

# The Stargazer

February 2004

President: Mark Folkerts	(425) 486-9733	folkerts at seanet.com	<i>The Stargazer</i>
Vice President: Bob Lyons	(425) 337-1510	bdlyons at verizon.net	
Librarian: Mike Locke	(425) 259-5995	mlocke at lioninc.com	Everett, WA 98206
Treasurer: Carol Gore	(360) 856-5135	janeway7C at aol.com	
Publicity: Mike Eytcheson*	(206) 364-5115	eytcheson at seanet.com	<i>See EAS website at:</i>
Newsletter co-editor Bill O'Neil	(774) 253-0747	woneil at u.washington.edu	<a href="http://members.tripod.com/everett_astronomy">http://members.tripod.com/everett_astronomy</a>
Web assistance: Cody Gibson	(425) 348-1608	sircody01 at email.msn.com	(change 'at' to @ to send email)

## EAS BUSINESS...

### RECAP OF LAST MEETING

The January meeting featured an update on the status of the two Mars Rovers, Spirit and Opportunity, with video of their development and journey to Mars, and images from the landing sites. NASA had just confirmed that the mineral hematite, usually associated with liquid water, had been found.

**NEXT EAS MEETING - SATURDAY FEBRUARY 28<sup>TH</sup> 7:00 PM  
- PROVIDENCE PACIFIC CLINIC (916 PACIFIC AVENUE)  
IN THE MONTE CRISTO ROOMS ON THE MAIN FLOOR.**

Map/directions to the meeting are available at: [http://members.tripod.com/everett\\_astronomy/directions\\_to\\_club\\_meeting\\_s.htm](http://members.tripod.com/everett_astronomy/directions_to_club_meeting_s.htm)

### Scheduled Meeting Dates:

**Feb 28<sup>th</sup> – EAS Meeting – 7:00 PM**  
 Mar 27<sup>th</sup> – EAS Meeting – 7:00 PM  
 Apr 17<sup>th</sup> – EAS Meeting – 7:00 PM  
 Apr 24<sup>th</sup> – Astronomy Day  
 May 22<sup>nd</sup> – EAS Mtg – (Bill Cook, Captain's on Optics) - 7PM  
 Jun 26<sup>th</sup> – EAS Meeting – 7:00 PM  
 Jul 14-17<sup>th</sup> – Table Mt. Star Party  
 Jul 31<sup>st</sup> – EAS Meeting – 7:00 PM  
 Aug 11-14<sup>th</sup> – Oregon Star Party  
 Aug 28<sup>th</sup> – EAS Meeting – 7:00 PM  
 Sep 17-18<sup>th</sup> – Sun Lakes Star Party  
 Sep 25<sup>th</sup> – EAS Meeting – 7:00 PM  
 Oct 30<sup>th</sup> – EAS Meeting – 7:00 PM  
 Nov 20<sup>th</sup> – EAS Meeting – 7:00 PM  
 Dec 11<sup>th</sup> – EAS Holiday Dinner

### MEMBER NEWS

There was general agreement at the meeting that the club should participate in the NASA Night Sky Network program, which helps increase outreach activities to the public.

### FINANCIAL HEALTH

The club maintains a \$700+ balance. We try to keep approximately a \$500 balance to allow for contingencies. We have tried unsuccessfully to get a waiver from the hospital for their increased charges for the use of the room (now \$45/mo). And 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 STAR PARTY INFO

**Upcoming star party schedule: None scheduled until spring.** 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.

### 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

#### February 2004

Feb 26 - Moon Occults Mars

**Feb 28 - EAS Meeting - Providence Pac. Hospital – 7:00 PM**

#### March 2004

Mar 04 - Jupiter At Opposition

Mar 20 - Vernal Equinox, 06:49 UT

Mar 25 - Moon Occults Mars

Mar 28 - Daylight Saving - Set Clock Ahead 1 Hour (Europe)

Mar 29 - Mercury Greatest Eastern Elongation (19 Degrees)

Mar 29 - Venus Greatest Eastern Elongation (46 Degrees)

**Mar 31 - EAS Meeting - Providence Pac. Hospital – 7:00 PM**

### 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.

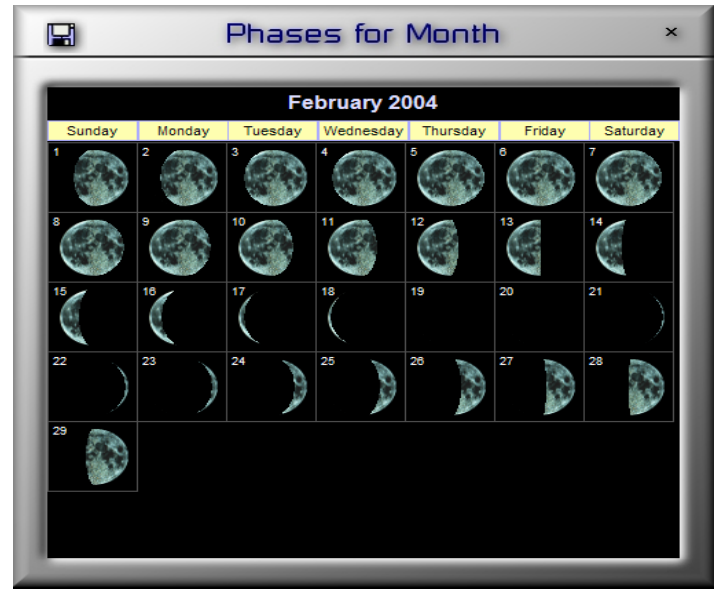
### MEMBERSHIP BENEFITS & INFORMATION

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 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



Feb 06	Full Moon
Feb 13	Last Quarter Moon
Feb 20	New Moon
Feb 27	First Quarter Moon
Mar 06	Full Moon
Mar 13	Last Quarter Moon
Mar 20	New Moon
Mar 28	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](http://www.lpi.usra.edu/research/lunar_orbiter)

### UP IN THE SKY -- THE PLANETS

Object	Rises	Transits	Sets	Constellation
Sun	7:00 am	12:22	17:45	Aquarius
Mercury	Daylight	Daylight	Daylight	Aquarius
Venus	Daylight	Daylight	21:41	Pisces
Mars	Daylight	19:32	23:57	Aries
Jupiter	18:23	1:02 am	Daylight	Leo
Saturn	Daylight	20:19	4:15 am	Gemini
Uranus	Daylight	Daylight	Daylight	Aquarius
Neptune	6:12 am	Daylight	Daylight	Capricornus
Pluto	2:24 am	Daylight	Daylight	Serpens

(times local time for Everett PST)

### 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>

### Pacific Science Center Space Lecture Series

**Dr. Steven Lee - "New Views of Mars - The History and Future of Mars Exploration"**

**Saturday, March 6, 2004 - 2 p.m. (Adobe Laser Dome)**

Dr.Lee's presentation will give an overview of how earlier telescopic and spacecraft observations have been used to explore the planet Mars, and will discuss what new Hubble Space Telescope, Pathfinder, Mars Global Surveyor, and Mars Odyssey data are revealing about conditions on Mars at present. The future of Mars exploration will be discussed, including previews of the missions currently en route to Mars, those planned for the coming decade, and plans for eventual human exploration of the Red Planet.

**Paul Hodge, author of "Higher Than Everest"**  
**Saturday, April 3, 2004 - 2 p.m.** (Adobe Laser Dome)

**Lynn Moroney, Chickasaw Storyteller - "Science Story"**  
**Saturday, May 1, 2004 - 2 p.m.** (Adobe Laser Dome)

Through "Science Story" Lynn Moroney explains how and why stories have been used to teach people about the world, and the place of story in astronomy and other space sciences. Long before we went into space, it was the stories, that helped us wonder about the universe and even today they invite us to wonder and spark our curiosity. Space isn't just for scientists, rather the arts help us "know" the world, and when we blend the two, we can have a richer understanding of the universes and ourselves.

**SPACE: A Journey To Our Future**, is open now through May 9, 2004. In an immersive exhibit experience, SPACE celebrates the past, present and the future of space exploration and discovery. For more information visit [www.spaceexhibit.com](http://www.spaceexhibit.com).

#### 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

**LEO MINOR:** The Lion Cub, as this small constellation is also known, borders on the constellations of Leo, Lynx, and Ursa Major, and ranks 52<sup>nd</sup> in overall brightness among the constellations, containing 15 stars brighter than magnitude 5.5. Its central point is located at RA=10h,11m and Dec.= +32.5 degrees. It is completely visible from latitudes North of -48 degrees, and completely invisible from latitudes South of -67 degrees; this constellation ranks 64<sup>th</sup> in overall size among the 88 official constellations. Leo Minor's only named star is Praecipua, and the nearest star to Earth within the borders of this constellation is the 11-Leo Minor A-B system, lying at 29.91 light years distance from Earth, with an absolute magnitude of 5.6 and 13.2 (for components A and B respectively; the apparent magnitudes are 5.4 and 13.0 respectively); this system is listed among the 200 nearest stars or star systems to Earth, coming in at number 157. Leo Minor has one associated meteor shower: the Leonis (or Leo) Minorids (24 Oct.), with a radiant of 10h48m and +37 degrees; its ZHR (zenithal hourly rate ) is low at 3. Leo Minor has no associated Messier objects. Leo Minor does have two relatively well known galaxies available to smaller scopes and amateur astronomers under good conditions. NGC-3344 is a magnitude 10.4 face-on spiral, measuring 6.0' x 5.1' across (an 8-inch scope can show a soft glow surrounding a stellar-like nucleus); NGC-3486 is a multi-armed spiral measuring 5.5' x 4.2', with a magnitude of 10.8, and it can appear in a similar telescope as a circular haze but with little additional detail of its central

areas. There is also a well-known interacting pair of galaxies: NGC-3395 and NGC-3396. NGC-3395 is a 12.4 magnitude elongated Sc spiral, measuring 1.4' x 0.8', which Burnham states is considerably bright for being so small; NGC-3396 is classified as a 12.8 magnitude, somewhat elongated hybrid between an irregular and barred spiral galaxy, measuring 1.0' x 0.5' across. This interacting pair, which telescopically looks like a puffy reverse 'S' attached by a thin, faint cloud bridge to a somewhat smaller cumulus-looking cloud, is separated by 1.7'. Leo Minor also has several double and multiple star systems (such as F.G.W. Struve #'s 1344, 1374, 1375, 1405, 1406 and 1492; as well as Herschel 475 and 2517; Aitken 2142; and Hussey 631, 634 and 875). This small but jam-packed constellation also contains some well-known variable stars, such as R-Leonis Minoris (a long-period variable, with a visual magnitude variability from 6.3 to fainter than 13.0, a 372 day period, and spectral class varying from M7e to M8e), and U-Leonis Minoris (a semi-regular variable with a visual magnitude from 9.8 to fainter than 13.0, a 272 day period, and a spectral class of M6e). On a clear night in a dark location this winter, see if you can find some of these wonders in the constellation of Leo Minor.

**VOLANS:** "The Flying Fish" as this constellation is also known, borders on the constellations of Carina, Chamaeleon, Dorado, Mensa, and Pictor, and lies near the Large Magellanic Cloud. It ranks 19<sup>th</sup> in overall brightness among the constellations, and contains 14 stars brighter than magnitude 5.5, the brightest ones of which are 3<sup>rd</sup> magnitude. Its central point is located at RA=7h48m and Dec.= -69.5 degrees. It is completely visible from latitudes South of + 15 degrees, and completely invisible from latitudes North of +26 degrees. This constellation ranks 76<sup>th</sup> in overall size, taking up 141.35 square degrees, or 0.343% of the sky. Volans has no known meteor showers and no Messier objects; it also has no associated asterisms. Its midnight culmination date is January 18<sup>th</sup>, and its solar conjunction date is July 19<sup>th</sup>. Volans is one of 11 constellations invented by Keyser and de Houtman, during the years 1595-7. Volans contains many double and multiple star systems; an example of the latter is Theta Volantis (Herschel #4134), which has visual magnitudes ranging from 5.5 to 10; the constellation also contains several variable stars (most notably M-type long period variables (LPV)), such as R Volantis, which has a period of 448 days, a visual magnitude variability of 8.7 to 13.9, and a spectral type of M(e), indicating bright hydrogen lines (common in many M-type variables). Finally, Volans also contains some notable galaxies within its confines: these include NGC-2397 (barred spiral (SBa), with visual magnitude of 12.8); NGC-2434 (elliptical (E1), also with visual magnitude of 12.8); and NGC-2442 (barred spiral (SBb), with visual magnitude of 11.8). If you are fortunate enough to travel to the Southern Hemisphere some day and to outline the constellation of the "Flying Fish", try to discover these lesser-known astronomical wonders for yourself!

**MONOCEROS:** Monoceros, or the Unicorn, is an interesting constellation which borders on many of our familiar winter star groupings, including Orion, Canis Major and Minor, Gemini, Hydra, Lepus, and Puppis. The constellation's central point is at RA=7h01m, and Dec.=+0.5 degrees; its overall brightness is listed at a magnitude of 7.476, and it contains 36 visible stars brighter than magnitude 5.5. Its midnight culmination date is January 5<sup>th</sup>, which makes it well placed for winter observing, and the grouping has one associated meteor shower (the Monocerotids), which peak on or about December 10<sup>th</sup>. This constellation ranks 35<sup>th</sup> in size, and is completely visible from latitudes +79 degrees to -78 degrees. Monoceros also contains one Messier object, M-50, which is a magnitude 6.3 galactic

(open) cluster. Perhaps more famous than the Messier object however, are a trio of objects well known to many astronomers. The first is Plaskett's Star, which is in reality a pair of extremely massive stars, among the most massive pairs yet identified. This duo sits almost directly on the Galactic Equator, and the total mass of the system is more than 100 times that of the sun. Also in Monoceros is "Hubble's Variable Nebula", a fan-shaped reflection nebula which has been seen to undergo changes in brightness, size, and shape, (but no regular period of variability has been found for the nebula). It is illuminated by the star R Monocerotis, a very young infrared-emitting stellar object surrounded by a disk of dust which is ejecting a bi-polar flow; this flow causes the variability in the nebula. Lastly, and most famous of all, is the beautiful emission nebula known as the Rosette. It surrounds an open cluster of stars containing the star 12 Monocerotis, and is an H-II region heated and ionized by this centrally located group of hot young stars. Try to enjoy the beauties of this well-placed constellation during these winter months; your time will be well spent.

### YOUNG ASTRONOMER'S CORNER

The Young Astronomer's Corner has in the past been published in a question and answer format. The purpose of this periodic feature is to answer some common and familiar questions heard frequently in astronomy circles and classrooms. So, we hope to answer some of your astronomy-related questions in this manner. If not, let us know what your questions are (by calling or e-mailing an Officer or the Newsletter co-editor for example), and we will do our best to answer them for you!

**QUESTION:** *Can you see a Constellation through a telescope?*

**ANSWER:** No. When an observer peers through a telescope, he or she will only see a few stars in a small area of the sky, a much smaller area than that taken up by the constellation, even the smaller constellations. Stars within the borders of a constellation are spread across much larger portions of the sky than can be seen through the telescope's eyepiece.

**QUESTION:** *Do astronomers study the Constellations?*

**ANSWER:** Not exactly. Constellations have been used for centuries to navigate the globe (especially in the old seafaring days of Columbus and Magellan), and to tell stories about the cultures of different societies, such as those of the ancient Greeks and Arabs. But Constellations are in effect large, unreal figures in the sky that *sometimes* look like the objects they are portraying (such as Leo the Lion or Delphinus the Dolphin), but more often do not. Astronomers don't study large mythical or unreal figures!! But they DO study the stars, groups of stars, galaxies, clusters, and other celestial objects contained within the classic outlines of each of the 88 Constellations. That is, astronomers study specific objects in the sky, not patterns or outlines of stars in the sky. Finally, there is a coordinate system (similar to latitude and longitude on Earth) used by astronomers to find objects in the sky, as well as more sophisticated methods of navigation (such as satellites, radio, and GPS), so that Constellations are no longer critical for these purposes. However, *and importantly*, Constellations remain a SUPERB AND EXCELLENT way for ANYBODY OF ANY AGE to learn about the sky and the locations of objects (as well as older mythologies), and they will ALWAYS be valuable to this end.

**QUESTION:** *Could a person travel through a black hole?*

**ANSWER:** No WAY!!! Remembering that humans haven't even traveled to another planet yet (!!...our own Moon yes... another planet no!!.....and definitely not to another star system similar to that of the Sun!), any person even *near* a black hole would be

killed by many things even before reaching it!! Within a few hundred miles of a black hole, the very strong gravity forces would rip any living object apart. Very strong X-ray sources from around the black hole would cook you, and the surrounding heat would melt even the strongest and toughest of metals. So then, after a living creature or object was ripped apart, cooked, and liquefied, whatever remained would be slurped into the black hole forever!!! Not a very pretty picture, we're afraid!!!!

### PLANETARY FOCUS

"Planetary Focus" is a periodic column that is published bi-monthly in the EAS "Stargazer". It last published in January; it will return next month.

### 'ASTRONOMY & TELESCOPE LINGO'

**ASTRONOMY LINGO: GREEN FLASH:** Also a meteorological phenomenon, the green flash is a flash of green light which may be seen near the upper rim of a rising or setting sun. When the sun is near the horizon, its light penetrates a thicker section of atmosphere (with more particles in the atmosphere to refract light); this thicker part of the atmosphere refracts sunlight, with purple and blue light bending the most, and red the least. Because of this refraction or bending, more blue light should appear along the top rim of the sun. However, because the atmosphere also selectively scatters blue light, very little of this wavelength reaches us, and we see green light (or the green flash) instead. Under certain atmospheric conditions (such as when the surface air is hot or when an upper level inversion exists), the green flash is magnified by the atmosphere, making the flash momentarily visible. The green flash usually lasts about a second, but can last longer in polar regions of Earth's atmosphere, where the sun slowly changes in elevation. Indeed, it has been documented in one of Admiral Byrd's southern expeditions that the green flash was observed for a total of 35 minutes (!!) one September, as the sun very slowly rose above the horizon, marking the end of the long winter!

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

**ASTRONOMY LINGO: EPIMETHEUS:** A small, irregularly shaped satellite of Saturn, co-orbital 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

### 'ASTRONOMY FUN FACTS'

★★ One of the greatest mountains in the solar system lies in the eastern Ishtar Terra highlands on Venus; it is known as Maxwell Montes. It is almost 35,000 feet above the "plain" level of Venus (an imaginary sphere with the planet's average radius of 3,758 miles), and is almost 1.2 miles (~2 kilometers) higher than Mt. Everest on Earth. The Maxwell mountain region is very rough terrain, the roughest on Venus according to Pioneer -Venus measurements. This spacecraft also discovered a dark feature on the eastern slopes of Maxwell Montes, with a diameter of

about 60 miles and a depth of about 3,000 feet; this is believed to be a volcanic crater almost 3 times larger than the largest caldera on Earth. About nine cities the size of New York could fit at the bottom of this massive cone crater.

★★ With its slow rotation and fast orbit, there are 1.5 days in every Mercury year; 6.2 Mercury days in every Earth year, and just over 4 Mercury years in every Earth year. In practical terms, this means for example that men from Earth first landed on Earth's moon about 200 Mercury days ago, and that one U.S. presidential term lasts only about 25 Mercury days.

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

★★ A baseball hit on the surface of the asteroid Eros would reach escape velocity immediately. It would go into orbit around the sun, and would never come down!!

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

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

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

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

★★ The central regions of the Milky Way Galaxy are obscured from visual astronomers by almost 30,000 light-years' worth of interposing gas and dust. If one were to optically view the center of the Galaxy, it would be similar to viewing the Sun through clouds so dense that any sunlight which is able to penetrate would only give off 1,000<sup>th</sup> as much light as the full Moon. Looking at this another way, the light reduction would be similar to the attenuation effect that several thousand feet of ocean water would have on the Sun's light!

★★ Sirius B (a companion of the brightest star in all the sky after the Sun: Sirius) is the first white dwarf to be discovered, and lies at a distance from Earth of about 9 light-years. Even though smaller than Earth, all its matter weighs almost as much as the Sun... as a matter of fact, just a handful of its matter would weigh about 500 tons!

## "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. (Because of an editing problem last month that truncated this article, it is republished this month.)**

**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, traveling 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...

### OPPORTUNITY SEES TINY SPHERES IN MARTIAN SOIL

NASA's Opportunity has examined its first patch of soil in the small crater where the rover landed on Mars and found strikingly spherical pebbles among the mix of particles there. *"There are features in this soil unlike anything ever seen on Mars before,"* said Dr. Steve Squyres of Cornell University, principal investigator for the science instruments on the two Mars Exploration Rovers. For better understanding of the soil, mission controllers at NASA's Jet Propulsion Laboratory, Pasadena, Calif., plan to use Opportunity's wheels to scoop a trench to expose deeper material. One front wheel will rotate to dig the hole while the other five wheels hold still. The spherical particles appear in new pictures from Opportunity's microscopic imager, the last of 20 cameras to be used on the two rover missions. Other particles in the image have jagged shapes. *"The variety of shapes and colors indicates we're having particles brought in from a variety of sources,"* said Dr. Ken Herkenhoff of the U.S. Geological Survey's Astrogeology Team. The shapes by themselves don't reveal the particles' origin with certainty. *"A number of straightforward geological processes can yield round shapes,"* said Dr. Hap McSween, a rover science team member. They include accretion under water, but apparent pores in the particles make alternative

possibilities of meteor impacts or volcanic eruptions more likely origins, he said.

A new mineral map of Opportunity's surroundings, the first ever done from the surface of another planet, shows that concentrations of coarse-grained hematite vary in different parts of the crater. The soil patch in the new microscopic images is in an area low in hematite. The map shows higher hematite concentrations inside the crater in a layer above an outcrop of bedrock and on the slope just under the outcrop. Hematite usually forms in association with liquid water, so it holds special interest for the scientists trying to determine whether the rover landing sites ever had watery environments possibly suitable for sustaining life. The map uses data from Opportunity's miniature thermal emission spectrometer, which identifies rock types from a distance. *"We're seeing little bits and pieces of this mystery, but we haven't pieced all the clues together yet,"* Squyres said. Opportunity's Moessbauer spectrometer, an instrument on the rover's robotic arm designed to identify the types of iron-bearing minerals in a target, found a strong signal in the soil patch for olivine. Olivine is a common ingredient in volcanic rocks. A few days of analysis may be needed to discern whether any fainter signals are from hematite, said Dr. Franz Renz.

## RESEARCHERS FIND FARTHEST KNOWN GALAXY IN THE UNIVERSE

The farthest known object in the universe may have been discovered by a team of astrophysicists using the Keck and Hubble telescopes. The object, a galaxy behind the Abell 2218 cluster, may be so far from Earth that its light would have left when the universe was just 750 million years old. The discovery demonstrates again that the technique known as gravitational lensing is a powerful tool for better understanding the origin of the universe. Via further applications of this remarkable technique, astrophysicists may be able to better understand the mystery of how the so-called "Dark Ages" came to an end. According to Caltech astronomer Jean-Paul Kneib, who is the lead author reporting the discovery, the galaxy is most likely the first detected close to a redshift of 7.0, meaning that it is rushing away from Earth at an extremely high speed due to the expansion of the universe. The distance is so great that the galaxy's ultraviolet light has been stretched to the point of being observed at infrared wavelengths.

The team first detected the new galaxy in a long exposure of the Abell 2218 cluster taken with the Hubble Space Telescope's Advanced Camera for Surveys. Analysis of a sequence of Hubble images indicate a redshift of at least 6.6, but additional work with the Keck Observatory's 10-meter telescopes suggests that the astronomers have found an object whose redshift is close to 7.0. Redshift is a measure of the factor by which the wavelength of light is stretched by the expansion of the universe. The greater the shift, the more distant the object and the earlier it is being seen in cosmic history. *"As we were searching for distant galaxies magnified by Abell 2218, we detected a pair of strikingly similar images whose arrangement and color indicated a very distant object,"* said Kneib. *"The existence of two images of the same object indicated that the phenomenon of gravitational lensing was at work."* The key to the new discovery is the effect the Abell 2218 cluster's gigantic mass has on light passing by it. As a consequence of Einstein's theory of relativity, light is bent and can be focused in a predictable way due to the warpage of space-time near massive objects. In this case the phenomenon actually magnifies and produces multiple images of the same source. The new source in Abell 2218 is magnified by a factor of 25. The role of gravitational lensing as a useful phenomenon in cosmology was first pointed out by the Caltech astronomer Fritz

Zwicky in 1937, who even suggested it could be used to discover distant galaxies that would otherwise be too faint to be seen. *"The galaxy we have discovered is extremely faint, and verifying its distance has been an extraordinarily challenging adventure,"* Kneib added. *"Without the magnification of 25 afforded by the foreground cluster, this early object could simply not have been identified or studied in any detail with presently available telescopes. Indeed, even with aid of the cosmic lens, our study has only been possible by pushing our current observatories to the limits of their capabilities."* Using the unique combination of the high resolution of Hubble and the magnification of the cosmic lens, the researchers estimate that the galaxy is small--perhaps measuring only 2,000 light-years across--but forming stars at an extremely high rate. An intriguing property of the new galaxy is the apparent lack of the typically bright hydrogen emission seen in many distant objects. Also, its intense ultraviolet signal is much stronger than that seen in later star-forming galaxies, suggesting that the galaxy may be composed primarily of massive stars. *"The unusual properties of this distant source are very tantalizing because, if verified by further study, they could represent those expected for young stellar systems that ended the dark ages,"* said Richard Ellis, a coauthor. The term "Dark Ages" was coined by the British astronomer Sir Martin Rees to signify the period in cosmic history when hydrogen atoms first formed but stars had not yet had the opportunity to condense and ignite. Nobody is quite clear how long this phase lasted, and the detailed study of the cosmic sources that brought this period to an end is a major goal of modern cosmology. The team plans to continue the search for additional extremely distant galaxies by looking through other cosmic lenses in the sky. *"Estimating the abundance and characteristic properties of sources at early times is particularly important in understanding how the Dark Ages came to an end,"* said Mike Santos, a former Caltech graduate student involved in the discovery and now a postdoctoral researcher. *"We are eager to learn more by finding further examples, although it will no doubt be challenging."*

## OXYGEN AND CARBON DISCOVERED IN EXOPLANET ATMOSPHERE "BLOW OFF"

An international team of astronomers has for the first time detected oxygen and carbon in the atmosphere of a planet beyond our solar system. Hydrogen gas flowing out from the planet at near-sonic speed is dragging heavier oxygen and carbon up from the lower atmosphere like dust in a whirlwind. Oxygen and carbon atoms surround the planet in an extended envelope. This tells scientists they for the first time are seeing a planet "blow off" its atmosphere. Some argue that early Venus and Earth may have lost their original atmospheres by the same kind of stunning hydrodynamic outflow. The planet is a hot Jupiter-like planet 150 light years away, orbiting star HD 209458 in the Pegasus constellation. It is unique among extrasolar planets because its orbit crosses in front of a star close and bright enough to be observed. The planet revolves completely around its star every 3 and 1/2 days, partly eclipsing its star during each 3-hour transit, or pass across the face of the star. Astronomers led by Alfred Vidal-Madjar of the Institut d'Astrophysique de Paris, used the Hubble Space Telescope for observations of the planet, called HD 209458b, in October and November 2003. They used Hubble's sensitive ultraviolet spectrograph to probe the structure and chemical make-up of the planet's atmosphere during the transits. Such observations can only be made from space because Earth's ozone layer filters out UV light. *"In some ways our discovery of oxygen and carbon is not so surprising,"* said Gilda Ballester of the University of Arizona Lunar and Planetary Laboratory, a member of the team. *"These are common species which have been identified in the lower atmospheres of our jovian planets,*

bound up in molecules such as methane and water. "What's key here is that we have detected oxygen and carbon in atomic form and in the outermost layers of the planet where we would not normally expect them," Ballester said. "These species are 10 times heavier than hydrogen atoms, so a force stronger than gravity is driving them up along with the hydrogen gas into the very extended envelope around the planet." Vidal-Madjar discovered in earlier Hubble Space Telescope observations that the planet has a huge hydrogen atmosphere. The planet's visible disk eclipses 1.5 percent of its star during a transit, Ballester said. But its expansive upper atmosphere covers between 8 and 15 percent of the star. When the astronomers saw UV absorption signatures of oxygen and ionized carbon in the planet's inflated upper atmosphere, they knew it was produced in an atmospheric blow off. Planet HD 209458b is only 4 million miles away from its star, so its lower atmosphere is already extremely hot, around 1,800 degrees Fahrenheit (1,000 degrees Celsius). Ultraviolet light adds a lot of energy to the planet's upper atmosphere, heating it up to around 18,000 degrees Fahrenheit (10,000 degrees Celsius). Ultraviolet light also splits gas molecules into atoms and ions. Absorbed UV light is also what produces the kinetic energy that fuels the planet's explosive gas outflow. Team member Jack McConnell had theorized that at such high temperatures, hydrogen atoms in the upper atmosphere would reach speeds great enough to escape the planet's gravity, which is comparable to Earth's gravity. And as the hydrogen atoms flowed out from the planet at near sonic speed, they would drag heavier oxygen and carbon atoms in the atmosphere up with them, called blow off. The team also observed that the planet is so close to its star that the combined gravity fields of the star and the planet shape its upper atmosphere into the form of a rugby ball, allowing even more gas to escape. Vidal-Madjar is among those who speculate that early Venus, Earth, and perhaps Mars lost their original atmospheres this way. "It's exciting that we found what we proposed we would find in observing the planet in the UV with the Hubble Space Telescope," Ballester said.

### MASSIVE OLD STAR REVEALS SECRETS ON DEATHBED

Like a doctor trying to understand an elderly patient's sudden demise, astronomers have obtained the most detailed observations ever of an old but otherwise normal massive star just before and after its life ended in a spectacular supernova explosion. Imaged by the Gemini Observatory and Hubble Space Telescope (HST) less than a year prior to the gigantic explosion, the star is located in the nearby galaxy M-74 in the constellation of Pisces. These observations allowed a team of European astronomers led by Dr. Stephen Smartt to verify theoretical models showing how a star like this can meet such a violent fate. The results provides the first confirmation of the long-held theory that some of the most massive (yet normal) old stars in the Universe end their lives in violent supernova explosions. "It might be argued that a certain amount of luck or serendipity was involved in this finding," said Dr. Smartt. "However, we've been searching for this sort of normal progenitor star on its deathbed for some time. I like to think that finding the superb Gemini and HST data for this star is a vindication of our prediction that one day we had to find one of these stars in the immense data archives that now exist." During the last few years, Smartt's research team has been using the most powerful telescopes, both in space and on the ground, to image hundreds of galaxies in the hope that one of the millions of stars in these galaxies will some day explode as a supernova. In this case, the renowned Australian amateur supernova hunter, Reverend Robert Evans, made the initial discovery of the explosion (identified as SN203gd) while scanning galaxies with a 12-inch (31cm) backyard telescope from his home in New South Wales, Australia

in June, 2003. Following Evans' discovery, Dr. Smartt's team quickly followed up with detailed observations using the Hubble Space Telescope. These observations verified the exact position of the original or "progenitor" star. Using this positional data, Smartt and his team dug through data archives and discovered that observations by the Gemini Observatory and HST contained the combination of data necessary to reveal the nature of the progenitor. The Gemini data was obtained during the commissioning of the Gemini Multi-Object Spectrograph (GMOS) on Mauna Kea, Hawaii in 2001 and were also used to produce a stunning high-resolution image of the galaxy that clearly shows the red progenitor star.

Armed with the earlier Gemini and HST observations Smartt's team was able to demonstrate that the progenitor star was what astronomers classify as a normal red supergiant. Prior to exploding, this star appeared to have a mass about 10 times greater, and a diameter about 500 times greater than that of our Sun. If our sun were the size of the progenitor it would engulf the entire inner solar system out to about the planet Mars. Red supergiant stars are quite common in the universe and an excellent example can be easily spotted during January from almost anywhere on the Earth by looking at Betelgeuse, the bright red shoulder star in the constellation of Orion. Like SN2003gd, it is believed that Betelgeuse could meet the same explosive fate at any time from next week to thousands of years from now. After SN2003gd exploded, the team observed its gradually fading light for several months using the Isaac Newton Group of telescopes on La Palma. These observations demonstrated that this was a normal type II supernova, which means that the ejected material from the explosion is rich in hydrogen. Computer models developed by astronomers have long predicted that red supergiants with extended, thick atmospheres of hydrogen would produce these type II supernovae but until now have not had the observational evidence to back up their theories. However, the fantastic resolution and depth of the Gemini and Hubble images allowed the Smartt team to estimate the temperature, luminosity, radius and mass of this progenitor star and reveal that it was a normal large, old star. "The bottom-line is that these observations provide a strong confirmation that the theories for both stellar evolution and the origins of these cosmic explosions are correct," said co-author Seppo Mattila. This is only the third time astronomers have actually seen the progenitor of a confirmed supernova explosion. The others were peculiar type II supernovae: SN 1987A, which had a blue supergiant progenitor, and SN 1993J, which emerged from a massive interacting binary star system <http://hubble.esa.int/science-e/www/object/index.cfm?fobjectid=34455>

Dr. Smartt concludes, "Supernova explosions produce and distribute the chemical elements that make up everything in the visible Universe -- especially life. It is critical that we know what type of stars produce these building blocks if we are to understand our origins." Archived Gemini and HST data was critical to the success of this project. "This discovery is a perfect example of archival data's immense value to new scientific projects," said Dr. Colin Aspin, the scientist responsible for the development of the Gemini Science Archive (GSA). He continued, "this discovery demonstrates the spectacular results that can be realized by using archival data and stresses the importance of developing the GSA for future generations of astronomers." The Gemini Multi-Object Spectrograph (GMOS) used to make the Gemini observations are twin instruments primarily designed for spectroscopic studies where several hundred simultaneous spectra are required, such as when

observing star and galaxy clusters. GMOS also has the ability to focus astronomical images on its array of over 28 million pixels.

The Isaac Newton Group of Telescopes (ING) is the 4.2 meter William Herschel Telescope, the 2.5 meter Isaac Newton Telescope, and the 1.0 meter Jacobus Kapteyn Telescope. The telescopes are located in the Spanish Roque de Los Muchachos Observatory on La Palma. Supernovae are among the most energetic phenomena observed in the entire Universe. When a star of more than about eight times the mass of our Sun reaches the end of its nuclear fuel reserve, its core is no longer stable from collapsing under its own immense weight. As the core of the star collapses, the outer layers are ejected in a fast-moving shock wave. This huge energy release results in a supernova that is about one billion times brighter than our Sun, and is comparable to the brightness of an entire galaxy. After destroying itself, the core of the star becomes either a neutron star or a black hole.

The Gemini Observatory consists of two identical 8-meter telescopes. The Gillett Gemini Telescope is located on Mauna Kea, Hawai'i (Gemini North) and the Gemini South telescope is located on Cerro Pachón in central Chile (Gemini South), and thus provide full coverage of both hemispheres of the sky. Both telescopes incorporate new technologies that allow large, relatively thin mirrors under active control to collect and focus both optical and infrared radiation from space. Images are available at [http://www.gemini.edu/media/images\\_2004-2.html](http://www.gemini.edu/media/images_2004-2.html)

#### **A FAILED STAR IS BORN; THE ORIGINS OF BROWN DWARFS**

In cosmic circles, brown dwarfs are something of a flop. Too big to be considered true planets, yet not massive enough to be stars, these free-floating celestial bodies are, in fact, sometimes referred to as failed stars. But do they really form as stars do -- from collapsing clouds of gas -- or are their origins completely different? A series of publications by astronomer Ray Jayawardhana and collaborators, offers evidence that brown dwarfs and Sun-like stars are born in much the same way. *"They at least have very similar infancies, which may mean that they also have very similar origins,"* said Jayawardhana. Stars form in cold clouds of gas and dust in interstellar space. Dense clumps within these clouds contract under their own gravity, spinning up in the process and gathering material from the surroundings into a disk. Eventually, if a growing protostar accumulates enough mass, its core becomes hot and dense enough for nuclear fusion to occur, and the new star begins to shine. Some scientists have suggested that brown dwarfs form the same way but simply don't accumulate enough mass to ignite hydrogen fusion, and calculations show that it's at least theoretically possible for objects with masses as low as those of brown dwarfs to be born this way. But other scientists have proposed that brown dwarfs are runts kicked out of stellar litters. In this scenario, brown dwarfs are born in multiple star systems and compete with their siblings for matter from the natal cloud. In such systems, the slowest-growing object may be ejected before it gathers enough material to become a star, computer simulations suggest. One way to distinguish between the two possibilities is by studying disks of dust and gas around young brown dwarfs. If brown dwarfs form as stars do, they should have large, long-lived accretion disks like those found around young stars. But if they have been ejected from multiple star systems, their disks should be shaved down by the gravitational interactions that lead to ejection. Jayawardhana and colleagues searched for dusty disks around young brown dwarfs by observing their infrared emission with the 8-meter Very Large Telescope (VLT) of the European Southern Observatory in Chile and the 10-meter Keck I telescope in Hawaii. Because dust particles in a disk absorb light and re-radiate the energy at infrared wavelengths, a brown dwarf with a

disk will emit more infrared light than one without a disk. *"We found that the majority of brown dwarfs are surrounded by dusty disks at an age of a million years or so,"* said Jayawardhana. *"That's similar to young stars at the same age."* Although it's not possible to directly determine the disks' sizes, their presence around some brown dwarfs as old as 10 million years suggests that they aren't pared away in early life. Other spectroscopic observations, using the twin 6.5-meter Magellan telescopes in Chile and the Keck I telescope, showed that brown dwarfs also accrete material from surrounding disks the same way as stars do -- although at a slower pace. *"We detect telltale signs of gas flowing from the inner edge of the disk onto the brown dwarf at velocities of over a hundred kilometers per second,"* said Jayawardhana. In one intriguing case, astronomers have also found evidence of material spewing out from the poles of a brown dwarf. Such jets have been seen in young stars of the same age, but not until now in brown dwarfs. *"If confirmed, the presence of jets would further strengthen the case for remarkably similar infancies for brown dwarfs and Sun-like stars,"* said Jayawardhana. *"I wouldn't say that the story is signed, sealed and delivered,"* Jayawardhana said, *"but the preponderance of evidence is very much leaning in the direction of these things forming the same way as stars."* And the evidence uncovered so far leads to even more tantalizing prospects. *"Now that we know many young brown dwarfs are surrounded by disks,"* he said, *"I can't help but wonder if comets and asteroids -- if not small planets -- could form in these disks."*

#### **WEB SITE BRINGS MARS EXPLORATION TO DESKTOPS**

JPL is enhancing the availability of all Mars rover images for students and the public by distributing them via the Internet. The images can be viewed on the NASA Web site at <http://marsrovers.jpl.nasa.gov> as well as the educational Web site MarsQuest Online at <http://www.marsquestonline.org/mer>

The sites allow anyone with an Internet connection to participate in the adventure of Mars exploration. MarsQuest Online is making the full set of images from Spirit and Opportunity available for public viewing, along with daily updates, in an integrated exploration and education environment. The site is a powerful example of inquiry-based learning and public engagement in the thrill of exploration and discovery. Dr. Eric De Jong of JPL heads the Science Data Visualization and Modeling team that produces images of the rovers and the Martian surface. He's also the co-principal investigator for MarsQuest Online. *"This is NASA's vision of 21st century exploration through the Internet, a shared experience of scientists, students and the public. The rovers' eyes are our eyes, and MarsQuest Online puts these eyes on your desktop."* MarsQuest Online enables the public, educators and students to gain a sense of what it's like to explore another world. According to Principal Investigator Daniel Barstow, MarsQuest Online was created *"to provide the public with a highly engaging and interactive experience while learning about Mars by directly exploring it, just as the scientists do."* Students are able to learn more about the red planet by examining the most recent panoramic views of the two landing sites and the images of rocks and soil investigated by the instruments on the rovers' robotic arms. They can also follow the progress of the twin robotic field geologists as they navigate around the Martian surface. Students will learn information about Mars and the search for water through an array of learning activities, such as an interactive feature that allows users to control 3-D virtual flyovers of prominent Martian landform features. These activities support key elements of the National Science Education Standards, including core concepts of Earth and space science. Adults will appreciate the site, with its daily updates and its intuitive point-and-click interface. Each image is visually organized so novice and expert users can easily

navigate across the Martian landscape through the eyes of the rovers. The site also provides current news about important scientific findings. MarsQuest Online extends the power of NASA's very popular Mars Web site to offer a more in-depth exploration environment for the images. *"The design of MarsQuest Online is based on extensive research on the most effective methods of using images and visualizations as tools by students and the general public,"* said Barstow. He emphasized that *"research findings show that most people can grasp concepts more quickly and intuitively by interacting with visual imagery than by simply reading text. With MarsQuest Online, students experience authentic science, venturing into the unknown, asking questions and pursuing answers."*

### SCIENTISTS WATCH "MOVIE" OF NEUTRON STAR EXPLOSION IN REAL TIME

A neutron star halfway across the Milky Way galaxy is ready for its close-up. A rare and massive explosion on this star illuminated the region and allowed scientists to view details never seen before, virtually bringing the scientists to the action occurring just a few miles above the star's surface. Scientists at NASA and the Canadian Institute for Theoretical Astrophysics (CITA) was captured second-by-second action in movie-like fashion through spectroscopy with NASA's Rossi X-ray Timing Explorer. A neutron star is the dense, core remains of an exploded star at least eight times more massive than the sun. The neutron star contains about a sun's worth of mass packed in a sphere only about 10 miles (16 kilometers) in diameter. Often neutron stars are in binary (two-star) systems. Gas from the nearby companion star can funnel towards the neutron star, attracted by the star's strong gravity. The gas spirals toward the neutron star like water going down a drain, forming what scientists call an accretion disk. *"This is the first time we have been able to watch the inner regions of an accretion disk, in this case literally a few miles from the neutron star's surface, change its structure in real time,"* said Dr. David Ballantyne. *"Accretion disks are known to flow around many objects in the universe, from newly forming stars to the giant black holes in distant quasars. Details of how such a disk flows could only be inferred up to now."* Under normal conditions, accretion disks appear far too minute to resolve with even the most powerful telescopes.

The explosion occurred on a neutron star named 4U 1820-30, 25,000 light years from Earth. It poured out more energy in three hours than the sun does in 100 years. The region was illuminated in such a way, the scientists could see details as fine as the accretion disk buckling from the explosion and then slowly recovering its original form after approximately 1,000 seconds. Such explosions are the result of accretion. As matter from the companion star crashes down on the neutron star, it builds up a 10 to 100 yard layer of material comprised mostly of helium. The fusion of the helium into carbon and other heavier elements releases enormous energy and powers a strong burst of X-ray light, far more energetic than visible light. Such bursts can occur several times a day on a neutron star and last for about 10 seconds.

Ballantyne and his colleague, Dr. Tod Strohmayer of NASA Goddard, observed a "superburst." These are much more rare than ordinary, helium-powered bursts and release 1000 times more energy. Scientists say superbursts are caused by a buildup

of nuclear ash in the form of carbon from the helium fusion. Current thinking suggests it takes several years for the carbon ash to build up to such an extent that it begins to fuse.

The superburst was so bright and long, it acted like a spotlight beamed from the neutron star surface onto the innermost region of the accretion disk. The X-ray light from the burst illuminated iron atoms in the accretion disk, a process called fluorescence. The Rossi Explorer captured the characteristic signature of the iron fluorescence, its spectrum. This, in turn, provided information about the iron's temperature, velocity and location around the neutron star. *"The Rossi Explorer can get a good measurement of the fluorescence spectrum of the iron atoms every few seconds,"* Strohmayer said. *"Adding up all this information, we get a picture of how this accretion disk is being deformed by the thermonuclear blast. This is the best look we can hope to get, because the resolution needed to actually see this action as an image, instead of spectra, would be a billion times greater than what the Hubble Space Telescope offers."*

The scientists said the bursting neutron stars serve as a laboratory to study accretion disks, which are seen (but in less detail) throughout the universe around nearby stellar black holes and exceedingly distant quasar galaxies. Stellar black holes with accretion disks do not produce X-ray bursts. Info and animation, <http://www.gsfc.nasa.gov/topstory/2004/0220stardisk.html>

### CENTRAL WASHINGTON ASTRONOMER-FRIENDLY LODGING OPPORTUNITY

*"Hello -*

*I live in Kent Washington, not a very good place to set up a telescope. But my family owns a place in the Moses Coulee of central Washington. The place is very remote and the night's sky is very black. We have a very large house with eight guest rooms. We use it ourselves much of the year but need to rent the place out some to select groups to help pay the bills. We have 200 acres of wildlife preserve with a private lake so most of our guests are nature lovers. Recently however a fellow showed up with a telescope and asked if he could setup as he thought we had perfect conditions. If your organization or some of its members are looking for a good place to meet and set-up we may have what you're looking for."*

*Thank you for your time,*

Mark Toland

mdnalot@msn.com

Our web site if you are interested is [www.whisperlaketelodge.com](http://www.whisperlaketelodge.com)

### 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.

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

### **In February's Stargazer:**

- \*\*\*\* **OBSERVER'S INFORMATION**
- \*\*\*\* **ASTRO CALENDAR**
- \*\*\*\* **CONSTELLATION OF THE MONTH**
- \*\*\*\* **YOUNG ASTRONOMER'S CORNER**
- \*\*\*\* **ASTRONOMY AND TELESCOPE "LINGO"**
- \*\*\*\* **ASTRONOMY FUN FACTS**
- \*\*\*\* **"MIRROR IMAGES"**
- \*\*\*\* **CENTRAL WASHINGTON ASTRONOMER-FRIENDLY LODGING OPPORTUNITY**
- \*\*\*\* **'OPPORTUNITY' SEES TINY SPHERES IN MARTIAN SOIL**
- \*\*\*\* **RESEARCHERS FIND FARTHEST KNOWN GALAXY IN THE UNIVERSE**
- \*\*\*\* **OXYGEN AND CARBON DISCOVERED IN EXOPLANET ATMOSPHERE "BLOW OFF"**
- \*\*\*\* **MASSIVE OLD STAR REVEALS SECRETS ON DEATHBED**
- \*\*\*\* **A FAILED STAR IS BORN; THE ORIGINS OF BROWN DWARFS**
- \*\*\*\* **WEB SITE BRINGS MARS EXPLORATION TO DESKTOPS**
- \*\*\*\* **SCIENTISTS WATCH "MOVIE" OF NEUTRON STAR EXPLOSION IN REAL TIME**

**The next EAS Meeting is 7:00 P.M. Saturday, February 28<sup>th</sup> at the Providence Pacific Clinic – 916 Pacific Avenue in Everett.**