



# The Stargazer

July 2007

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**The Stargazer**  
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**Everett, WA 98206**

See EAS website at:

[http://members.tripod.com/everett\\_astronomy](http://members.tripod.com/everett_astronomy)

## EAS BUSINESS...

**NEXT EAS MEETING – WEDNESDAY JULY 25<sup>TH</sup>**  
**AT 7:00 PM AT JIM BIELAGA'S STORE, 'AURORA**  
**ASTRO PRODUCTS', AT 11419 19TH AVENUE SE**  
**#A102, EVERETT, WA 98208, 425-337-4384**

### ★★★ July 25<sup>h</sup> MEETING PROGRAM: ★★★

Wednesday July 25th at 3:00 PM at Aurora Astro Products (Jim Bielaga's store) the program will be by Sonny Tremoulet, discussing building telescope mirrors using automated grinding machine he designed and testing them using an interferometer.

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 Aug 11th - 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@nwlinc.com](mailto:tam1951@nwlinc.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.

**Sep 08 - Saturday**

**Sep 15 - 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.

**People should also join and send mail to the mail list [everett\\_astronomy@topica.com](mailto: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.

The annual Seattle Astronomical Society club star party is scheduled for the weekend of September 15<sup>th</sup>, 2007, at Brooks Memorial State Park, on Hwy 97 north of Goldendale.. For info, contact Karl R Schroeder, 15761 Palatine Ave N, Shoreline, WA. 98133, (206) 362-7605

### \$\$ - FINANCIAL HEALTH - \$\$

The club maintains a \$950+ balance. We try to keep approximately a \$500 balance to allow for contingencies. .

### CLUB SCOPES

#### SCOPE

10-INCH WARD DOBSONIAN

10-INCH SONOTUBE DOBSONIAN

8-INCH DOBSONIAN

#### LOAN STATUS

ON LOAN

AVAILABLE

AVAILABLE

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

### EAS MEMBER NEWS

#### EAS Member Ken Ward.

Long time active EAS member Ken Ward died unexpectedly at a hospital Saturday night July 14th, from a blood clot in the lungs. He was 52.

Ken and Judy Ward hosted EAS star parties at their house north of Monroe many times over past years. He was also the builder of the TMSP award-winning EAS 10" club telescope that many of you have used, had a telescope-building business 'Sky Valley

Scopes' for several years, and created a number of custom-designed dobsonian telescopes using advanced lightweight composite materials.



**Photos - Ken Ward and one of his custom designed telescopes, with EAS members at Astronomy Day at the Library.**

The service for Ken will be Saturday July 21st at 1:00 pm at Purdy & Kerr Funeral Home in Monroe. Purdy & Kerr Funeral Home - 409 W Main St, Monroe, WA 98272, (360) 794-7049

There will not be an EAS meeting at the library this Saturday, but will instead be one the following Wednesday at Jim Bielaga's store, Aurora Astro Products, at 7:00 pm, at 11419 19th Avenue SE #A102, Everett, WA 98208, 425-337-4384.

**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**

**Aurora Astro Products**

11419 19th Avenue SE #A102  
Everett, WA 98208  
425-337-4384

[www.auroraastro.com](http://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. NWRAL 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**

**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](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 Parties - [http://www.olympicastrologicalsociety.com/hurricane\\_ridge\\_star\\_parties.htm](http://www.olympicastrologicalsociety.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 - **EAS Meeting – Everett Public Library Auditorium – 3:00pm**
- 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.olympicastrologicalsociety.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 15 - **SAS Star Party – Brooks Mem. Park – Hwy 97**
- 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](http://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](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](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](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**

Aug 05	Last Quarter Moon
Aug 12	New Moon
Aug 20	First Quarter Moon
Aug 28	Full Moon
Sep 04	Last Quarter Moon
Sep 11	New Moon
Sep 19	First Quarter Moon
Sep 26	Full Moon
Oct 03	Last Quarter Moon
Oct 11	New Moon
Oct 19	First Quarter Moon
Oct 26	Full Moon

**Digital Lunar Orbiter Photographic Atlas of the Moon**

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

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

[http://www.lpi.usra.edu/research/lunar\\_orbiter](http://www.lpi.usra.edu/research/lunar_orbiter)

**Observing Jupiter's Moons - Java tool**

<http://skytonight.com/observing/objects/javascript/jupiter>

**Transit times for Jupiter's Great Red Spot in 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.srb.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 (EQUULEUS)

**EQUULEUS:** “The Foal” as this constellation is also known, borders on the constellations of Aquarius, Delphinus, and Pegasus. It ranks 46th in overall brightness among the constellations, and contains five stars brighter than magnitude 5.5. Its central point is located at RA=21h08m and Dec.= +7.5 degrees. It is completely visible from latitudes North of -77 degrees, and completely invisible from latitudes South of -88 degrees. This constellation ranks 87th in overall size (next to smallest), taking up 71.64 square degrees, or 0.174% of the sky. Equuleus has no known meteor showers, and has no Messier objects; it also has no associated asterisms. Its midnight culmination date is August 8th, and its solar conjunction date is February 7th. Delta Equulei is a close binary system, with both members of the system being spectral type F-7 main sequence stars, and both have approximately the same visual magnitude as well (5.2 and 5.3). This system lies only about 53 light years away, and it is thus calculated that the distance (apparent separation is 0.34”) between these two stars is just slightly more than the distance between our own Sun and the planet Jupiter. The two stars in this binary association orbit each other every 5.7 years.

### PLANETARY FOCUS - MERCURY

The “Planetary Focus” column appears periodically in the EAS newsletter. Mercury is currently low in the glow of dawn and has brightened to about magnitude zero (0), and continues to brighten. One should look for it above the east-northeast horizon about an hour before sunrise. It will be located to the far lower right of Capella, and to the far lower left of Aldebaran. This month, our guest planet is Mercury, and these are the facts:

**Rotation around the Sun:** 88 days (earth = 365 days).

**Orbit:** from 0.31 to 0.47 astronomical units (AU); this is about 29-44 million miles from closest to furthest points away from the Sun. This is a very eccentric (non-circular) orbit.

**Inclination of orbit:** 7 degrees.

**Diameter at equator:** 3,048 miles.

**Mass:** one-sixteenth that of earth.

**Density:** 5.4 times that of water.

**Period of rotation on its own axis:** 58 days, 15 hours, 30.5 minutes (earth=24 hours).

**Satellites (moons):** None

**Gravity:** about one-third that of earth's.

**Special Notes:** Mercury is one of two (the other is Venus) planets closer to the Sun than the earth. It is never more than 28 degrees from the Sun, which makes it always so difficult to observe. It has

a temperature range of between +450 degrees C. (when it's close to the sun) , to -180 degrees C. at night. It has an almost imperceptible atmosphere, which contains very small levels of helium, oxygen, and argon, as well as some sodium and potassium. It resembles our own moon in that it is heavily cratered. Mariner 10, a U.S. probe, made close approaches to the planet in 1974 and 1975. Mercury is a rocky planet (terrestrial planet), with a probable nickel-iron core, and a silicate-rich crust.

### 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/](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 FUN FACTS; AND "MIRROR IMAGES" ARE TAKING A MID-SUMMER BREAK. SEE YOU NEXT MONTH, AND HOPE YOU GET TO ENJOY SOME STAR PARTY ACTIVITIES THIS SUMMER!**

**SPECIAL NOTE FROM THE EAS STARGAZER NEWSLETTER CO-EDITOR:**

**TO OUR VERY GOOD FRIEND KEN WARD: REST IN WONDERFUL PEACE KEN, WITH THE MOST BEAUTIFUL PART OF OUR UNIVERSE - THE STARS.**

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

#### **GREAT PERSEIDS**

July 11, 2007: Got a calendar? Circle this date: Sunday, August 12th. Next to the circle write "all night" and "Meteors!" Attach the above to your refrigerator in plain view so you won't miss the 2007 Perseid meteor shower.

"It's going to be a great show," says Bill Cooke of NASA's Meteoroid Environment Office at the Marshall Space Flight Center. "The Moon is new on August 12th--which means no moonlight, dark skies and plenty of meteors." How many? Cooke estimates one or two Perseids per minute at the shower's peak.

The source of the shower is Comet Swift-Tuttle. Although the comet is nowhere near Earth, the comet's tail does intersect Earth's orbit. We glide through it every year in August. Tiny bits of comet dust hit Earth's atmosphere traveling 132,000 mph. At that speed, even a smidgen of dust makes a vivid streak of light--a meteor--when it disintegrates. Because Swift-Tuttle's meteors fly out of the constellation Perseus, they are called "Perseids."

Note: In the narrative that follows, all times are local. For instance, 9:00 pm means 9:00 pm in your time zone, where you live.

The show begins between 9:00 and 10:00 pm on Sunday, August 12th, when Perseus rises in the northeast. This is the time to look for Perseid Earthgrazers--meteors that approach from the horizon and skim the atmosphere overhead like a stone skipping the surface of a pond.

"Earthgrazers are long, slow and colorful; they are among the most beautiful of meteors," says Cooke. He cautions that an hour of watching may net only a few of these--"at most"--but seeing even one makes the long night worthwhile.

As the night unfolds, Perseus climbs higher and the meteor rate will increase many-fold. "By 2 am on Monday morning, August 13th, dozens of Perseids may be flitting across the sky every

hour." The crescendo comes before dawn when rates could exceed a meteor a minute.

For maximum effect, Cooke advises, "get away from city lights." The brightest Perseids can be seen from cities, he allows, but the greater flurry of faint, delicate meteors is visible only from the countryside. Scouts, this is a good time to go camping.

And there's a bonus: Mars. In the constellation Taurus, just below Perseus, Mars shines like a bright red star. Many of the Perseids you see on August 12th and 13th will flit right past it. Instead of following the meteor, you may find you have a hard time taking your eyes off Mars. There's something bewitching about it, maybe the red color or perhaps the fact that it doesn't twinkle like a true star. You stare at Mars and it stares right back. Earth and Mars are converging for a close encounter in December 2007. [http://science.nasa.gov/headlines/y2007/11jul\\_greatperseids.htm](http://science.nasa.gov/headlines/y2007/11jul_greatperseids.htm)

### LARGEST TRANSITING EXTRASOLAR PLANET FOUND AROUND A DISTANT STAR LOWELL OBSERVATORY

An international team of astronomers with the Trans-Atlantic Exoplanet Survey announce today the discovery of TrES-4, a new extrasolar planet in the constellation of Hercules. 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-4 was discovered less than half a degree (about the size of the full Moon) from the team's third planet, TrES-3.

"TrES-4 is the largest known exoplanet," said Georgi Mandushev, Lowell Observatory astronomer and the lead author of the paper announcing the discovery. "It is about 70 percent bigger than Jupiter, the Solar System's largest planet, but less massive, making it a planet of extremely low density. Its mean density is only about 0.2 grams per cubic centimeter, or about the density of balsa wood! And because of the planet's relatively weak pull on its upper atmosphere, some of the atmosphere probably escapes in a comet-like tail."

The new planet TrES-4 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-4, confirming the initial detections. TrES-4 is about 1400 light years away and orbits its host star in three and a half days. Being only about 4.5 million miles from its home star, the planet is also very hot, about 1,600 Kelvin or 2,300 degrees Fahrenheit.

"TrES-4 appears to be something of a theoretical problem," said Edward Dunham, Lowell Observatory Instrument Scientist. "It is larger relative to its mass than current models of superheated giant planets can presently explain. Problems are good, though, since we learn new things by solving them."

"We continue to be surprised by how relatively large these giant planets can be," adds Francis O'Donovan, a graduate student in astronomy who operates one of the TrES telescopes. "But if we can explain the sizes of these bloated planets in their harsh environments, it may help us understand better our own Solar System planets and their formation."

By definition, a transiting planet passes directly between the Earth and the star, blocking some of the star's light and causing a slight drop in its brightness. 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 observations are

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-4 blocks off about one percent of the light of the star as it passes in front of it," said Mandushev. "With our telescopes and observing techniques, we can measure this tiny drop in the star's brightness and deduce the presence of a planet there."

Not only is the planet TrES-4 mysterious and intriguing, but so is its host star cataloged as GSC 02620-00648. Georgi Mandushev explains: "The host star of TrES-4 appears to be about the same age as our Sun, but because it is more massive, it has evolved much faster. It has become what astronomers call a 'subgiant', or a star that has exhausted all of its hydrogen fuel in the core and is on its way of becoming a 'red giant', a huge, cool red star like Arcturus or Aldebaran."

In order to help confirm they had found a planet, Gáspár Bakos of the Hungarian Automated Telescope Network (HATNet) and Harvard's Guillermo Torres switched from the 10-centimeter TrES telescopes to one of the 10-meter telescopes at the W. M. Keck Observatory on the summit of Mauna Kea, Hawaii. Using this giant telescope, they confirmed that the TrES team had indeed found a new planet. In order to measure accurately the size and other properties of TrES-4, astronomers also made follow up observations with bigger telescopes at Lowell Observatory and Fred Whipple Observatory in Arizona. <http://www.lowell.edu/media/releases.php?release=20070806>

### STAR SURFACE POLLUTED BY PLANETARY DEBRIS

Looking at the chemical composition of stars that host planets, astronomers have found that while dwarf stars often show iron enrichment on their surface, giant stars do not. The astronomers think that the planetary debris falling onto the outer layer of the star produces a detectable effect in a dwarf star, but this pollution is diluted by the giant star and mixed into its interior.

"It is a little bit like a Tiramisu or a Capuccino," says Luca Pasquini from ESO, lead-author of the paper reporting the results. "There is cocoa powder only on the top!"

Just a few years after the discovery of the first exoplanet it became evident that planets are preferentially found around stars that are enriched in iron. Planet-hosting stars are on average almost twice as rich in metals than their counterparts with no planetary system. The immediate question is whether this richness in metals enhances planet formation, or whether it is caused by the presence of planets. The classic chicken and egg problem. In the first case, the stars would be metal-rich down to their centre. In the second case, debris from the planetary system would have polluted the star and only the external layers would be affected by this pollution.

When observing stars and taking spectra, astronomers indeed only see the outer layers and can't make sure the whole star has the same composition. When planetary debris fall onto a star, the material will stay in the outer parts, polluting it and leaving traces in the spectra taken.

A team of astronomers has decided to tackle this question by looking at a different kind of stars: red giants. These are stars that, as will the Sun in several billion years, have exhausted the hydrogen in their core. As a result, they have puffed up, becoming much larger and cooler.

Looking at the distribution of metals in fourteen planet-hosting giants, the astronomers found that their distribution was rather different from normal planet-hosting stars.

"We find that evolved stars are not enriched in metals, even when hosting planets," says Pasquini. "Thus, the anomalies found in planet-hosting stars seem to disappear when they get older and puff up!"

Looking at the various options, the astronomers conclude that the most likely explanation lies in the difference in the structure between red giants and solar-like stars: the size of the convective zone, the region where all the gas is completely mixed. In the Sun, this convective zone comprises only 2% of the star's mass. But in red giants, the convective zone is huge, encompassing 35 times more mass. The polluting material would thus be 35 times more diluted in a red giant than in a solar-like star.

"Although the interpretation of the data is not straightforward, the simplest explanation is that solar-like stars appear metal-rich because of the pollution of their atmospheres," says co-author Artie Hatzes.

When the star was still surrounded by a proto-planetary disc, material enriched in more heavy elements would fall onto the star, thereby polluting its surface. The metal excess produced by this pollution, while visible in the thin atmospheres of solar-like stars, is completely diluted in the extended, massive atmospheres of the giants.

#### **BENCHMARK SURVEY SHOWS THAT GIANT OUTER EXTRASOLAR PLANETS ARE RARE**

Astronomers who used powerful telescopes in Arizona and Chile in a survey for planets around nearby stars have discovered that extrasolar planets more massive than Jupiter are extremely rare in other outer solar systems.

Astronomers just concluded a benchmark 3-year survey using direct detection techniques sensitive to planets farther from their stars. The survey looked at 54 young, nearby stars that were among the best candidates for having detectable giant Jupiter-like planets at distances beyond 5 astronomical units (AU), or the distance between Jupiter and the sun. (One AU is the distance between Earth and the sun.)

Since 1995, astronomers have found more than 230 "super Jupiters" orbiting very close to their parent stars using the radial velocity method. This indirect planet-detecting technique measures the slight back-and-forth motion of the star as it is tugged by an unseen planet's gravity. Scientists have written more than 2,000 scholarly papers about these giant Jupiter-like planets within a few Earth-to-sun distances of their stars.

However, the radial velocity method presently used is most sensitive to planets close to their stars. The technique reveals little about extrasolar planets farther out in nearby solar systems.

Astronomers need other techniques to map extrasolar planets beyond 5 AU so they can determine what the "average" planetary system looks like -- and whether ours is a typical solar system.

The 3-year survey didn't turn up even one giant extrasolar planet in the outer part of any nearby solar system.

"We certainly had the ability to detect outer super Jupiter planets at 10 AU, and farther out, around young sun-like stars," said UA astronomy Professor Laird Close. Close, along with Rainer Lenzen and Don McCarthy, designed the unique, methane-planet sensitive imagers used on two powerful telescopes for the survey.

"The odds are extremely slight that planets larger than four to five Jupiter masses exist at distances greater than 20 AU from these stars," concluded graduating doctoral student Beth Biller. Biller is lead author on the first scholarly paper reporting direct-imaging

results for farther-out massive Jupiters from this survey, the most sensitive to date.

"There is no 'planet oasis' between 20 and 100 AU," doctoral student Eric Nielsen agreed. "We achieved contrasts high enough to find these super Jupiters, but didn't." 20 AU is the orbital distance of the planet Uranus in our own solar system.

Astronomers were surprised in the early days of planet finding to discover a population of planets more massive than Jupiter, within the orbit of Mercury, taking only a few days to orbit their host star, Biller said. "Now that we know there aren't large numbers of giant planets lurking at large distances from their stars, astronomers have a more complete picture, and can better constrain how planets are formed," she said.

The team used Close's novel Simultaneous Differential Imager (SDI) for observations made with the ESO 8.2-meter Very Large Telescope's (VLT) in Chile and with the 6.5-meter, MMT Observatory on Mount Hopkins, Ariz. One SDI instrument was used with Lenzen's CONICA adaptive optics camera on the VLT, and another SDI instrument was used with McCarthy's ARIES adaptive optics camera on the MMT. The SDI devices made the highest contrast astronomical images ever made from ground or space of methane-rich companions within an arc second of their stars. (An arc second is the diameter of a dime seen from two miles away.) A related previous news release about SDI is online at <http://uanews.org/spots/sci-12395.html> and [http://uanews.org/silk/request/ABDor\\_blinky\\_L\\_T3\\_pr.gif](http://uanews.org/silk/request/ABDor_blinky_L_T3_pr.gif)

Comparison of images taken with SDI on and off. A number of fake planets (at separations of 0.55", 0.85", and 1.15" from the star) were added in to this data, which was then analyzed first using the SDI method and second, using standard adaptive optics techniques. The simulated planets, each seen as a pair of black-and-white dots 33 degrees apart in the SDI image, are easily detected yet are 10,000 times fainter than the central star in the standard adaptive optics analysis.

#### **THE GOBLING DWARF THAT EXPLODED**

Evidence for Type Ia Supernovae Scenario - A unique set of observations, obtained with the VLT, has allowed astronomers to find direct evidence for the material that surrounded a star before it exploded as a Type Ia supernova. This strongly supports the scenario in which the explosion occurred in a system where a white dwarf is fed by a red giant.

Because Type Ia supernovae are extremely luminous and quite similar to one another, these exploding events have been used extensively as cosmological reference beacons to trace the expansion of the Universe.

However, despite significant recent progress, the nature of the stars that explode and the physics that governs these powerful explosions have remained very poorly understood.

In the most widely accepted models of Type Ia supernovae the pre-explosion white dwarf star orbits another star. Due to the close interaction and the strong attraction produced by the very compact object, the companion star continuously loses mass, 'feeding' the white dwarf. When the mass of the white dwarf exceeds a critical value, it explodes.

The team of astronomers studied in great detail SN 2006X, a Type Ia supernova that exploded 70 million light-years away from us, in the splendid spiral Galaxy Messier 100 (see ESO 08/06). Their observations led them to discover the signatures of matter lost by the normal star, some of which is transferred to the white dwarf.

The observations were made with the Ultraviolet and Visual Echelle Spectrograph (UVES), mounted at ESO's 8.2-m Very Large Telescope, on four different occasions, over a time span of four months. A fifth observation at a different time was secured with the Keck telescope in Hawaii. The astronomers also made use of radio data obtained with the Very Large Array as well as images extracted from the Hubble Space Telescope archive. *"No Type Ia supernova has ever been observed at this level of detail for more than four months after the explosion,"* says Ferdinando Patat, lead author of the paper reporting the results in this week's issue of Science Express, the online version of the Science research journal. *"Our data set is really unique."*

The most remarkable findings are clear changes in the absorption of material, which has been ejected from the companion giant star. Such changes of interstellar material have never been observed before and demonstrate the effects a supernova explosion can have on its immediate environment. The astronomers deduce from the observations the existence of several gaseous shells (or clumps) which are material ejected as stellar wind from the giant star in the recent past. *"The material we have uncovered probably lies in a series of shells having a radius of the order of 0.05 light-years, or roughly 3 000 times the distance between Earth and the Sun,"* explains Patat. *"The material is moving with a velocity of 50 km/s, implying that the material would have been ejected some 50 years before the explosion."* Such a velocity is typical for the winds of red giants. The system that exploded was thus most likely composed of a white dwarf that acted as a giant 'vacuum cleaner', drawing gas off its red giant companion. In this case however, the cannibal act proved fatal for the white dwarf. This is the first time that clear and direct evidence for material surrounding the explosion has been found.

*"One crucial issue is whether what we have seen in SN 2006X represents the rule or is rather an exceptional case,"* wonders Patat. *"But given that this supernova has shown no optical, UV and radio peculiarity whatsoever, we conclude that what we have witnessed for this object is a common feature among normal SN Ia. Nevertheless, only future observations will give us answers to the many new questions these observations have posed to us."*

During Type Ia supernova events, remnants of stars with an initial mass of up to a few times that of the Sun (so-called "white dwarf stars") explode, leaving nothing behind but a rapidly expanding cloud of "stardust". Their peak brightness rivals that of their parent galaxy, hence qualifying them as prime cosmic yardsticks. Type Ia supernovae are apparently quite similar to one another. This provides them a very useful role as 'standard candles' that can be used to measure cosmic distances. Astronomers have exploited this fortunate circumstance to study the expansion history of our Universe, leading to the conclusion that the Universe is expanding at an accelerating rate.

White dwarfs are Earth-size, hot and extremely dense stars that represent the end products of the evolution of solar-like stars. During most of their life, such stars draw most of their energy from the transformation of hydrogen into helium. But at some moment, the hydrogen fuel will run out: this phase -- still many billions of years into the future for the Sun -- signals the beginning of profound, increasingly rapid changes in the star which will ultimately lead to its death. The star dramatically increases in radius, becoming a red giant. Later, it will expel huge quantities of gas and appear as a planetary nebula. After the planetary nebula has dissipated into interstellar space, the star left behind is a white dwarf.

## CHARON: AN ICE MACHINE IN THE ULTIMATE DEEP FREEZE

Frigid geysers spewing material up through cracks in the crust of Pluto's companion Charon and recoating parts of its surface in ice crystals could be making this distant world into the equivalent of an outer solar system ice machine.

Evidence for these ice deposits comes from high-resolution spectra obtained using the Gemini Observatory's Adaptive Optics system, ALTAIR coupled with the near-infrared instrument NIRI. The observations, made with the Frederick C. Gillett Gemini North telescope on Hawaii's Mauna Kea, show the fingerprints of ammonia hydrates and water crystals spread in patches across Charon, and have been described as the best evidence yet for the existence of these compounds on worlds such as Charon. The observations suggest that liquid water mixed with ammonia from deep within Charon is pushing out to the ultra-cold surface. This action could be occurring on timescales as short as a few hours or days, and at levels that would recoat Charon to a depth of one millimeter every 100,000 years. This discovery could have profound implications for other similar-type worlds in the Kuiper Belt, which is the region of the solar system that extends out beyond the orbit of Neptune and contains a number of small bodies, the largest of which include Pluto and Charon.

*"There are a number of mechanisms that could explain the presence of crystalline water ice on the surface of Charon,"* said Jason Cook, the PhD student who led the team of planetary scientists studying the surface of Charon. *"Our spectra point consistently to cryovolcanism, which brings liquid water to the surface, where it freezes into ice crystals. That implies that Charon's interior possesses liquid water."*

About Pluto and Charon

Charon is the companion world to Pluto (or one would say a moon of Pluto, except that Pluto is no longer considered to be a planet). It is one the largest members of the Kuiper Belt, a group of objects that orbit the Sun in the solar system beyond Neptune. The pair has an exceptionally low mass ratio (8:1; the ratio of Earth and the Moon's masses is 81:1), and is tidally locked in synchronous orbit. Pluto rotates on its axis once every 6.3 days, and Charon takes the same amount of time to make one orbit with respect to Pluto. As a result, they each show the other the same face at all times.

Because Charon is a somewhat typical Kuiper Belt Object for its size, the NIRI observations imply that other KBOs of similar size and composition (containing water ice and ammonia hydrates on their surfaces) could also harbor reservoirs of water deep beneath their surfaces. If so, the team speculates that there could be more liquid water in the Kuiper Belt than on Earth. *"If Charon contains a liquid ocean,"* said Jason Cook, *"then all Kuiper Belt objects greater than 500 kilometers across have oceans."*

This idea flows from work being done by Steve Desch, who has been developing internal models of the thermal evolution of KBOs that take into account the antifreeze properties of ammonia as seen on Charon. *"We find that bodies the size of Charon end up with about half of their rock content in a central core,"* he said. The other half remains in a crust that is a mixture of rock and ice.

To reach this conclusion, Cook and his collaborators studied a number of other mechanisms that could explain the presence of water ice crystals on Charon. The crystals are not likely to be "primordial ice" made at the time the solar system formed because such ice would become amorphous (that is, it would lose its crystalline appearance) in a few tens of thousands of years, due to solar ultraviolet radiation and cosmic ray bombardment. Processes that create fresh, icy patches on other worlds, such as impact "gardening" by meteorites and convection of subsurface

materials to the surface, are not supported by the chemical fingerprints of the water and ammonia hydrates on Charon's surface. The only mechanism that explained the data was cryovolcanism, the eruption of liquids and gases in an ultra-cold environment.

The key to understanding cryovolcanism on Charon, according to Cook, is to look at Charon's physical makeup. "*Charon's surface is almost entirely water ice,*" he said. "So it must have a vast amount of water under the surface, and much of that should be frozen as well. Only deep inside Charon could water be a liquid. Yet, there is fresh ice on the surface, meaning that some liquid water must somehow reach the surface. The ammonia sitting on the surface provides the clue. It's the ammonia that helps keep some material liquid. It makes it all feasible. Without ammonia the water could not get out there."

Cryovolcanism in the outer solar system is a fairly common occurrence. Enceladus (a moon of Saturn) and Europa (orbiting Jupiter) both show evidence of water ice oozing or spewing out from beneath the surfaces. So-called "tiger stripes" on Enceladus were first reported in 2006 by planetary scientist Carolyn Porco. They may be created by geysers that send water ice out through surface cracks. Markings seen on the Uranian moon Ariel in Voyager 2 fly-by images also suggest active cryovolcanism of some kind. Enceladus and Europa are tidally squeezed by the gravitational forces of their giant planets and in some cases by large nearby moons. This forces water out through cracks. Ariel may have been affected by tidal squeezing in the past. By contrast, Kuiper Belt Objects (KBOs) such as Charon, Quaoar, Orcus, and others are not tidally squeezed. Yet, they seem to show evidence of cryovolcanism.

In the case of Charon, it is thought that heat from internal radioactivity creates a pool of melted water mixed with ammonia inside the ice shell. "*As some of the subsurface water cools and approaches the freezing point, it expands into the cracks in the ice shell above it,*" said Cook. "*Due to the expansion, even a small vertical crack of a half a kilometer at the base of the ice shell will allow material to propagate to the outer surface of Charon in a matter of hours, making that the conduit for the water.*" As the water sprays out through the crack, it freezes and immediately "snows" back down to the surface, creating bright ice patches that can be distinguished in near-infrared light. "*I half expect that if we ever get to actually SEE a plume going off on Charon, we'd be seeing the process that makes tiger stripes similar to what we see on Enceladus and other frozen worlds,*" Cook said. "*The real proof will come from the deep-space NASA probe New Horizons, which will arrive at this system in 2015 and send back images that can verify what we've seen in our Gemini results.*"

The team's intent was to find evidence of methane, carbon dioxide, ammonia, and a form of ammonia called ammonia hydrate on the surface of Charon, which has also been reported on Quaoar and suspected on at least one other KBO. According to Steven Desch, Cook's colleague and thesis advisor, ammonia hydrates help keep liquid water from freezing solid, making it easier for water to escape from the inside before it turns to ice. "*It is literally an antifreeze,*" he said, "*and like the antifreeze we're familiar with here on Earth, it depresses the melting point of water.*"

Cook and his colleagues concentrated their observations on Charon's anti-Pluto and sub-Pluto hemispheres, where patches of

water ice exist at temperatures between 40-50 Kelvin (-387 to -369 F). They used NIRI to observe at 2.21 and 1.65 microns, wavelengths that reveal the presence of ammonia hydrates and water ice, respectively.

Prior to this work, all observations of Charon made by Cook and others showed crystalline water ice on its surface. Cook's finding is the only one to date to take two hemispheres and try to estimate the temperatures from the spectra. He notes that more observations are needed to show how temperatures might change with rotation.

"*We were using the rotation of Charon to see if these ices are distributed evenly across its surface or are found preferentially at certain longitudes,*" Cook said. "*Based on measurements from 2001, we knew the ices were there, but we didn't have precise locations. What we needed to do was to get high resolution, time-resolved spectra. NIRI coupled with ALTAIR was the best way to do that. And using an 8-meter telescope was a no-brainer. It all came together so well.*"

According to Desch, the spectra obtained by Cook and the team are the best evidence yet for the existence of ammonia hydrates on KBOs. "*It had been tentatively identified on Charon before by other groups,*" he said, "*but the lack of spectral resolution hindered its identification. This clinches it. These spectra are also better than those of other KBOs. I've talked to seasoned observers who are convinced for the first time that ammonia hydrates exist on KBOs.*"

The next step is to get better spectra of other Kuiper Belt Objects such as Quaoar and Orcus. "*Those larger than 500 kilometers across show us crystalline water ice,*" Cook said. "*But, there's a whole set of intermediate-sized objects, between 200 and 500 kilometers across that we want to sample to test our ideas. As I think about at these other KBOs, I want to look for the ammonia hydrate. I think it has to be out there.*"

#### 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 July's StarGazer:**

- \*\*\*\* PASSING OF EAS MEMBER KEN WARD**
- \*\*\*\* ASTRO CALENDAR – STAR PARTY SCHEDULE – WESTERN US 2007 STAR PARTIES**
- \*\*\*\* OBSERVER'S INFORMATION**
- \*\*\*\* YOUNG ASTRONOMER'S CORNER**
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**The next EAS Meeting is 7:00 P.M. Wednesday July 25<sup>th</sup> at the Jim Bielaga's 'Aurora Astro Products' store, 11419 19th Avenue SE #A102, Everett, WA 98208, 425-337-4384.**