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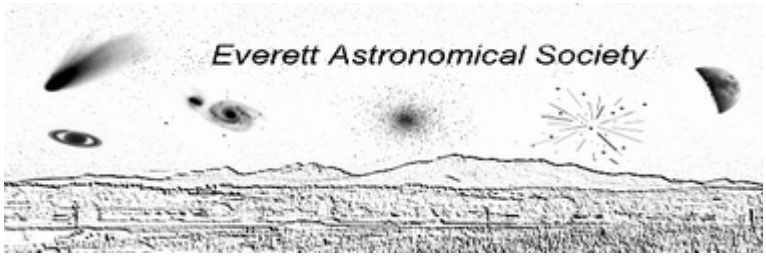

The Stargazer

June 2007

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

EAS BUSINESS…

NEXT EAS MEETING – SATURDAY JUNE 16TH AT 3:00 PM AT THE EVERETT PUBLIC LIBRARY, IN THE AUDITORIUM (DOWNSTAIRS)

★★★ JUNE 16th MEETING PROGRAM: ★★★

This Saturday June 16th at 3:00 PM at Everett Public Library auditorium, the program will be the Timothy Ferris documentary on 'Life Beyond Earth' -- about origins of life on Earth, the planets and moons of the solar system, and the search for possible homes for life beyond that -- produced by KCTS in Seattle.

Map to library - http://www.epls.org/about/mlmap.htm

2702 Hoyt Avenue
Everett, WA 98201

Directions to library - http://www.epls.org/about/mldirect.htm

★ STAR PARTY INFO ★

Upcoming EAS star party schedule: (also see the regional star parties listed in the 'Astro Calendar for 2007')

Saturday June 16th - weather permitting.

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@nwlink.com) 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.

Jun 16 - Saturday
Jul 07 - Saturday
Aug 11 - Saturday
Sep 08 - Saturday
Sep 19 - Saturday
Oct 13 - Saturday
Nov 10 - Saturday

Other dates may be available, but these coincide with times around the new moon, and any conflicts we may have.

PacSci Astronomy Weekend in North Cascades - July 13-15

This July, Pacific Science Center is excited to offer a weekend of astronomy and natural discovery for its members. Educators from Pacific Science Center and the North Cascades Institute are teaming up to offer a variety of hands-on, family-friendly educational programs. During the day, there will be astronomy classes, guided nature hikes and canoe trips on nearby Diablo Lake. And then at night, discover the night sky like you've never seen it before. We hope you'll join us for a great weekend. July 13-15, North Cascades Environmental Learning Center North Cascades National Park. More information including pricing, detailed program, and reservation forms available shortly, so please check back at Pacific Science Center's website. **http://www.pacsci.org/travel/astronomy_weekend.html**

People should also join 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.

$$ - FINANCIAL HEALTH - $$

The club maintains a $650+ balance. We try to keep approximately a $500 balance to allow for contingencies. .

CLUB SCOPES

SCOPE	LOAN STATUS
10-INCH WARD DOBSONIAN	ON LOAN
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"

Aurora Astro Products
11419 19th Avenue SE #A102
Everett, WA 98208
425-337-4384
www.auroraastro.com
Open Monday - Friday 9:00 am to 6:00 pm
Saturday 10:00 am to 5:00 pm
Over 37 product dealerships, and growing

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
- Who started the club
- When club joined the Astronomical League.

Astro Calendar for 2007

June 2007

Jun 01 - Asteroid 4 Vesta Closest Approach To Earth (1.14 AU)
Jun 06 - Jupiter at opposition
Jun 16 - EAS March Meeting 3:00 PM – Everett Public Library
Jun 16 - Saturday, EAS Star party at Ron Tam's
Jun 18 - Dwarf Planet 134340 Pluto Closest Approach To Earth (30.2AU)
Jun 20 - Summer Solstice, 20:24 UT
Jun 22-24 - Klickitat County Star Party - http://www.klickitatstarparty.net/
June 30 - Blue Moon (2nd Full Moon of month)

July 2007

Jul 04 - 4th of July Holiday
Jul 07 - Earth At Aphelion (1.017 AU from Sun)
Jul 07 - Saturday, EAS Star party at Ron Tam's
Jul 9-16 - Shingletown Star Party - http://www.shingletownstarparty.net/
Jul 11-14 Golden State Star Party at Mt Lassen NP
http://www.goldenstatestarparty.org/
Jul 13-15 - PacSci Astronomy Weekend in North Cascades
http://www.pacsci.org/travel/astronomy_weekend.html
Jul 12-14 - Table Mountain Star Party - http://www.tmspa.com/
Jul 13-15 - Klickitat County Star Party - http://www.klickitatstarparty.net/
Jul 14 - OAS Hurricane Ridge Star Party -
http://www.olympicastronomicalsociety.com/hurricane_ridge_star_parties.htm
Jul 29 - South Delta-Aquarids Meteor Shower Peak

August 2007

Aug 01 - Alpha Capricornids Meteor Shower Peak
Aug 3-4 - ALCON 2007 Portland Oregon - http://www.alconexpo.com/
Aug 06 - Southern Iota Aquarids Meteor Shower Peak
Aug 8-12 - Mt Bachelor Star Party - http://www.mbsp.org/
Aug 11 - Saturday, EAS Star party at Ron Tam's
Aug 11 - Silver Falls (OR) Star Party -
http://www.oregonstateparks.org/park_211.php
August 11 - ICAS Artist Point Lookout Star Party -
http://groups.msn.com/WashingtonICAS/memberonlyevents.msnw
Aug 11-19 Mt. Kobau Star Party - http://www.mksp.ca/
Aug 12 - Perseids Meteor Shower Peak
Aug 11 - OAS Hurricane Ridge Star Party -
http://www.olympicastronomicalsociety.com/hurricane_ridge_star_parties.htm
Aug 16-19 - Oregon Star Party - http://www.oregonstarparty.org/
Aug 24-26 - RASCal's Star Party - http://victoria.rasc.ca/events/StarParty/
Aug 25 - Northern Iota Aquarids Meteor Shower Peak
Aug 28 - Total Lunar Eclipse - entire eclipse visible

September 2007

Sep 03 - Labor Day Holiday
Sep 6-9 - OAS Camp Delaney Fall Star Party -
http://www.olympicastronomicalsociety.com/Documents/CAMP%20DELANY%20V2.pdf
Sep 08 - Saturday, EAS Star party at Ron Tam's
Sep 6-9 Alberta Star Party - http://calgary.rasc.ca/asp2007.htm
Sep 15 - ASTRONOMY DAY (For Fall too this year!) Star Party
Sep 14-16 - Klickitat County Star Party - http://www.klickitatstarparty.net/
Idaho Star Party, September 9-11, 2005 Boise Astronomical Society
http://www.boiseastro.org/
Sep 19 - Saturday, EAS Star party at Ron Tam's
Sep 20-23 - Orion Nebula Star Party -
http://www.seattleastro.org/orionnebsp.html
Sep 23 - Autumnal Equinox (09:51 UT)
Merritt Star Quest - http://www.merrittastronomical.com/

October 2007

Oct 09 - Draconids Meteor Shower Peak
Oct 13 - Saturday, EAS Star party at Ron Tam's
Oct 14 - Dwarf Planet 136199 Eris Closest Approach To Earth (95.8AU)
Oct 12-14 - Klickitat County Star Party - http://www.klickitatstarparty.net/
Oct 21 - Orionids Meteor Shower Peak
Oct 31 - Halloween

November 2007

Nov 03 - Taurids Meteor Shower Peak
Nov 04 - End Daylight Saving time - Set Clock Back 1 Hour (US)
Nov 10 - Saturday, EAS Star party at Ron Tam's
Nov 12 - Dwarf Planet Ceres Closest Approach To Earth (1.832 AU)
Nov 17 - Leonids Meteor Shower Peak
Nov 22 - Thanksgiving Holiday

December 2007

Dec 07 - 35th Anniv (1972), Apollo 17 Launch (Last Mission to Moon)
Dec 13 - Geminids Meteor Shower Peak
Dec 22 - Winter Solstice, 22:06 UT

Dec 22 - Ursids Meteor Shower Peak
Dec 24 - Mars at opposition
Dec 25 - Christmas Holiday

UW Astronomy Speakers Colloquium Schedule

The Astronomy Department weekly colloquium meets Thursdays at 4:00 pm in PAB A102 - the classroom part of the Physics/Astronomy Building complex, (or at 11:30 in C520). www.astro.washington.edu/dept/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 mlocke at lioninc.com, 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

Jun 15	New Moon
Jun 22	First Quarter Moon
Jun 30	Full Moon
Jul 07	Last Quarter Moon
Jul 14	New Moon
Jul 22	First Quarter Moon
Jul 30	Full Moon
Aug 05	Last Quarter Moon
Aug 12	New Moon
Aug 20	First Quarter Moon
Aug 28	Full Moon
Sep 04	Last Quarter 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	Transits	Sets	Con	Mag
Sun	**05:10am**	**13:09**	**21:08**	**Ari**	**-27.5**
Mercury	Daylight	Daylight	**22:10**	**Gem**	**+2.3**
Venus	Daylight	Daylight	**00:02am**	**Can**	**-4.3**
Mars	**02:26am**	Daylight	Daylight	**Psc**	**+0.8**
Jupiter	Daylight	**00:26am**	**04:45am**	**Oph**	**-2.6**
Saturn	Daylight	Daylight	**00:26am**	**Leo**	**+0.5**
Uranus	**01:31am**	Daylight	Daylight	Aqr	+5.8
Neptune	**00:15am**	Daylight	Daylight	**Cap**	**+7.9**
Pluto	Daylight	**01:27am**	Daylight	**Sag**	**+13.9**

(times local time for Everett PDT)

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

Transit times for Jupiter's Great Red Spot in 2007
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 – http://spaceflight.nasa.gov/realdata/sightings/SSapplications/Post/SightingData/Seattle.html or also see link http://www.heavens-above.com/PassSummary.asp?lat=47.979&lng=-122.201&alt=0&loc=Everett&TZ=PST&satid=25544

CONSTELLATION OF THE MONTH (CORONA BOREALIS)

CORONA BOREALIS: (The Northern Crown). With a midnight culmination date of May 19th, Corona Borealis is perfectly placed for spring viewing. It contains no asterisms, but the stars of the constellation do trace out an "upside-down letter 'C'" (the closed portion of the 'C' faces south), situated between the Northern constellations of Bootes and Hercules. The only other bordering constellation is that of Serpens, located to its south.

Corona Borealis ranks 11th in overall brightness among the constellations, but 73rd in size; it takes up almost 179 square degrees of the entire sky (0.433%).

It contains no known meteor showers, and no Messier objects. Corona Borealis is completely visible from latitudes North of –50 degrees, and completely invisible from latitudes South of –64 degrees. It has 22 stars greater than magnitude 5.5, and its central point is at RA=15h48m, Dec.= +33 degrees. The solar conjunction date of Corona Borealis is November 18th.

Even though Corona Borealis has no Messier objects or known meteor showers, besides being a visually beautiful constellation, it does contain two very interesting objects in their own right. Near epsilon Corona Borealis, a nova suddenly flared up in May, 1866. It reached 2nd magnitude and remained easily visible for over a week. It is now known as the "Blaze Star" (also known as T Corona Borealis), and is the most famous example of a recurring nova. (It last brightened, to 3rd magnitude, in 1946). There is also another interesting variable star within Corona Borealis (CrB), known as R CrB. It is normally a 6th magnitude star, but it dims (at irregular intervals) to as low as 15th magnitude. It is suspected that clouds of carbon (e.g., soot and graphite) are emitted form the star and therefore dim its light; when these materials are reabsorbed, the star brightens.

There are two well-known legends associated with the constellation of Corona Borealis. The Native (North) American Indians considered it to be a semicircle of chiefs, at council to discuss the future of their peoples. In ancient Greek mythology, Ariadne (daughter of King Minos) was asked by Bacchus (the god of vegetation and wine) to marry him. But Ariadne did not believe that Bacchus was a god. To prove that he was, Bacchus asked Venus (goddess of love) to design a crown of jewels as his wedding present to Ariadne. When Ariadne saw the crown, she believed that Bacchus was a god, and consented to marry him. Bacchus was so overwhelmed with joy, that he threw the crown into the heavens, where it has resided and shone ever since. Corona Borealis is a visually beautiful Northern constellation, and is well placed to be easily enjoyed by any spring sky-watcher.

PLANETARY FOCUS - NEPTUNE

The "Planetary Focus" column appears periodically in the EAS newsletter. This month, our guest planet is Neptune, and these are the facts:

Rotation around the Sun: every 164.79 years

Orbit: from 29.76 (closest or 'perihelion') to 30.36 (furthest or 'aphelion') Astronomical Units (AU)*; this is an orbit that varies between approximately 2.77 billion and 2.82 billion miles from the sun. (*Note: One AU equals approximately 93 million miles).

Inclination of Orbit to Ecliptic: 1.8 degrees.

Mean Orbital Velocity: 5.43 km/sec.

Diameter at Equator: 50,538 kilometers (or 31,586 miles).

Mass: 17.2 (approximately 17.2 times more massive than earth); (5.9742 x (10 e24 (10 to the 24th power)) kilograms = 1 Earth Mass).

Density: approximately 1.80 times that of water (global density).

Surface Gravity (Earth = 1): 1.19

Period of Rotation on its own axis: approximately 18 hours, 25 minutes.

Axis tilt: 29.56 degrees.

Satellites (moons): 8, as well as planetary rings.

Special Notes About Neptune: Neptune is the fourth largest planet in the solar system (one of the gas giants) in terms of equatorial diameter, but is more massive than Uranus, the third largest planet in diameter. Neptune is the most distant of the giant planets, and was discovered in 1846 by J.G. Galle at the Berlin Observatory, based on French (Urbain Leverrier) predictions resulting from disturbances in the orbit of Uranus (there were similar estimates made by Englishman John C. Adams).

Neptune returns to opposition two days later every year, and appears as an indistinct magnitude 7.7 bluish-green object in binoculars; in fact, no markings can be seen on its bluish-green disk from earth-bound telescopes. Neptune's color arises primarily from methane within its atmosphere, which is principally helium and hydrogen and a blend of methane, water, and ammonia. In 1989, Voyager 2 sent back remarkable images of Neptune during its fly-by. The Great Dark Spot was noted in its atmosphere. Like Jupiter's Great Red Spot, it occupies a equivalent proportion of the surface area of Neptune (as the GRS does of Jupiter's surface area), and is a high-pressure system around which near-supersonic winds flow in an anti-clockwise circuit. The Great Dark Spot measures approximately 12,000 by 8,000 kilometers. At about 50-70 kilometers above the main cloud plane, there are whitish cirrus-like clouds composed of methane ice crystals. Neptune also has belts and zones similar to Jupiter's, only much fainter.

The core of Neptune is believed to be rocky, composed primarily of silicon and iron. The atmosphere of Neptune revolves more slowly than its core, and this is opposite to the atmospheres of the other gas giants; the implication is that circulation of Neptune's atmosphere may take place in a retrograde (backward or opposite) manner. Neptune also gives off more energy than it receives from the Sun, suggesting that it has its own internal source of heat; the planet also has a magnetic field, which is somewhat weaker than that of the other gas giant planets. Four dark planetary rings were discovered during the Voyager 2 fly-by in 1989.

Neptune has 8 known moons; six of them were discovered during the 1989 Voyager 2 fly-by, and the remaining two (Triton and Nereid) were discovered from Earth. Triton is the largest moon of Neptune, and was discovered the same year (1846) as the planet itself; it is about ¾ the size of our own Earth's Moon. Interestingly, Triton has an orbit in the opposite direction to that of Neptune (retrograde), and is slowly coiling its way down towards Neptune. Triton is a very cold moon, and has a thin atmosphere of mostly nitrogen, with some methane and carbon monoxide. Its South Pole cap is pinkish in color (probably nitrogen snow and

ice). Triton's face has been shown to have both craters and long cracks, but no mountains; its surface resembles that of a cantaloupe. It has also been noted to have geysers of nitrogen, some reaching 8 km in height! Nereid was discovered from Earth in 1949, and has a very eccentric orbit (going from 2 to 10 million kilometers from the planet at various times during its orbit).

YOUNG ASTRONOMER'S CORNER - STAR PARTY

The following column publishes yearly in the EAS newsletter. It was also handed out at this year's Astronomy Day in April, and published last month in this newsletter. However, since it is star party season, it remains a timely column, with important observing and safety information that will make any star party experience more enjoyable for all. Thus, this column will be repeated in this newsletter during the summer observing season so that its content will be available to the maximum number of readers. It is very informative for star party use - and especially for this time of year when more people are getting out again for various outdoor pursuits. Hopefully this will include stargazing for you and your family this year!

Star Parties: Hints for More Enjoyable Stargazing (and Outdoor Pursuits in General) !!!

Star "Parties" are simply gatherings of people who are interested in looking at the stars and learning about the night sky, either with telescopes, binoculars, or just the naked eye (or any combination thereof!). If you can go to an official Star Party this summer with family or friends, such as the upcoming Table Mountain Star Party or Oregon Star Party, you should. Less 'formal' Star Parties given year-round and locally by amateur astronomers (such as those in the Everett Astronomical Society) are also lots of fun. It is a wonderful experience to look at the beautiful night stars and sky, and to meet lots of great people and perhaps make new friends. Your experience can be even more enjoyable if you follow a few certain 'rules' and hints that are tried and true in amateur astronomy circles, to help make your experience the most enjoyable and rewarding it can be. Some of these suggestions may even be "official" star party rules or regulations that must be followed in courtesy to other observers (these rules will be noted as such). (If you would like more information about Astronomy, Star Parties, and the Everett Astronomical Society in general, log on to: http://members.tripod.com/everett_astronomy/). So if you follow these specific practices and helpful hints, you're sure to have a great time at the next Star Party you attend:

★★ Dress warmly, or be prepared to dress warmly. Just because the evening starts out warm, it doesn't necessarily mean that it will end up that way. So take warm clothes with you just in case.

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

★★ Make sure you have a good hat that covers the ears, and also good gloves as well. Polypropylene glove liners make excellent astronomy gloves because they are not bulky, making it easier to use flashlights, eyepieces, and charts, for example.

★★ Never underestimate the power of a good hooded piece of clothing. Wearing a hood cuts down, and can sometimes almost eliminate, cool or cold wind from going down your neck and down your back or front. Wearing a hood serves two purposes: it cuts down on the aforementioned wind, and also helps to keep body heat in, as the head radiates more heat away from the body than any other area. A good hat that covers the ears is also essential in keeping body heat in.

★★ Always wear warm socks. Again, socks that conserve heat and take moisture away from the skin (such as polypropylene or wool) are excellent. It doesn't hurt to have an extra pair or two on hand either just in case it's extra nippy for you.

★★ A good windbreaker (such as Gortex or nylon), which also has an integral hood, is an excellent way to conserve body heat and minimize chill, and can be used over other layered clothing as necessary.

★★ Always eat well and drink plenty of fluids to avoid dehydration. Good nutrition (and yes, including carrots or other sources of Vitamin A which improves night vision) and hydration helps to maintain alertness, body warmth (especially by using drinks like hot chocolate), and helps to battle fatigue. Being hungry and thirsty, like in many other areas of life including school work, does not make for an enjoyable experience. Most areas allow camp stoves, but open fires are usually prohibited. Importantly, alcohol and nicotine can interfere with the conservation of body heat. Also, tobacco use may also be annoying to your fellow astronomers, as the majority of people are non-smokers. So always be courteous to your fellow astronomers, and good to your own body, by NOT smoking.

★★ Always follow established Star Party etiquette. Use red flashlights ONLY, and point them downwards so as not to shine them in someone's eyes. Using any color other than red will cause your night adapted vision (the ability to see some contrast in the dark, and to see beautiful telescope objects more clearly) will be interrupted, and will not return to where it was at least for a good 20 minutes to a half-hour. (Night vision is never perfect, so it is also important to know your immediate surroundings and move slowly and ask questions if you are unsure of them; this helps to protect you from injury and from damaging other people's equipment). The use of red lights is a basic star party rule, and is a courtesy to other astronomers as well. No white lights (including car headlights!) are ever allowed in proximity to an official and large Star Party after darkness has arrived. Note: you may also want to have extra batteries for your red light, just in case.

★★ Everybody has different tastes in music. If you would like to listen to music while you observe, it is best and most often a Star Party rule (as well as a courtesy to your neighbors) to wear headsets. Star Parties may also have rules about pets, so be sure to check those rules out as well. If they are allowed, they should not be roaming freely.

★★ Always ask an amateur astronomer if it is OK to look through his or her scope. They make be taking pictures, or they may want to take a rest for a while without being disturbed. It is common courtesy to always respect another's wishes. Many, if not most, astronomers are very friendly and love to have people look through their telescopes, but always be sure to ask.

★★ Star Parties are frequently held in remote areas. It is never a good idea to go to unknown or remote areas alone. Also remember that such areas are also remote from medical attention. If you have bee-sting allergies, or other potential serious conditions, always be prepared, and be prepared for the fact that you may be an hour or more from medical attention. Always let someone at home know where you are and where you will be, including expected time of arrival back home.

★★ It is not necessary to have a telescope to enjoy a star party. A lawn chair and a blanket, perhaps with a pair of binoculars and a good, basic book of the sky, can give you countless hours of enjoyment and learning about astronomy without spending much money. IT IS NOT NECESSARY TO SPEND LOTS OF MONEY

TO ENJOY THE NIGHT SKY. Going to a Star Party sponsored by your local astronomy club, or perhaps even joining your local astronomy club, is a GREAT way to learn about astronomy. Star parties also give you the opportunity to meet new people, ask lots of questions (and perhaps share your knowledge of astronomy too), as well as to look through many telescopes and possibly binoculars as well.

★★ Finally, respect for your fellow astronomers by following the simple rules as listed above, and respect for the environment (never leave trash around, and stay away from fragile areas of grass and wilderness) will also make your Star Party experience more enjoyable. See you at an upcoming Star Party!!

ASTRONOMY AND TELESCOPE LINGO

ASTRONOMY "LINGO": **61 CYGNI:** A faint star in the constellation of Cygnus and one of the nearest stars to the Sun. Because of its large proper motion (thought to be the largest at the time), it was the first star to have its trigonometric parallax measured (by F. Bessel in 1838). 61 Cygni is a visual-binary star system, and one of the components is itself a binary. Disturbances discovered in the motions of the visual-binary members have been explained as resulting from the influence of one or more very large planets. .

TELESCOPE / EQUIPMENT "LINGO": RADIO HELIOGRAPH: A telescope designed for mapping the sun in radio wavelengths

ASTRONOMY "FUN FACTS"

★★ About 500,000 craters on the Moon can be seen from the Earth with the world's largest and most powerful telescopes; this large amount does not include those craters on the Moon's far side, which cannot be seen from the Earth. It would take one person at least 400 continuous hours to count all the visible craters on the moon.

★★ Sunlight falling on one square yard of land in Arizona for one year was worth $83.00 in 1980. If all the sunlight falling on an Arizona one-acre home lot in all of 1980 were converted into electricity, it would have been worth almost $403,000 dollars at the time!

★★ Sunlight exerts a pressure on anything in its way, including the Earth; a square mile of sunlight, if it could be placed in one's hand, would weigh 3 pounds!!

★★ One square inch of the Sun shines with an intensity of 300,000 candles. In order to manufacture enough candles to equal the total brightness of the Sun, the amount of tallow needed would be 10 times larger than the mass of the Earth itself. If all those candles were placed on a birthday cake, the circumference of the cake would be equal to the orbit of the Earth around the Sun - almost 600 million miles!!! Make a wish and blow out the candles indeed!!!!!

"MIRROR IMAGES" - SUPERGIANT STARS

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

CLASS OF OBJECT: SUPERGIANT: The largest and most luminous class of star. Supergiants lie above both the main sequence and the giant region of the Hertzprung-Russell diagram. Supergiants are classified in luminosity classes Ia (bright supergiants) and Ib (supergiants), and ordinarily have absolute bolometric magnitudes (the luminosity calculated over all wavelengths, instead of any one or several particular wavelengths) of between –5 and –12. These stars are very rare, since only the most immense stars become supergiants. Their brightness is so great however, that they can stand out in external galaxies. The absolute bolometric magnitude of cool red supergiants has an upper limit of –9.7; as a result, the brightest supergiants can also be used as indicators of distance. Supergiants have masses exceeding 50 solar masses, and diameters 100 to 1000 times greater than that of the Sun; supergiants are also 10 to 20 times hotter than the Sun, and 10,000 to one million times brighter!!

REPRESENTATIVE NORTHERN HEMISPHERE OBJECT: P CYGNI: This bluish white supergiant in Cygnus has surface temperatures of approximately 25,000 degrees Celsius. P Cygni is an unstable variable star about 2,000 parsecs away. It has randomly undergone outbursts, and then faded, in recorded history; since 1700 however it has continually and gradually brightened. It is also an ultraviolet source; its UV brightness is decreasing as its visual brightness is increasing however. There are many known stars (P Cygni stars) with similar characteristics to the P Cygni prototype; their spectra show numerous strong emission lines and sharp blueshifted (resulting from a continuously ejected and expanding shell of low density matter) absorption lines. P Cygni stars are a subclass of luminous blue variables (LBVs), very massive stars known for sporadic mass ejections, which are most likely due to fluctuations in their stellar outer layer because of radiation pressure.

REPRESENTATIVE SOUTHERN HEMISPHERE OBJECT: ANTARES: In the constellation of Scorpius, Antares was one of the four Royal Stars of the ancient Persians (the others were Aldebaran, Regulus, and Fomalhaut). Antares is an M1 ruddy-colored supergiant (luminosity class Ia-b) of magnitude 0.9. It is about 700 times larger than the Sun, but is only about 15 times more massive than it because of its low density: it is about 600 million miles across and approximately 160 parsecs away from Earth. Antares has a surface temperature of only a few thousand degrees, but it is the brightest star in Scorpius. Antares is also a visual binary with a 5th magnitude greenish companion.

ASTRONOMICAL NOTES -- ON & OFF THE WEB…

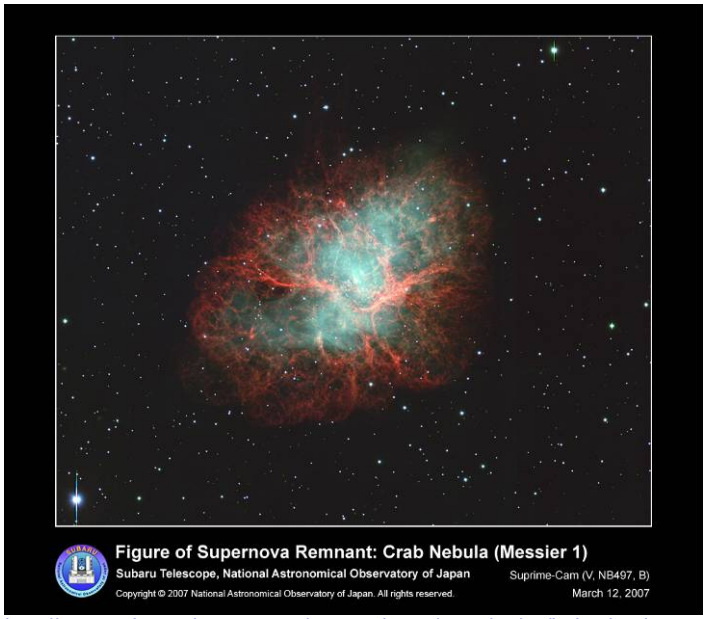
UNDERGRAD SOLVES LONG-STANDING CRAB NEBULA PUZZLE

A team of astronomers has recalculated the explosion date of the famous Crab Nebula supernova and found excellent agreement between their measurements and the classic date of the 1054 A.D. appearance of a bright "guest star" seen in the constellation of Taurus the Bull. The research was led by Gwen Rudie, a senior physics major at Dartmouth. She and her adviser, Robert Fesen, along with Toru Yamada from Japan's Subaru Observatory in Hawaii, used photographs taken 17 years apart to study the expansion speed of the Crab Nebula. These astronomers found that the outermost part of the supernova remnant, a very faint "jet" of stellar debris, shows clearly for the first time that the Crab exploded around the middle of the 11th century, in perfect accord with historic records. "*For the past 100 years astronomers have puzzled over the discrepancy between the measured age of the Crab Nebula versus the age suggested by numerous historical sightings around the ancient world,*" Rudie

said. "*This work verifies some long-standing assumptions about the nature of the Crab -- with our result, science and history finally agree*." The Crab Nebula is one of the most studied remains of a stellar explosion and is widely accepted to be due to a supernova seen in the year 1054 A.D. by Chinese, Japanese, Korean, and Arab astronomers, who reported sighting a new bright star in the heavens. The star was so brilliant that it was visible even during the day for nearly three weeks and only faded from view nearly two years later.

While the Crab Nebula's location in the sky agreed very well with the reported position of this bright new star, several studies of the expanding cloud of stellar debris unexpectedly indicated that it was expanding much too fast to be associated with a supernova explosion in 1054. Instead, these studies pointed later in time, toward an explosion date in the first half of the 12th century. This dilemma led astronomers to the idea that the remnant's central pulsar -- the rapidly spinning and extremely dense neutron star left over from Crab's supernova explosion -- emitted such copious amounts of energy that it actually accelerated the expanding cloud of debris, making it move faster with time. "*Previous studies have focused on the main body of the Crab Nebula, which has been accelerated with time*," Rudie explained. "*We chose to look at the northern jet because it is farther from the pulsar. That was the key to our new age determination.*"

The images used in this study were taken 17 years apart: one in October 2005 with the Prime Focus Camera on the Subaru 8.2-meter telescope on Mauna Kea by astronomers from the National Astronomical Observatory of Japan, and one taken with t he Mayall 4-meter telescope at Kitt Peak National Observatory, Tucson, Arizona, by Robert Fesen in November 1988. The results are a scientific study of the movement of the supernova debris across the plane of the sky. By measuring this proper motion over the course of 17 years and tracing it backward in time, this group of astronomers was able to confirm the 1054 explosion date.



http://www.subarutelescope.org/Pressrelease/2007/03/12/index.html

Located approximately 7,200 light-years from Earth, the Crab Nebula was named due to its resemblance to a crab's claw in an early sketch made in 1855 by astronomer R.J. Mitchell. The nebula was probably first noticed in 1731 by John Bevis, and it was significant enough to be the first entry in Charles Messier's list of nebulae (compiled to avoid mistaking these nebulae for comets).

The supernova debris cloud has a diameter of about 10 light-years, with material rushing outward at more than 1,500 kilometers per second. There is a faint-blue neutron star at the center of the Crab Nebula. It rotates rapidly, at a rate of 33 times per second, and emits radio waves, x-rays and gamma rays, in addition to visible light.

STRONG EVIDENCE THAT MARS ONCE HAD AN OCEAN

A paper this week demolishes one of the key arguments against the past presence of large oceans on Mars. Even from Earth, a large plain surrounding the planet's north pole looks like a sediment-filled ocean basin. In the 1980s, Viking spacecraft images revealed two possible ancient shorelines near the pole, each thousands of kilometers long with features like those found in Earth's coastal regions. The shorelines -- Arabia and the younger Deuteronilus -- date from between 2 and 4 billion years ago.

In the 1990s, however, Mars Global Surveyor mapped the Martian topography to a resolution of 300 meters, and found that the shoreline varies in elevation by several kilometers (more than a mile), rising and falling like a wave with several thousand kilometers from one peak to the next. Because shoreline elevations on Earth, measured relative to sea level, are typically constant, many experts rejected the notion that Mars once had oceans.

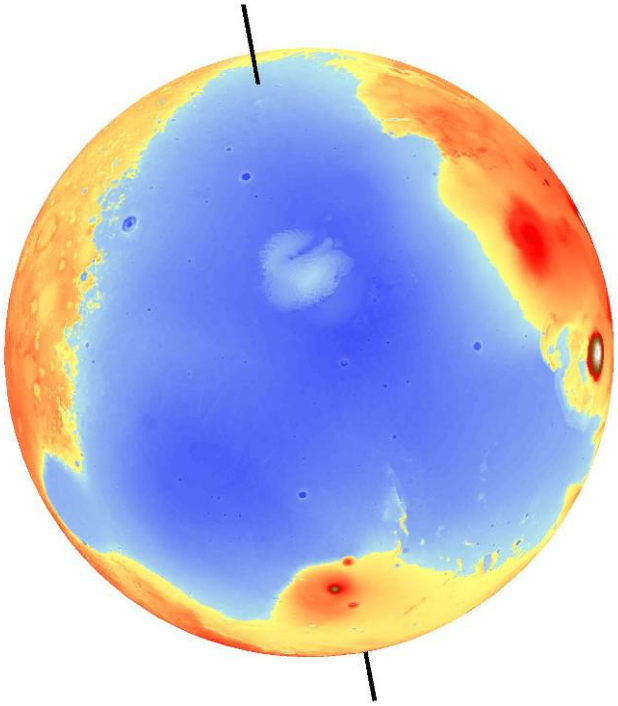
Scientists have now discovered that these undulating Martian shorelines can be explained by the movement of Mars' spin axis, and thus its poles, by nearly 3,000 kilometers along the surface sometime within the past 2 or 3 billion years. Because spinning objects bulge at their equator, this so-called "true polar wander" could have caused shoreline elevation shifts similar to those observed on Mars.

"*When the spin axis moves relative to the surface, the surface deforms, and that is recorded in the shoreline*," said study coauthor Michael Manga. "*On planets like Mars and Earth that have an outer shell, or lithosphere, that behaves elastically, the solid surface will deform differently than the sea surface, creating a non-uniform change in the topography*," added primary author Taylor Perron. Perron's calculations show that the resistance of Mars' elastic crust could create several-kilometer elevation differences for features like a shoreline, in accord with topographic measurements. The Arabia shoreline varies in elevation by about 2.5 kilometers, while the Deuteronilus shoreline varies by about 0.7 kilometers.

"*This is a beautiful result that Taylor got. The mere fact that you can explain a good fraction of the information about the shorelines with such a simple model is just amazing. It's something I never would have guessed at the outset*," said co-author Mark Richards. Richards goes so far as to add, "*This really confirms that there was an ocean on Mars*."

Richards pointed out that the tilt of the rotation axis of a planet actually remains fixed relative to the sun, but the crust moves relative to this axis. The question remains: What caused Mars' rotation axis to move relative to the crust? Any major shift of mass on a planet -- within the mantle, or between the mantle and the crust to form a volcano, or even via impact from outer space -- could cause a shift of the rotation axis because a spinning planet is most stable with its mass farthest from its spin axis. Richards has modeled true polar wander in Earth's past that was generated by the upwelling of hot mantle in the interior of the planet, which

some scientists claim shifted our planet's rotation axis 90 degrees some 800 million years ago, tipping the planet on its side. Perron, Manga, Richards and their colleagues calculate that on Mars, an initial shift of 50 degrees from today's pole, equal to about 3,000 kilometers on the surface, would be sufficient to disrupt the Arabia shoreline, while a subsequent shift of 20 degrees from today's pole, or 700 kilometers, would have altered the Deuteronilus shoreline. Interestingly, today's pole and the two ancient poles lie in a straight line equidistant from the planet's biggest feature, the Tharsis rise, a bulge just north of the equator that contains Mars' most recent volcanic vent, Olympus Mons. Tharsis is the largest volcano in the solar system, and formed about 4 billion years ago, not long after Mars solidified. Dynamically, the relative positions of Tharsis and the pole path is exactly what would be expected for any mass shift on Mars that is smaller than the Tharsis rise, since the planet would reorient in a way that keeps Tharsis on the equator.



A view of Mars as it might have appeared more than 2 billion years ago, with a low-latitude ocean filling the lowland basin that now occupies the north polar region. Topographic deformation of features that ring the basin, which are hypothesized to be shorelines formed by an ancient ocean, suggests that Mars experienced significant true polar wander -- reorientation of the planet relative to its rotation axis -- that brought the planet into its present rotational state. The margins of the ocean shown here account for the topographic deformation that would have resulted from this reorientation. Sinuous features near the top of the image are valleys carved by large floods that may have supplied the ocean water. The image was generated using Viking Orbiter images and topographic data from the Mars Orbiter Laser Altimeter on board the Mars Global Surveyor spacecraft.

"*This alignment is unlikely to occur by coincidence*," the team wrote. Manga has a hunch about the mass shift that precipitated the tilt of Mars' rotation axis. If a flood of water had filled the Arabia ocean about 3 billion years ago, to a depth some have calculated at up to several kilometers, that mass at the pole might have been enough to shift the pole 50 degrees to the south. Once the water disappeared, the pole could have shifted back, then shifted again by 20 degrees during the deluge that created the Deuteronilus shoreline.

Because it's unclear whether the two shorelines represent separate inundations or whether one is the receded shoreline of a larger sea, an alternative scenario features the Arabia ocean receding to the Deuteronilus shoreline, shifting the pole from 50 to 20 degrees. Then, once the Arabia ocean disappears entirely, the pole returns to its current position.

Richards is skeptical of this, however, pointing out that thermal convection within the hot interior of Mars could also have caused the poles to wander. "*There must certainly be thermal convection in Mars now because Olympus Mons had new lava flows very recently, within the last 100 million years*," he said. "*But the jury's still out*." Manga said, too, that the source of the water, while unknown, must have produced a deluge greater than any observed on Earth, since huge canyons are cut in the flanks of the Tharsis rise. The water may have evaporated, but it may also have sunk back into underground dikes, frozen near the surface but possibly liquid below. The study's coauthors include Jerry X. Mitrovica and Isamu Matsuyama, who have developed models for the effect of polar wander and internal dynamic processes on the surface deformation of Mars. http://www.berkeley.edu/news/media/download/2007/06/Marsocean_elev.jpg http://www.berkeley.edu/news/media/download/2007/06/perron-marsocean.jpg

HIDDEN PLANET PUSHES FOMALHAUT'S RING A BILLION MILES OFF-CENTER

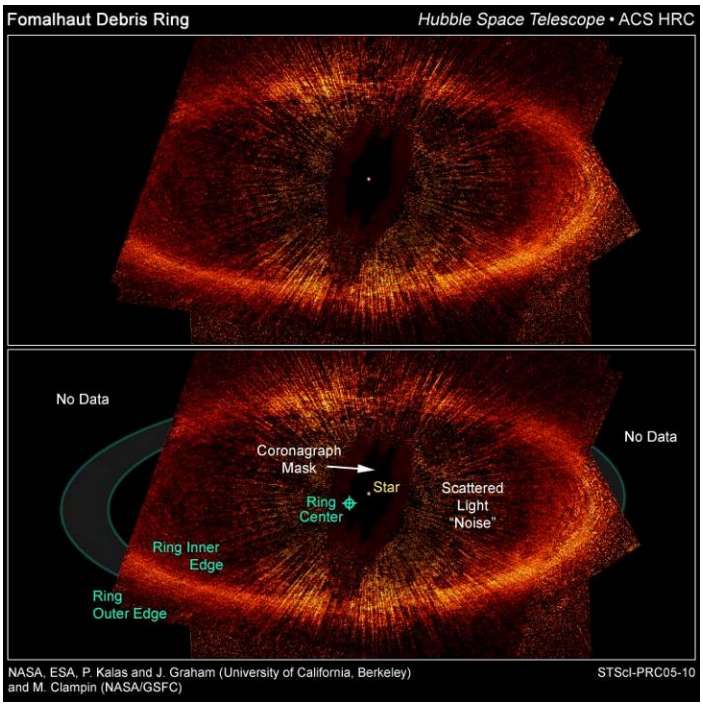
A young star's strange elliptical ring of dust likely heralds the presence of an undiscovered Neptune-sized planet, says an astronomer. Stars in the early stages of life are surrounded by dust clouds that thin out and dissipate as the star reaches maturity, becoming rings in their final stages. One star, however, has a dust ring that has long puzzled astronomers because it is not centered around the star as usual. Instead, the ring is elliptical, with the parent star off to one side. "*We wanted to know why this ring was off-center*," says Alice C. Quillen, author of the study. "*People guessed there might be a planet in there, but nobody knew where it might be, or how big it might be. Now we've got a very good idea*."

Roughly 250 planets have been discovered so far around stars other than our Sun. Most have been revealed by the way the planets influence their parent stars, but Quillen has been working for years on understanding the delicate interaction between stellar dust disks and the planets that shape them. She is now one of the world's experts in predicting planet size and position from the features of a star's dust ring.

Quillen used new images from the HST that caught the star, Fomalhaut, and its surrounding ring almost edge-on and in more detail than ever before. Fomalhaut, 25 light-years away, is the brightest star in the autumn sky. Using a device called a coronagraph that blocks out a star's light so dimmer objects near it can be seen, the Hubble revealed that Fomalhaut was indeed off-center within its ring. The images were also clear enough to show that the ring itself had a surprisingly sharp edge.

That sharp edge was the clue Quillen was looking for. Since ascertaining one of the first extra-solar planets using dust-ring analysis in 2002, Quillen has greatly strengthened her planet-ring interaction models. Treating the ring like a hydrodynamic structure, for instance, is necessary for younger stars whose dust is relatively fine and acts more like a fluid -- while the physics of

dust collision become dominant in older ring systems where the dust has begun clumping into larger bodies.



The sharp inside edge of Fomalhaut, Quillen calculated, demanded that a relatively small, Neptune-size planet was tucked right up against the inner side of the ring, using its gravity to toss dust in the area out of orbit.

According to Quillen's calculations, the ring is elliptical because the Neptunian planet's own orbit around Fomalhaut is elliptical -- a curiosity in such a young system. When stars form from a giant cloud of gas and dust, the angular momentum of the cloud carries over to all the objects that form from the cloud, including new planets. Those new planets should, initially at least, orbit in nice, circular paths -- not elliptical ones. Fomalhaut's ring is offset by 1.4 billion miles, more than 15 times the distance from the Earth to the Sun, suggesting the hidden planet's orbit is also tremendously skewed.

"*Something had to skew that planet, and that's what we're working on now*," says Quillen. "*There may have been fantastic planetary collisions early on that changed their orbits. We're working on figuring out how many more planets of what size you'd need to account for that elliptical orbit, and to account for why there is no other dust inside that ring*."

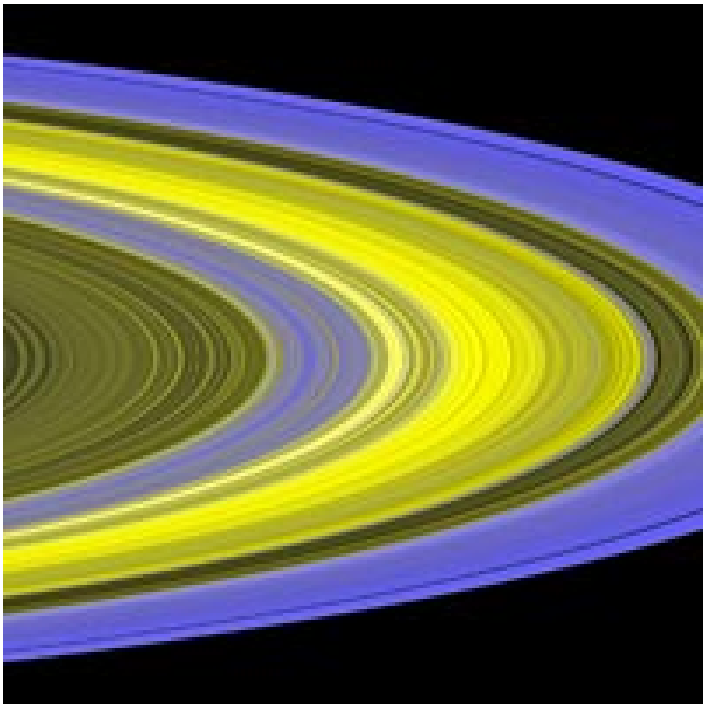
Quillen's model will remain just a theory until a new generation of telescopes can actually see the Fomalhaut planets in question. These telescopes will be equipped with sophisticated coronagraphs that can block out Fomalhaut's light enough to let the planets themselves shine through. http://hubblesite.org/newscenter/archive/releases/2005/10/image/a/

CASSINI 'CAT SCAN' MAPS CLUMPS IN SATURN'S RINGS

Saturn's largest and most densely packed ring is composed of tightly packed clumps of particles separated by nearly empty gaps, according to new findings from the Cassini spacecraft. These clumps in Saturn's B ring are neatly organized and constantly colliding, which surprised scientists. "*The rings are different from the picture we had in our minds. We originally thought we would see a uniform cloud of particles. Instead we find that the particles are clumped together with empty spaces in between*," said Larry Esposito, principal investigator for the Cassini ultraviolet imaging spectrograph.

"*If you were flying under Saturn's rings in an airplane, you would see these flashes of sunlight come through the gaps, followed by dark and so forth. This is different from flying under a uniform cloud of particles*." Because previous interpretations assumed the ring particles were distributed uniformly, scientists underestimated the total mass of Saturn's rings. The mass may actually be two or more times previous estimates. "*These results will help us understand the overall question of the age and hence the origin of Saturn's rings*," said Josh Colwell, team member of the Cassini ultraviolet imaging spectrograph.

Scientists observed the brightness of a star as the rings passed in front of the star on multiple occasions. This provided a measurement of the amount of ring material between the spacecraft and the star. "*Combining many of these occultations at different viewing geometries is like doing a CAT scan of the rings,*" said Colwell. "*By studying the brightness of stars as the rings pass in front of them, we are able to map the ring structure in 3-D and learn more about the shape, spacing and orientation of clusters of particles*."



The observations confirm that the gravitational attraction of ring particles to each other creates clumps, or "self-gravity wakes." If the clumps were farther from Saturn, they might continue to grow into a moon. But because these clumps are so close to Saturn, their different speeds around the planet counteract this gravitational attraction so that the clumps get stretched like taffy and pulled apart. The clumps are constantly forming and coming apart once they reach about 30 to 50 meters (about 100 to 160 feet) across. "*At any given time, most particles are going to be in one of the clumps, but the particles keep moving from clump to clump as clumps are destroyed and new ones are formed*," added Colwell. In the dense B ring, the classical cloud model of the rings predicted that particles collide about twice per hour on average. "*Our results show that the particles in the B ring spend most of their time in almost continuous contact with other particles*," said Colwell. These clumps may act like super-sized particles, changing the way the rings spread due to collisions. The clumps are seen in all regions of the B ring that are not

opaque. One surprising aspect of the measurements is that the clumps in the B ring are broad and very flat, like big sheets of particles. They are roughly 10 to 50 times wider than they are thick. Scientists are also surprised that the B ring clumps are flatter and have smaller spaces between them than those found in the neighboring A ring. http://www.nasa.gov/cassini http://saturn.jpl.nasa.gov http://lasp.colorado.edu/cassini/whats_new/ http://www.jpl.nasa.gov/news/news.cfm?release=2007-062

ASTRONOMERS FIND MULTI-PLANET SYSTEM AROUND UNEXPECTED STAR; MAY ALTER PLANET-FORMATION THEORIES

Astronomers William Cochran and Michael Endl, working with graduate students Robert Wittenmyer and Jacob Bean, have used the 9.2-meter Hobby-Eberly Telescope (HET) at McDonald Observatory to discover a system of two Jupiter-like planets orbiting a star whose composition might seem to rule out planet formation. This study has implications for theories of planet formation. Cochran and Endl have been monitoring the star, HD 155358, since 2001 using the High Resolution Spectrograph on HET. Their measurements of its "radial velocity," or motion toward and away from Earth, show that the star has a wobble in its motion, which is caused by unseen companions tugging on the star.

HD 155358 is slightly hotter than the Sun, but a bit less massive. Most important, it only contains 20 percent as much of the chemical elements called "metals" - elements heavier than hydrogen or helium - as the Sun. Along with one other star (called HD 47536), it contains the fewest metals of any star found to harbor planets. Bean specializes in studying the metal contents of stars. His in-depth studies of the star's spectrum revealed its metal-poor nature, and allowed him to deduce the star's age of roughly 10 billion years.

One planet has an orbital period of 195 days and, at a minimum, is 90 percent as massive as Jupiter. It orbits HD 155358 at a distance of 0.6 AU. (An astronomical unit, or AU, is the Earth-Sun distance of 150 million km, or 93 million miles.) The other planet orbits HD 155358 in 530 days, with a minimum mass half that of Jupiter, at a distance of 1.2 AU.

Wittenmyer used the supercomputer "Lonestar" to calculate the two massive planets' orbits 100 million years into the future. The planets' orbits are not circular, and they orbit close to each other and thus interact gravitationally -- they push each other around. "*It's like a dance*," Endl said. He explained that "*Rob's calculations show us how the orbits change over time: first more eccentric, then more circular, and back again*." The system is stable, Endl said, and the pattern repeats about every 3,000 years. According to Wittenmyer, "*The planets are trading eccentricity with each other. When one orbit is more circular, the other is more eccentric*." The combination of massive planets orbiting a metal-poor star has consequences for theories of planet formation. "*There are two competing planet-formation models*," Endl said. Those models are known as the "core accretion model" and the "disk instability model." Both models start with a rotating cloud with a star forming at its center. As it rotates, the cloud flattens into a disk. Over time, dust in the disk begins to clump together to form the seeds that will eventually become planets. Where the two models differ is in terms of timescale. In the core accretion model, a Jupiter-like planet forms in a two-step process. Over about a million years, a proto-planetary "core" several times the mass of Earth forms through gravitational accumulation of solid materials. When it reaches this mass, it has enough gravity to then pull huge amounts of gas onto itself. Over several million more years, it grows into a gas giant planet. This model relies on large amounts of heavy elements to be present in the disk - and, of course, in the star- to form the cores, Endl said.

"*Most of the planets found using the radial velocity technique are found around metal-rich stars*," he said. "*That argues for the 'core accretion' model. Many astronomers in this field agree that the higher fraction of planets around metal-rich stars is supporting evidence for the core-accretion model*." "*Having this process happen to form not just one, but two, planets around a star that had so little solid material available for planet-building is quite remarkable*." Cochran said.

The competing model of planet formation is called the disk instability model. It argues that the rotating disk of gas and dust around the forming star becomes unstable very soon after the disk forms, causes the disk to break into giant clumps. Gravity within each clump can cause the gas to collapse under its own gravity, forming giant planets in only several hundred years. "*Gas giant planets formed this way might not have any solid core at all*," Endl said. Cochran and his colleagues argue that HD 155358 could have formed the two planets through either method of planet formation. "*The major result of our discovery is that these planets required a very massive disk to form, several times more massive than we think our solar system disk was*," Endl said. "*This demonstrates that disk masses can vary significantly and might even be the most crucial factor in planet formation*."

Cochran and colleagues first began using radial velocity techniques to search for planets from McDonald Observatory in the late 1980s, using the 2.7-meter Harlan J. Smith Telescope. The program continues today on both the Smith Telescope and HET, and Cochran's team has found planets orbiting several stars. http://austral.as.utexas.edu/planets/hd155358/hd155358.html

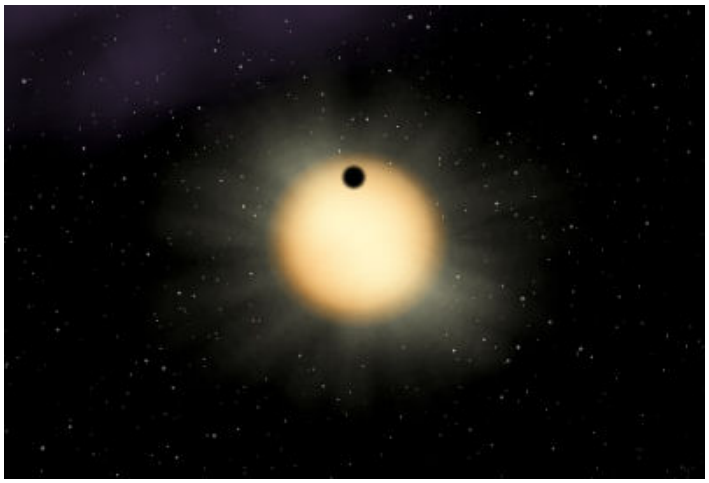
MASSIVE TRANSITING PLANET WITH 31-HOUR YEAR FOUND AROUND DISTANT STAR

An international team of astronomers with the Trans-Atlantic Exoplanet Survey today announce the discovery of their third planet, TrES-3. The new planet was identified by astronomers looking for transiting planets - that is, planets that pass in front of their home star - using a network of small automated telescopes in Arizona, California, and the Canary Islands. TrES-3 was discovered in the constellation Hercules about 10 degrees west of Vega, the brightest star in the summer skies. "*TrES-3 is an unusual planet as it orbits its parent star in just 31 hours!,"* said Georgi Mandushev, Lowell Observatory astronomer. "*That is to say, the year on this planet lasts less than one and a third days. It is also a very massive planet - about twice the mass of the solar system's biggest planet, Jupiter - and is one of the planets with the shortest known periods*."

The new planet TrES-3 was first noticed by Lowell Observatory's Planet Search Survey Telescope (PSST), set up and operated by Edward Dunham and Georgi Mandushev. The Sleuth telescope, maintained by David Charbonneau and Francis O'Donovan, at Palomar Observatory also observed transits of TrES-3, confirming the initial detections. TrES-3 is about 800 light-years distant and because it is so close to its host star, it is very hot, about 1,500 degrees Kelvin. "*TrES-3 will be an intriguing object to study more deeply*", said Edward Dunham, Lowell Observatory instrument scientist. "*For example, its tight orbit causes it to be illuminated very strongly. This may make it possible to measure the variation in reflected light as it goes through its phases. This will tell us how reflective its atmosphere is*."

By definition, a transiting planet passes directly between Earth and the star, causing a slight dimming of the star's light in a manner similar to that caused when the moon passes between

the Sun and Earth during a solar eclipse. To look for transits, the small telescopes are automated to take wide-field timed exposures of the clear skies on as many nights as possible. When an observing run is completed for a particular field - usually over an approximate two-month period - astronomers measure very precisely the light from every star in the field in order to detect the possible signature of a transiting planet. "*TrES-3 blocks off about 2.5 percent of the light of the star as it passes in front of it*," said Mandushev. "*With our telescopes, we can measure this tiny drop in the star's brightness and deduce*



In order to help confirm they had found a planet, Gaspar Bakos and Guillermo Torres switched from the 10-centimeter TrES telescopes to one of the 10-meter telescopes at the Keck Observatory on the summit of Mauna Kea. Using this giant telescope, they confirmed that they had found a new planet. In order to measure accurately the size and other properties of TrES-3, astronomers also made follow up observations of it with bigger telescopes at Lowell and at the Fred Whipple Observatory in Arizona, and with the Las Cumbres Observatory Global Telescope in Hawaii. The paper "TrES-3: A Nearby, Massive, Transiting Hot Jupiter in a 31-hour Orbit," in the Astrophysical Journal is available online at: http://arxiv.org/abs/0705.2004 http://www.lowell.edu/press_room/TrES-3_images.html

MUCH ADO ABOUT NOTHING – HUGE GALACTIC VOID

Our Milky Way galaxy lies at the edge of a huge void and is being repulsed by the void at high speed. This observation provides astronomers with a fundamental insight into how dark matter is distributed and into the process of galaxy formation. Brent Tully discussed the discovery at the meeting of the American Astronomical Society . His collaborators in this research are Helene Courtois, Dale Kocevski, Luca Rizzi, Ed Shaya, Alan Peel, and Igor Karachentsev.

Two decades ago, Brent Tully and his collaborator Richard Fisher noted that our galaxy lives adjacent a vast empty region that they called the 'Local Void'. Today, thanks to the contributions of many astronomers around the world, there is information on the distribution of hundreds of thousands of galaxies and an increasingly detailed knowledge of the rich tapestry in the distribution of galaxies. Galaxies collect along filaments and in clusters, at places where the filaments intersect. Elsewhere there are empty regions called voids. Our galaxy resides in a filament that bounds a void. We call this filament the 'Local Sheet'.

It has also been known for two decades that our Milky Way galaxy is traveling through intergalactic space at high speed. The Cosmic Microwave Background (CMB) is radiation that comes to us in all directions from the time when the universe was a hot plasma, 3 hundred thousand years after the Big Bang. A tiny one part in a hundred systematic variation in frequency of the peak of the CMB radiation is taken to be a Doppler shift caused by our motion with respect to the ensemble of all other matter. Some of the components of our motion have been known for a long time. The Earth orbits the Sun once a year and the Sun orbits the center of the Milky Way Galaxy every 250 million years. We also have known that our galaxy is being pulled toward neighboring concentrations of matter, particularly our nearest giant neighbor, the Andromeda Galaxy, at a distance of 2 million light-years and the nearest rich cluster of thousands of galaxies, the Virgo Cluster, at 55 million light-years. It has also become clear that there are very long-range forces pulling on us. We have a motion in a direction toward two huge concentrations of galaxies that happen by chance to line up, one behind the other, at distances of 200 and 600 million light-years. The relative importance of these two attractors has remained a detail in dispute among astronomers.

Yet until now part of our motion inferred from the variation in the CMB remained unexplained. It is in a direction aligned with the flattened disk of our galaxy and there was the possibility that something important was being hidden by the veil of obscuring dust clouds in the plane of the Milky Way. However, radiation at X-ray, infrared, and radio wavelengths are not blocked. Years of observing by many astronomers have failed to reveal anything important.

Now, another kind of observation has resolved the mystery. Astronomers have been measuring the distances to galaxies with precision techniques. With accurate distances it is possible to distinguish between the motions of galaxies due to the general expansion of the universe and the local deviant motions caused by the way matter is clumped, with its consequent gravitational effects. It is found that galaxies are flowing in streams, with coherent flows caused by large attractors far away and eddies caused by modest attractors nearby. The influences on our motion discussed above have been confirmed. In addition, features of the local streaming pattern reveal the source of the additional component.

The critical new information comes from observations of relatively nearby galaxies with Hubble Space Telescope. Accurate distances to galaxies are provided by measuring the luminosities of the brightest old stars that lie on what is known as the Red Giant Branch. These stars have well established properties. The accurate distances give a detailed map of the flow pattern of nearby galaxies and reveal several remarkable things. First, the direction of our motion with respect to the nearest several thousand galaxies is well defined. Second, all the galaxies within 15 million light years, within our Local Sheet, are moving together. Third, this motion is NOT shared by galaxies just beyond our Local Sheet and, in fact, we are moving on a collision course toward the nearest adjacent filament, the Leo Spur (it will be at least 10 billion years before the Local Sheet and the Leo Spur pancake together).

These patterns reveal the cause: the Local Void. Whereas concentrations of matter pull, a void pushes! If an object is surrounded uniformly by matter in all directions, except for one sector in which there is nothing, then the absence of a pull is a push away from that sector. The effect can be astonishingly large. Our velocity away from the Local Void is 600,000 miles per hour. To generate such a large velocity, the void must be very large and very empty. The current standard model of the universe with dark matter and dark energy does allow for voids that are as large as we infer for the Local Void, but it is

impressive that we should live next to such a large feature. More importantly for our theoretical understanding, we conclude that the void is really empty. Only a small fraction of the matter of the universe is in a visible form, so it is not a given that an apparently empty region is truly empty. However, the large push we are getting from the Local Void is convincing evidence that it really is empty!

The determination of distances from the properties of Red Giant Branch stars is based on observations by the authors and others made with Hubble Space Telescope. Distance determinations of many more galaxies have been made by a variety of methods, in part by the authors. http://www.ifa.hawaii.edu/info/press-releases/AAS/tully_aas07-630.jpg

Distribution of galaxies in the region around our Milky Way in supergalactic coordinates. Each little dot represents a galaxy of typically 100 billion stars. The colors indicate the relative motions of galaxies with accurately measured distances, with shades of green and blue indicating motions toward us and shades of yellow to red indicating motions away from us. Our nearest neighbors have only small relative motions (represented by yellows and greens) as seen best in the exploded view of the right panel. The observed pattern of velocities is explained as follows. We, along with all these nearest neighbors, are moving together toward the lower right corner of the figures. The result is that all the galaxies in the lower right appear to be moving toward us and all the galaxies in the upper left appear to be moving away -- but it is us and our neighbors that are moving. Our motion is represented by the orange arrow. We now understand that there are two main causes for this motion. The concentration of objects at the right of the figures is the Virgo Cluster and its mass of quadrillion (10**15) times the Sun causes an attraction indicated by the blue vector in the exploded panel. The red vector in this panel is what is left over and this represents our motion of 600,000 miles per hour away from the Local Void. In detail, the Local Void may consist of several components, identified in the left panel as the Local Void and the North and South extensions.

Amateur Astronomers Help Keep Tabs on White Dwarf Overdue for Massive Starquake

Researchers have enlisted a world wide team of amateur / semi-professional astronomers to keep watch on one of the fastest spinning white dwarf stars ever found. The star is long overdue for a major eruption that will increase its brightness a thousand fold.

The researchers, led by Dr Boris Gsicke, first discovered the star in 2005. Known as HS2331+3905, it is 260 light years away in the constellation of Andromeda. It belongs to the class of objects called white dwarfs, which are the burnt out cores of stars like our Sun. HS2331+3905 is roughly the size of the Earth, but weighs about 170000 times more. While the Earth rotates around its axis once per day, HS2331+3905 does so in only 67 seconds, and its surface is pulsating every five minutes. As if that wasn't dramatic enough the researchers have discovered that it sits in particularly turbulent surroundings that should cause it to erupt once every ten to twenty years, increasing in brightness a thousand fold. The next such eruption is decades overdue and could happen at any time.

The white dwarf is slowly stripping material from a nearby small companion star that is orbiting around it. That material is building up in an increasingly hot disc surrounding the white dwarf. When the temperature of the disc reaches a critical value, the equivalent of a pressure valve opens and pours the hot material onto the surge of the White Dwarf. During this eruption, the star will brighten by a thousand fold for a month or two, and then slowly fade into oblivion. These cataclysmic events should happen roughly every few decades but the Warwick team have now been able to piece together observation records for that part of the sky stretching back to the 1950's which show no sign of an eruption over that period.

When the eruption does come it will obviously be a dramatic event for that star system, but it will also catapult it from its usual dim state into the reach of everybody equipped with a pair of binoculars. The researchers have thus recruited a team of gifted amateur astronomers to keep watch on the star and sound the alert if they see a sign of brightening of HS2331+3905. Once this happens, the astronomers will swing their large telescopes on the ground and in space to study the eruption in all details.

One of that network of dedicated amateurs is Gary Poyner in Birmingham U.K. who specialize in observing variable stars. He owns a number of sophisticated telescopes and in 2000 he was awarded the British Astronomical Steavenson Award for "Outstanding contribution to Observational Astronomy".

He said: "*The prospect of catching this object undergoing a rare outburst, is motivation enough for amateur observers like myself to continue monitoring the field on every possible occasion. Although too faint to see whilst in it's quiescent state, the long periods of looking at 'empty space' will eventually be rewarded once HS2331+3905 finally undergoes the outburst which will cause a ripple of excitement though both amateur and professional astronomical communities alike*". http://www2.warwick.ac.uk/newsandevents/pressreleases/amateur_astronomers_help/ http://www.garypoyner.pwp.blueyonder.co.uk/varstars.html

Sun's Deep Interior Revealed by Computer Model; Provides Clues to the Inner Dynamics of Stars

A new computer model simulates convection patterns in the deep interior of the Sun in unprecedented detail. The patterns, known as giant cells, play a critical role in solar variability, influencing magnetic storms that take aim at Earth. The model was developed by a team of scientists led by Mark Miesch. "*This model provides us with an unprecedented view of how the solar interior works*," says Miesch, a scientist in NCAR's High Altitude Observatory. "*It opens a window on a number of important solar processes, including the delicate balance of forces that causes the Sun's equator to rotate faster than its poles*." "*This is our first indication of what the chaotic interior of a star looks like*," Miesch explains. "*Stars are the building blocks of the universe, and*

understanding what goes on within them is critical to understanding diverse aspects of astrophysics."

Giant cells and churning masses of plasma - Convection near the surface of the Sun occurs when hot plasma rises and cooler, denser plasma sinks, which is a process similar to what occurs in water that is heated on a stove. Convection also takes place far beneath the Sun's surface, where scientists suspect there are churning masses of plasma up to 10 times larger than the size of Earth. These masses, known as giant cells, may hold the key to the movement of sunspots and the behavior of solar storms, which can buffet Earth's atmosphere and affect satellites as well as power and communications systems.

To map the giant cells, Miesch and his team drew on data from helioseismology and used supercomputers to solve the equations of stellar fluid dynamics. Helioseismology is a technique to measure sound waves that propagate deep within the interior of the Sun. By analyzing variations in the light and velocity of the waves as they emerge on the Sun's surface, scientists can glean information about hidden subsurface structures.

The model simulations capture processes in the outer 30 percent of the solar interior. They correspond to existing maps that are based on helioseismic data about subsurface processes. The simulations also capture the Sun's unusual rotational pattern, which occurs when the giant cells redistribute angular momentum. This causes the solar equator to rotate every 28 days while higher latitudes take about 35 days.

Glimpses into the inner workings of the Sun - The model reveals details about the giant cells that could help scientists learn more about the inner workings of the Sun, which are hidden from any current observational technique. The team's simulations indicate that, at low solar latitudes, cooler and denser plasma sinks along north-south corridors, with the corridors moving eastward relative to hotter plasma that rises. But at higher latitudes, rising and falling areas of plasma meet and create solar cyclones that last for several days.

The model also can help scientists understand how giant cells induce a global circulation. The circulation, acting like a conveyor belt, moves plasma from the solar equator toward the poles just beneath the surface of the Sun and then back toward the equator at a greater depth. This circulation, working with convection and rotation, generates and organizes magnetic fields, giving rise to patterns of magnetic activity such as the 11-year sunspot cycle. To create the model, Miesch worked with Allan Sacha Brun, Marc DeRosa and Juri Toomre.
http://www.ucar.edu/news/releases/2007/solarmodelvisuals.shtml

SURPRISE DURING THE SEARCH FOR A 'SECOND EARTH'

A team of scientists investigated the habitability of the planetary system Gliese 581 in the constellation of Libra, 20 light-years away. With the help of a model for the evolution of Earth-like planets coupled with a climate model they were able to demonstrate habitable conditions on the planet Gl 581d, while its smaller brother, Gl 581c, has to be classified uninhabitable. This contradicts the findings of another research team in April of this year that announced Gl 581c to be the first habitable planet outside our solar system.

The new investigations of the scientists Werner von Bloh, Christine Bounama, Siegfried Franck, and Manfred Cuntz incorporate the thermal evolution of planets, i.e. the cooling of the planetary body from its formation and the connected geodynamic parameters. Because of its heavy mass the Potsdam scientists consider it likely that Gl 581c has a dense atmosphere. Previous calculations derived the habitability of the planet only from temperatures calculated for the radiation balance of the planetary surface without an atmosphere.

The planetary system Gliese 581 contains probably three planets orbiting a Red Dwarf. The central star has 100 times less luminosity than our Sun. Both planets investigated are so-called Super-Earths, i.e. planets with a mass up to 10 times higher than that of the Earth.

Among the extrasolar planets detected so far, the planet Gl 581c, already acclaimed by the media as a "second Earth", has the most similar dimensions compared to Earth, because it has "only" five times its mass. But according to the new calculations the orbit is too close to the central star so that the surface is too hot for the evolution of life. In contrast to previous assumptions, the environmental conditions on the planet Gl 581d with an eight times higher mass than Earth and a more distant orbit could allow the evolution of primitive life forms. Because the planet always has the same side turned towards its central star -- as the Moon does to the Earth -- the emergence of higher life forms is very unlikely. On the day side it is probably warm, while on the night side severe cold dominates. Nor could Gliese 581d become a second home planet for mankind because even on its sunlit side, red twilight prevails and wild storms blow.

The search for a "second Earth" able to harbor higher life forms is therefore still far from over. Nevertheless, a more detailed investigation of Gl 581d would be exciting because it orbits in the habitable zone, where the emergence of life might be possible. This planet and its neighbors are within the range of detection of the Darwin satellite mission planned by the Europeans for 2015, a mission designed for the observation of extrasolar planets and the detection of life. The Super-Earth Gl 581d should be explicitly observed as part of this endeavor. http://arxiv.org/abs/0705.3758v1
http://www.pik-potsdam.de/PLACES

FROM THE EDITOR'S TERMINAL

The Stargazer is your newsletter and therefore it should be a cooperative project. Ads, announcements, suggestions, and literary works should be received by the editor at least two weeks prior to the next upcoming scheduled EAS meeting. If you wish to contribute an article or suggestions to ***The Stargazer*** please contact Mark Folkerts by email or by telephone (425) 486-9733 or co-editor Bill O'Neil, at (774) 253-0747.

The Star Gazer
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In June's StarGazer:

The next EAS Meeting is 3:00 P.M. Saturday June 16th at the Everett Public Library Auditorium.