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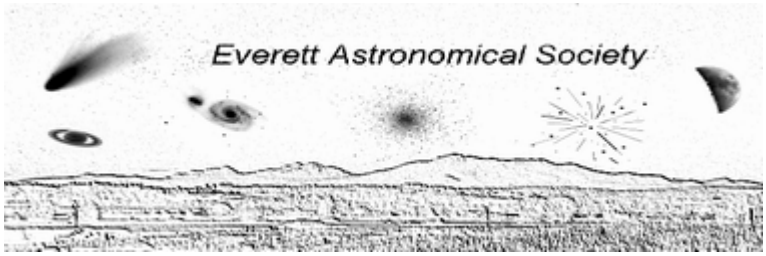
Volume MMVI. No. 9



The Stargazer

September 2006

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VP & Librarian: Mike Locke	(425) 259-5995	mlocke at lionmts.com	**P.O. Box 12746**
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Web assistance: Cody Gibson	(425) 348-1608	sircody01 at comcast.net	*See EAS website at:*
		(change 'at' to @ to send email)	http://members.tripod.com/everett_astronomy

EAS BUSINESS…

NEXT EAS MEETING - SATURDAY SEPTEMBER 23RD AT 3:00 PM AT THE EVERETT PUBLIC LIBRARY, IN THE AUDITORIUM (DOWNSTAIRS)

THIS MONTH'S MEETING PROGRAM:
The presentation will be **"Origins – part III – Where are the aliens?"** Mini-series with Neil Degrasse-Tyson.

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

2702 Hoyt Avenue
Everett, WA 98201

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

Next month's meeting will be Saturday October 21st at 3:00 pm, and the November meeting will be Tuesday November 14th at 6:30 pm

STAR PARTY INFO

Upcoming EAS star party schedule:

EAS member Ron Tam has offered a flexible opportunity to EAS members to come to his home north of Snohomish for observing on clear weekend evenings and for EAS starparties. Anyone wishing to do so needs to contact him in advance and confirm available dates, and let him know if plans change. "Our place is open for star parties any Saturday except weekends of the Full Moon. People can call to get weather conditions or to confirm that there is a star party. Our phone number is (360) 568-5152. They can e-mail me too (tam1951@nwlink.com) but I don't check my email daily. They can email me for directions if they never have been out here."

People should also join and send mail to the mail list *everett_astronomy@topica.com* to coordinate spur-of-the-moment observing get-togethers, on nights when the sky clears. We try to hold informal close-in star parties each month during the spring, summer, and fall months on a weekend near the New moon at a member's property or a local park. (call Mike Locke at (425) 259-5995 for info or check the EAS website.) Members contact Mike Locke for scope borrowing.

Sep 21-24 – 15th Annual Fall OAS Camp Delaney Star Party – Olympic Astronomical Society – Sun Lakes State Park – See OAS web site for advance sign-up.

Orion Nebula Star Party - Table Mountain Sep 29th & 30th.

We are going to go to Table Mountain Friday-Sunday Sept 29-Oct 1st - an unofficial 'Orion Nebula Star Party' on those dates. I still have some things to give out. Nothing big, I will bring snacks and movie player if it is cloudy. But no door prizes this year, and no t-shirts. The Big 29.5" scope is gone so only 13.1" will be there, but can find anything with it…

See you all then,
Jim Bielaga

360-333-7887 (cell/home if anyone needs me)
Jamesbielaga@aol.com

Other Western US Star Parties this season:

Sep 20-23 - The Enchanted Skies Star Party 2006
http://www.socorro-nm.com/starparty/ Socorro NM

Sep 22-24 - Klickatat September 2006 Star Party
http://klickitatstarparty.net/ Goldendale WA

Sep 22-24 - Craters Star Party -
Craters of the Moon National Monument, ID
http://www.boiseastro.org/

Sep 21-24 - Alberta Star Party 2006
http://calgary.rasc.ca/asp2006.htm

Sep 21-23 - California Star Party (CAS)
San Jose Astronomical Association 2
Lake San Antonio Park http://www.sjaa.net/

Oct 20-22 - Klickatat October 2006 Star Party
http://klickitatstarparty.net/ Goldendale WA

Oct 19-22 - Annual Nightfall (RTMC)
Riverside, CA

Nov 08 – RCA observing of the Mercury Transit
OMSI East Parking Lot, Portland OR
http://www.omsi.edu/visit/planetarium/starparties.cfm

$$ - Financial Health - $$

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

Club Scopes

Scope	Loan Status	Waiting
10-inch Club Dobsonian	On loan	No wait list
8-inch Dobsonian	Free	No wait list

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

Astro Calendar for 2006

September 2006

Sep 05 - Uranus at Opposition
Sep 07 - Partial Lunar Eclipse
Sep 08 - 40th Anniversary (1966), 1st Star Trek Episode on TV
Sep 22 - OAS Camp Delaney Star Party – Sun Lakes SP WA
Sep 23 - EAS Meeting – Saturday 23rd 3:00 pm – Everett Library
Sep 22 - Annular Solar Eclipse
Sep 23 - Autumnal Equinox (04:03 UT)
Sep 23 - Cassini, Titan Flyby
Sep 28 - Orion Star Party – Table Mountain near Ellensburg WA

October 2006

Oct 09 - Draconids Meteor Shower Peak
Oct 17 - Mercury at Greatest Eastern Elongation (25 Degrees)
Oct 21 - Orionids Meteor Shower Peak
Oct 21 - EAS Meeting – Saturday 21st 3:00 pm – Everett Library
Oct 29 - Daylight Saving - Set Clock Back 1 Hour

November 2006

Nov 03 - Taurids Meteor Shower Peak
Nov 08 - Mercury Transits the Sun
Nov 13 - Asteroid 7 Iris At Opposition (6.8 Magnitude)
Nov 14 - EAS Meeting – Tuesday 14th 6:30 pm – Everett Library
Nov 17 - Leonids Meteor Shower Peak

December 2006

Dec 13 - Geminids Meteor Shower Peak
Dec 22 - Winter Solstice, 00:22 UT
Dec 22 - Ursids Meteor Shower Peak

January 2007

Jan 03 - Earth At Perihelion (0.983 AU From Sun)
Jan 03 - Quadrantids Meteor Shower Peak
Jan 08 - Stephen Hawking's 65th Birthday (1942)

February 2007

Feb 07 - Mercury at Greatest Eastern Elongation
Feb 18 - Chinese New Year

March 2007

Mar 21 - Vernal Equinox, 00:07 UT

UW Astronomy Colloquium Schedule

The Astronomy Department weekly colloquium meets Thursdays at 4:00 pm in PAB A102 (the classroom part of the Physics/Astronomy Building complex).

Over The Airwaves

"Our group of radio script writers now consists of EAS and SAS members Jim Ehrmin, Greg Donohue, and Ted Vosk, who are now regularly writing and helping to produce our astronomy radio show, "**It's Over Your Head**" on radio station **KSER, FM 90.7.** The six-minute segment is broadcast **every Wednesday morning at approximately 7:20 A.M.** and gives a weekly look at what's up in the sky over Snohomish County, with other information. If you are a listener to the program, show your support by giving the program director of KSER a call!" Web page with lots of archives and other info is available at http://www.itsoveryourhead.org/

KPLU 88.5 FM National Public Radio has daily broadcasts of "Star Date" by the McDonald Observatory of the University of Texas at Austin, Monday through Friday at about 6:05 pm. The short 2 minute radio show deals with current topics of interest in astronomy. The University of Washington TV broadcasts programs from NASA at 12:00 AM Monday through Friday, 12:30 AM Saturday, and 1:30 AM Sunday on the Channel 27 cable station.

EAS Library – Book & Video List

The EAS has a library of books, videotapes, and software for members to borrow. We always value any items you would like to donate to this library. You can contact a club officer or **Librarian Mike Locke**, phone (425) 259-5995, email mlocke at lioninc.com, to borrow or donate any materials. See list here: http://members.tripod.com/everett_astronomy/eas_library.htm

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 Mike Locke, 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. Link to registration form: http://members.tripod.com/everett_astronomy/application.htm

(**When renewing your subscription to *Sky & Telescope* you should send your S&T renewal form along with a check made out to Everett Astronomical Society to the EAS address.** The EAS treasurer 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. Contact Mike Locke (425) 259-5995 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

Sep 14	Last Quarter Moon
Sep 22	New Moon
Sep 30	First Quarter Moon
Oct 07	Full Moon
Oct 14	Last Quarter Moon
Oct 22	New Moon
Oct 29	First Quarter Moon
Nov 05	Full Moon
Nov 12	Last Quarter Moon
Nov 20	New Moon
Nov 28	First Quarter Moon

Dec 05	Full Moon

Digital Lunar Orbiter Photographic Atlas of the Moon

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

UP IN THE SKY -- THE PLANETS

Object	Rises	Transits	Sets	Con	Mag
Sun	**6:54 am**	**13:02**	**19:09**	**Virgo**	**-27.5**
Mercury	Daylight	Daylight	**19:37**	**Can**	**+0.4**
Venus	**6:01 am**	Daylight	Daylight	**Leo**	**-3.9**
Mars	Daylight	Daylight	**19:30**	**Virgo**	**+1.7**
Jupiter	Daylight	Daylight	**20:54**	**Lib**	**-1.8**
Saturn	**03:26 am**	Daylight	Daylight	**Leo**	**+0.5**
Uranus	**18:32**	**00:04 am**	**5:32 am**	**Aqr**	**+5.7**
Neptune	Daylight	**22:25**	**3:19 am**	**Cap**	**+7.9**
Pluto	Daylight	**18:42**	**23:31**	**Ser**	**+13.9**

(times local time for Everett PDT)

Transit times for Jupiter's Great Red Spot in 2006
http://skyandtelescope.com/observing/objects/planets/article_107_2.asp

NOAA SUN CALCULATOR

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

MEMBER NEWS

- **Starwatchers revel in their 'grunt work'** –Article in the Everett Herald starring Dr. Don Dillinger here.
- **Starlight? Too bright? The pursuit of a dark sky takes stargazers ever farther from Puget Sound** –News article in the Everett Herald here.
- Photos from local and EAS astronomers featured in the Everett Herald here.

The Northwest Region of the Astronomical League (NWRAL) is putting together a new website and needs the following information from each club of the NWRAL. The EAS is looking for any information from members about the early history. Please contact Mark Folkerts if you have any info that could be of help. NRWAL would like a brief history of the club
- Club established date
- Who started the club
- When club joined the Astronomical League.

YOUNG ASTRONOMER'S CORNER

It's time for some questions and answers again!!!

Q: Do we have a real picture of our Galaxy (the Milky Way)?

A: No, we don't have an actual picture of our Galaxy from a distance. Because we live inside the Milky Way, we would have to travel thousands of light-years away from it to "get it all in" the picture (so to speak……..just like you would have to move away from your car or house to "get it all in" the picture). Unfortunately, human beings cannot even travel a few million miles to the next planet, let alone thousands of light-years (one light-year equals about 95,000,000,000,000 kilometers or 57,000,000,000,000 miles!!). Even spacecraft that are on the boundaries of the outer Solar System (like the Voyager craft) could only "look" at their home solar system or a little bit beyond, let alone "getting all in" the vast number of stars (and solar systems) that make up the Milky Way Galaxy.

Q. How many galaxies are there in the universe?

A: Over 100 billion! There are even more galaxies in the Universe than there are stars in our night sky. We can see only three galaxies from Earth without a telescope: the Andromeda galaxy and the two Magellanic clouds in the Southern Hemisphere; all the others are too faint without the assistance of a telescope. Astronomers have photographed "only" thousands of these (over 100 billion) distant galaxies, ***each*** of which contains ***billions*** of stars!!

Q: Are all galaxies shaped like the Milky Way…….that is, like a spiral or "pinwheel"?

A: No: there are many other galaxy shapes in the Universe. Elliptical shaped galaxies are huge balls of stars without spiral or pinwheel structure; these can range from almost perfect circle or sphere shapes to more oval shapes. Irregular galaxies don't have any specific pattern: the Milky Way's two companion galaxies (the Large and Small Magellanic Clouds) are examples of irregular galaxies. Peculiar galaxies are stranger still: they may have some spiral or elliptical structure, but they may also have been recently colliding with another galaxy (leading to some very odd appearances), or have large amounts of energy coming from them (such as very active star-forming "Starburst" galaxies). Other galaxies included in the list of peculiar galaxies are dwarf galaxies, ring galaxies, and even "spiral" galaxies with very weird looking "spiral" arms – or perhaps even only one spiral arm!!!

Constellation 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 in the spring and early summer, try to enjoy some of the wonders of the constellation Lupus.

INDUS: (The American Indian). With a midnight culmination date of August 12th, Indus (abbreviated Ind) is best viewed from August to October, and is thus well placed for winter viewing in the Southern Hemisphere. It contains no asterisms, associated Messier objects or meteor showers. Bordering constellations include Grus, Microscopium, Octans, Pavo, Telescopium, and Tucana. Indus ranks 80th in overall brightness among the constellations (overall brightness is calculated by dividing the number of visible stars in a constellation by the size of the constellation in square degrees, and then multiplying that number by 100). Indus ranks 49th in size, taking up 294.01 square degrees (0.713% of the sky; note: this square degree factor would be the denominator in the above equation: the smaller the denominator the larger the result – in this case, overall brightness). The number of visible stars (stars brighter than magnitude 5.5) in this moderately sized constellation is 13.

Indus is completely visible from latitudes South of +15 degrees, and completely invisible from latitudes North of +45 degrees. Its central point is at RA=21h55m, Dec.= -60 degrees. The solar conjunction date of Indus is February 19th.

Some interesting facts about Indus:

Indus is one of 11 constellations invented by Pieter Dirksz Keyser and Frederick de Houtman, during the years 1595-97. One of the nearest of the solar-type stars – magnitude +4.68 Epsilon Indi – lies within this constellation and is 11.2 light years away. This star has been investigated by radio astronomers (searching for signs of other planets) and by SETI. Except for Alpha Indi, the stars are faint. Theta Indi is an interesting double star with magnitude 4.5 and 6.9 components, separated by seven arc seconds. There is a relatively good selection of galaxies in Indus however, (located in the northern areas of the constellation), and these are best viewed in a eight-inch scope or larger. One interesting galaxy is IC-5152, an irregular 11.6 magnitude galaxy. However, with an eight-magnitude star in its field of view that outshines the galaxy itself, IC-5152 is a difficult galaxy to view.

PLANETARY FOCUS

This month, our guest planet is Neptune, and these are the facts:

Rotation around the Sun: every 164.79 years

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

Inclination of Orbit to Ecliptic: 1.8 degrees.

Mean Orbital Velocity: 5.43 km/sec.

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

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

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

Surface Gravity (Earth = 1): 1.19

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

Axis tilt: 29.56 degrees.

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

Special Notes About Neptune: **Neptune** is the fourth largest planet in the solar system (one of the gas giants) in terms of equatorial diameter, but is more massive than Uranus, the third largest planet in diameter. Neptune is the most distant of the giant planets, and was discovered in 1846 by J.G. Galle at the Berlin Observatory, based on French (Urbain Leverrier) predictions resulting from disturbances in the orbit of Uranus (there were similar estimates made by Englishman John C. Adams). Neptune returns to opposition two days later every year, and appears as an indistinct magnitude 7.7 bluish-green object in binoculars; in fact, no markings can be seen on its bluish-green disk from earth-bound telescopes. Neptune's color arises primarily from methane within its atmosphere, which is principally helium and hydrogen and a blend of methane, water, and ammonia. In 1989, Voyager 2 sent back remarkable images of Neptune during its fly-by. The Great Dark Spot was noted in its atmosphere. Like Jupiter's Great Red Spot, it occupies a equivalent proportion of the surface area of Neptune (as the GRS does of Jupiter's surface area), and is a high-pressure system around which near-supersonic winds flow in an anti-clockwise circuit. The Great Dark Spot measures approximately 12,000 by 8,000 kilometers. At about 50-70 kilometers above the main cloud plane, there are whitish cirrus-like clouds composed of methane ice crystals. Neptune also has belts and zones similar to Jupiter's, only much fainter. The core of Neptune is believed to be rocky, composed primarily of silicon and iron. The atmosphere of Neptune revolves more slowly than its core, and this is

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

Neptune has 8 known moons; six of them were discovered during the 1989 Voyager 2 fly-by, and the remaining two (Triton and Nereid) were discovered from Earth. Triton is the largest moon of Neptune, and was discovered the same year (1846) as the planet itself; it is about ¾ the size of our own Earth's Moon. Interestingly, Triton has an orbit in the opposite direction to that of Neptune (retrograde), and is slowly coiling its way down towards Neptune. Triton is a very cold moon, and has a thin atmosphere of mostly nitrogen, with some methane and carbon monoxide. Its South Pole cap is pinkish in color (probably nitrogen snow and ice). Triton's face has been shown to have both craters and long cracks, but no mountains; its surface resembles that of a cantaloupe. It has also been noted to have geysers of nitrogen, some reaching 8 km in height! Nereid was discovered from Earth in 1949, and has a very eccentric orbit (going from 2 to 10 million kilometers from the planet at various times during its orbit).

ASTRONOMY AND TELESCOPE "LINGO"

Astronomy "Lingo": Gravitational Lens: The bending of radiation from a distant source by the gravitational field of an intervening mass, such as a galaxy located between the distant mass and the observer.

Telescope / Equipment "Lingo": collimation: The proper alignment of lenses or mirrors in any telescope.

ASTRONOMY FUN FACTS

★★ The temperature of lightning is hotter than the surface of the Sun: lightning is about 30,000 degrees Kelvin compared to the Sun's photosphere temperature of 5,000 degrees Kelvin. If we were to travel to and visit the Sun (it is not possible, and you wouldn't survive), you would first have to pass through the even hotter Sun's corona: it's temperature is 15,000,000 degrees Kelvin, 500 times the temperature of lightning!!

★★ Two of the planets, when seen through telescopes, go through phases like the Moon: i.e., they go from crescent to full, just like our Moon: these are Mercury and Venus. Because these two planets have orbital paths closer to the Sun than does Earth, they appear fully illuminated when they are beyond the Sun in their orbits; only crescent rims of the illuminated portions are seen however when their orbits bring them closer to Earth (i.e., when their orbits bring them between them to the Earth side of the Sun).

★★ Astronomers call the average distance between the Sun and the Earth – 93,000,000 million miles – an astronomical unit. Thus, Earth is one (1) astronomical unit from the Sun. The distance from the Sun to the its nearest stellar neighbor – Proxima Centauri – is 4.3 light years, or 267,000 astronomical units!!

★★ Both Ganymede (Jupiter's largest moon) and Titan (Saturn's largest) are themselves larger than the planet Mercury, as well as the (former???) planet Pluto!!!

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 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.***

RV Tauri Stars: A small group of very luminous pulsating variables; these are primarily G and K stars with some F stars included as well. RV Tauri stars are yellow supergiants with extended atmospheres of gas that emit infrared radiation; these atmospheres may have possibly been driven off (or 'extended') by the pulsations themselves. RV Tauri stars have characteristic light curves with alternating shallow and deep minima, and periods ranging from 20 to 145 days. These stars are classified as semiregular variables, because the luminosity fluctuations can be significantly perturbed in shape and period (for example), being most pronounced for longer-period stars. RV Tauri stars can be discerned from other similar semiregular yellow stars by variations in their color indices: RV Tauri stars' color indices mimic the light curves of these other similar yellow stars, but go through a maximum only a short time before the luminosity minimum. A smaller group of RV Tauri stars also have double periodicity: DF Cygni is an example. DF Cygni has two separate oscillations in luminosity: one is a rapid 50-day oscillation, and this is superimposed on a much slower 780-day oscillation with a significantly greater amplitude.

Northern Hemisphere Example: ***RV Tauri.***

Southern Hemisphere Example(s): ***R Scuti; R Sagittae.***

ASTRONOMICAL NOTES -- ON & OFF THE WEB…

EARTH-LIKE PLANETS MAY BE MORE COMMON THAN ONCE THOUGHT

More than one-third of the giant planet systems recently detected outside Earth's solar system may harbor Earth-like planets, many covered in deep oceans with potential for life, according to a new study. The study focuses on a type of planetary system unlike our solar system that contains gas giants known as "Hot Jupiters" orbiting extremely close to their parent stars -- even closer than Mercury to our sun, said researcher Sean Raymond. Such gas giants are believed to have migrated inward toward their parent stars as the planetary systems were forming, disrupting the space environment and triggering the formation of ocean-covered, Earth-like planets in a "habitable zone" conducive to the evolution of life, according to the new study.

"Exotic Earths: Forming Habitable Worlds with Giant Planet Migration" was published in the Sept. 8 issue of Science and authored by Raymond, Avi Mandell, and Steinn Sigurdsson. The study indicates Hot Jupiters push and pull proto-planetary disk material during their journeys, flinging rocky debris outward where it is likely to coalesce into Earth-like planets, said Raymond. At the same time, turbulent forces from the dense surrounding gas slow down the orbits of small, icy bodies in the outer reaches of the disk, causing them to spiral inward and deliver water to the

fledgling planets. Such planets may eventually host oceans several miles deep, according to the study.

"*These gas giants cause quite a ruckus*," said Raymond. "*We now think there is a new class of ocean-covered, and possibly habitable, planets in solar systems unlike our own*." Scientists had previously assumed that as Hot Jupiters plowed through proto-planetary material on their inward migrations toward parent stars, all the surrounding material would be "vacuumed up" or ejected from the system, he said. "*The new models indicate these early ideas were probably wrong*," said Raymond.

The research team ran exhaustive simulations lasting more than eight months each on more than a dozen desktop computers, starting with proto-planetary disks containing more than 1,000 moon-sized, rocky and icy bodies. The initial conditions for each computer model were based on current theories of how planets form in our own solar system and simulated about 200 million years of planetary evolution. The team concluded that about one of every three known planetary systems could have evolved as-yet-undetected Earth-like planets in so-called habitable zones like the one Earth is in, he said. A whopping 40 percent of the 200 or so known planets around other stars are Hot Jupiters, although the percentage probably will decrease as more distant planets are discovered, said Raymond. In addition to Earth-like planets that form in habitable zones outside Hot Jupiters, the simulations showed some rocky planets known as "Hot Earths" often form inside the orbits of Hot Jupiters, said Raymond. A Hot Earth, with a radius twice that of our own Earth, was discovered in 2005 in a nearby star system orbiting just 2 million miles from its parent star by a team led by Berkeley planetary scientist Geoffrey Marcy.

The new simulations showed both Hot Earths and Earth-like planets in habitable zones formed with large amounts of water, up to 100 times the water present on Earth today, he said. The models indicate such water-rich planets would probably contain a lower percentage of iron -- which may be important for the evolution and possible oxygenation of evolving atmospheres -- than Earth, he said.

According to the team's simulations, Hot Earths can form astoundingly fast, in just 100,000 years or so. Earth-like planets in habitable zones form much more slowly, taking up to 200 million years, said Raymond. Geologists believe Earth took about 30 million years to 50 million years to fully form.

"*I think there are definitely habitable planets out there*," said Raymond. "*But any life on these planets could be very different from ours. There are a lot of evolutionary steps in between the formation of such planets in other systems and the presence of life forms looking back at us*." The new research effort may allow planet hunters to determine "rough limits" indicating where to search for habitable planets in known systems of giant planets, according to the team, whose research was funded by NASA's Astrobiology Institute. "*Upcoming space missions such as NASA's Kepler and Terrestrial Planet finder and ESA's COROT and Darwin will discover and eventually characterize Earth-like planets around other stars*," wrote the authors in Science. "*We predict that a significant fraction of systems with close-in giant planets will be found to have a Hot Earth or potentially habitable, water-rich planets on stable orbits in the Habitable Zone*."

Shown is a schematic view (not to scale) of a habitable planetary system with a "hot Jupiter" (bottom row), compared with Earth's solar system (top row). Earth's solar system has four terrestrial planets: Mercury Venus, Earth and Mars, all between Jupiter and the sun. Earth is in the habitable zone, where water can exist on its surface. The "hot Jupiter" system contains a "hot Earth" a few times larger than our own Earth but very close to the parent star, and an ocean-covered planet (in blue) in the habitable zone just outside of the ringed giant. Three icy planets are shown in the outer reaches of the "hot Jupiter" system. See - http://www.nasa.gov/centers/goddard/images/content/156609main_system_diff_lg.jpg Credit and copyright: Sean Raymond, 2006

ASTEROIDS AND METEORITES REVEAL FAMILY RESEMBLANCE

Using data collected by the Japanese space probe Hayabusa in a rendezvous with the 550-meter asteroid Itokawa, researchers have demonstrated that space weathering occurs even on small asteroids. The new data, published in Nature, confirm that the mineral composition of such asteroids is consistent with meteorites fallen on Earth. Asteroids and meteorites are supposed to be made of the same stuff - at least that's what earth science teachers have been telling their students for decades. But until recently, the data didn't quite fit the story. When researchers compared the near-infrared reflectance of asteroids (as measured from Earth) and meteorites (collected on Earth) they found enough differences to raise doubts about whether the asteroids really could be the source of Earth's meteorites.

A detailed new comparison of the near-Earth asteroid Itokawa with existing meteorite samples confirms that the process of space-weathering can explain the difference in reflectance pattern (spectrum) between asteroids and ordinary chondrites, the most common class of meteorites. "*They [chondritic meteorites] are so abundant, there have to be many, many asteroid sources*," said Takahiro Hiroi, the paper's lead author, "*but we couldn't find any that matched so clearly, until now. These observations really let us see space weathering at work*." Over millions of years, the flow of high-energy ions and microscopic particles vaporizes the surface of asteroids, depositing a thin film that changes the asteroid's optical properties. Highly weathered areas tend to appear dark and red. (The near infrared spectrum of such areas is shifted toward the red end of the spectrum.)

Hiroi visited several museums and collected dozens of samples of fresh, or newly fallen, meteorites. He rejected many samples because the oxidation caused by rain and air on the Earth's surface changes the rock's composition and interferes with the asteroid comparison. Together with other researchers from the Hayabusa mission, Hiroi compared the near-infrared reflectance spectra of meteorite samples with spectra observed at specific locations on the asteroid.

One sample (from a meteorite dubbed Alta'ameem, for the area in Iraq where it fell) resulted in a near-identical match after correction for the changes that result from space weathering. Those changes include a reduction in mean optical path length - usually a sign of smaller grain size - and an increase in tiny iron particles known as nanophase metallic iron or npFeo.

Hiroi was able to see the effects of space weathering by taking spectra from one light and one dark area on the asteroid's surface. Matching the observed spectra to that of the Alta'ameem meteorite, he estimated that the highly weathered site contained about 0.069 percent nanophase metallic iron and the less-weathered site contained about 0.031 percent. Because Alta'ameem is an LL chondrite, a class that represents only 10 percent of ordinary chondrite meteorites, Hiroi suggests that there must be many asteroids in near Earth orbit with compositions similar to the more common L- and H-type meteorites.

Evidence of space weathering has been seen before on moons and larger asteroids, but such clear evidence is new for smaller asteroids, such as the 550-meter Itokawa. It had been thought that such bodies, with their smaller gravitational fields, would quickly be stripped of the weathered material. This new evidence

shows that space weathered material does accumulate on small asteroids, which probably are the source of most meteorites.

JUPITER-SIZED TRANSITING PLANET FOUND BY ASTRONOMERS USING NOVEL TELESCOPE NETWORK

Our home solar system may be down by a planet with the recent demotion of Pluto, but the number of giant planets discovered in orbit around other stars continues to grow steadily. Now, an international team of astronomers has detected a planet slightly larger than Jupiter that orbits a star 500 light-years from Earth in the constellation Draco. Unlike the mythological names associated with the solar system's planets, the newly discovered planet is known by "TrES-2" and passes in front of the star "GSC 03549-02811" every two and a half days.

The new planet is especially noteworthy because it was identified by astronomers looking for transiting planets (that is, planets that pass in front of their home star) with a network of small automated telescopes. The humble telescopes used in the discovery consist of mostly amateur-astronomy components and off-the-shelf 4-inch camera lenses. This is the third transiting planet found using telescopes similar to those used by many amateur astronomers.

By definition, a transiting planet passes directly between Earth and the star, causing a slight reduction in the light in a manner similar to that caused by the moon's passing between the sun and Earth during a solar eclipse. According to Francis O'Donovan, "*When TrES-2 is in front of the star, it blocks off about one and a half percent of the star's light, an effect we can observe with our TrES telescopes*. " "*We know of about 200 planets around other stars*," says O'Donovan, lead author of the paper announcing the discovery in an upcoming issue of the Astrophysical Journal, "*but it is only for the nearby transiting planets that we can precisely measure the size and mass of the planet, and hence study its composition. That makes each new transiting planet an exciting find. And because TrES-2 is the most massive of the nearby transiting planets, it sets a new limit to our understanding of how these gas planets form around stars*."

The planet TrES-2 is also noteworthy for being the first transiting planet in an area of the sky known as the "Kepler field," which has been singled out as the targeted field of view for the upcoming NASA Kepler mission. Using a satellite-based telescope, Kepler will stare at this patch of sky for four years, and should discover hundreds of giant planets and Earth-like planets. Finding a planet in the Kepler field with the current method allows astronomers to plan future observations with Kepler that include searching for moons around TrES-2.

And finally, the research team hails the discovery as the second transiting "hot Jupiter" found with the Trans-Atlantic Exoplanet Survey (TrES), an effort involving the "Sleuth" telescope at Caltech's Palomar Observatory in San Diego County, the Planet Search Survey Telescope (PSST) at Lowell Observatory near Flagstaff, Arizona, and the "STellar Astrophysics and Research on Exoplanets (Stare) telescope in the Canary Islands. The name of the planet, TrES-2, is derived from the name of the survey.

To look for transits, the small telescopes are automated to take wide-field timed exposures of the clear skies on as many nights as possible. When an observing run is completed for a particular field-usually over an approximate two-month period-the data are run through software that corrects for various sources of distortion and noise.

The end result is a "light curve" for each of thousands of stars in the field. If the software detects regular variations in the light curve for an individual star, then the astronomers do additional work to see if the source of the variation is indeed a transiting planet. One possible alternative is that the object passing in front of the star is another star, fainter and smaller.

In order to confirm they had found a planet, O'Donovan and his colleagues switched from the 10-centimeter TrES telescopes to one of the 10-meter telescopes at the Keck Observatory on the summit of Mauna Kea. Using this giant telescope, they confirmed that they had found a new planet. O'Donovan says, "*Each of us had spent countless hours working on TrES at that point, and we had suffered many disappointments. All our hard work was made worthwhile when we saw the results from our first night's observations, and realized we had found our second transiting planet.*" TrES-2 was first spotted by the Sleuth telescope, which was set up by David Charbonneau, a coauthor of the paper. The PSST, which is operated by Georgi Mandushev and Edward Dunham (coauthors), also observed transits of TrES-2, confirming the initial detections. http://www.astro.caltech.edu/~ftod/tres/tres2.html

ASTRONOMERS TRACE THE EVOLUTION OF THE FIRST GALAXIES IN THE UNIVERSE

A systematic search for the first bright galaxies to form in the early universe has revealed a dramatic jump in the number of such galaxies around 13 billion years ago. These observations of the earliest stages in the evolution of galaxies provide new evidence for the hierarchical theory of galaxy formation -- the idea that large galaxies built up over time as smaller galaxies collided and merged.

Astronomers Rychard Bouwens and Garth Illingworth, used the Hubble Space Telescope to explore the formation of galaxies during the first 900 million years after the Big Bang. Deep observations in three dark patches of sky -- the Hubble Ultra Deep Field and the Great Observatories Origins Deep Survey fields -- gathered the faint light emitted 13 billion years ago by stars in primeval galaxies. Only the brightest galaxies could be detected at such great distances. "*These are the deepest infrared and optical data ever taken. We're looking at a very early stage in the buildup of galaxies*," said Illingworth.

The researchers observed hundreds of bright galaxies at around 900 million years after the Big Bang. But when they looked deeper, about 200 million years earlier in time, they only found one. Relaxing their search criteria a bit turned up a few more candidates, but clearly a lot of changes took place during those 200 million years, Illingworth said. "*The bigger, more luminous galaxies just were not in place at 700 million years after the Big Bang. Yet 200 million years later there were many more of them, so there must have been a lot of merging of smaller galaxies during that time*," he said.

Astronomers can determine when light was emitted from a distant source by its redshift, a measure of how the expansion of the universe stretched the wavelengths of the light as it traveled through space across vast distances. Bouwens, author of the paper, developed software to systematically sift through the Hubble data in search of high-redshift galaxies.

The data came from two powerful instruments on Hubble, the Advanced Camera for Surveys (ACS) and the Near Infrared Camera and Multi-Object Spectrograph (NICMOS). The researchers compared the numbers of galaxies detected at a redshift of 7 to 8 (700 million years after the Big Bang) with what they might have expected to find if the population of galaxies then were like the population they had observed at redshift 6 (200 million years later). Depending on the strictness of their selection

criteria, they found one galaxy where they would have expected 10, or four where they would have expected 17.

"*Our approach provides a very quantitative way of measuring the buildup of structure in the universe, so we can see how fast it changed over time as smaller galaxies merged to form larger ones*," Bouwens said.

The galaxies observed in this survey are much smaller than our own Milky Way and other giant galaxies seen today in the nearby universe. These early galaxies were also ablaze with star formation, emitting bluish light that was shifted to red light during its 13-billion-year journey to Hubble's sensitive detectors.

"*It's quite amazing that we are able to look back across 13 billion years of time. We're looking at galaxies that have already evolved from smaller precursors, but it's only a few hundred million years after the formation of the first stars*," Illingworth said.

If the Milky Way is a galactic senior citizen, then these galaxies are toddlers or preschoolers. For now, researchers are unable to detect the even smaller infant galaxies that must have merged to form these first bright galaxies.

But the seeds of those first galaxies can be seen in the cosmic microwave background radiation, measured most recently and accurately by the Wilkinson Microwave Anisotropy Probe (WMAP), which shows slight fluctuations of density in a remarkably homogeneous universe about 400,000 years after the Big Bang.

"*Very early in the evolution of the universe, everything was very smooth. But over time the universe became more and more clumpy as gravity pulled more matter into the denser areas*," Bouwens said. "*Our observations of early galaxies allow us to measure how fast the universe was evolving from smaller to larger clumps*."

Detection of the very first galaxies to form will be possible with the successor to Hubble, the James Webb Space Telescope, currently planned for launch in 2013, Illingworth said. http://firstgalaxies.ucolick.org/

COSMIC ARCHEOLOGY UNCOVERS UNIVERSE'S DARK AGES

Astronomers using the Subaru telescope in Hawai'i have looked 60 million years further back in time than any other astronomers, to find the most distant known galaxy in the universe. In doing so, they are upholding Subaru's record for finding the most distant and earliest galaxies known. Their most recent discovery is of a galaxy called I0K-1 that lies so far away that astronomers are seeing it as it appeared 12.88 billion years ago.

This discovery, based on observations made by Masanori Iye, Kazuaki Ota, Nobunari Kashikawa, and others indicates that galaxies existed only 780 million years after the universe came into existence about 13.66 billion years ago as a hot soup of elementary particles.

To detect the light from this galaxy, the astronomers used Subaru telescope's Suprime-Cam camera outfitted with a special filter to look for candidate distant galaxies. They found 41,533 objects, and from those identified two candidate galaxies for further study using the Faint Object Camera and Spectrograph (FOCAS) on Subaru. They found that IOK-1, the brighter of the two, has a redshift of 6.964, confirming its 12.88 billion-light-year distance.

The discovery challenges astronomers to determine exactly what happened between 780 and 840 million years after the Big Bang. IOK-1 is one of only two galaxies in the new study that could belong to this distant epoch. Given the number of galaxies that have been discovered from 840 million years after the Big Bang, the research team had expected to find as many as six galaxies at this distance. The comparative rarity of objects like IOK-1 means that the universe must have changed over the 60 million years that separate the two epochs.

The most exciting interpretation of what happened is that we are seeing an event known to astronomers as the reionization of the universe. In this case, 780 million years after the Big Bang, the universe still had enough neutral hydrogen to block our view of young galaxies by absorbing the light produced by their hot young stars. Sixty million years later, there were enough hot young stars to ionize the remaining neutral hydrogen, making the universe transparent and allowing us to see their stars.

Another interpretation of the results says that there were fewer big and bright young galaxies 780 million years after the Big Bang than 60 million years later. In this case, most of the reionization would have taken place earlier than 12.88 billion years ago.

No matter which interpretation finally prevails, the discovery signals that astronomers are now excavating light from the "Dark Ages" of the universe. This is the epoch when the first generations of stars and galaxies came into existence, and an epoch which astronomers have not been able to observe until now.

Archeology of the Early Universe Using Special Filters

Newborn galaxies contain stars with a wide range of masses. Heavier stars have higher temperatures, and emit ultraviolet radiation that heats and ionizes nearby gas. As the gas cools it radiates away excess energy so that it can return to a neutral state. In this process, hydrogen will always emit light at 121.6 nanometers, called the Lyman-alpha line. Any galaxy with many hot stars should shine brightly at this wavelength. If stars form all at once, the brightest stars could produce Lyman-alpha emission for 10 to 100 million years.

In order to study galaxies like IOK-1 that exist at early times in the universe, astronomers must search out Lyman-alpha light that is stretched and redshifted to longer wavelengths as the universe expanded. However, at wavelengths longer than 700 nanometers, astronomers have to deal with foreground emissions from OH molecules in Earth's own atmosphere that interfere with faint emissions from distant objects.

To detect the faint light from distant galaxies, the research team had been observing at wavelengths where Earth's atmosphere doesn't glow much, through windows at 711, 816, and 921 nanometers. These windows correspond to the redshifted Lyman-alpha emission from galaxies with redshifts of 4.8, 5.7, and 6.6, respectively. These numbers indicate how much smaller the universe was compared to now, and correspond to 1.26 billion years, 1.01 billion years, and 840 million years after the Big Bang. This is like doing archaeology of the early universe with particular filters allowing scientists to see into different layers of an excavation.

To obtain their spectacular new results, the team had to develop a filter sensitive to light with wavelengths only around 973 nanometers, which corresponds to Lyman alpha emission at a redshift of 7.0. This wavelength is at the limit of modern CCDs, which lose sensitivity at wavelengths longer than 1000 nanometers. This one of its kind filter, called the NB973, uses multilayer coating technology, and took more than two years to develop. Not only did the filter have to pass light with wavelengths only around 973 nanometers, but it also had to cover uniformly the entire field of view of the telescope's prime focus. The team

worked with a company, Asahi Spectra Co.Ltd, to design a prototype filter to use with Subaru's Faint Object Camera, and then applied that experience to making the filter for Suprime-Cam.

The Observations

The observations with the NB973 filter took place during the spring of 2005. After more than 15 hours of exposure time, the data obtained reached a limiting magnitude of 24.9. There were 41,533 objects in this image, but a comparison with images taken at other wavelengths showed that only two of the objects were bright only in the NB973 image. The team concluded that only those two objects could be galaxies at a redshift of 7.0. The next step was to confirm the identity of the two objects, IOK-1 and IOK-2, and the team observed them with the Faint Object Camera and Spectrograph (FOCAS) on the Subaru telescope. After 8.5 hours of exposure time, the team was able to obtain a spectrum of an emission line from the brighter of the two objects, IOK-1. Its spectrum showed an asymmetrical profile that is characteristic of Lyman-alpha emission from a distant galaxy. The emission line was centered at a wavelength of 968.2 nanometers (redshift 6.964), corresponding to a distance of 12.88 billion light years and time of 780 million years after the Big Bang.

Identity of the Second Candidate Galaxy

Three hours of observation time did not yield any conclusive results to determine the nature of IOK-2. The research team has since obtained more data that is now being analyzed. It is possible that IOK-2 may be another distant galaxy, or it could be an object with variable brightness. For example, a galaxy with a supernova or a black hole actively swallowing material that just happened to appear bright during the observations with the NB973 filter. (Observations in the other filters were made one to two years earlier.)

The Subaru Deep Field

The Subaru telescope is particularly well suited for the search of the most distant galaxies. Of all the 8- to 10-meter-class telescopes in the world, it is the only one with the ability to mount a camera at prime focus. The prime focus, at the top of the telescope tube, has the advantage of a wide field of view. As a result, Subaru currently dominates the list of the most distant known galaxies. Many of these are in a region of the sky in the direction of the constellation Coma Berenices called the Subaru Deep Field that the research team selected for intense study at many wavelengths.

Early History of the Universe and the Formation of the First Galaxies

To put this Subaru accomplishment into context, it is important to review what we know about the history of the early universe. The universe began with the Big Bang, which occurred about 13.66 billion years ago in a fiery chaos of extreme temperature and pressure. Within its first three minutes, the infant universe rapidly expanded and cooled, producing the nuclei of light elements such as hydrogen and helium but very few nuclei of heavier elements. In 380,000 years, things had cooled to a temperature of around 3,000 degrees. At that point, electrons and protons could combine to form neutral hydrogen.

With electrons now bound to atomic nuclei, light could travel through space without being scattered by electrons. We can actually detect the light that permeated the universe back then. However, due to time and distance, it has been stretched by a factor of 1,000, filling the universe with radiation we detect as microwaves (called the Cosmic Microwave Background). The Wilkinson Microwave Anisotropy Probe (WMAP) spacecraft studied this radiation and its data allowed astronomers to calculate the age of the universe at about 13.66 billion years. In addition, these data imply the existence of such things as dark matter and the even more enigmatic dark energy.

Astronomers think that over the first few hundred million years after the Big Bang, the universe continued to cool and that the first generation of stars and galaxies formed in the densest regions of matter and dark matter. This period is known as the "Dark Ages" of the universe. There are no direct observations of these events yet, so astronomers are using computer simulations to tie together theoretical predictions and existing observational evidence to understand the formation of the first stars and galaxies.

Once bright stars are born, their ultraviolet radiation can ionize nearby hydrogen atoms by splitting them back into separate electrons and protons. At some point, there were enough bright stars to ionize almost all the neutral hydrogen in the universe. This process is called the reionization of the universe. The epoch of reionization signals the end of the Dark Ages of the universe. Today most of the hydrogen in the space between galaxies is ionized.

Pinpointing the Epoch of Reionization

Astronomers have estimated that reionization occurred sometime between 290 to 910 million years after the birth of the universe. Pinpointing the beginning and end of the epoch of reionization is one of the important stepping stones to understanding how the universe evolves, and is an area of intense study in cosmology and astrophysics.

It appears that as we look farther back in time, galaxies get rarer and rarer. The number of galaxies with a redshift of 7.0 (which corresponds to a time about 780 million years after the Big Bang) seems smaller than what astronomers see at a redshift of 6.6 (which corresponds to a time about 840 million years after the Big Bang). Since the number of known galaxies at a redshift of 7.0 is still small (only one!) it is difficult to make robust statistical comparisons. However, it is possible that the decrease in number of galaxies at higher redshift is due to the presence of neutral hydrogen absorbing the Lyman-alpha emission from galaxies at higher redshift. If further research can confirm that the number density of similar galaxies decreases between a redshift of 6.6 and 7.0, it could mean that IOK-1 existed during the epoch of the universe's reionization. http://www.subarutelescope.org/Pressrelease/2006/09/13/index.html

CASSINI DETECTS VAST POLAR ETHANE CLOUD ON TITAN

Cassini's Visual and Infrared Mapping Spectrometer (VIMS) has detected what appears to be a massive ethane cloud surrounding Titan's north pole. The cloud might be snowing ethane snowflakes into methane lakes below.

The cloud may be the clue needed in solving a puzzle that has confounded scientists who so far have seen little evidence of a veil of ethane clouds and surface liquids originally thought extensive enough to cover the entire surface of Titan with a 300-meter-deep ocean.

Before the Cassini-Huygens mission began visiting Titan in 2004, "*We expected to see lots of ethane -- vast ethane clouds at all latitudes and extensive seas on the surface of Saturn's giant moon Titan*," planetary scientist Caitlin Griffith said.

That's because solar ultraviolet light irreversibly breaks down methane in Titan's mostly nitrogen atmosphere. Ethane is by far

the most plentiful byproduct when methane breaks down. If methane has been a constituent of the atmosphere throughout Titan's 4.5-billion-year lifetime -- and there was no reason to suspect it had not -- the large moon would be awash with seas of ethane, scientists theorized.

The Cassini spacecraft radar found lakes in Titan's north arctic latitudes on a flyby last July 22. However, "*We now know that Titan's surface is largely devoid of lakes and oceans*," Griffith said. She is a member of the Cassini VIMS team, headed by Robert Brown.

The missing ethane is all the more mysterious because Cassini images suggest that other less abundant solid precipitates from the photochemical reactions in Titan's atmosphere have formed dunes and covered craters on its surface, Griffith said. VIMS made the first detection of Titan's vast polar ethane cloud when it probed Titan's high northern latitudes on Cassini flybys in December 2004, August 2005, and September 2005. VIMS detected the cirrus cloud as a bright band at altitudes from between 30 km and 60 km at the edge of Titan's arctic circle, between 51 degrees and 69 degrees north latitude. VIMS saw only part of the cloud because most of the northern polar region is in winter's shadow and won't be fully illuminated until 2010, Griffith noted.

"*Our observations imply that surface deposits of ethane should be found specifically at the poles, rather than globally distributed across Titan's disk as previously assumed*," Griffith said. "*That may partially explain the lack of liquid ethane oceans and clouds at Titan's middle and lower latitudes*." "*We think that ethane is raining or, if temperatures are cool enough, snowing on the north pole right now. When the seasons switch, we expect ethane to condense at the south pole during its winter*," Griffith said. If polar conditions are as cool as predictions say, ethane could accumulate as polar ice.

Ethane dissolves in methane, which scientists predict is raining from the atmosphere at the north pole during its cool winter. "*During the polar winters, we expect the lowlands to cradle methane lakes that are rich with ethane*," Griffith noted. "*Perhaps these are the lakes recently imaged by Cassini*." If ethane was produced at today's rate over Titan's entire lifetime, a total of two kilometers of ethane would have precipitated over the poles. But that seems unlikely, Griffith said.

Scientists have no direct evidence for polar caps of ethane ice. Titan's north pole is in winter darkness, and Cassini cameras have yet to see it in reflected light. Cassini cameras have imaged Titan's south pole. "*The morphology seen in those images doesn't suggest a two kilometer polar ice cap, but the images do show flow features*," Griffith said. "*We're going to start making more polar passes in the upcoming months*," she added. "*By the end of next year Cassini will have recorded the first polar temperature profile of Titan, which will tell us how cold conditions are at the pole*."

Griffith, Pinteado and Robert Kursinski collaborated earlier in studies of the thousand-mile-long methane clouds that band Titan at southern latitudes. They concluded from analyzing VIMS images that these highly localized, convective clouds, which are composed of methane, result from summer heating much as thunderstorms form on Earth.

The VIMS instrument is an imaging spectrometer that produces a special data set called an image cube. It takes an image of an object in many colors simultaneously. An ordinary video camera takes images in three primary colors (red, green, and blue) and combines them to produce images as seen by the human eye. The VIMS instrument takes images in 352 separate wavelengths, or colors, spanning a realm of colors far beyond those visible to humans. All materials reflect light in a unique way. So molecules of any element or compound can be identified by the wavelengths they reflect or absorb, their "signature" spectra.

STRANGE NEW PLANET BAFFLES ASTRONOMERS

Using a network of small automated telescopes known as HAT, Smithsonian astronomers have discovered a planet unlike any other known world. This new planet, designated HAT-P-1, orbits one member of a pair of distant stars 450 light-years away in the constellation Lacerta. With a radius about 1.38 times Jupiter's, HAT-P-1 is the largest known planet. In spite of its huge size, its mass is only half that of Jupiter. "*This planet is about one-quarter the density of water*," Gaspar Bakos said. "*In other words, it's lighter than a giant ball of cork! Just like Saturn, it would float in a bathtub if you could find a tub big enough to hold it, but it would float almost three times higher*."

"*We could be looking at an entirely new class of planets*," said Bakos. Bakos designed and built the HAT network and is lead author of a paper submitted to the Astrophysical Journal describing the discovery.

HAT-P-1 revolves around its host star every 4.5 days in an orbit one-twentieth of the distance from Earth to the Sun. Once each orbit, it passes in front of its parent star, causing the star to appear fainter by about 1.5 percent for more than two hours, after which the star returns to its previous brightness. HAT-P-1's parent star is one member of a double-star system called ADS 16402 and is visible in binoculars. The two stars are separated by about 1500 times the Earth-Sun distance. The stars are similar to the Sun but slightly younger - about 3.6 billion years old compared to the Sun's age of 4.5 billion years.

Although stranger than any other extrasolar planet found so far, HAT-P-1 is not alone in its low-density status. The first planet ever found to transit its star, HD 209458b, also is puffed up about 20 percent larger than predicted by theory. HAT-P-1 is 24 percent larger than expected. "*Out of eleven known transiting planets, now not one but two are substantially bigger and lower in density than theory predicts,"* said co-author Robert Noyes. "*We can't dismiss HD209458b as a fluke. This new discovery suggests something could be missing in our theories of how planets form*."

Theorists had already considered a number of possibilities to explain the large size of HD 209458b, but so far without success. The only way to puff up these giant planets beyond the size calculated from planetary structure equations would be to supply additional heat to their interiors. Simple heating of the surface due to the host star's proximity would not work. (If it could, all close-in transiting giant planets should be expanded, not just two of them.) One way to inject energy into the planet's center is by tipping it on its side, similar to Uranus in the solar system. A planet in that state orbiting close to its star would be subjected to tidal heating of the interior. But according to Smithsonian astronomer Matthew Holman (who was not a member of the discovery team), "*the circumstances required to tip over a planet are so unusual that this would seem unlikely to explain both known examples of inflated worlds*."

According to co-author Dimitar Sasselov, "*Another explanation for HD 209458b's large size was tidal heating due to an eccentric orbit, but recent observations have pretty much ruled that out*." The scientists will continue observing HAT-P-1 to see if such an explanation could hold in this case, but "*until we can find an explanation for both of these swollen planets, they remain a great mystery*," Sasselov said. The HAT network consists of six

telescopes, four at the Smithsonian Astrophysical Observatory's Whipple Observatory in Arizona and two at its Submillimeter Array facility in Hawaii. These telescopes conduct robotic observations every clear night, each covering an area of the sky 300 times the size of the full moon with every exposure.

HAT searches for planets by watching for stars that dim slightly when an orbiting planet crosses directly in front of the star as viewed from Earth - a sort of mini-eclipse. Transits offer astronomers a unique opportunity to measure a planet's physical size from the amount of the dimming. Combined with the mass, which is determined by measuring the amount of the star's wobble as the planet orbits it, researchers then calculated a planet's density. Measurements of the wobble of HAT-P-1's parent star were led by co-author Debra Fischer. http://www.cfa.harvard.edu/press/pr0624image.html

THE DWARF PLANET (FORMERLY KNOWN AS XENA) HAS OFFICIALLY BEEN NAMED 'ERIS', IAU ANNOUNCES

The International Astronomical Union (IAU) today announced that the dwarf planet known as Xena since its 2005 discovery has been named Eris, after the Greek goddess of discord. Eris's moon will be known as Dysnomia, the demon goddess of lawlessness and the daughter of Eris.

The names are those suggested by the discoverers of the dwarf planet--Mike Brown, a professor of planetary astronomy at Cal Tech, Chad Trujillo, and David Rabinowitz, and by the discoverers of the moon--Brown and the engineering team of Keck Observatory where the observations were made.

"*Eris is the Greek goddess of discord and strife*," explains Brown. "*She stirs up jealousy and envy to cause fighting and anger among men. At the wedding of Peleus and Thetis, all the gods were invited with the exception of Eris, and, enraged at her exclusion, she spitefully caused a quarrel among the goddesses that led to the Trojan War*." "*She's quite a fun goddess, really*," Brown adds. "*And, for the Xena fans out there who are sad to see the name go, Eris appeared in her Latin version of Discordia as a recurring character on Xena: Warrior Princess*."

True to its name, the dwarf planet Eris has stirred up a great deal of trouble among the international astronomical community, most recently last month when the question of its proper designation led to a raucous meeting of the IAU in Prague. At the end of the conference, IAU members voted to demote Pluto to dwarf-planet status, leaving the solar system with eight planets. However, the ruling effectively settled the year-long controversy about whether Eris would rise to planetary status. Somewhat larger than Pluto, the body was formally announced to the world on July 29, 2005. With the August IAU ruling, Eris is the largest dwarf planet.

Eris, about 2,400 kilometers in diameter, was discovered on January 8, 2005, at Palomar Observatory with the 48-inch Samuel Oschin Telescope. A Kuiper-belt object like Pluto, but slightly less reddish-yellow, Eris is currently visible in the constellation Cetus to anyone with a top-quality amateur telescope.

Eris is now about 97 astronomical units from the sun (an astronomical unit is the distance between the sun and Earth), which means that it is some nine billion miles away at present. On a highly elliptical 560-year orbit, Eris sweeps in as close to the sun as 38 astronomical units. At present, however, it is nearly as far away as it ever gets. Pluto's own elliptical orbit takes it as far away as 50 astronomical units from the sun during its 250-year revolution. This means that Eris is sometimes much closer to Earth than Pluto--although never closer than Neptune.

Dysnomia, the only satellite of Eris discovered so far, is about 250 kilometers in diameter and reflects only about 1 percent of the sunlight that its parent reflects. The name is both a nod to Lucy Lawless, the actress who played Xena on the TV show, and to the astronomical tradition of naming the first satellites of dwarf planets.

Based on spectral data, the researchers think Eris is covered with a layer of methane that has seeped from the interior and frozen on the surface. As in the case of Pluto, the methane has undergone chemical transformations, probably due to the faint solar radiation, causing the methane layer to redden. But the methane surface on Eris is somewhat more yellowish than the reddish-yellow surface of Pluto, perhaps because Eris is farther from the sun.

Brown, Trujillo, and Rabinowitz first photographed Eris with the Samuel Oschin Telescope on October 31, 2003. However, the object was so far away that its motion was not detected until they reanalyzed the data in January of 2005. http://www.astro.caltech.edu/palomarnew/sot.html http://www.gps.caltech.edu/~mbrown http://www.planeteris.com

SATURN'S RINGS TO SHINE AS NEVER BEFORE

Ring scientists have been waiting for this. Finally, after more than two years orbiting Saturn, the Cassini spacecraft reaches one of the ultimate vantage points. The rings should shine with majesty worthy of the "Jewel of the Solar System."

The event is a solar occultation -- when the sun passes directly behind the planet as Cassini looks on. And this is not just any solar occultation; it's a very long one. The Cassini spacecraft will be right where scientists studying the rings want it: far enough from Saturn to be able to image it all and, more importantly, with the Sun blocked by the planet for 12 hours, long enough to properly map the elusive microscopic particles moving within the extended ring system. Data collected during this observation might also uncover clues about Enceladus' past behavior and aid mission planners in refining ring hazard models for future ring crossings. Thanks to the slow occultation, images taken during this carefully designed orbit may also uncover new ring structures and, at the very least, capture truly spectacular views of the D, F, G and E rings.

"*We are all sort of on pins and needles waiting for the results*," says Brad Wallis, Cassini Rings Discipline Scientist. "*When you get these kinds of high phase angles, very small particles almost focus the light right at the observer. So these faint rings that are so hard to see are going to be considerably brighter and show us details that are just not possible to see in other viewing conditions. All the space between Enceladus and the G ring is probably going to be pretty well lit up. It's really a unique event*." While solar occultations in the mission typically last only an hour, this time it will last almost 12 hours, truly a dream come true considering it takes about 30 minutes to turn the spacecraft to the proper position. During "regular" occultations, scientists can only take a few images before the Sun reappears and the spacecraft has to be turned away to avoid damaging its sensitive instruments.

"*So far we have only had some tiny snapshots of the E ring at high phase angles*," Wallis says. "*In this case we can basically image the entire ring. During that period of time, we can image all of the rings from the outer E ring inward at very high phase angles, which means that we are almost looking straight into the sun, but the sun is behind Saturn*."

Besides mapping the E ring, the observation will allow scientists to learn if there are structures within the ring. Structure within the E ring would be a good indication that Enceladus is not spewing material out at a regular pace. "*We know that the E ring is a large, diffuse cloud going out from a little beyond the G ring to far beyond Enceladus*," Wallis says. "*Enceladus seems to be the source of it, given the ice jets Cassini has recently discovered, so if the whole ring looks uniform, that means Enceladus has being spewing stuff at the same rate for quite a long time. But if there are clumps and/or ringlets in it that we can not explain, it means the spew rate out of Enceladus changes. This is the one chance we have to see a snapshot of the history of Enceladus*." The E ring is a very large cloud of dust made up of extremely fine particles -- 1 or 2 microns -- more or less the size of smoke particles. It stretches from 150,000 to 240,000 kilometers (93,000 to 149,000 miles) from the center of Saturn and is about 5,000 to 10,000 kilometers (3,100 to 6,200 miles) thick. Crossing the E ring, however, poses no hazard to the spacecraft.

"*We pass through the E ring all the time, and we get samples of particles every time we cross it, but we have only a rough idea of what the structure looks like in detail because the difference between detecting three particles or four particles at any ring plane crossing is insignificant*," Wallis explains. "*This is the only chance we get to point the cameras right at the Sun and see these things in this very forward scattered mode*."

The same technique worked in the past, and it allowed mission planners to cross the rings safely.

"*Voyager 2 discovered a vast and complex new system of ringlets around Uranus this way, using only one single image taken in several minutes. We'll have 10 straight hours*," Wallis says. Cassini is slated to send home the images starting on Sept. 17. To better exploit the rare opportunity, Cassini will take images in multiple exposures and colors. The Imaging Science Subsystem and Visible and Infrared Mapping Spectrometer will be the prime instruments in this set of unique observations.

"*The imaging team will use the wide-angle camera to do a mosaic of the entire area in multiple colors and multiple exposures because the brightness of the particles changes very steeply when you move into these high-phase angle areas. The team will also use the narrow-angle camera to get some high resolution looks at selected areas*." Wallis says.

"*Because this is somewhat uncharted territory (viewing these faint rings at these very high phase angles), and because we only have one opportunity like this in the entire 4-year mission, the teams planning this science want to be sure they get it and get it right*," adds Wallis. http://saturn.jpl.nasa.gov/news/features/feature20060915.cfm

Scientists Snap Images of First Brown Dwarf in Planetary System

Scientists using the Spitzer Space Telescope have discovered and directly imaged a small brown dwarf star, 50 times the mass of Jupiter, orbiting with a planet around a sunlike star. Such an arrangement has never before been seen but might be common, the scientists said, leading to solar systems with distorted planetary orbits.

Kevin Luhman is the lead author on a report describing this discovery, which will be published in The Astrophysical Journal. The discovery concerns a class of the coldest brown dwarfs, called T dwarfs. "*Over the last 10 years, astronomers have been extremely successful in finding planets close to their host stars using indirect detection methods*," said Luhman. "*Because of its infrared capabilities, Spitzer is well suited for directly detecting cool T dwarfs, and perhaps even large planets, in the outer parts of planetary systems*."

Luhman's team also discovered a second brown dwarf that is smaller yet, about 20 times the mass of Jupiter, orbiting another star. This smaller object could be the youngest T dwarf known, offering scientists a snapshot of early brown-dwarf development. The two T dwarfs are the first to be imaged by Spitzer. Shortly after these companions were found, Spitzer also discovered a T dwarf that is floating through space by itself rather than orbiting a star. The team that discovered that T dwarf is led by Daniel Stern.

Brown dwarfs are small stars that are not massive enough to burn hydrogen, like the sun does. Their cores are not hot enough to trigger such nuclear fusion. As a result, their surface temperature is only a few thousands of degrees when young, cooling considerably to about the temperature of a planet as they age. Consequently, they are dim and hard to identify and, as a result, the first unambiguous identification came only about 10 years ago.

The more massive of the two newly discovered T dwarfs is called HD 3651 B, located in the constellation Pisces. This object is in a solar system containing a star slightly less massive than the sun that is orbited by a planet slightly smaller than Saturn.

The planet's orbit around the sunlike star is highly elliptical, which had suggested that the gravity of some unseen object farther away from the star was pulling the planet outward. Sure enough, it was a T dwarf. Many extrasolar planets have been discovered with highly elliptical orbits. The Spitzer discovery is the first evidence to support the theory that small companions such as T dwarfs can hide in such solar systems and can cause the orbits of planets to be extreme.

"*The orbit of the planet in this system is similar to Mercury's, but the T dwarf has an orbit more than 10 times larger than Pluto's*," said Brian Patten, a co-author. "*Although HD 3651 B would be just beyond naked-eye visibility to an intrepid astronomer living on this system's planet, the T dwarf makes its presence known through gravity*."

The other T dwarf is called HN Peg B in the constellation Pegasus. Whereas most brown dwarfs are billions of years old, HN Peg B is relatively young, only about 300 million years old. The scientists determined its age by carefully studying the companion star, which was formed at the same time from the same gas cloud. The system also contains a previously discovered disk of dust and rocks. "*Detectable debris disks and T dwarf companions are fairly rare, so the presence of both around the same star makes this a particularly exciting star system*," said Giovanni Fazio, a co-author. http://live.psu.edu/story/19570

Scientists Discover New Ring and Other Features at Saturn

Saturn sports a new ring in an image taken by Cassini spacecraft on Sunday, Sept. 17, during a one-of-a-kind observation. Other spectacular sights captured by Cassini's cameras include wispy fingers of icy material stretching out tens of thousands of kilometers from the active moon, Enceladus, and a cameo color appearance by planet Earth.

The images were obtained during the longest solar occultation of Cassini's four-year mission. During a solar occultation, the sun passes directly behind Saturn, and Cassini lies in the shadow of Saturn while the rings are brilliantly backlit. Usually, an occultation lasts only about an hour, but this time it was a 12-hour marathon.

Sunday's occultation allowed Cassini to map the presence of microscopic particles that are not normally visible across the ring system. As a result, Cassini saw the entire inner Saturnian system in a new light. The new ring is a tenuous feature, visible outside the brighter main rings of Saturn and inside the G and E rings, and coincides with the orbits of Saturn's moons Janus and Epimetheus. Scientists expected that meteoroid impacts on Janus and Epimetheus might kick particles off the moons' surfaces and inject them into Saturn orbit, but they were surprised that a well-defined ring structure exists at this location.

Saturn's extensive, diffuse E ring, the outermost ring, had previously been imaged one small section at a time. The 12-hour marathon enabled scientists to see the entire structure in one view. The moon Enceladus is seen sweeping through the E ring, extending wispy, fingerlike projections into the ring. These very likely consist of tiny ice particles being ejected from Enceladus' south polar geysers, and entering the E-ring. "*Both the new ring and the unexpected structures in the E ring should provide us with important insights into how moons can both release small particles and sculpt their local environments*," said Matt Hedman, a research associate working with team member Joseph Burns, an expert in diffuse rings.

In the latest observations, scientists once again see the bright ghost-like spokes -- transient, dusty, radial structures -- streaking across the middle of Saturn's main rings. Capping off the new batch of observations, Cassini cast its powerful eyes in our direction and captured Earth, a pale blue orb, and a faint suggestion of our moon. Not since Voyager 1 spacecraft saw Earth as a pale blue dot from beyond the orbit of Neptune has Earth been imaged in color from the outer solar system. "*Nothing has greater power to alter our perspective of ourselves and our place in the cosmos than these images of Earth we collect from faraway places like Saturn*," said Carolyn Porco, Cassini imaging team leader. Porco was one of the Voyager imaging scientists involved in taking the Voyager `Pale Blue Dot' image. "*In the end, the ever-widening view of our own little planet against the immensity of space is perhaps the greatest legacy of all our interplanetary travels*."

In the coming weeks, several science teams will analyze data collected by Cassini's other instruments during this rare occultation event. The data will help scientists better understand the relationship between the rings and moons, and will give mission planners a clearer picture of ring hazards to avoid during future ring crossings. Images of the new ring, the E-ring, Enceladus and Earth are available at: http://www.nasa.gov/cassini, http://saturn.jpl.nasa.gov and http://ciclops.org

"CHAMPAGNE SUPERNOVA" CHALLENGES IDEAS ABOUT HOW SUPERNOVAE WORK

An international team of astronomers have discovered a supernova more massive than previously believed possible. This has experts rethinking their basic understanding of how stars explode as supernovae. The lead author of the study, postdoctoral researcher Andy Howell, identified a Type Ia supernova, named SNLS-03D3bb, in a distant galaxy 4 billion light years away that originated from a dense evolved star, termed a "white dwarf," whose mass is far larger than any previous example. Type Ia supernovae are thermonuclear explosions that destroy white dwarfs when they accrete matter from a companion star.

The discovery was made possible through images taken as part of a long-term survey for distant supernovae with the Canada France Hawaii Telescope. Follow-up spectroscopy led by Richard Ellis, with the 10-meter Keck Telescope was key to determining the unusually high mass of the new event.

Researchers say the surprisingly high mass of SNLS-03D3bb has opened up a Pandora's box on the current understanding of Type Ia supernovae and, in particular, how well they might be used for future precision tests of the nature of the mysterious "dark energy" responsible for the acceleration of the cosmic expansion. Current understanding is that Type Ia supernova explosions occur when the mass of a white dwarf approaches 1.4 solar masses, or the "Chandrasekhar limit." This important limit was calculated by Nobel laureate Subramanyan Chandrasekhar in 1930, and is founded on well-established physical laws. Decades of astrophysical research have been based upon the theory. Yet somehow the star that exploded as SNLS-03D3bb reached about two solar masses before exploding. "*It should not be possible to break this limit," says Howell, "but nature has found a way! So now we have to figure out how nature did it*."

In a separate "News & Views" article on the research in the same issue of Nature, professor David Branch has dubbed this the "Champagne Supernova," since extreme explosions that offer new insight into the inner workings of supernovae are an obvious cause for celebration. The team speculates that there are at least two possible explanations for how this white dwarf got so fat before it went supernova. One is that the original star was rotating so fast that centrifugal force kept gravity from crushing it at the usual limit. Another is that the blast was in fact the result of two white dwarfs merging, and that the body was only briefly more massive than the Chandrasekhar limit before exploding.

Since Type Ia supernovae usually have about the same brightness, they can be used to map distances in the universe. In 1998 they were used to make the surprising discovery that the expansion of the universe is accelerating. Although the authors are confident that the discovery of a supernova that doesn't follow the rules does not undermine this result, it will make them more cautious about using them to measure distance in the future. Ellis summarizes: "*This is a remarkable discovery that in no way detracts from the beautiful results obtained so far by many teams, which convincingly demonstrate the cosmic acceleration and hence the need for dark energy. However, what it does show is that we have much more to learn about supernovae if we want to use them with the necessary precision in the future. This study is an important step forward in this regard*."

FROM THE EDITOR'S TERMINAL

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

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In September's StarGazer:

****** EARTH-LIKE PLANETS MAY BE MORE COMMON THAN ONCE THOUGHT**
****** ASTEROIDS AND METEORITES REVEAL FAMILY RESEMBLANCE**
****** ASTRONOMERS TRACE THE EVOLUTION OF THE FIRST GALAXIES IN THE UNIVERSE**
****** COSMIC ARCHEOLOGY UNCOVERS UNIVERSE'S DARK AGES**
****** CASSINI DETECTS VAST POLAR ETHANE CLOUD ON TITAN**
****** STRANGE NEW PLANET BAFFLES ASTRONOMERS**
****** SATURN'S RINGS TO SHINE AS NEVER BEFORE**
****** THE DWARF PLANET (FORMERLY KNOWN AS XENA) OFFICIALLY RENAMED 'ERIS'**
****** SCIENTISTS SNAP IMAGES OF FIRST BROWN DWARF IN PLANETARY SYSTEM**
****** CASSINI DISCOVERS NEW RING AND OTHER FEATURES AT SATURN**
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****** "CHAMPAGNE SUPERNOVA" CHALLENGES IDEAS ABOUT HOW SUPERNOVAE WORK**
****** EAS ASTRO CALENDAR**
****** EAS AND REGIONAL STAR PARTY SEASON INFO**
****** OBSERVER'S INFORMATION – WHAT'S UP IN THE SKY**
****** CONSTELLATION OF THE MONTH**
****** 'MIRROR IMAGES'**
****** ASTRONOMY AND TELESCOPE 'LINGO'**
****** THE YOUNG ASTRONOMER'S CORNER**

The next EAS Meeting is 3:00 P.M. Saturday, September 23rd 2006 at the Everett Public Library Auditorium.