



The Stargazer

Jun 2005

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The Stargazer
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See EAS website at:

http://members.tripod.com/everett_astronomy

EAS BUSINESS...

NEXT EAS MEETING - SUNDAY JUNE 26ST AT 3:00 PM AT THE EVERETT PUBLIC LIBRARY, IN THE AUDITORIUM (DOWNSTAIRS)

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>

Scheduled Meeting Dates: (NOTE THAT THEY CHANGE)

Jun 26 – EAS Meeting – SUNDAY 3:00 PM at Everett Public Library - Jim 'Moondog' Tegerdine – Amateur CCD imaging www.moondogastronomy.com

Jul 31 – EAS Meeting – SUNDAY 3:00 PM at Everett Public Library
 Aug 27 - EAS Meeting – SUNDAY 3:00 PM at Everett Public Library

CLUB STAR PARTY INFO

Upcoming star party schedule:

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 Mike Locke at (425) 259-5995 for info or check the EAS website.) Members contact Mike Locke for scope borrowing.

Camp Delaney Star Party – Labor Day Weekend ---

My name is Cliff Mygatt and I am the President of the Olympic Astronomical Society in Bremerton. I would like to invite your EAS members to our annual camp Delaney star party at Sun Lakes state park. The star party will be over Labor Day weekend. We have had several of your members attend over the years. If any members are interested, they can contact me at cliffandchris@wavecable.com. Cost is \$50.00 due to additional day of food and lodging. Anyone interested in attending can get a registration form from me, which needs to be in by 24 Aug. Thanks, LCDR Cliff Mygatt

Oregon Star Party – Labor Day Weekend -

I would like to ask that you include a note in your next newsletter, and/or announce at your next meeting that our registration for the

2005 Oregon Star Party is online and available. It is a short 3 months until OSP and we have a great lineup of speakers, events, and of course, the dark central Oregon skies. We invite your members to tour our website at <http://www.oregonstarparty.org> to obtain more information, register, and plan for a great Labor Day star party. Thanks much, and I hope we see you soon!

- Bill Jensen, OSP Committee

Klickitat County Star Party(s) <http://klickitatstarparty.net/>

August 5th - 7th, 2005

Sept 30th - Oct 2nd, 2005

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

The club maintains a \$500+ balance. We try to keep approximately a \$500 balance to allow for contingencies. Emailing a digital copy of the newsletter has been suggested to reduce printing and postage costs, and speed up delivery, please email Mark if electronic copy would be OK for you.

CLUB SCOPES

SCOPE	LOAN STATUS	WAITING
10-INCH DOBSONIAN	ON LOAN	NO WAIT LIST

EAS members: contact Mike Locke at (425) 259-5995 or 'mlocke at lionmts.com' to borrow a scope.

ASTRO CALENDAR FOR 2005

June 2005

Jun 13 - Pluto at opposition
 Jun 21 - Summer Solstice, 06:46 UT – first day of N hemisphere summer
 Jun 26 - Mercury passes 1.4 degrees from Saturn
 Jun 27 - Mercury passes 0.1 degrees from Venus
Jun 26 - EAS MEETING - SUNDAY 3:00 PM at Everett Public Library

July 2005

Jul 02 - Potential Saturday EAS star party night, location TBD
 Jul 03 - Venus 0.4 deg. North of M44 Beehive cluster
 Jul 04 - Deep Impact, Comet Tempel 1 impact/flyby
 Jul 04 - Earth at aphelion (1.017 AU From Sun)
Jul 6-10 - Mt Bachelor Star Party
Jul 6-10 - Shingleton Star Party – Redding California
 Jul 09 - Mercury Greatest Eastern Elongation (26 Degrees)
 Jul 09 - Potential Saturday EAS star party night, location TBD
 Jul 12 - Asteroid 3259 Brownlee closest approach to Earth (2.19 AU)

Jul 13 - Moon occults Jupiter
 Jul 18 - Moon occults Antares from southern US, near for north.
 Jul 21 - Largest full moon for 2005
 Jul 23 - 10th Anniversary (1995), Discovery of Comet Hale-Bopp
 Jul 27-29 - South Delta-Aquarids meteor shower peak
Jul 31 - EAS MEETING - SUNDAY 3:00 PM at Everett Public Library
 Jul 30-Aug 07 Mt. Kobau Star Party – Osoyoos BC

August 2005

Aug 01 - Alpha Capricornids Meteor Shower Peak
Aug 4-6 - Table Mountain Star Party
 Aug 04 - Furthest lunar apogee of 2005
 Aug 05 - Neil Armstrong's 75th birthday (1930)
 Aug 06 - Southern Iota Aquarids meteor shower peak
 Aug 08 - Moon 1.0 right of Venus
 Aug 08 - Neptune at opposition – visible all night
 Aug 11 - Perseid meteor watch - Rooster Rock St Park - Columbia Gorge
 Aug 12 - Perseids meteor shower peak
 Aug 24 - Mercury at Greatest Western Elongation (18 degrees from Sun)
 Aug 25 - Northern Iota Aquarids meteor shower peak
Aug 27 - EAS MEETING - Saturday 4:00 PM at Everett Public Library
 Aug 31 - Uranus at opposition – visible all night

September 2005

Sep 01 - Uranus at opposition
 Sep 01 - Venus passes 1.2 degrees from Jupiter
 Sep 03 - New Moon
 Sep 03 - Potential Saturday EAS star party night, location TBD
Sep 1-4 - Oregon Star Party
Sep 2-5 - Olympic Astronomy – Dry Falls Star Party
 Sep 05 - Labor Day holiday
 Sep 07 - Moon occults Venus
 Sep 22 - Autumnal Equinox (22:23 UT) – 1st day of autumn N hemisphere
Sep 24 - EAS MEETING - Saturday 4:00 PM at Everett Public Library

October 2005

Oct 01 - Potential Saturday EAS star party night, location TBD
 Oct 03 - New Moon
 Oct 03 - Annular Solar Eclipse, Visible From Africa
 Oct 04 - Moon occults Mercury
 Oct 05 - Mercury passes 1.3 degrees From Jupiter
 Oct 09 - Draconids meteor shower Peak
 Oct 16 - Venus occults PPM 265560 (7.7 Magnitude Star)
 Oct 17 - Partial Lunar eclipse
 Oct 21 - Orionid meteor shower peak
Oct 29 - EAS MEETING - Saturday 4:00 PM at Everett Public Library
 Oct 30 - Daylight Saving - set clock back 1 Hour

November 2005

Nov 01 - New Moon
 Nov 05 - Potential Saturday EAS star party night, location TBD
 Nov 03 - Taurids meteor shower peak
 Nov 03 - Mercury at its Greatest Eastern Elongation (23 Degrees)
 Nov 03 - Venus at its Greatest Eastern Elongation (47 Degrees)
 Nov 07 - Mars at opposition
Nov 19 - EAS MEETING - Saturday 4:00 PM at Everett Public Library

December 2005

Dec 02 - 10th anniversary (1995), SOHO Launch
 Dec 12 - Moon occults Mars
 Dec 12 - Mercury at its Greatest Western Elongation (21 Degrees)
 Dec 13 - Geminids meteor shower peak
 Dec 21 - Winter Solstice, 18:35 UT
 Dec 22 - Ursids meteor shower peak
Dec 10th or 17th – EAS Dinner - Saturday 7:00 PM

UW Astronomy 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).

OVER THE AIRWAVES

“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 LIBRARY – BOOK & VIDEO LIST

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.

MEMBERSHIP BENEFITS & INFORMATION

Membership in the **Everett Astronomical Society (EAS)** will give you access to all the material in the lending library. The library, which is maintained by Scott Gibson, consists of several VCR tapes, many books, magazines, and software titles. Membership includes invitations to all of the club meetings and star parties, plus the monthly newsletter, *The Stargazer*. In addition you will be able to subscribe to *Sky and Telescope* for \$7 off the normal subscription rate, contact the treasurer for more information. **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 will renew your *Sky and Telescope* subscription for you. **Astronomy** magazine offers a similar opportunity to club members.

EAS is a member of the **Astronomical League** and you will receive the Astronomical League's newsletter, *The Reflector*. Being a member also allows you the use of the club's telescopes, an award winning 10 inch Dobsonian mount reflector, built as a club project or the 60mm refractor. Contact Bob Lyons (425) 337-1510 to borrow a telescope. EAS dues are \$25. Send your annual dues to the **Everett Astronomical Society**, P.O. Box 12746, Everett, WA 98206. Funds obtained from membership dues allows the Society to publish the newsletter, pay Astronomical League dues and maintain our library.

OBSERVER'S INFORMATION...

LUNAR FACTS

Jun 28	Last Quarter Moon
Jul 06	New Moon
Jul 14	First Quarter Moon
Jul 21	Full Moon
Jul 28	Last Quarter Moon
Aug 05	New Moon
Aug 13	First Quarter Moon
Aug 19	Full Moon
Aug 26	Last Quarter Moon
Sep 03	New Moon
Sep 11	First Quarter Moon
Sep 18	Full Moon

Digital Lunar Orbiter Photographic Atlas of the Moon

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

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

UP IN THE SKY -- THE PLANETS

Jupiter is at opposition on April 3, at its best for the year.

Object	Rises	Transits	Sets	Con	Mag
Sun	5:13 am	13:12	21:11	Tau	-27
Mercury	Daylight	Daylight	22:40	Can	+0.3
Venus	Daylight	Daylight	22:41	Can	-3.9
Mars	1:20 am	Daylight	Daylight	Cet	+0.0
Jupiter	Daylight	Daylight	1:20 am	Vir	-2.5
Saturn	Daylight	Daylight	22:29	Can	+0.2
Uranus	0:14 am	5:40 am	Daylight	Aqr	+5.9
Neptune	23:14 am	4:09 am	Daylight	Cap	+7.9
Pluto	19:24	0:21 am	5:13 am	Ser	+13.9

(times local time for Everett PDT)

Transit times for Jupiter's Great Red Spot in 2005

http://skyandtelescope.com/observing/objects/planets/article_107_2.asp

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>

MEMBER NEWS

Observing NASA's Deep Impact/Comet 9P/Tempel 1 at Table Mountain – July 4th Weekend

I (Jim Bachesta) am planning to go to Table Mountain to observe the Deep Impact mission for comet 9P/Tempel 1. The event will occur at 6 AM July 4 (GMT) - that's 11 PM on Sunday July 3rd PDT. This is perfect for a weekend trip.

More information on the NASA Deep Impact mission can be found at: <http://deepimpact.jpl.nasa.gov/> Sky and Telescope also has a number of good articles. A useful website oriented at amateur astronomers with CCDs and specific filters is: <http://www.deepimpact.umd.edu/stsp/>

Here's a site for people without CCD's and want to participate with visual observations and sketches.
<http://www.deepimpact.umd.edu/amateur/>

This mission has been setup to encourage amateurs to participate in the event by collecting and submitting scientifically useful data.

Let me know if you're interested in going. I can provide additional information regarding directions. You should plan on primitive

camping over night. There will not be any rest room facilities. You will also need to get a camping pass from REI or GI Joes.

I will definitely bring my camper. Let me know if you're interested in meeting me on the mountain.

The plan follows:

Saturday July 2

- Leave Sammamish sometime in the afternoon, perhaps 2 PM.
- Spend the evening setting up and testing the equipment and observing.

Sunday July 3

- Observe the deep impact event on Comet 9P/Tempel 1. The magnitude should be 9.7, with in increase to magnitude 6 (and perhaps 5) after the impact at 11 PM (PDT)

Monday July 4

- Return sometime in the mid morning (~ 10 AM) arriving back to Sammamish around noon.

Feel free to pass this on to others who may want to join us on the mountain. - Jim Bachesta jbachesta@comcast.net.

CONSTELLATIONS OF THE MONTH:

PYXIS: The ("Compass of Argo Navis") is a relatively dim constellation bordering on the constellations of Antlia, Hydra, Puppis, and Vela, and ranks 72nd in overall brightness, containing only 12 visible stars brighter than magnitude 5.5. Its central point is located at RA=8h56m and Dec.= -27 degrees. It is completely visible from latitudes South of +53 degrees, and completely invisible from latitudes North of +73 degrees. This constellation ranks 65th in overall size, taking up 220.83 square degrees, or 0.535% of the sky. Pyxis contains no very well known or very bright stars, and contains no Messier objects and no known meteor showers. Its midnight culmination date is February 4th. Pyxis is one of the 14 constellations invented by Lacaille during his travels at the Cape of Good Hope in 1751-52; however, Pyxis is not officially one of the constellations into which Lacaille subdivided the antiquated constellation of Argo Navis (those three are Puppis, Carina, and Vela). Although small, Pyxis does contain some objects of interest to the backyard astronomer. NGC-2818 is an open cluster shining at magnitude 8.2; it contains 40 relatively faint stars (a dim, 13th magnitude planetary nebula lies on the western edge of this cluster, and it may be visible as a gray smudge of light in larger backyard scopes). The spiral galaxy NGC-2613 in northern Pyxis shines at magnitude 10.4 and has dimensions of 7.2' by 2.1'. However, this galaxy would appear even brighter and more impressive if it were not obscured by dust in the plane of the Milky Way. Finally, a very famous object in Pyxis is the variable star known as T-Pyxis; this star is among the most active of all recurring novae. (A recurrent nova is a cataclysmic variable, which undergoes periodic, violent nova-like flare-ups. Like all such variables, it is a binary system with one component being a white dwarf and the other a red giant. Gas is transferred from the latter to the former, until enough (mostly hydrogen) is built up to cause a periodic thermonuclear explosion; i.e., the periodic "flare-up"). This star's magnitude is normally around 14; every 18-24 years (it has a variable period), it brightens to a magnitude of about 6.5, a huge jump in magnitude by any standards.

TUCANA: "The Toucan", for which this constellation is named, borders on the constellations of Grus, Hydrus, Indus, Octans, and Phoenix in the Southern Hemisphere. It ranks 74th in overall

brightness among the constellations, containing 15 stars brighter than magnitude 5.5. Its central point is located at RA=23h43m and Dec.= -66.5 degrees. It is completely visible from latitudes South of +14 degrees, and completely invisible from latitudes North of +33 degrees. This constellation ranks 48th in overall size, taking up 294.56 square degrees, or 0.714% of the sky. Tucana has no known meteor showers, and no associated Messier objects; it also has no associated asterisms. Its midnight culmination date is September 17th, and its solar conjunction date is March 18th. Tucana is one of 11 constellations invented by Pieter Keyser and Frederick de Houtman, during the years 1595-1597. The Small Magellanic Cloud (SMC) is located within the region of Tucana; this object was discussed in last month's column of "Mirror Images". The mass of the SMC is about 2,000 million times that of the sun, and it lies at a distance of approximately 200,000 light years. Roughly 1 degree from the western edge of the SMC lies one of the best globular clusters in the sky, 47 Tucanae. Optically this globular appears near to the SMC, but it is actually located within the outer confines of our Milky Way. 47 Tucanae is second only to Omega Centauri as the finest globular cluster in the entire sky. Finally, the constellation of Tucana has the distinction of being the discovery point of one of the best comets of the 20th Century: Comet Bennett. This comet reached a magnitude of very nearly zero in March, 1970.

YOUNG ASTRONOMER'S CORNER

This month, the Young Astronomer's Corner will give some in-depth scientific information about our planet Earth; these are some of the basic astronomy-related facts about our home planet:

Rotation around the Sun: every 365.26 days

Orbit: from 0.98 (closest or 'perihelion') to 1.02 (furthest or 'aphelion') Astronomical Units (AU)*; this is an orbit that varies between approximately 91.14 and 94.86 million miles from the sun. (*Note: One AU equals approximately 93 million miles).

Inclination of Orbit to Ecliptic: 0 (zero) degrees.

Diameter at Equator: 12,756 kilometers (or 20,410 miles).

Mass: 5.9742 x (10 e24 (10 to the 24th power)) kilograms

Density: 5.5 times that of water (global density).

Period of Rotation on its own axis: 23 hours, 56.1 minutes.

Axis tilt: 23.45 degrees.

Satellites (moons): one

Special Note: For the Earth and Moon system, there is so much of interest for our home planet (geological, atmospheric, demographic, biological, space exploration, etc....). This month, we will talk briefly about the Earth's atmosphere.

The Earth's atmosphere is composed of many chemicals and other inclusions. The primary elements and molecules are nitrogen, oxygen, argon, neon, helium, hydrogen, xenon, water vapor, carbon-dioxide, methane, nitrous oxide, ozone, particles (such as dust, sogg, etc...), and chlorofluorocarbons - byproducts of the use of air conditioners, various sprays, and other industrial processes the world over. Water vapor is highest in tropical areas, where it can be as much as 4% of all atmospheric gases, and is important because it releases large amounts of latent heat, an important source for the transfer of atmospheric energy such as through thunderstorms and hurricanes. Water vapor is also an important greenhouse gas, because it absorbs and re-emits strongly some of the heat (infrared radiation) that leaves the Earth (like a greenhouse works), thus potentially contributing to global warming. Carbon dioxide, another "greenhouse gas" is

also an important component of the Earth's atmosphere. Ozone is a component of photochemical (formed by a chemical reaction with sunlight) smog. Saltwater droplets which evaporate and leave microscopic salt particles, dust, soil, and smoke from fires and volcanoes are called aerosols and are suspended in the atmosphere. Most man-made impurities such as nitrous dioxide, carbon monoxide, and hydrocarbons are all emitted by automobiles, and the burning of oil and coal releases destructive sulfur dioxide into the atmosphere.

What does this mean for astronomers? Simply put, the higher you are above an atmosphere that contains so many useful and not-so-useful chemicals that can interfere with the gathering of light from objects from space, the better you will see these objects. Thus, observing from downtown Seattle for example, one must realize that you are looking through a large portion of atmosphere that potentially contains a lot of dust and other impurities. The troposphere is the bottom layer of the atmosphere (about 11 kilometers thick) that contains most of the impurities that we have talked about, and this layer is also subject to the turbulence caused by rising and descending air currents. Observatories such as Mauna Kea and McDonald Observatory in Texas are placed very high on mountaintops, to help minimize the effects on observing of all these atmospheric inclusions and phenomena. For these reasons, the very best place to observe the heavens is where there is no atmosphere, which is exactly why we have the Hubble Space Telescope above us. Finally, even though they seem to, do stars themselves actually twinkle? The answer is really NO!! The Earth's atmosphere actually causes the light from a star to twinkle because of the turbulent air currents in the atmosphere. So the higher the telescope is above sea level (all the way up to the Hubble Space Telescope!!), the steadier (i.e., less or no "twinkling") the observing and telescope "seeing" will be!!

ASTRONOMY AND TELESCOPE LINGO

ASTRONOMY LINGO: EPIMETHEUS: A small, irregularly shaped satellite of Saturn, coorbital with Janus (another small satellite of Saturn). These two objects orbit between the F and G rings of the planet's ring system. Epimetheus has two named craters, Hilairea and Pollux.

TELESCOPE LINGO: EISCAT: Acronym for *European Incoherent Scatter Radars*. This radar system was used in the mid-1980's in Northern Scandinavia to study the Earth's ionosphere.

PLANETARY FOCUS

"Planetary Focus" is a periodic column that will be published occasionally in the EAS "Stargazer". (and see Earth article in Young Astronomers' Corner this month) If you have a favorite planet that you would like information and/or statistics on, please contact newsletter co-editor Bill O'Neil.

ASTRONOMY FUN FACTS

★ The following are some Astronomy "Fun Facts" about our nearby "sister" planet Venus:

★ On Venus, sunrise is in the west, and sunset in the east (opposite to that of Earth). That is, Venus rotates east to west (unlike the other 8 planets (the other odd rotator is Uranus, which is lying on its side(!) compared to the other planets)). This is called retrograde rotation. The rotation of Venus is thus unique in 2 ways: it is extremely slow (it rotates about once every 8 months;

Earth rotates once per 24 hours), and it has retrograde rotation compared to the other planets.

★ Venus, at its closest to Earth, is still about 106 times further away from Earth than is the Moon. At the average speed of an Apollo mission, it would still take a one-way manned mission about 1.5 years to reach the planet .

★ Even with a manned mission however, Venus would be a very inhospitable place indeed. The surface temperature of Venus is about 470 degrees Celsius, enough to make lead molten, and more than enough to make steel red hot; the surface temperature of Venus is essentially controlled by a runaway greenhouse effect. The three distinct cloud layers (with very high upper level winds) of Venus are all composed of sulfur and sulfuric acid, and the atmosphere itself is composed of about 96% carbon dioxide. The atmospheric pressure on the surface of Venus is about 90 times that of Earth's surface (about 1,320 pounds per square inch); additionally, Russian and American space probes have detected far, far more lightning strokes per unit area than is found on Earth. Indeed, Venus appears to be the type of other world best left to the research done by mechanical probes!

MIRROR IMAGES

“MIRROR” IMAGES: Because we live in the Northern Hemisphere, we often tend to focus (in both observing and reading) on celestial objects in this hemisphere. The point of this bi-monthly 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: SYMBIOTIC STARS: A variable ‘star’ whose spectrum demonstrates spectral lines characteristic of gases at two very different temperatures; typically these lines are of an M-star (approx. 3,500 degrees K) and a B-star (approx. 20,000 degrees K) superimposed. A symbiotic ‘star’ is in fact a semi-detached close binary system. The red giant component produces the low-temperature spectral lines, whereas the higher-temperature spectral lines come from gas streams that are falling on to a companion star, which is usually a white dwarf or a main-sequence star, but it is suspected that this star may possibly also, with some systems, be a neutron star. Mass loss is due to the red giant's stellar wind, and is thus much slower than the gravitational transfer seen in otherwise similar recurrent novae systems. Symbiotic stars, a form of cataclysmic variable, have smaller and more irregular outbursts than other cataclysmics. An outburst in the R-Aquarii system has been noted to have produced a narrow jet, travelling at about 2,000 kilometers per second and approximately 1,500 AU in length, which is visible in both optical and radio telescopes.

REPRESENTATIVE NORTHERN HEMISPHERE OBJECT: Z Andromedae

REPRESENTATIVE SOUTHERN HEMISPHERE OBJECT: RW Hydrae

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

SPITZER CAPTURES ECHO OF DEAD STAR'S RUMBLINGS

An enormous light echo etched in the sky by a fitful dead star was spotted by the infrared eyes of the Spitzer Space Telescope.

The surprising finding indicates Cassiopeia A, the remnant of a star that died in a supernova explosion 325 years ago, is not resting peacefully. Instead, this dead star likely shot out at least one burst of energy as recently as 50 years ago.

"We had thought the stellar remains inside Cassiopeia A were just fading away," said Dr. Oliver Krause. "Spitzer came along and showed us this exploded star, one of the most intensively studied objects in the sky, is still undergoing death throes before heading to its final grave."

Infrared echoes trace the dusty journeys of light waves blasted away from supernova or erupting stars. As the light waves move outward, they heat up clumps of surrounding dust, causing them to glow in infrared light. The echo from Cassiopeia A is the first witnessed around a long-dead star and the largest ever seen. It was discovered by accident during a Spitzer instrument test. "We had no idea that Spitzer would ever see light echoes," said Dr. George Rieke. "Sometimes you just trip over the biggest discoveries."

A supernova remnant like Cassiopeia A typically consists of an outer, shimmering shell of expelled material and a core skeleton of a once-massive star, called a neutron star. Neutron stars come in several varieties, ranging from intensely active to silent. Typically, a star that has recently died will continue to act up. Consequently, astronomers were puzzled that the star responsible for Cassiopeia A appeared to be silent so soon after its death.

The new infrared echo indicates the Cassiopeia A neutron star is active and may even be an exotic, spastic type of object called a magnetar. Magnetars are like screaming dead stars, with eruptive surfaces that rupture and quake, pouring out tremendous amounts of high-energy gamma rays. Spitzer may have captured the "shriek" of such a star in the form of light zipping away through space and heating up its surroundings.

"Magnetars are very rare and hard to study, especially if they are no longer associated with their place of origin. If we have indeed uncovered one, then it will be just about the only one for which we know what kind of star it came from and when," Rieke said. Astronomers first saw hints of the infrared echo in strange, tangled dust features that showed up in the Spitzer test image. When they looked at the same dust features again a few months later using ground-based telescopes, the dust appeared to be moving outward at the speed of light. Follow-up Spitzer observations taken one year later revealed the dust was not moving, but was being lit up by passing light.

A close inspection of the Spitzer pictures revealed a blend of at least two light echoes around Cassiopeia A, one from its supernova explosion, and one from the hiccup of activity that occurred around 1953. Additional Spitzer observations of these light echoes may help pin down their enigmatic source. <http://www.spitzer.caltech.edu/Media>. To view the echoes dancing through clouds of dust surrounding Cassiopeia A, visit: <http://www.spitzer.caltech.edu/Media/releases/ssc2005-14/visuals.shtml>

NASA ANNOUNCES SPECTACULAR DAY OF THE COMET

After a voyage of 173 days and 268 million miles, NASA's Deep Impact spacecraft will get up-close-and-personal with comet Tempel 1 on July 4. The first of its kind, hyper-speed impact between space-borne iceberg and copper-fortified probe is scheduled for approximately 1:52 a.m. EDT on Independence Day. The potentially spectacular collision will be observed by the Deep Impact spacecraft, ground and space-based observatories.

"We are really threading the needle with this one," said Rick Grammier, Deep Impact project manager at JPL. "In our quest of a great scientific payoff, we are attempting something never done before at speeds and distances that are truly out of this world."

During the early morning hours of July 3, the Deep Impact spacecraft will deploy a 39-inch cubic shaped impactor into the path of the comet, which is about one-half the size of Manhattan Island, N.Y. Over the next 22 hours, Deep Impact navigators and mission members, more than 83 million miles away at JPL, will steer both craft towards the comet. The impactor will steer into the comet and the flyby craft will pass approximately 310 miles below. Tempel 1 is hurtling through space at approximately 6.3 miles per second. At that speed you could travel from New York to Los Angeles in less than 6.5 minutes. Two hours before impact, when mission events will be happening so fast and so far away, the impactor will kick into autonomous navigation mode. It must perform its own navigational solutions and thruster firings to make contact with the comet. "The autonav is like we have a little astronaut on board," Grammier said. "It has to navigate and fire thrusters three times to steer the wine cask-sized impactor into the mountain-sized comet nucleus closing at 23,000 miles per hour."

The crater produced by the impact could range in size from a large house up to a football stadium from two to 14 stories deep. Ice and dust debris will be ejected from the crater, revealing the material beneath. The flyby spacecraft has approximately 13 minutes to take images and spectra of the collision and its result before it must endure a potential blizzard of particles from the nucleus of the comet.

"The last 24 hours of the impactor's life should provide the most spectacular data in the history of cometary science," said Deep Impact Principal Investigator Dr. Michael A'Hearn of the University of Maryland, College Park. "With the information we receive after the impact, it will be a whole new ballgame. We know so little about the structure of cometary nuclei that almost every moment we expect to learn something new."

The Deep Impact spacecraft has four data collectors to observe the effects of the collision. A camera and infrared spectrometer, which comprise the High Resolution Instrument, are carried on the flyby spacecraft, along with a Medium Resolution Instrument. A duplicate of the Medium Resolution Instrument on the impactor will record the vehicle's final moments before it is run over by Tempel 1.

"In the world of science, this is the astronomical equivalent of a 767 airliner running into a mosquito," said Don Yeomans, a Deep Impact mission scientist at JPL. "The impact simply will not appreciably modify the comet's orbital path. Comet Tempel 1 poses no threat to the Earth now or in the foreseeable future."

Deep Impact will provide a glimpse beneath the surface of a comet, where material from the solar system's formation remains relatively unchanged. Mission scientists expect the project will answer basic questions about the formation of the solar system, by offering a better look at the nature and composition of the frozen celestial travelers we call comets.

For more information about Deep Impact on the Internet, visit: <http://www.nasa.gov/deepimpact>

MOST EARTH-LIKE PLANET YET FOUND OUTSIDE THE SOLAR SYSTEM

Taking a major step forward in the search for Earth-like planets beyond our own solar system, a team of astronomers has

announced the discovery of the smallest extrasolar planet yet detected. About seven-and-a-half times as massive as Earth, with about twice the radius, it may be the first rocky planet ever found orbiting a normal star not much different from our Sun.

All of the nearly 150 other extrasolar planets discovered to date around normal stars have been larger than Uranus, an ice-giant planet in our own solar system that is about 15 times the mass of the Earth. "We keep pushing the limits of what we can detect, and we're getting closer and closer to finding Earths," said team member Steven Vogt. The newly discovered "super-Earth" orbits the star Gliese 876, located just 15 light years away in the direction of the constellation Aquarius. This star also possesses two larger, Jupiter-size planets. The new planet whips around the star in a mere two days, and is so close to the star's surface that its dayside temperature probably tops 400 to 750 degrees Fahrenheit (200 to 400 degrees Celsius)--oven-like temperatures far too hot for life as we know it. Nevertheless, the ability to detect the tiny wobble the planet induces in the star gives astronomers confidence that they will be able to detect even smaller rocky planets in orbits more hospitable to life. "This is the smallest extrasolar planet yet detected and the first of a new class of rocky terrestrial planets," said team member Paul Butler. "It's like Earth's bigger cousin."

The team measures a minimum mass for the planet of 5.9 Earth masses, orbiting Gliese 876 with a period of 1.94 days at a distance of 0.021 astronomical units (AU), or 2 million miles. Though the team has no direct proof the planet is rocky, they believe its low mass precludes it from retaining gas like Jupiter. Three other purported rocky planets have been reported outside the solar system, but they orbit a pulsar, the flashing corpse of an exploded star. "This planet answers an ancient question," said team leader Geoffrey Marcy. "Over 2,000 years ago, the Greek philosophers Aristotle and Epicurus argued about whether there were other Earth-like planets. Now, for the first time, we have evidence for a rocky planet around a normal star." "Today's results are an important step toward answering one of the most profound questions that mankind can ask: Are we alone in the universe?" said Michael Turner. The team's work, conducted at the Keck Observatory in Hawaii.

Gliese 876 is a small, red star known as an M dwarf--the most common type of star in the galaxy. It is located in the constellation Aquarius, and, at about one-third the mass of the sun, is the smallest star around which planets have been discovered. Butler and Marcy detected the first planet there in 1998; it was a gas giant about twice the mass of Jupiter. Then, in 2001, they reported a second planet, another gas giant about half the mass of Jupiter. The two are in resonant orbits, the outer planet taking 60 days to orbit the star, twice the period of the inner giant planet. Lissauer and Rivera have been analyzing Keck data on the Gliese 876 system in order to model the unusual motions of the two known planets, and three years ago got an inkling that there might be a smaller, third planet orbiting the star. In fact, if they hadn't taken account of the resonant interaction between the two known planets, they never would have seen the third planet. "We had a model for the two planets interacting with one another, but when we looked at the difference between the two-planet model and the actual data, we found a signature that could be interpreted as a third planet," Lissauer said. A three-planet model consistently gave a better fit to the data, added Rivera. "But because the signal from this third planet was not very strong, we were very cautious about announcing a new planet until we had more data," he said.

Recent improvements to the Keck Telescope's high-resolution spectrometer (HIRES) provided crucial new data. Vogt, who

designed and built HIRES, worked with the technical staff in the UC Observatories/Lick Observatory Laboratories at the UC Santa Cruz, to upgrade the spectrometer's CCD (charge-coupled device) detectors last August. *"It is the higher precision data from the upgraded HIRES that gives us confidence in this result,"* Butler said.

The team now has convincing data for the planet orbiting very close to the star, at a distance of about 10 stellar radii. That's less than one-tenth the size of Mercury's orbit in our solar system. *"In a two-day orbit, it's about 200 degrees Celsius too hot for liquid water,"* Butler said. *"That tends to lead us to the conclusion that the most probable composition of this thing is like the inner planets of this solar system--a nickel-iron rock, a rocky planet, a terrestrial planet."* *"A planet seven and a half times the mass of the Earth could easily hold onto an atmosphere,"* noted Laughlin. *"It would still be considered a rocky planet, probably with an iron core and a silicate mantle. It could even have a dense steamy water layer. I think what we are seeing here is something that's intermediate between a true terrestrial planet like the Earth and a hot version of the ice giants Uranus and Neptune."*

Combined with improved computer software, the new CCD detectors designed by this team for Keck's HIRES spectrometer can now measure the Doppler velocity of a star to within one meter per second--human walking speed--instead of the previous precision of three meters per second. This improved sensitivity will allow the planet-hunting team to detect the gravitational effect of an Earth-like planet within the habitable zone of M dwarf stars like Gliese 876. *"We are pushing a whole new regime at Keck to achieve one meter per second precision, triple our old precision, that should also allow us to see Earth-mass planets around sun-like stars within the next few years,"* Butler said. *"Our UC Santa Cruz and Lick Observatory team has done an enormous amount of optical and technical and detector work to make the Keck telescope a rocky planet hunter, the best one in the world,"* Marcy added. Lissauer also is excited by another feat reported in the paper submitted to the journal. For the first time, he, Rivera and Laughlin have determined the line-of-sight inclination of the orbit of the stellar system solely from the observed Doppler wobble of the star. Using dynamical models of how the two Jupiter-size planets interact, they were able to calculate the masses of the two giant planets from the observed shapes and precession rates of their oval orbits. Precession is the slow turning of the long axis of a planet's elliptical orbit.

They showed that the orbital plane is tilted 40 degrees to our line of sight. This allowed the team to estimate the most likely mass of the third planet as seven and a half Earth masses. *"There's more dynamical modeling involved in this study than any previous study, much more,"* Lissauer said. The team plans to continue to observe the star Gliese 876, but is eager to find other terrestrial planets among the 150 or more M dwarfs they observe regularly with Keck. *"So far we find almost no Jupiter-mass planets among the M dwarf stars we've been observing, which suggests that, instead, there is going to be a large population of smaller mass planets,"* Butler noted.

THREE PLANETS BUNCH UP IN TWILIGHT

Gaze low to the west into the deepening twilight for the next couple of weeks, and three planets will await your view. One is bright; two are fainter. You can follow them through their celestial gyrations as they shift position day by day. The direction to look is low in the west-northwest. The brightest light shining there is Venus, the "Evening Star." Dimmer Saturn is closing in on it from the upper left, while Mercury is closing in on it from the lower right. These three planets will form a remarkably tight bunch from

June 24th to 27th, appearing close enough together to be covered by your thumb at arm's length.

After that, Saturn gets lower every day and sinks out of sight, while Venus and Mercury remain closely paired into the first week of July. The crescent Moon hangs with Mercury and Venus on July 8th. Meanwhile, the background stars Pollux and Castor add to the scene. Binoculars will enhance the view.

A fourth bright planet is also in evening view, far to the upper left of the group of three. This is Jupiter, shining high in the southwest. Aside from Venus, it's the brightest point of light in the sky. (In fact, some people may confuse it with Venus until they realize they should be looking much lower and to the right for the Evening Star.) All these planets appear about the same distance away as you watch them in the deepening dusk, but this is an illusion. Mercury is roughly 90 million miles away (its distance changes during the period illustrated); Venus is about 140 million miles away, and Saturn is 930 million miles -- about 10 times farther than Mercury. Jupiter is about 500 million miles away. Such big distances are better expressed by how long it takes light to cross them. Mercury is about 8 light-minutes distant, Venus is about 12 light-minutes away, and Saturn is 85 light-minutes from us. Jupiter is 45 light-minutes distant. By comparison, the stars Pollux and Castor, in the constellation Gemini, are 34 and 52 light-years away, respectively.

NASA's Comet Crash in the Sky

There's another reason to start paying attention to the western dusk. On the night of July 3rd, NASA's Deep Impact probe will slam at 23,000 miles per hour into the icy, mountain-size nucleus of Comet Tempel 1. Nothing of this event will be visible to the unaided eye (contrary to over-optimistic claims), but at least you can see the place in the sky where it happens.

Find Jupiter again high in the southwest. Off to its left, by somewhat more than the width of your fist at arm's length, is the fainter star Spica, in the constellation Virgo. The impact with the comet will happen a couple of finger-widths above Spica.

The crash is set to happen around 10:52 p.m. Pacific Daylight Time July 3rd (1:52 a.m. Eastern Daylight Time on the morning of July 4th). At that time, Jupiter, Spica, and the comet's position will be in good view from the western United States, especially the Southwest. Deep Impact's 800-pound projectile should blast a crater anywhere from the size of a large house to the size of a stadium in the comet's 9-by-2 1/2-mile nucleus, while instruments aboard the main spacecraft watch from a safe distance. Scientists hope this first-ever comet excavation will provide information about comets' internal composition and structure. Some of the world's biggest telescopes will also be watching in the following hours, days, and weeks. Countless amateur telescope users will be watching too. But even during and after impact the comet is expected to be faint, and telescope users will need to use a detailed star chart to locate it.

Suitable charts also appear in the June 2005 issue of Sky & Telescope, the July-August 2005 issue of Night Sky, and online at <http://SkyandTelescope.com>. Anyone who's not already familiar with how to use star charts with a telescope will need to follow the beginner's instructions in the online article.

If your evening sky is clear on July 6th or 7th, there's a much easier way to find Comet Tempel 1 with your telescope. Just center Spica in your lowest-power eyepiece, then let the sky drift by (turn off the scope's tracking motor if it has one). Wait exactly 20 minutes, and Comet Tempel 1 should be in the field of view.

http://skyandtelescope.com/abo-utsky/pressreleases/article_15-28_1.asp

'BUMPY SPACE DUST' EXPLAINS ORIGIN OF MOST COMMON MOLECULE IN UNIVERSE

Science fiction writer Harlan Ellison once said that the most common elements in the universe are hydrogen and stupidity. While the verdict is still out on the volume of stupidity, scientists have long known that hydrogen is indeed by far the most abundant element in the universe. When they peer through their telescopes, they see hydrogen in the vast clouds of dust and gas between stars -- especially in the denser regions that are collapsing to form new stars and planets. But one mystery has remained: why is much of that hydrogen in molecular form -- with two hydrogen atoms bonded together -- rather than its single atomic form? Where did all that molecular hydrogen come from? Researchers recently decided to try to figure it out.

They discovered that one seemingly tiny detail -- whether the surfaces of interstellar dust grains are smooth or bumpy -- could explain why there is so much molecular hydrogen in the universe. Hydrogen is the simplest atomic element known; it consists of just one proton and one electron. Scientists have always taken for granted the existence of molecular hydrogen when forming theories about where all the larger and more elaborate molecules in the universe came from. But nobody could explain how so many hydrogen atoms were able to form molecules -- until now. For two hydrogen atoms to have enough energy to bond in the cold reaches of space, they first have to meet on a surface, explained Eric Herbst. Though scientists suspected that space dust provided the necessary surface for such chemical reactions, laboratory simulations of the process never worked. At least, they didn't work well enough to explain the full abundance of molecular hydrogen that scientists see in space.

Herbst, joined with Herma Cuppen, a postdoctoral researcher, and Qiang Chang, a doctoral student, both in physics, to simulate different dust surfaces on a computer. They then modeled the motion of two hydrogen atoms tumbling along the different surfaces until they found one another to form a molecule.

Given the amount of dust that scientists think is floating in space, the researchers were able to simulate the creation of the right amount of hydrogen, but only on bumpy surfaces. When it comes to making molecular hydrogen, the ideal microscopic host surface is "less like the flatness of Ohio and more like a Manhattan skyline," Herbst said. The problem with past simulations, it seems, is that they always assumed a flat surface. Cuppen understands why. "When you want to test something, starting with a flat surface is just faster and easier," she said. She should know. She's an expert in surface science, yet it still took her months to assemble the bumpy dust model, and she's still working to refine it. Eventually, other scientists will be able to use the model to simulate other chemical reactions in space.

In the meantime, the scientists are collaborating with colleagues at other institutions who are producing and using actual bumpy surfaces that mimic the texture of space dust. Though real space dust particles are as small as grains of sand, these larger, dime-sized surfaces will enable scientists to test whether different textures help molecular hydrogen to form in the lab.

ARE METEOR SHOWERS MISUNDERSTOOD?

NASA's Deep Impact mission is about to smash into comet 9P/Tempel 1 to excavate a crater and probe the comet's internal structure. It's possible, however, that the comet will break into

fragments, creating a cloud of meteoroids. That, say astronomers, may not be unnatural.

"If comet 9P/Tempel 1 breaks during NASA's Deep Impact mission on July 4, a meteoroid stream will be created in much the same manner as the mechanism that causes most of our meteor showers," according to SETI Institute astronomer Dr. Peter Jenniskens. Jenniskens has discovered a fragment of lost comet D/1819 W1 (Blanpain), last seen in 1819. It has survived for 36 orbits, and was detected on November 22, 2003 by the Catalina Sky Survey as a minor planet called 2003 WY25. It passed Earth at a distance of only 0.025 AU (3.7 million kilometers) on December 11, 2003. After its orbit was better determined, Jenniskens traced the object back to that of Blanpain in 1819. 2003 WY25 is a tiny object, only 400 meters in diameter, assuming that, like similar objects, it reflects about 4% of the sunlight that hits it.

Jenniskens and co-author Esko Lyytinen, an amateur astronomer from Finland, calculated how the debris of a breakup in 1819 would have spread under the influence of planetary perturbations. They discovered that a breakup during (or just before) the return of 1819 can explain a spectacular shower of meteors that radiated from the constellation of Phoenix in 1956. In that year, the planet Jupiter had steered the trail of debris into Earth's path.

"The 19th century idea that meteor showers originate from the breakup of comets went into remission after astronomer Fred Whipple, in 1951, developed a quantitative description of meteoroid acceleration by the drag of water vapor," says Jenniskens. "Ever since, meteor showers were thought to be caused by the gradual ejection of meteoroids when the comet's ices evaporated on approach to the Sun." Instead, it now appears that many meteoroid streams are caused by wholesale disintegration of comets, which are loose assemblages of cometesimals and are known to frequently break apart. There are several possible causes of such fragmentations, one of which is collisions with large meteoroids such as simulated in the Deep Impact mission.

Last year, Jenniskens identified minor planet 2003 EH1 in the orbit of the strong Quadrantid shower of January, and argued that the object was the residue of a broken comet giving rise to the Quadrantid shower. A comet seen in A. D. 1490 - 1491 (C/1490 Y1) was perhaps the manifestation of that breakup. The detection of 2003 WY25 provides a second example of the formation of a meteoroid stream by the disintegration of a comet. Other well known meteor showers that likely originated from the breakup of a comet, according to Jenniskens, include the December Geminids (with remnant 3200 Phaethon), as well as the June Daytime Arietids and July delta-Aquariids that are associated with the Marsden-group of sun-skirting comet fragments. It is now also likely that the spectacular meteor storms of Andromedids in 1872 and 1885 were due to the progressive fragmentation of comet 3D/Biela in 1846 and 1852. <http://www.seti.org/atf/cf/%7BB0D4BC0E-D59B-4CD0-9E79-113953A58644%7D/WY25d.pdf>

CLUES TO PLANET FORMATION REVEALED

The most detailed measurements to date of the dusty disks around young stars confirm a new theory that the region where rocky planets such as Earth form is much farther away from the star than originally thought. These first definitive measurements of planet-forming zones offer important clues to the initial conditions that give birth to planets. Understanding planet formation is key to understanding Earth's origins, yet this remains

a mysterious process, said John Monnier, lead author on the paper, "*The near-infrared size luminosity relations for Herbig Ae/Be disks*" Very young stars are surrounded by thick, rotating disks of gas and dust, which are expected to eventually disappear as material is either pulled into the star, is blown from the disk, or collects into larger pieces of debris. This transition marks the leap from star formation to planet formation.

The scientists examined the innermost region of such disks where the star's energy heats the dust to extremely high temperatures. These dusty disks are where the seeds of planets form, where dusty particles stick together and eventually grow to large masses. However, if the dust orbits too close to the star, it evaporates, shutting off any hope of planet formation. It's important to know where the evaporation begins since it has a dramatic effect on planet formation, Monnier said. The initial temperature and density of dust surrounding young stars are critical ingredients for advanced computer models of planet formation.

For the study, scientists looked at young stars that are about one and a half times the mass of the sun. "*We can study these stars more in-depth because they are brighter and easier to see,*" Monnier said. In the last decade or so, beliefs about the systems that build planets have changed drastically with the onset of powerful observatories that can take more precise measurements, Monnier said. They found that measurements thought to be accurate were actually very different than originally thought. For this work, scientists used the two largest telescopes in the world linked together to form the Keck Interferometer. This ultra-powerful duo acts as the ultimate zoom lens allowing astronomers to peer into planetary nurseries with 10X the detail of the Hubble Space Telescope. By combining the light from the two Keck Telescopes, researchers were able to achieve the capabilities of a single telescope that spans a football field, but for a fraction of the cost, Monnier said. <http://www.astro.lsa.umich.edu/~monnier/>

ICY JUPITER MOON THROWS CURVE BALL AT FORMATION THEORIES

Scientists studying data from the Galileo spacecraft have found that Jupiter's moon Amalthea is a pile of icy rubble less dense than water. Scientists expected moons closer to the planet to be rocky and not icy. The finding shakes up long-held theories of how moons form around giant planets.

"I was expecting a body made up mostly of rock. An icy component in a body orbiting so close to Jupiter was a surprise," said Dr. John D. Anderson. Anderson is lead author of a paper on the findings. *"This gives us important information on how Jupiter formed, and by implication, how the solar system formed,"* Anderson said.

Current models imply that temperatures were high at Amalthea's current position when Jupiter's moons formed, but this is inconsistent with Amalthea being icy. The findings suggest that Amalthea formed in a colder environment. One possibility is that it formed later than the major moons. Another is that the moon formed farther from Jupiter, either beyond the orbit of Jupiter's moon Europa or in the solar nebula at or beyond Jupiter's position. It would have then been transported or captured in its current orbit around Jupiter. Either of these explanations challenges models of moon formation around giant planets.

"Amalthea is throwing us a curve ball," said Dr. Torrence Johnson, co-author and project scientist for the Galileo mission. *"Its density is well below that of water ice, and even with substantial porosity, Amalthea probably contains a lot of water*

ice, as well as rock." Analysis of density, volume, shape and internal gravitational stresses lead the scientists to conclude that Amalthea is not only porous with internal empty spaces but also contains substantial water ice.

One model for the formation of Jupiter's moons suggests that moons closer to the planet would be made of denser material than those farther out. That is based on a theory that early Jupiter, like a weaker version of the early Sun, would have emitted enough heat to prevent volatile, low-density material from condensing and being incorporated into the closer moons. Jupiter's four largest moons fit this model, with the innermost of them, Io, also the densest, made mainly of rock and iron.

Amalthea is a small red-tinted moon that measures about 168 miles in length and half that in width. It orbits about 181,000 kilometers (112,468 miles) from Jupiter, considerably closer than the Moon orbits Earth. Galileo passed within about 99 miles of Amalthea on Nov. 5, 2002. Galileo's flyby of Amalthea brought the spacecraft closer to Jupiter than at any other time since it began orbiting the giant planet on Dec. 7, 1995. After more than 30 close encounters with Jupiter's four largest moons, the Amalthea flyby was the last moon flyby for Galileo.

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 before the 1st of the month of publication, for example, material for May's newsletter should be received May 1st. If you wish to contribute an article or suggestions to *The Stargazer* please contact Mark Folkerts by email or by telephone (425) 486-9733 or co-editor Bill O'Neil, at (774) 253-0747.

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In June's Stargazer:

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- **** **CONSTELLATIONS OF THE MONTH:**
- **** **ASTRONOMY FUN FACTS**
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**The next EAS Meeting is 3:00 P.M. SUNDAY, June 26th
at the Everett Public Library Auditorium.**