milky Way disk. The collision may trigger a period of rapid star formation fueled by the new gas and the shock from the collision. Some theories say that the ring of bright stars near the Sun, called Gould's Belt, was created by just such a collision event. http://www.nrao.edu/pr/2008/smithscloud/

WHITE DWARF PULSES LIKE A PULSAR

New observations from Suzaku, a joint Japanese Aerospace Exploration Agency (JAXA) and NASA X-ray observatory, have challenged scientists' conventional understanding of white dwarfs. Observers had believed white dwarfs were inert stellar corpses that slowly cool and fade away, but the new data tell a completely different story. At least one white dwarf, known as AE Aquarii, emits pulses of high-energy (hard) X-rays as it whirls around on its axis. "*We're seeing behavior like the pulsar in the Crab Nebula, but we're seeing it in a white dwarf*," says Koji Mukai. The Crab Nebula is the shattered remnant of a massive star that ended its life in a supernova explosion. "*This is the first time such pulsar-like behavior has ever been observed in a white dwarf*." Mukai is co-author of a paper on the observations.

White dwarfs and pulsars represent distinct classes of compact objects that are born in the wake of stellar death. A white dwarf forms when a star similar in mass to our sun runs out of nuclear fuel. As the outer layers puff off into space, the core gravitationally contracts into a sphere about the size of Earth, but with roughly the mass of our sun. The white dwarf starts off scorching hot from the star's residual heat. But with nothing to sustain nuclear reactions, it slowly cools over billions of years, eventually fading to near invisibility as a black dwarf.

A pulsar is a type of neutron star, a collapsed core of an extremely massive star that exploded in a supernova. Whereas white dwarfs have incredibly high densities by earthly standards, neutron stars are even denser, cramming roughly 1.3 solar masses into a city-sized sphere. Pulsars give off radio and X-ray pulsations in lighthouse-like beams.

The discovery team, led by Yukikatsu Terada, was not expecting to find a white dwarf mimicking a pulsar. Instead, the astronomers were hoping to find out if white dwarfs could accelerate charged subatomic particles to near-light speed, meaning they could be responsible for many of the cosmic rays that zip through our galaxy and occasionally strike Earth.

Some white dwarfs, including AE Aquarii, spin very rapidly and have magnetic fields millions of times stronger than Earth's. These characteristics give them the energy to generate cosmic rays. To find out if this is happening, Terada and his colleagues targeted AE Aquarii with Suzaku in October 2005 and October 2006. The white dwarf resides in a binary system with a normal companion star. Gas from the star spirals toward the white dwarf and heats up, giving off a glow of low-energy (soft) X-rays. But Suzaku also detected sharp pulses of hard X-rays. After analyzing the data, the team realized that the hard X-ray pulses match the white dwarf's spin period of once every 33 seconds.

The hard X-ray pulsations are very similar to those of the pulsar in the center of the Crab Nebula. In both objects, the pulses appear to be radiated like a lighthouse beam, and a rotating magnetic field is thought to be controlling the beam. Astronomers think that the extremely powerful magnetic fields are trapping charged particles and then flinging them outward at near-light speed. When the particles interact with the magnetic field, they radiate X-rays. "*AE Aquarii seems to be a white dwarf equivalent of a pulsar," says Terada. "Since pulsars are known to be sources of cosmic rays, this means that white dwarfs should be quiet but numerous particle accelerators, contributing many of the low-energy cosmic rays in our galaxy*." http://www.nasa.gov/centers/goddard/news/topstory/2007/whitedwarf_pulsar.html

NEXT GENERATION OF 'SKY IN GOOGLE EARTH'

Google's Andrew Moore announced a new version of 'Sky in Google Earth' (aka unofficially Google Sky). Sky now includes several new features that provide scientists, students and amateur stargazers with new tools to explore the millions of stars and galaxies visible in Sky, get up to date on current sky events, learn basic concepts of astronomy, see historical sky maps and much more:

- Earth & Sky Podcasts: podcasts about stars, galaxies, planets and events coming up in the sky from the NPR program Earth and Sky.
- Current Sky Events: provides timely updates on recent cosmological events from VOEventNet.
- Featured Observatories: images from NASA observatory satellites including x-ray images from Chandra satellite; infrared images by the Spitzer Space Telescope and the Infrared Astronomical Satellite (IRAS); ultraviolet images by the GALEX Satellite; and a microwave map of the sky by the Wilkinson Microwave Anistropy Probe (WMAP).
- Historical Sky Maps: a favorite in Google Earth, David Rumsey's historical maps of the sky date back to 1792 and illustrate how conceptions of the sky have changed over time. Also available is a beautiful Constellations Art layer based on engravings by astronomer Johannes Hevelius from 1690 Grand tour of the sky: the best of Sky imagery in a tour that takes the user through 100 of our favorite spots in the Sky.
- Sky community: The best content published by the Sky community on the Sky discussion forums.

To access Sky, users need only click "Switch to Sky" from the "view" drop-down menu in Google Earth, or click the Sky button on the Google Earth toolbar. The interface and navigation are similar to that of standard Google Earth steering, including dragging, zooming, search, "My Places," and layer selection.

Also introduced today, the Sky API will enable developers to develop their own sky mashups using the extensive sky imagery. Already several partners have implemented the API: Night View from the folks at www.heywhatsthat.com and a version for the iPhone from Alasdair Allan.

OPENING UP THE INFRARED SKY TO THE WORLD WITH UKIRT

The infrared sky is expanding significantly for the world astronomical community with the first world release of data (DR1) from the UKIRT Infrared Deep Sky Survey (UKIDSS), which has mapped a larger volume of the sky than any previous infrared survey. As the project progresses, it will gradually become the dominant source of information about the infrared sky, expanding its volume by a factor of 15 beyond DR1.

For the past two years, the UK Infrared Telescope (UKIRT) in Hawaii has been systematically scanning the heavens for five different "colors" of faint infrared light. This allows astronomers to penetrate dark clouds where stars are currently forming, and to locate stars much less massive and much cooler than the Sun. Furthermore, our own Galaxy (the Milky Way) is transparent to the infrared, making it possible to see all the way to its center and beyond. And finally, the expansion of the Universe stretches visible light from the most distant (and youngest) galaxies and quasars into the infrared part of the spectrum, and by observing this infrared light we can trace the evolution of galaxies from their youngest members. The first world release of these data makes all this information available to researchers everywhere.

Andy Lawrence, the UKIDSS Principal Investigator, said: "*We are moving into new territory. This survey probes huge volumes of space, so that we can locate rare but important objects like the very coolest and least luminous stars and the most distant galaxies. Astronomers in Europe have started getting the science out, but this world release should really unleash the scientific potential of the dataset*." The present release, large though it is, however, is just the beginning. Andy Adamson, Associate Director of UKIRT, says: "*WFCAM has recently taken its one millionth observation, and the UKIDSS survey is progressing strongly. UKIDSS will have surveyed a volume 15 times larger than the current release, DR1, by the time it is completed in 2012*."

Results from this world-leading effort are released in two stages -- first to the member nations of the European Southern Observatory (ESO), and 18 months later to the world astronomical community. The data now being released worldwide were obtained in the first, intensive and exciting, WFCAM observing periods on the UKIRT telescope, up to January 2006. There will be new data releases approximately every six months over the coming five years.

Astronomers from the ESO nations have been busily following up on the early UKIDSS data for the past year. The survey has proved itself a rich source of exotic objects, exactly as expected. Steve Warren, the UKIDSS Survey Scientist, highlights the

discovery of the coolest known brown dwarf in the Galaxy -- ULAS J0034 for short -- which, at an absolute temperature only just over twice that of the Earth, is fully 100 degrees cooler than any other known brown dwarf. This is likely one of the closest astronomical objects outside the Solar System, and was discovered in the shallow UKIDSS Large Area Survey (LAS).

UKIDSS is also expected to discover some of the most distant objects known, and it appears to be well on the way to this goal. DR1 includes early data from the Ultra-Deep Survey (UDS), which aims to study the evolution of galaxies when the Universe was a fraction of its current age.

This project is extraordinarily ambitious, requiring the telescope to revisit the same square-degree area of sky on hundreds of nights. "*A hundred thousand very distant galaxies are detected even in the earliest UDS data, and there is also a 'needle in a haystack' object -- a quasar at a redshift just in excess of 6, meaning 12.7 billion light years from Earth*," says co-discoverer Ross McLure. "*The light we now see from this object is very, very old, having set off on its journey to the telescope only a billion years after the big bang*."

An image shows a globular cluster observed as part of the UKIDSS DR1 release, in the constellation of Aquila, about 9,000 light years from Earth.

The first world release also contains large amounts of data on the Milky Way, with millions of stars, young stars and other objects seen clearly through the thick veils of dust which block the Milky Way to visible light, as illustrated in the accompanying images. Phil Lucas, head of the Galactic Plane Survey (GPS), notes that "*in terms of detected objects, the GPS dominates UKIDSS, with hundreds of millions of infrared stars in DR1 and many times that still to come. And with the science archive now hosting a large-scale image of the GPS so far, we're able to visualize the infrared Milky Way better than ever before*."

These results are among the motivations for carrying out surveys of the infrared sky. Comprising five separate surveys, some of which are highlighted here, UKIDSS has now scoured a larger volume of the Universe than any previous sky survey, and only slightly less than the largest visible light surveys. When the observations are completed in 2012, UKIDSS will have probed some 70 times deeper on average than the previous largest survey.

"*The UKIDSS survey program was expressly designed to capitalize on the unique technical capabilities of the UKIRT Wide-Field Camera*" said Gary Davis, Director of the Joint Astronomy Center in Hawaii, which operates the UKIRT. WFCAM was developed at the UK Astronomy Technology Center in Edinburgh at a cost of 5M Sterling Pound, and it is now the world's leading infrared panoramic camera. "*It is rewarding to see the effort and dedication of a large team of scientists and engineers over many years coming to fruition. The release of DR1 presages the huge impact that UKIRT will make on world astronomy over the next several years by probing deeper into the infrared universe than ever before*."

Astronomers from around the world will access the UKIDSS data from the Science Archive, which is bracing for the influx of new users. A small preliminary release, of about 1/4 the size of DR1, has been scrutinized from all over the world since it was opened up in August 2007. Nigel Hambly, the scientist responsible for operation of the Science Archive, says that interest is likely to be intense. "*Follow-up of objects discovered in this data release within the ESO nations has already revealed the power of the UKIDSS survey to turn up unique objects and we expect the world community will want to quickly make the most of the data now becoming available*."
http://outreach.jach.hawaii.edu/pressroom/2008_ukidss_dr1/ukidss_dr1_gc.png

A Rare Triple Cosmic Collision

Using the Very Large Telescope, an international team of astronomers has discovered a stunning rare case of a triple merger of galaxies. This system, which astronomers have dubbed 'The Bird' -- albeit it also bears resemblance with a cosmic Tinker Bell -- is composed of two massive spiral galaxies and a third irregular galaxy. he galaxy ESO 593-IG 008, or IRAS 19115-2124, was previously merely known as an interacting pair of galaxies at a distance of 650 million light-years. But surprises were revealed by observations made with the NACO instrument attached to ESO's VLT, which peered through the all-pervasive dust clouds, using adaptive optics to resolve the finest details. Underneath the chaotic appearance of the optical Hubble images -- retrieved from the HST archive -- the NACO images show two unmistakable galaxies, one a barred spiral while the other is more irregular. The surprise lay in the clear identification of a third, clearly separate component, an irregular, yet fairly massive galaxy that seems to be forming stars at a frantic rate. "Examples of mergers of three galaxies of roughly similar sizes are rare," says Petri Vaisanen, lead author of the paper reporting the results. "Only the near-infrared VLT observations made it possible to identify the triple merger nature of the system in this case."

Because of the resemblance of the system to a bird, the object was dubbed as such, with the 'head' being the third component, and the 'heart' and 'body' making the two major galaxy nuclei in-between of tidal tails, the 'wings'. The latter extend more than 100,000 light-years, or the size of our own Milky Way.

Subsequent optical spectroscopy with the new Southern African Large Telescope, and archive mid-infrared data from the Spitzer space observatory, confirmed the separate nature of the 'head', but also added further surprises. The 'head' and major parts of the 'Bird' are moving apart at more than 400 km/s (1.4 million km/h !). Observing such high velocities is very rare in merging galaxies.

Also, the 'head' appears to be the major source of infrared luminosity in the system, though it is the smallest of the three galaxies.

"It seems that NACO has caught the action right at the time of the first high-speed fly-by of the 'head' galaxy through the system consisting of the other two galaxies," says Seppo Mattila, member of the discovery team. "These two galaxies must have met earlier, probably a couple of hundred million years ago." The 'head' is forming stars violently, at a rate of nearly 200 solar masses per year, while the other two galaxies appear to be at a more quiescent epoch of their interaction-induced star formation history.

The 'Bird' belongs to the prestigious family of luminous infrared galaxies, with an infrared luminosity nearly one thousand billion times that of the Sun. This family of galaxies has long been thought to signpost important events in galaxy evolution, such as mergers of galaxies, which in turn trigger bursts of star formation, and may eventually lead to the formation of a single elliptical galaxy.

ONE PLANET OF GLIESE 581 MIGHT BE HABITABLE

In April, a team of astronomers announced the discovery of two possibly habitable Earth-like planets. Now there are two independent, detailed studies of this system, which confirm that one of the planets might indeed be located within the habitable zone around the star Gliese 581.

More than 10 years after the discovery of the first extrasolar planet, astronomers have now discovered more than 250 of these planets. Until a few years ago, most of the newly discovered exoplanets were Jupiter-mass, probably gaseous, planets. Recently, astronomers have announced the discovery of several planets that are potentially much smaller, with a minimum mass lower than 10 Earth masses: the now so-called super-Earths.

In April, a team announced in Astronomy & Astrophysics the discovery of two new planets orbiting the M star Gliese 581 (a red dwarf), with masses of at least 5 and 8 Earth masses. Given their distance to their parent star, these new planets (now known as Gliese 581c and Gliese 581d) were the first ever possible candidates for habitable planets.

Contrary to Jupiter-like giant planets that are mainly gaseous, terrestrial planets are expected to be extremely diverse: some will be dry and airless, while others will have much more water and gases than the Earth. Only the next generation of telescopes will allow us to tell what these new worlds and their atmospheres are made of and to search for possible indications of life on these planets. However, theoretical investigations are possible today and can be a great help in identifying targets for these future observations.

In this framework, Astronomy & Astrophysics now publishes two theoretical studies of the Gliese 581 planetary system. Two international teams, one led by Franck Selsis and the other by Werner von Bloh, investigate the possible habitability of these two super-Earths from two different points of view. To do so, they estimate the boundaries of the habitable zone around Gliese 581, that is, how close and how far from this star liquid water can exist on the surface of a planet.

Selsis and his colleagues compute the properties of a planet's atmosphere at various distances from the star. If the planet is too close to the star, the water reservoir is vaporized, so Earth-like life forms cannot exist. The outer boundary corresponds to the distance where gaseous CO_2 is then unable to produce the strong greenhouse effect required to warm a planetary surface above the freezing point of water. The major uncertainty for the precise location of the habitable zone boundaries comes from clouds that cannot currently be modeled in detail. These limitations also occur when one looks at the Sun's case: climate studies indicate that the inner boundary is located somewhere between 0.7 and 0.9 AU, and the outer limit is between 1.7 and 2.4 AU. The Sun has larger habitable zone boundaries, compared to the case for Gliese 581 as computed both by Selsis and von Bloh. Von Bloh and his colleagues study the narrower region of the habitable zone where Earth-like photosynthesis is possible. This photosynthetic biomass production depends on the atmospheric CO_2 concentration, as much as on the presence of liquid water on the planet. Using a thermal evolution model for the super-Earths, they have computed the sources of atmospheric CO_2 (released through ridges and volcanoes) and its sinks (the consumption of gaseous CO_2 by weathering processes). The main aspect of their model is the persistent balance (that exists on Earth) between the sink of CO_2 in the atmosphere-ocean system and its release through plate-tectonics. In this model, the ability to sustain a photosynthetic biosphere strongly depends on the age of the planet, because a planet that is too old might not be active anymore, that is, would not release enough gaseous CO_2. In this case, the planet would no longer be habitable. To compute the boundaries of the habitable zone, von Bloh assumed a CO_2 level of 10 bars.

Both teams found that, while Gliese 581 c is too close to the star to be habitable, the planet Gliese 581 d might be habitable. However, the environmental conditions on planet d might be too harsh to allow complex life to appear. Planet d is tidally locked, like the Moon in our Earth-Moon system, meaning that one side of the planet is permanently dark. Thus, strong winds may be caused by the temperature difference between the day and night sides of the planet. Since the planet is located at the outer edge of the habitable zone, life forms would have to grow with reduced stellar irradiation and a very peculiar climate.

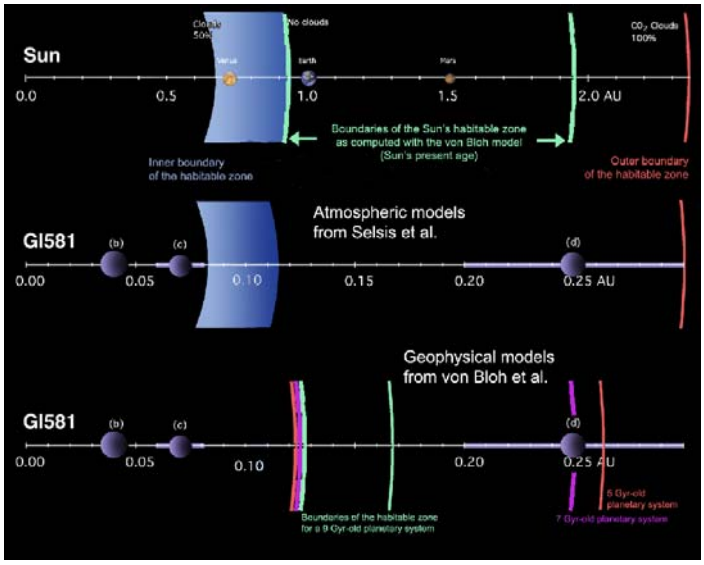
The distance of planets c and d to the central star has strong variations due to the eccentricity of their orbits. In addition, being close to the star, their orbital periods are short: 12.9 days for planet c and 83.6 days for planet d. Planet d might temporarily leave and re-enter the habitable zone during its journey. However, even under these strange conditions, it might still be habitable if its atmosphere is dense enough. In any case, habitable conditions on planet d should be very different from what we encounter on Earth.

Last but not least, the possible habitability of one of these planets is particularly interesting because of the central star, which is a red dwarf, M-type star. About 75% of all stars in our Galaxy are M stars. They are long-lived (potentially tens of billion years), stable, and burn hydrogen. M stars have long been considered as poor candidates for harboring habitable planets: first because planets located in the habitable zone of M stars are tidally locked, with a permanent dark side, where the atmosphere is likely to condense irreversibly. Second, M stars have an intense magnetic activity associated with violent flares and high X and extreme UV fluxes, during their early stage that might erode planetary atmospheres. Theoretical studies have recently shown that the environment of M stars might not prevent these planets from harboring life. M stars have then become very interesting for astronomers because habitable planets orbiting them are easier to detect by using the radial-velocity and transit techniques than are the habitable planets around Sun-like stars.

Both studies definitely confirm that Gliese 581c and Gliese 581d will be prime targets for the future space mission Darwin/Terrestrial Planet Finder (TPF), dedicated to the search

for life on Earth-like planets. These space observatories will make it possible to determine the properties of their atmospheres.

A third paper on Gliese 581 has recently been published by Beust and his team studying the dynamical stability of the Gliese 581 planetary system. Such studies are very interesting in the framework of the potential habitability of these planets because the long-term evolution of the planetary orbits may regulate the climate of these planets. Mutual gravitational perturbations between different planets are present in any planetary system with more than one planet. In our solar system, under the influence of the other planets, the Earth's orbit periodically evolves from purely circular to slightly eccentric. This is actually enough to trigger the alternation of warm and glacial eras. More drastic orbital changes could well have prevented the development of life. Beust and his colleagues computed the orbits of the Gliese 581 system over 100 Myr and find that the system appears dynamically stable, showing periodic orbital changes that are comparable to those of the Earth. The climate on the planets is expected to be stable, so it at least does not prevent life from developing, although it does not prove it happened either.



The expression "super-Earths", which is often used to refer to exoplanets in the 2-10 Earth-mass range, might be confusing, as it indeed suggests that these planets are rocky planets that differ from the Earth only by their mass. But Gliese 581 c and d could very well be big icy planets, with a very different composition from the Earth.

"*The habitability of super-Earths in Gliese 581*", by W. von Bloh, C. Bounama, M. Cuntz, and S. Franck. Astronomy & Astrophysics, 2007, vol. 476, p. 1365. Full article, http://dx.doi.org/10.1051/0004-6361:20077939

"*Habitable planets around the star Gliese 581*", by F. Selsis, J.F. Kasting, B. Levrard, J. Paillet, I. Ribas, and X. Delfosse. Astronomy & Astrophysics, 2007, vol. 476, p. 1373. Full article http://dx.doi.org/10.1051/0004-6361:20078091

"*Dynamical evolution of the Gliese 581 planetary system*", by H. Beust, X. Bonfils, X. Delfosse, and S. Udry. Full article, http://dx.doi.org/10.1051/0004-6361:20078794

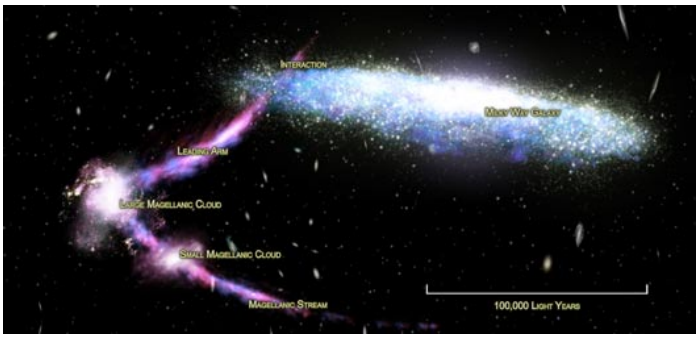
Illustration of the habitable zone (HZ) boundaries as obtained by the two teams. The upper part of the figure shows the HZ of the Sun (at its present age). The red curve shows only the most extreme outer limit of the HZ. The actual outer boundary is indeed located somewhere between 1.7 and 2.4 AU. The green limits show the boundaries of the photosynthetic zone as computed with the model by von Bloh et al. The middle part of the figure shows the limits of the HZ of Gliese 581 computed with the atmospheric models from Selsis et al. The lower part illustrates the boundaries of the photosynthetic zone computed with the geophysical models from von Bloh et al. The boundaries are shown for several possible ages (5, 7, and 9 Gyr-old) of the Gliese 581 planetary system. Following the latest estimation, Gliese 581 would be 7 Gyr-old. The purple bars surrounding planets Gliese 581 c and d illustrate the variable distance to the star caused by the eccentricity of the orbits. http://www.aanda.org/images/stories/PressRelease/PRaa200708/figure.gif

GIANT GAS 'FINGER' POINTS TO GALAXIES' FUTURES

Like a fork piercing a fried egg, a giant finger of hydrogen gas is poking through our Milky Way Galaxy from outside, astronomers using CSIRO radio telescopes at Parkes and Narrabri have found. The location of the intrusion may give a crucial clue to the fate of the little galaxies the gas flows from, the Large and Small Magellanic Clouds. "*We're thrilled because we can determine exactly where this gas is plowing into the Milky Way -- it's usually extremely hard to get distances to such gas features*," said the research team leader, Dr Naomi McClure-Griffiths. The gas finger, called HVC306-2+230, is running into the starry disk of our Galaxy about 70 thousand light-years (21kpc) away from us. On the sky, the point of contact is near the Southern Cross. The finger is the pointy end of the so-called Leading Arm of gas that streams ahead of the Magellanic Clouds towards the Milky Way.

Until last year, astronomers generally thought that the Magellanic Clouds had orbited our Galaxy many times, and were doomed to be ripped apart and swallowed by their gravitational overlord. But then new Hubble Space Telescope measurements showed the Clouds were moving much faster than previously thought. In turn, this implied that the Clouds are paying our Galaxy a one-time visit rather than being its long-term companions.

Knowing where the Leading Arm is crossing the Galactic Disk may help astronomers to predict where the Clouds themselves will go in future. "*We think the Leading Arm is a tidal feature, gas pulled out of the Magellanic Clouds by the Milky Way's gravity*," said Dr McClure-Griffiths. "*Where this gas goes, we'd expect the Clouds to follow, at least approximately*."



The team's measurement of where the Leading Arm intrudes into the Milky Way is more in line with the models that assume the Magellanic Clouds have been orbiting our Galaxy than with the models that have the Clouds just passing by. Dr McClure-Griffiths cautions that this is not the final word on the subject, saying that the latter models were far from ruled out. But the new result suggests that the Magellanic Clouds will eventually merge with the Milky Way, rather than zooming past.

http://www.scienceimage.csiro.au/mediarelease/mr08-16.html

SCALED-DOWN JUPITER & SATURN IN FARAWAY SOLAR SYSTEM LIKE OUR OWN

A team of astronomers has discovered two planets that resemble smaller versions of Jupiter and Saturn in a solar system nearly 5,000 light years away. The find suggests that our galaxy hosts many planetary systems like our own, said Scott Gaudi. The two planets were revealed when the star they orbit crossed in front of a more distant star as seen from Earth. For a two-week period from late March through early April of 2006, the nearer star magnified the light shining from the farther star. The phenomenon is called gravitational microlensing, and this was a particularly dramatic example: the light from the more distant star was magnified 500 times.

The Optical Gravitational Lensing Experiment (OGLE) first detected the event, dubbed OGLE-2006-BLG-109, on March 28, 2006. The Microlensing Follow Up Network (MicroFUN), led by Andrew Gould, then joined with OGLE to organize astronomers worldwide to gather observations of it. Andrzej Udalski is the leader of OGLE.

Gaudi took the lead in analyzing the data as they came in. As he studied the light signal, he saw a distortion that he thought was caused by a Saturn-mass planet. Then, less than a day later, came an additional distortion he wasn't expecting: a "blip" in the signal that appeared to be caused by a second, larger planet orbiting the same star. Over the next few months, Gaudi demonstrated that this two-planet interpretation was correct. Then David Bennett refined Gaudi's preliminary model using sophisticated software, and revealed additional details about the system. This is the third time a Jupiter-mass planet was found by microlensing, Gaudi explained. In the previous two cases, additional planets would have been very difficult to detect, had they been there.

"*This is the first time we had a high-enough magnification event where we had significant sensitivity to a second planet -- and we found one*." Gaudi said. "*You could call it luck, but I think it might just mean that these systems are common throughout our galaxy*." Astronomers have found two planets at once before, "*but using other techniques that don't pick up on solar systems like ours*," he said. The newly-discovered planets appear to be gaseous planets like Jupiter and Saturn -- only about 80 percent as big -- and they orbit a star about half the size of the sun. The star is dim and cold compared to ours, issuing only five percent as much light.

Still, the new solar system appears to be a smaller analog of our own. The larger planet is about as massive compared to its star as Jupiter is to ours. The smaller planet shares a similar mass ratio with Saturn. Also, the smaller planet is roughly twice as far from its star as the larger one, just as Saturn is roughly twice as far away from the sun as Jupiter. Although the star is much dimmer than our sun, temperatures at both planets are likely to be similar to that of Jupiter and Saturn, because they are closer to their star.

"*The temperatures are important because these dictate the amount of material that is available for planet formation*," Gaudi said. "*Most theorists think that the biggest planet in our solar system formed at Jupiter's location because that is the closest to the sun that ice can form. Saturn is the next biggest because it is in the next location further away, where there is less primordial material available to form planets*." "*Theorists have wondered whether gas giants in other solar systems would form in the same way as ours did. This system seems to answer in the affirmative*." The fact that astronomers found the planets during the first event that allowed such a detection suggests that these scaled-down versions of our solar system are very common, he added. Previously, astronomers had found four planets using microlensing. The latest two planets make six, and he expects that number to double over the next year as other teams publish new findings.

"*We're just getting better at what we do*," Gaudi said. "*We've hit our stride with this technique*." He has also calculated that the next generation of microlensing experiments -- using telescopes on the ground and in space -- will likely be able to detect analogs to all of our solar system's planets, except for the tiniest one, Mercury. The current discovery relied on 11 different ground-based telescopes in countries around the world, including New Zealand, Tasmania, Israel, Chile, the Canary Islands, and the United States. Both professional and amateur skywatchers joined in. People from three other microlensing collaborations -- the Microlensing Observations in Astrophysics (MOA) Collaboration, the Probing Lensing Anomalies NETwork (PLANET), and the RoboNet Collaboration -- all contributed observations and are co-authors of the study with MicroFUN and OGLE.

Gaudi described this microlensing event as the most complicated one ever studied. The astronomers carefully modeled their data on computers, and explored all possible explanations for the light signal. A year and a half later, they were confident that they'd found two planets. In part, their confidence came from additional observations from the Keck Observatory in Hawaii, which they used to calculate the mass of the star. http://researchnews.osu.edu/archive/analogpix.htm Animation showing an artist's conception of what the new planets might look like http://researchnews.osu.edu/archive/analogvideo.htm

STRONG GALAXY-WIDE STAR FORMATION IN DISTANT UNIVERSE

An international team of astronomers from France, Germany, the USA and India has observed for the first time the cool molecular gas in ordinary massive galaxies in the young, distant universe. The scientists discovered much more of it than being observed in galaxies in the local universe. This gas is the building material for stars still nowadays born in normal, undisturbed and not active galaxies in our local universe. The observations have been made with the millimeter interferometer located at the Plateau de Bure (France).

This finding indicates that massive galaxies built major fractions of their stars at lower rates and over longer timescales and not than thought before during explosive events being triggered through the collisions of two or more galaxies. This result opens new major possibilities for understanding galaxy formation in the young, distant universe shortly after the big bang.

In galaxies of our cosmological neighborhood we are observing how star formation is currently going on. Here star formation is observed to take place in two fundamental modes. In more or less undisturbed, ordinary spiral galaxies -- like our Milky Way -- new stars are formed primarily in the spiral arms of the disk-like structure. These are the sites which contain most of the building material for star formation -- molecular hydrogen gas. Currently, a few solar masses per year of newborn stars are produced in our Milky Way.

When spiral galaxies merge due to a close encounter, a more efficient process is observed in which stars are formed at much higher rates but at limited time scales up to a few hundred million years. During major galaxy collisions, the molecular gas is efficiently compressed toward the center of the merging system, reaching densities that are much higher than in spiral galaxies.

This can enhance in the central regions the rate of star formation up to several hundred solar masses per year, or more, in these objects, which are thought to very rapidly consume their gas. Astronomers call the resulting galaxies Ultra-Luminous InfraRed Galaxies.

But what is the dominating mode of star formation in the young universe? As observations showed, collisions of galaxies in the distant Universe are thought to be much more common than nowadays due to the higher spatial density of galaxies (since then because of the cosmic expansion the galaxy density went gradually down); and even ordinary massive galaxies in the distant Universe were forming stars at prodigious rates. This provided widespread support to the idea that the predominant star formation mode in the distant Universe was the collisions-like, high efficient ULIRG-phase. Observations of molecular gas properties in distant galaxies, limited to the brightest and rarest systems (the ULIRGS), had so far confirmed this picture.

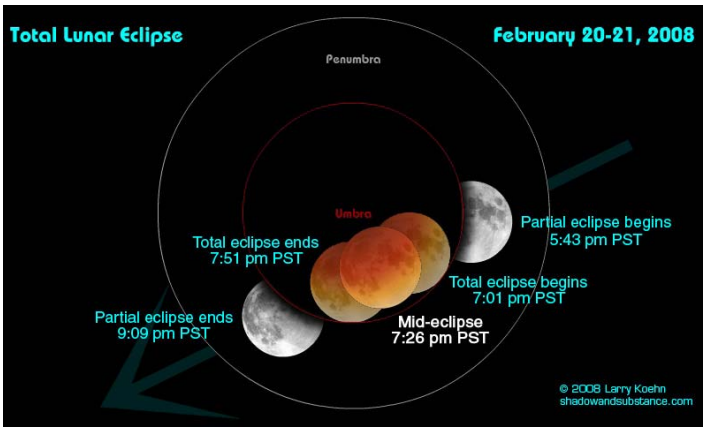
Using high sensitivity newly refurbished detectors for radio waves in the millimeter range at the Plateau de Bure Interferometer, the authors of this here presented work have been able for the first time to measure the molecular gas content of ordinary and representative galaxies in the distant universe. The team, including Helmut Dannerbauer, observed two massive, disk-like galaxies which emitted their light 4.3 billion years after the big bang and succeeded in detecting both sources.

The findings of this project have profound consequences for understanding the processes regulating massive galaxy formation in the distant Universe. Both galaxies are found to host giant gas reservoirs, but with a star formation mode that closely resembles the one observed in local spiral galaxies -- a phenomenon observed here for the first time: The ordinary distant massive galaxies behave like scaled-up version of the Milky Way galaxy, with proportionally larger molecular gas reservoir and star formation activity, but with overall similar efficiency in forming stars.

This discovery is helping astronomers to shed light into the way galaxy gradually built up their stellar component. It suggests that mergers between galaxies are not the major channel for star formation in distant galaxies. The large gas reservoirs newly observed could maintain star formation in these galaxies over hundreds of million years, ten times longer than in the extreme sources that were known before, implying that a large fraction of the stars in massive galaxies is formed relatively slowly. These observations also help to explain the clumpy-like appearance of distant galaxies, because the large gas reservoirs are prone to fragmentation due to gravitational instabilities.

These new observations have also shown that ordinary galaxies in the distant Universe, 10-100 times more common than the extreme sources (e.g. the ULIRGS) so far studied, are now within reach of direct observations of their molecular gas content with current.

February 20th Total Eclipse



FROM THE EDITOR'S TERMINAL

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

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

The Star Gazer
P.O. Box 12746
Everett, WA 98206

In February's StarGazer:

The next EAS Meeting is 7:00 P.M. Saturday February 16th at the 'Aurora Astro Products' store location at Silver Lake.