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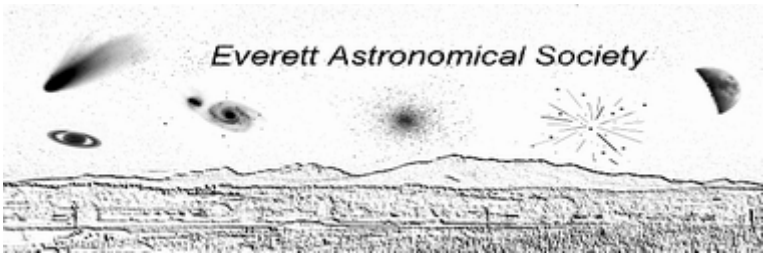

The Stargazer

May 2004

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EAS BUSINESS…

RECAP OF APRIL MEETING

At the April EAS meeting, Vincent Woolf from UW discussed very rare Helium Stars, apparently a short-lived transitional phase of middle mass stars, with processed material on the surface, and almost no measurable trace of hydrogen, with levels as much as 100,000 times less that the sun.

Astronomy Day – Our Astronomy Day activities were successful, with members sharing information at the library, and sharing crisp clear views of four of the five naked-eye planets at a beautiful clear Saturday night star party, and a mostly clear Friday event.

NEXT EAS MEETING - SATURDAY MAY 22ND 7:00 PM - PROVIDENCE PACIFIC CLINIC (916 PACIFIC AVENUE) IN THE MONTE CRISTO ROOMS ON THE MAIN FLOOR.

-- Note Early Meeting This Month Due to Memorial Day --

Jonathan Fay will show a presentation of building his 'Littlebear' observatory in Redmond by converting a garden shed into a domed observatory. See http://www.littlebear-observatory.com/ .

Map/directions to the EAS meeting are available at: http://members.tripod.com/everett_astronomy/directions_to_club_meetings.htm

Scheduled Meeting Dates:

May 22nd – EAS Mtg – Jonathan Fay – Observatory Building– 7:00 PM
Jun 26th – EAS Mtg – (Eric Algol, UW, T Tauri Star) 7:00 PM
Jul 14-17th – Table Mt. Star Party
Jul 31st – EAS Mtg – (Bill Cook, Captain's on Optics) – 7:00 PM
Aug 11-14th – Oregon Star Party
Aug 28th – EAS Mtg – (Dr. Julie Lutz, UW Astronomy) 7:00 PM
Sep 17-18th – Sun Lakes Star Party
Sep 25th – EAS Meeting – 7:00 PM
Oct 30th – EAS Meeting – 7:00 PM
Nov 20th – EAS Meeting – 7:00 PM
Dec 11th – EAS Holiday Dinner

MEMBER NEWS

New EAS T-Shirts available ! See our updated T-shirts, available at this month's meeting. Chose from T, Long-sleeve T, or sweat shirt in a variety of sizes.

Telescope for Sale: The club has been contacted by a woman wishing to sell a 5" Celestron Cometron reflector and mount, along with an observing stool, and some astronomy books – asking $325 OBO. Contact Mark Folkerts if interested.

CLUB STAR PARTY INFO

Upcoming star party schedule:

We try to hold informal close-in star parties each month during the spring and summer months on a weekend near the New moon at a member's property or a local park. (call Bob Lyon at (425) 337-1510 for info or check the EAS website.)
Members contact Bob Lyons for scope borrowing.

FINANCIAL HEALTH

The club maintains a $700+ 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' STATUS

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

EAS members: contact Bob Lyons (425) 337-1510 or 'bdlyons at verizon.net' to borrow a scope.

ASTRO CALENDAR

May 2004
May 07 - Comet C/2001 Q4 (NEAT) Closest Approach To Earth (.32 AU)
May 14 - Mercury at Greatest Western Elongation (25 Degrees)
May 15 - Comet C/2001 Q4 (NEAT) Perihelion (0.962 AU)
May 21 - Moon Occults Venus
May 25 - Mars Passes 1.6 Degrees From Saturn

June 2004
Jun 08 - Venus Transits The Sun
Jun 09 - Moon Occults Vesta
Jun 11 - Pluto At Opposition
Jun 12 - Mercury Passes 1.3 Degrees From Venus
Jun 21 - Summer Solstice (00:57 UT)
Jun 26 - Mercury Passes 2.1 Degrees From Saturn

July 2004
Jul 01 - Cassini, Saturn Orbit Insertion
Jul 05 - Earth At Aphelion (1.017 AU From Sun)
Jul 07 - Asteroid 3 Juno At Opposition (9.6 Magnitude)
Jul 11 - Mercury Passes 0.1 Degrees From Mars
Jul 26 - Mercury Greatest Eastern Elongation (27 Degrees)
Jul 29 - South Delta-Aquarids Meteor Shower Peak

August 2004
Aug 01 - Alpha Capricornids Meteor Shower Peak
Aug 06 - Southern Iota Aquarids Meteor Shower Peak
Aug 06 - Neptune At Opposition
Aug 12 - Perseids Meteor Shower Peak
Aug 25 - Northern Iota Aquarids Meteor Shower Peak
Aug 27 - Uranus At Opposition
Aug 31 - Venus Passes 1.9 Degrees From Saturn
Aug 31 - Start of Mars Solar Conjunction

September 2004
Sep 22 - Autumnal Equinox, 16:30 UT
Sep 27 - Mars Passes 0.2 Degrees From Jupiter
Sep 29 - Mercury Passes 0.6 Degrees From Jupiter
Sep 29 - Mercury Passes 0.8 Degrees From Mars

October 2004
Oct 09 - Draconids Meteor Shower Peak
Oct 13 - Moon Occults Mars
Oct 14 - Moon Occults Mercury
Oct 21 - Orionid Meteor Shower Peak
Oct 28 - Lunar Eclipse
Oct 31 - Daylight Saving - Set Clock Back 1 Hour

OVER THE AIRWAVES

"Our group of radio script writers now consists of EAS and SAS members Jim Ehrmin, Pat Lewis writer emeritus, 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 have a good idea for an astronomy broadcast or would like to try your hand at writing a script, call Pat Lewis at (206) 524-2006 or email to joagreen@aol.com 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 8:58 A.M. and 5:58 P.M. Saturday and Sunday). 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 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

May 04	Full Moon
May 11	Last Quarter Moon
May 19	New Moon
May 27	First Quarter Moon
Jun 03	Full Moon
Jun 09	Last Quarter Moon
Jun 17	New Moon
Jun 25	First Quarter Moon

Digital Lunar Orbiter Photographic Atlas of the Moon

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

UP IN THE SKY -- THE PLANETS

Object	Rises	Transits	Sets	Constellation
Sun	**5:28 am**	**13:05**	**20:43**	**Taurus**
Mercury	**4:45 am**	Daylight	Daylight	**Pisces**
Venus	Daylight	Daylight	**23:28**	**Taurus**
Mars	Daylight	Daylight	**23:58**	**Gemini**
Jupiter	Daylight	**20:09**	**2:57 am**	**Leo**
Saturn	Daylight	Daylight	**0:06 am**	**Gemini**
Uranus	**2:42 am**	Daylight	Daylight	**Aquarius**
Neptune	**1:50 am**	Daylight	Daylight	**Capricornus**
Pluto	**21:50**	**2:53 am**	Daylight	**Serpens**

(times local time for Everett PDT)

NOAA SUN CALCULATOR

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

INTERNATIONAL SPACE STATION – VISIBLE SEATTLE PASSES

ISS Visibility –
http://spaceflight.nasa.gov/realdata/sightings/SSapplications/Post/SightingData/Seattle.html or also see link

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

CONSTELLATIONS OF THE MONTH

LUPUS: Lupus (the Wolf) borders on the constellations of Centaurus, Circinus, Libra, Norma, and Scorpius. There are no established asterisms within its borders. Lupus ranks 5th in overall brightness among the constellations, but 46th in size: it takes up approximately 333.68 square degrees (0.809%) of the sky. Lupus contains no known meteor showers, and no Messier objects. Lupus is completely visible from latitudes South of +35 degrees, and completely invisible from latitudes North of +60 degrees. It has 50 stars brighter than magnitude 5.5, and its central point is at RA=15h09m, Dec.= -42.5 degrees. The solar conjunction date of Lupus is November 8th, and its midnight culmination date is May 9th. One of the most spectacular and brightest supernovae explosions occurring in our Galaxy was observed near Beta Lupi in the year 1006. The only supernova to be recorded in Europe and the Arab empire before the Renaissance, historical descriptions estimated its brightness as "three times as bright as Venus" and "a quarter the brightness of the Moon". These and other descriptions place the visual magnitude at approximately –8 to –10. Lupus is well known for containing some fine globular and open clusters, as well as planetary nebulae. The unusually shaped planetary nebula IC-4406 glows at photographic magnitude 10.6, and has a long dimension of only 28"; this gives a relatively high average surface brightness. IC-4406's central star is embedded in a thick cloud of nebulosity, dimly glowing at photographic magnitude 14.7, making it extremely difficult for backyard observers. Larger scopes show this nebula to be a bright, bluish-gray rectilinear patch of light. NGC-5882, another planetary nebula in Lupus, appears as a slightly out-of-focus bluish green "star", with a photographic magnitude of 10.5; it is located right between two relatively bright stars of 7th and 8th magnitude. Another planetary nebula in Lupus (NGC-6026) lies near its eastern border, about halfway between Chi and Theta Lupi: this is NGC-6026, a 45" diameter planetary. This object for a long time was thought to be a galaxy, until University of Texas astronomer Gerard de Vaucouleurs identified it as a member of the Milky Way. NGC-6026 is a rather large planetary with a very low surface brightness due to a magnitude of 12.5; a moderate sized scope shows this object as uniformly illuminated faint haze, with a condensed stellar-like nucleus. NGC-5824 is a fine globular cluster in Northwestern Lupus. It shines at magnitude 9.0, and measures 6.2' across. This cluster is condensed strongly towards its center and is thus difficult to resolve with smaller scopes. Brighter and larger than NGC-5824 is NGC-5986; this globular measures 9.6' across, and shines at magnitude 7.1, making it easily visible as a large, fuzzy disk of light. A moderate backyard scope at high power shows many individual points of light ringing the cluster's edges. Another beautiful globular in Lupus is NGC-5927, lying about 3 degrees northeast of Zeta Lupi. It glows at magnitude 8.3, and measures about 12'; it appears in smaller scopes as a nebulous haze dotted with tiny stellar points with a bright white central core surrounded by a field full of sparkling stars. Many astronomers have raved about this lesser known globular cluster. Lupus also contains two bright open clusters : NGC-5749 and NGC-5822. NGC-5749 is a 9th magnitude group of 30 stars compressed into an area measuring only 8' across. NGC-5822 is a much larger and brighter open cluster, requiring a larger field of view. It contains 150 stars in an area covering 40', and has a total photographic magnitude of 6.5; its brightest stars glow at 10th magnitude, making the object visible in small telescopes as a large scattered field of bright and faint stars loosely comprising an open, or galactic, cluster. If you are able to get a good southern horizon this spring and early summer, try to enjoy some of the wonders of the constellation Lupus.

YOUNG ASTRONOMER'S CORNER

Speaking of Star Parties, the following column publishes yearly in the EAS newsletter. It was also handed out at this year's Astronomy Day in April. It is always a timely column, especially this time of year when people are starting to get out again for outdoor pursuits… hopefully this will include stargazing for you this year!!

Star Parties: Hints for More Enjoyable Stargazing!!!

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

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

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

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

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

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

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

★★ Always eat well and drink plenty of fluids to avoid dehydration. Good nutrition (and yes, including carrots or other

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

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

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

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

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

★★ It is not necessary to have a telescope to enjoy a star party. A lawn chair and a blanket, perhaps with a pair of binoculars and a good, basic book of the sky, can give you countless hours of enjoyment and learning about astronomy without spending much money. IT IS NOT NECESSARY TO SPEND LOTS OF MONEY TO ENJOY THE NIGHT SKY. Going to a Star Party sponsored by your local astronomy club, or perhaps even joining your local astronomy club, is a GREAT way to learn about astronomy. Star parties also give you the opportunity to meet new people, ask lots of questions (and perhaps share your knowledge of astronomy too), as well as to look through many telescopes and possibly binoculars as well.

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

PLANETARY FOCUS

"Planetary Focus": The focus of this month's column will be our home planet **Earth**:

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….), that this information will become the next series of "Young Astronomer's Corner" columns for the next few months. 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, sott, etc…), and chlorofluorcarbons - 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 & TELESCOPE LINGO

Astronomy "Lingo": *Peculiar Stars:* Stars with spectral characteristics that do not exactly correspond with the usual classification of spectral types. They are generally designated with a 'p' after their spectral type (e.g., 'Ap' stars); however, specific features are also given individual designators (such as 'e' for emission or 'm' for metallic).

Telescope "Lingo": *Monochromator:* An instrument in which one narrow band of wavelengths is separated and isolated from a light beam, or other radiation. This isolation is usually achieved by using a narrow-band interference filter, or via a diffraction grating or prism, used together with an exit slit through which the desired waveband passes. Intensity changes in the monochromatic beam can then be studied.

ASTRONOMY FUN FACTS

★★ 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" is a bi-monthly column which, because of this short month, will resume with the next edition of the EAS newsletter; it will publish monthly over the summer - June, July and August – instead of the usual bi-monthly frequency

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

MARS ROVER FINDS ROCK RESEMBLING METEORITES THAT FELL TO EARTH

NASA's Opportunity rover has examined an odd volcanic rock on the plains of Mars' Meridiani Planum region with a composition unlike anything seen on Mars before, but scientists have found similarities to meteorites that fell to Earth. "We think we have a rock similar to something found on Earth," said Dr. Benton Clark of Lockheed Martin Space Systems, Denver, science-team member for the Opportunity and Spirit rovers on Mars. The similarity seen in data from Opportunity's alpha particle X-ray spectrometer "*gives us a way of understanding 'Bounce Rock' better*," he said. Bounce Rock is the name given to the odd, football-sized rock because Opportunity struck it while bouncing to a stop inside protective airbags on landing day. The resemblance helps resolve a paradox about the meteorites, too. Bubbles of gas trapped in them match the recipe of martian atmosphere so closely that scientists have been confident for years that these rocks originated from Mars. But examination of rocks on Mars with orbiters and surface missions had never found anything like them, until now. "*There is a striking similarity in spectra*," said Christian Schroeder, a rover science-team collaborator from the University of Mainz, Germany, which supplied both Mars rovers' Moessbauer spectrometer instruments for identifying iron-bearing minerals.

Mars Exploration Rover scientists described two such meteorites in particular during a Mars Exploration Rover news conference at JPL. One rock, named Shergotty, was found in India in 1865 and it gave its name to a class of meteorites called shergottites. A shergottite named EETA79001 was found in Antarctica in 1979 and has an elemental composition even closer to Bounce Rock's. Those two and about 18 other meteorites found on Earth are believed to have been ejected from Mars by the impacts of large asteroids or comets hitting Mars.

Opportunity's miniature thermal emission spectrometer indicates that the main ingredient in Bounce Rock is a volcanic mineral called pyroxene, said science-team collaborator Deanne Rogers. The Moessbauer spectrometer also identified pyroxene in the rock. The high proportion of pyroxene makes it unlike not only any other rock studied by Opportunity or Spirit, but also unlike the volcanic deposits mapped extensively around Mars by a similar spectrometer on NASA's Mars Global Surveyor orbiter, Rogers said. Thermal infrared imaging by another orbiter, Mars Odyssey, suggests a possible origin for Bounce Rock. An impact crater about 25 kilometers wide (16 miles wide) lies about 50 kilometers (31 miles) southwest of Opportunity. The images show that some rocks thrown outward by the impact that formed that crater flew as far as the distance to the rover. "*Some of us think Bounce Rock could have been ejected from this crater*," Rogers said. Opportunity is driving eastward, toward a crater dubbed "Endurance" that might offer access to thicker exposures of bedrock than the rover has been able to examine so far. With new software to improve mobility performance, the rover may reach Endurance within two weeks, said JPL's Jan Chodas, flight software manager for both Mars Exploration Rovers.

Mission controllers at JPL successfully sent new versions of flight software to both rovers. Spirit switched to the new version successfully on Monday, and Opportunity did late Tuesday.

SCIENTISTS SIZE-UP, CLASSIFY METEORITE THAT NEARLY LANDED IN THEIR BACKYARDS

The meteorites that punched through roofs in Park Forest, Illinois., on the evening of March 26, 2003, came from a larger

mass that weighed no less than 1,980 pounds before it hit the atmosphere, according to scientific analyses led by the University of Chicago's Steven Simon, who himself also happens to live in Park Forest. Simon holds a unique distinction among scientists: his home sits in the middle of the strewnfield, the area from which the meteorites were recovered. "*I don't know of any other time when a meteoriticist was in the middle of a strewnfield*," said Lawrence Grossman, one of Simon's co-authors. In fact, Simon actually saw the flash the meteorite created. He had the drapes closed when the rock entered the sky over Illinois, but "*the whole sky lit up*," he said. Grossman, who lives in Flossmoor, not far from Park Forest, also experienced the meteorite's arrival firsthand. He was awakened by the sound of the meteorite entering the atmosphere that night. "*I heard a detonation*," Grossman said. "*It was sharp enough to wake me up*."

The team calculated the projectile's size range based on measurements of the galactic cosmic rays that it absorbed. Measurements of a radioactive form of cobalt provided the projectile's minimum size. "*If the object is too small the cosmic rays will just pass through and not make 60-cobalt*," Simon explained.

Simon and Grossman classify the meteorite as an L5 chondrite, a type of stony meteorite, one low in iron that was heated for a long period of time inside its parent body, probably an asteroid. "*It's a fairly common type of meteorite*," Simon said. The Park Forest meteorite also showed signs that it had been highly shocked, probably when it was part of a rock that was broken from a much larger asteroid following a collision. The evidence for shock includes shocked feldspar. Apollo astronauts recovered shocked specimens of the mineral from the moon, as well, Simon said. Impact shock was common in the early history of the solar system because of the large quantity of interplanetary debris then in existence.

Witnesses in Michigan, Illinois, Indiana and Missouri reported seeing the fireball that the meteorite produced as it broke up in the atmosphere, Simon and his colleagues reported. Local residents collected hundreds of meteorite fragments totaling approximately 65 pounds from an area extending from Crete in the south to the southern end of Olympia Fields in the north. Located in Chicago's south suburbs, "*this is the most densely populated region to be hit by a meteorite shower in modern times*," the authors write. One meteorite narrowly missed striking a sleeping Park Forest resident after it burst through the ceiling of a bedroom. The meteorite sliced through some window blinds, cratered the windowsill, then bounced across the room and broke a mirror before coming to rest. A resident of Park Forest, Ill., found a piece of the meteorite lodged in the street. Some yellow paint that it picked up on impact is visible on the it.

The meteorites were recovered from a track that trends southeast to northwest. Satellite data analyzed by Peter Brown of the University of Western Ontario indicates that the meteorite traveled from southwest to northeast, however. "*The meteorite broke up in the atmosphere, and the fragments encountered strong westerly winds as they fell*," the authors write. "*The smallest pieces were deflected the furthest eastward from the trajectory, and the largest pieces, carrying more momentum, were deflected the least*."
http://www-news.uchicago.edu/releases/04/040414.parkforest3.jpg.zip

RESEARCHER PREDICTS GLOBAL CLIMATE CHANGE ON JUPITER AS GIANT PLANET'S SPOTS DISAPPEAR

If a Berkeley, physicist's vision of Jupiter is correct, the giant planet will be in for a major global temperature shift over the next decade as most of its large vortices disappear. But fans of the Great Red Spot can rest easy. The most famous of Jupiter's vortices - which are often compared to Earth's hurricanes - will stay put, largely because of its location near the planet's equator, says Philip Marcus. Using whirlpools and eddies for comparison, Marcus bases his forecast on principals learned in junior-level fluid dynamics and on the observation that many of Jupiter's vortices are literally vanishing into thin air.

"*I predict that due to the loss of these atmospheric whirlpools, the average temperature on Jupiter will change by as much as 10 degrees Celsius, getting warmer near the equator and cooler at the poles*," says Marcus. "*This global shift in temperature will cause the jet streams to become unstable and thereby spawn new vortices. It's an event that even backyard astronomers will be able to witness.*"

According to Marcus, the imminent changes signal the end of Jupiter's current 70-year climate cycle. Jupiter's stormy atmosphere has a dozen or so jet streams that travel in alternating directions of east and west, and that can clock speeds greater than 330 miles per hour. As on Earth, vortices on Jupiter that rotate clockwise in the northern hemisphere are considered anticyclones, while those that spin counterclockwise are cyclones. The opposite is true in the southern hemisphere, where clockwise vortices are cyclones and counterclockwise spinners are anticyclones.

The Great Red Spot, located in the southern hemisphere, holds title as Jupiter's largest anticyclone; spanning 12,500 miles wide, it is large enough to swallow Earth two to three times over. Unlike the cyclonic storms on Jupiter, Earth's hurricanes and storms are associated with low-pressure systems and dissipate after days or weeks. The Great Red Spot, in comparison, is a high-pressure system that has been stable for more than 300 years, and shows no signs of slowing down.

About 20 years ago, Marcus developed a computer model showing how the Great Red Spot emerged out of and endured in the chaotic turbulence of Jupiter's atmosphere. His efforts to explain the dynamics governing it and other vortices on Jupiter led to his current projection of the planet's impending climate change. He says the current 70-year cycle began with the formation of three distinct anticyclones - the White Ovals - that developed south of the Great Red Spot in 1939. "*The birth of the White Ovals was seen through telescopes on Earth*," he says. "*I believe we're in for a similar treat within the next 10 years*." Marcus says the first stage of the climate cycle involves the formation of vortex streets which straddle the westward jet streams. Anticyclones form on one side of the street, while cyclones form on the other side, with no two vortices rotating in the same direction directly adjacent to each other. Most of the vortices slowly decay with turbulence. By stage two of the cycle, some vortices become weak enough to get trapped in the occasional troughs, or Rossby waves, that form in the jet stream. Multiple vortices can get caught in the same trough. When they do, they travel bunched together, and turbulence can easily make them merge. When the vortices are weak, trapping and merging continues until only one pair is left on each vortex street. The noted disappearance of two White Ovals, one in 1997 or 1998 and a second in 2000, exemplified the merging of the vortices in stage two, and as such, signaled the "*beginning of the end*" of Jupiter's current climate cycle, says Marcus.

Why would the merger of vortices affect global temperature? Marcus says the relatively uniform temperature of Jupiter - where the temperatures at the poles are nearly the same as they are at the equator - is due to the chaotic mixing of heat and airflow from the vortices. "*If you knock out a whole row of vortices, you stop*

all the mixing of heat at that latitude," says Marcus. "*This creates a big wall and prevents the transport of heat from the equator to the poles*." Once enough vortices are gone, the planet's atmosphere will warm at the equator and cool at the poles by as much as 10 degrees Celsius in each region, which is stage three of the climate cycle. This temperature change destabilizes the jet streams, which will react by becoming wavy. The waves steepen and break up, like they do at the beach, but they then roll up into new large vortices in the cycle's fourth stage. In the fifth and final stage of the climate cycle, the new vortices decrease in size, and they settle into the vortex streets to begin a new cycle. The weakening of the vortices is due to turbulence and happens gradually over time. It takes about half a century for newly formed vortices to gradually shrink down enough to be caught up in a jet stream trough, says Marcus. Fortunately, the Great Red Spot's proximity to the equator saves it from destruction. Unlike Jupiter's other vortices, the Great Red Spot survives by "eating" its neighboring anticyclones, says Marcus.

Marcus notes that his theory of Jupiter's climate cycle relies on the existence of a roughly equal number of cyclones and anticyclones on the planet. Since the telltale signs of vortices are the clouds they create, it was easy to miss the presence of long-lived cyclones, says Marcus. He explains that unlike an anticyclone's distinct spot, cyclones create patterns of filamentary clouds that are less clearly defined. "*On the face of it, it is easy to think that Jupiter is dominated by anticyclones because their spinning clouds show up clearly as bull's-eyes*," says Marcus. Marcus presents a computer simulation showing that the warm center and cooler perimeter of a cyclone creates the appearance of the filamentary clouds. In contrast, anticyclones have cold centers and warmer perimeters. Ice crystals that form in the anticyclone's center swell up and move to the sides where they melt, creating a darker swirl surrounding a lighter colored center.

Marcus approaches the study of planetary atmospheres from the untraditional viewpoint of a fluid dynamicist. "*I'm basing my predictions on the relatively simple laws of vortex dynamics instead of using voluminous amounts of data or complex atmospheric models*," says Marcus. Marcus says the lesson of Jupiter's climate could be that small disturbances can cause global changes. However, he cautions against applying the same model to Earth's climate, which is influenced by many different factors, both natural and manmade. "*Still, it's important to have different 'labs' for climate*," says Marcus. "*Studying other worlds helps us better understand our own, even if they are not directly analogous*."

THE CASE OF THE ELECTRIC MARTIAN DUST DEVILS

Scientists have found clues dust devils on Mars might have high-voltage electric fields, based on observations of their terrestrial counterpart. This research supports the vision for space exploration by helping to understand challenges the martian environment presents to explorers, both robotic and, eventually, human.

Researchers discovered dust devils on Earth have unexpectedly large electric fields, in excess of 4,000 volts per meter, and can generate magnetic fields as well. Like detectives chasing down a suspect, the scientists attached instruments to a truck and raced across deserts in Nevada (2000) and Arizona (2001). They drove through dust devils to get measurements as part of the Martian Atmosphere and Dust in the Optical and Radio (MATADOR) activity. The Arizona observations included a fixed base camp with a full suite of meteorological instruments.

Dust devils are like miniature tornadoes. They are about 10- to-100 meters wide with 20-to- 60 mph (32-to-96 kph) winds swirling around a hot column of rising air. "*Dust devils are common on Mars, and NASA is interested in them as well as other phenomena as a possible nuisance or hazard to future human explorers*," said Dr. William Farrell of NASA Goddard. "*If Martian dust devils are highly electrified, as our research suggests, they might give rise to increased discharging or arcing in the low-pressure Martian atmosphere, increased dust adhesion to space suits and equipment, and interference with radio communications*," Farrell said. "*The track patterns are known to change from season to season, so these huge dust pipes must be a large factor in transporting dust and could be responsible for eroding landforms*," Smith said. "*Two ingredients, present on both Earth and Mars, are necessary for a dust devil to form: rising air and a source of rotation*," said Dr. Nilton Renno, a member of the research team and expert in the fluid dynamics of dust devils. "*Wind shear, such as a change in wind direction and speed with altitude, is the source for rotation. Stronger updrafts have the potential to produce stronger dust devils, and larger wind shear produces larger dust devils*," Renno said.

Dust particles become electrified in dust devils, when they rub against each other as they are carried by the winds, transferring positive and negative electric charge the same way you build up static electricity if you shuffle across a carpet. Scientists thought there would not be a high-voltage, large-scale electric field in dust devils, because negatively charged particles would be evenly mixed with positively charged particles, so the overall electric charge in the dust devil would be in balance.

However, the team's observations indicate smaller particles become negatively charged, while larger particles become positively charged. Dust devil winds carry the small, negatively charged particles high into the air, while the heavier, positively charged particles remain near the base of the dust devil. This separation of charges produces the large-scale electric field, like the positive and negative terminals on a battery. Since the electrified particles are in motion, and a magnetic field is just the result of moving electric charges, the dust devil also generates a magnetic field. If Martian dust grains have a variety of sizes and compositions, dust devils on Mars should become electrified the same way as their particles rub against each other, according to the team. Martian dust storms, which can cover the entire planet, are also expected to be strong generators of electric fields. The team hopes to measure a large dust storm on Earth and have instruments to detect atmospheric electric and magnetic fields on future Mars landers.

"*Complex tracks, generated by the large Martian dust devils, are commonly found in many regions of Mars, and several dust devils have been photographed in the act of scouring the surface*," said MATADOR Principal Investigator Dr. Peter Smith . "*These Martian dust devils dwarf the five-to-10 meter terrestrial ones, can be greater than 500 meters in diameter*. http://www.gsfc.nasa.gov/topstory/2004/0420marsdust.html

TWO COMETS TO GLOW IN THE SPRING SKY

Seven years have passed since Comet Hale-Bopp graced the evening sky in the spring of 1997. Now not just one but two new comets are heading into springtime view -- though they won't come near Hale-Bopp for brightness and grandeur. In fact, no one yet knows whether they'll reach naked-eye visibility for most people in North America and Europe. But even if they don't, anyone should be able to catch them with binoculars. But you'll have to know when and where to look. Sky & Telescope's editors are tracking the comets' brightnesses and will post updates on the magazine's Web site,

http://SkyandTelescope.com, in the coming weeks so that no one need miss this spring's comet show.

Here is an overview of what to expect:

The two arriving visitors are named Comet LINEAR and Comet NEAT, after the search programs that found them (Lincoln Near-Earth Asteroid Research, which uses a pair of telescopes in New Mexico, and the Near-Earth Asteroid Tracking program, which uses telescopes in California and Hawaii). In April, Comet LINEAR were hard to find in the bright glow of dawn just above the eastern horizon before sunrise, and Comet NEAT was visible only from the Southern Hemisphere. But that will change in May. In subsequent weeks both LINEAR and NEAT will come into in the evening sky, where they'll be in more convenient view. Starting around May 5th or 6th, scan for Comet NEAT just above the southwest horizon as evening twilight fades. You're looking for a small, fuzzy "star" with a small tail pointing to the upper left. (The much brighter star Sirius will also be low in the southwest; on May 5th the comet will be not far to its left, and on May 6th the comet will be to Sirius's upper left.) In the next two weeks Comet NEAT will get much higher in the southwest at nightfall, though it will also fade. Binocular users may be able to follow it through the end of May.

Around May 26th or 28th, Comet LINEAR could steal the show when it too enters the evening sky. Look for it just above the west-southwest horizon as twilight fades. It will get only a little higher in the following week or two, while fading rapidly. Full details, including charts showing when and where to look for both comets appear in the May 2004 issue of Sky & Telescope and in the online article "The Double Comet Show of 2004", http://skyandtelescope.com/observing/objects/comets/article_1229_1.asp

METEORITE IMPACT EVIDENCE FOUND OFF AUSTRALIAN COAST

An impact crater believed to be associated with the "Great Dying," the largest extinction event in the history of life on Earth, appears to be buried off the coast of Australia, according to a research project headed by Luann Becker, a scientist at the University of California, Santa Barbara (UCSB), with a description of the crater published in Science Express, the electronic publication of the journal Science paper.

Most scientists agree a meteor impact, called Chicxulub, in Mexico's Yucatan Peninsula, accompanied the extinction of the dinosaurs 65 million years ago. But until now, the time of the Great Dying 250 million years ago, when 90 percent of marine and 80 percent of land life perished, lacked evidence and a location for a similar impact event.

Becker and her team found extensive evidence of a 125-mile-wide crater, called Bedout, off the northwestern coast of Australia. They found clues matched up with the Great Dying, the period known as the end-Permian. This was the time period when the Earth was configured as one primary land mass called Pangea and a super ocean called Panthalassa.

During recent research in Antarctica, Becker and her team found meteoric fragments in a thin claystone "breccia" layer, pointing to an end-Permian event. The breccia contains the impact debris that resettled in a layer of sediment at end- Permian time. They also found "shocked quartz" in this area and in Australia. "*Few Earthly circumstances have the power to disfigure quartz, even high temperatures and pressures deep inside the Earth's crust*," Becker said. Quartz can be fractured by extreme volcanic activity, but only in one direction. Shocked quartz is fractured in several directions and is therefore believed to be a good tracer for the impact of a meteor.

Becker discovered oil companies in the early 70's and 80's had drilled two cores into the Bedout structure in search of hydrocarbons. The cores sat untouched for decades. Becker and co-author Robert Poreda went to Australia to examine the cores held by the Geological Survey for Australia in Canberra. "*The moment we saw the cores, we thought it looked like an impact breccia*," Becker said. Becker's team found evidence of a melt layer formed by an impact in the cores. Becker documented how the Chicxulub cores were very similar to the Bedout cores. When the Australian cores were drilled, scientists did not know exactly what to look for in terms of evidence of impact craters.

Co-author Mark Harrison, from the Australian National University, determined a date on material obtained from one of the cores, which indicated an age close to the end-Permian era. While in Australia on a field trip and workshop about Bedout, co-author Kevin Pope found large shocked quartz grains in end-Permian sediments, which he thinks formed as a result of the Bedout impact. Seismic and gravity data on Bedout are also consistent with an impact crater. The Bedout impact crater is also associated in time with extreme volcanism and the break-up of Pangea. "*We think that mass extinctions may be defined by catastrophes like impact and volcanism occurring synchronously in time*," Becker said. "*This is what happened 65 million years ago at Chicxulub but was largely dismissed by scientists as merely a coincidence. With the discovery of Bedout, I don't think we can call such catastrophes occurring together a coincidence anymore*," she added. http://beckeraustralia.crustal.ucsb.edu/

COSMIC MAGNIFYING GLASS: DISTANT STAR REVEALS PLANET

Like Sherlock Holmes holding a magnifying glass to unveil hidden clues, modern day astronomers used cosmic magnifying effects to reveal a planet orbiting a distant star.

This marks the first discovery of a planet around a star beyond Earth's solar system using gravitational microlensing. A star or planet can act as a cosmic lens to magnify and brighten a more distant star lined up behind it. The gravitational field of the foreground star bends and focuses light, like a glass lens bending and focusing starlight in a telescope. Albert Einstein predicted this effect in his theory of general relativity and confirmed it with our sun. "*The real strength of microlensing is its ability to detect low-mass planets*," said lead author Dr. Ian Bond of the Institute for Astronomy in Edinburgh. The discovery was made possible through cooperation between two international research teams: Microlensing Observations in Astrophysics (MOA) and Optical Gravitational Lensing Experiment (OGLE). Well-equipped amateur astronomers might use this technique to follow up future discoveries and help confirm planets around other stars. The newly discovered star-planet system is 17,000 light years away in the constellation Sagittarius. The planet, orbiting a red dwarf parent star, is most likely one-and-a- half times bigger than Jupiter. The planet and star are three times farther apart than Earth and the sun. Together, they magnify a farther, background star some 24,000 light years away, near the Milky Way center. In most prior microlensing observations, scientists saw a typical brightening pattern, or light curve, indicating a star's gravitational pull was affecting light from an object behind it. The latest observations revealed extra spikes of brightness, indicating the existence of two massive objects. By analyzing the precise shape of the light curve, Bond and his team determined one smaller object is only 0.4 percent the mass of a second, larger object. They concluded the smaller object must be a planet orbiting its parent star.

Dr. Bohdan Paczynski, an OGLE team member, first proposed using gravitational microlensing to detect dark matter in 1986. In 1991, Paczynski and his student, Shude Mao, proposed using microlensing to detect extrasolar planets. Two years later, three groups reported the first detection of gravitational microlensing by stars. Earlier claims of planet discoveries with microlensing are not regarded as definitive, since they had too few observations of the apparent planetary brightness variations. "*I'm thrilled to see the prediction come true with this first definite planet detection through gravitational microlensing*," Paczynski said. He and his colleagues believe observations over the next few years may lead to the discovery of Neptune-sized, and even Earth-sized planets around distant stars. Microlensing can easily detect extrasolar planets, because a planet dramatically affects the brightness of a background star. Because the effect works only in rare instances, when two stars are perfectly aligned, millions of stars must be monitored. Recent advances in cameras and image analysis have made this task manageable. Such developments include the new large field-of-view OGLE-III camera and the MOA-II 1.8 meter (70.8 inch) telescope being built and cooperation between microlensing teams. "*It's time-critical to catch stars while they are aligned, so we must share our data as quickly as possible*," said OGLE team-leader Dr. Andrzej Udalski of Poland's Warsaw University Observatory.

PROBING A PULSAR PAIR

The only known gravitationally bound pair of pulsars -- extremely dense, spinning stars that beam radio waves -- may be pirouetting around each other in an intricate dance. "*Pulsars are intriguing and puzzling objects. They pack as much mass as the Sun crammed into an object with a cross-sectional area about as large as Boston*," said Fredrick Jenet of JPL. Jenet and Scott Ransom of McGill University, Montreal, have developed a theoretical model to explain the behavior of this one-of-a-kind set of pulsars. "*The physics of radio pulsar emission has eluded researchers for more than three decades*," Jenet said. "*This system may be the 'Rosetta stone' of radio pulsars, and this model is one step toward its translation*." Jenet and Ransom studied the recently-discovered double pulsar system, in which two spinning pulsars orbit each other.

The discovery of the two-star system, officially named PSR J0737-3039B, was announced in 2003 by a multinational team of researchers from Italy, Australia, the United Kingdom and the United States. Those researchers proposed that the duo contained one spinning pulsar and a neutron star. Later in 2003, scientists working at the Parkes Observatory in New South Wales, Australia, determined that both stars are actually pulsars. This discovery marked the first known example of a "binary," or double, pulsar system. The stars are referred to as A and B.

Pulsars emit high-intensity radio radiation into a narrow beam. As the pulsar rotates, this beam moves in and out of our line of sight. Hence, we see periodic bursts of radio radiation. In this sense, a pulsar works like a lighthouse, in which the light may be on all the time, but it appears to blink on and off. Scientists were surprised to find that the B pulsar is on only at certain locations in its orbit. "*It's as though something is turning B on and off*," Jenet said. According to Jenet and Ransom, this "something" is closely related to the radio emission beam emanating from the A pulsar. They believe that B becomes bright when it is illuminated by emission from A. Jenet and Ransom used Einstein's Theory of General Relativity to predict the future evolution of this pulsar system. The theory implies that gravitational effects will change the emission pattern of A, which will then alter the exact orbital locations where B becomes bright. The double pulsar system is located about 2,000 light years, or 10 million billion miles, from Earth. Jenet and Ransom based their research on observations made at the Green Bank Telescope in West Virginia.

FROM THE EDITOR'S TERMINAL

The Stargazer is <u>your</u> newsletter and therefore it should be a cooperative project. Ads, announcements, suggestions, and literary works should be received by the editor 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.

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

In May's Stargazer:

The next EAS Meeting is 7:00 P.M. Saturday, May 22nd at the Providence Pacific Clinic – 916 Pacific Avenue in Everett.