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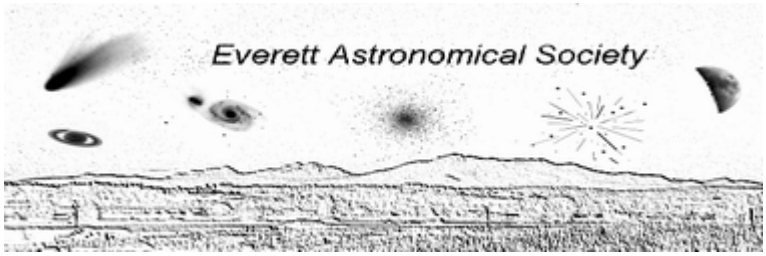
Volume MMVI. No. 10



The Stargazer

October 2006

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		(change 'at' to @ to send email)	http://members.tripod.com/everett_astronomy

EAS BUSINESS…

NEXT EAS MEETING - SATURDAY OCTOBER 21ST AT 3:00 PM AT THE EVERETT PUBLIC LIBRARY, IN THE AUDITORIUM (DOWNSTAIRS)

THIS MONTH'S MEETING PROGRAM:

The Saturday October 21st speaker will be past EAS president Jim Bielaga. He will be speaking on 'Observing Off The Beaten Path' - great objects for observing, especially if you have looked at popular ones like M-13, M-57, and M-42 so many times you want to find some new and interesting objects to explore, and have asked yourself - 'What else should I look at now..?' There are lots of great things to see in the sky year around, great galaxies in the fall, great clusters and nebulae in the winter, and all sorts of combinations. Jim has a great depth of knowledge of these deep-sky objects; almost everyone will learn about some new ones from his presentation. Jim will also have a special announcement for EAS members...

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

2702 Hoyt Avenue
Everett, WA 98201

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

STAR PARTY INFO

Upcoming EAS star party schedule:

Saturday evening October 21 at Ron Tam's place. "I am having a Star Party at my place this Saturday, October 21. Sunset is around 6:00 PM so plan arriving around that time. Weather this time of the year is iffy but I plan on being here. No need to call, just show up. E-mail me or call if you need directions. Remember to dress warmly."

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.

Other Western US Star Parties this season:

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

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 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 2005

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 October Meeting 3:00 pm – Everett Public 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 October Meeting 6:30 pm – Everett Public 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)

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

Oct 14	Last Quarter Moon
Oct 22	New Moon
Oct 29	First Quarter Moon
Nov 05	Full Moon
Nov 16	Last Quarter Moon
Nov 20	New Moon
Nov 28	First Quarter Moon
Dec 05	Full Moon
Dec 12	Last Quarter Moon
Dec 20	New Moon
Dec 27	First Quarter Moon
Jan 03	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	**6:36 am**	**11:53**	**17:10**	**Vir**	**-27.5**
Mercury	Daylight	Daylight	**17:46**	**Lib**	**+0.0**
Venus	Daylight	Daylight	Daylight	**Vir**	**-3.9**
Mars	Daylight	Daylight	Daylight	**Vir**	**+1.8**
Jupiter	Daylight	Daylight	**18:11**	**Lib**	**-2.0**
Saturn	**0:43 am**	Daylight	Daylight	**Leo**	**+0.4**
Uranus	Daylight	**20:59**	**2:29am**	**Aqr**	**+5.8**
Neptune	Daylight	**19:25**	**0:19 am**	**Cap**	**+7.8**
Pluto	Daylight	Daylight	**20:34**	**Oph**	**+13.9**

(times local time for Everett PST)

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

Send any announcements you have for publication here.

CONSTELLATION OF THE MONTH: PHOENIX

PHOENIX: Phoenix borders on the constellations of Eridanus, Fornax, Grus, Sculptor, and Tucana. The abbreviation for this constellation is "Phe", and the possessive form is Phoenicis. There are no established asterisms within its borders. Phoenix ranks 64th in overall brightness among the constellations, but 37th in size; it takes up approximately 469.32 square degrees (or 1.138% of the sky). Phoenix contains two known meteor showers: the July Phoenicids (July 14th) and the December Phoenicids (December 5th), and no Messier objects. Phoenix is completely visible from latitudes South of +32 degrees, and completely invisible from latitudes North of +50 degrees. It has 27 stars brighter than magnitude 5.5, and its central point is at RA=00h54m, Dec.= -49 degrees. The solar conjunction date of Phoenix is April 5th, and its midnight culmination date is October 4th. Phoenix is one of 11 constellations invented by Pieter Dirksz Keyser and Frederick de Houtman, during the years 1595-1597. Some sources state that this in one of Johann Bayer's constellations, outlined in the year 1603.

Representing the mythological bird that rose from its own ashes, Phoenix is dominated by its brightest star: magnitude +2.4 Alpha (also known as Ankaa). Beta Phoenicis is a triple star system, with magnitude +4 A and B components separated by 1.4 arc seconds. The third component (with a magnitude of +11.5) is found 57.5 arc seconds distant. Zeta Phoenicis is also a triple star system, with its A and B components too close to split with anything less than a 10-inch (25 centimeter) telescope. Component A is magnitude +4; component B is magnitude +7, and these are separated by less than one arc second. Component C is magnitude +8 and is 6.4 arc seconds distant. The brightest star is also itself an eclipsing binary; its magnitude ranges from +3.9 to +4.4 in a period of 1.67 days. Phoenix contains one galaxy of note: NGC 625, an elongated oval of light (brighter along the central axis). It is a barred spiral lying two degrees south of Gamma Phoenicis. It has a condensed and bright nuclear area 30" across, surrounded by a 3.0' x 1.3' diameter haze of greenish hue. Phoenix also contains the unusual Cepheid variable star SX Phoenicis, about 8 degrees west of Ankaa. Its magnitude range is 6.8 to 7.5 (it must be carefully compared with surrounding stars to accurately determine its brightness), and its period is only 0.05 days (just 1.2 hours!). With careful observation, you can see this star change noticeably during a single observing session.

PLANETARY FOCUS

Planetary Focus last published in September, and will return next month.

ASTRONOMY AND TELESCOPE "LINGO"

Astronomy "Lingo": CONSTANT OF PRECESSION: The ratio of the luni-solar precession to the cosine of the obliquity of the ecliptic. It is approximately 54.94 arc seconds per year, and varies only slightly with time.

Telescope / Equipment "Lingo": PHOTODETECTOR: Any electronic device designed to respond to or detect photons of light or other radiation. Examples include the photomultiplier and the CCD imager.

YOUNG ASTRONOMER'S CORNER

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

Q: What is a red giant?

A: A big, old red star. Stars are not born this way however. A star like our Sun becomes a red giant when it uses up its main hydrogen fuel and begins to swell and expand. As such a star grows in size, its surface begins to cool off and turn red in color. (In star temperature colors, cool=red; warm=yellow; and hot=blue or white). When our Sun becomes a red giant a few billion years from now, it will grow and expand until it swallows Mercury and Venus and extends even out to the vicinity of the Earth, if not beyond. That is why it is also called a "giant".

Q: How many stars can you actually see at night?

A: Although it may seem like "billions and billions"(!), what we can actually see on a clear night is "only" about 5,500. There are approximately 200 billion stars in the Milky Way Galaxy. However, even on the darkest of nights, human can only pick up less than 6,000 of these, and only again if you stay up all night to see them all (as the Earth rotates different stars will come into view). Human eyes are not sensitive enough to see the remaining 199+++ billion stars, because they are too faint. That is one reason why astronomers use telescopes!!

ASTRONOMY FUN FACTS

★★ The estimated mass of the entire Milky Way Galaxy is equal to about 180 billion Suns. Even if this entire mass were converted to energy, it would still not be enough to accelerate the period at the end of this sentence to the speed of light. Theory states that an infinite amount of energy would be needed to thrust the tiny dot of the period to the speed of light, and even though massive, the Galaxy's mass is NOT infinite.

★★ Our Galaxy has a diameter of approximately 100,0000 light years, or about 500 million billion miles!

★★ The Milky Way Galaxy is flying through the Universe at a speed of about 1.4 million miles an hour; it is heading in the direction of the constellation Hydra. No one quite knows where we are going(!!!), but some believe we are being pulled along and strongly influenced by a supercluster of distant galaxies. Even though the galactic velocity is fast, it would still take a spacecraft over 2,100 years, traveling at this speed, just to reach our nearest star system, Alpha Centauri. It would take 50 million years for the Milky Way to cover a distance equal to its own diameter (about 100,000 light years) – a turtle's pace on a cosmic scale!

MIRROR IMAGES

"MIRROR" IMAGES" : This column is a bi-monthly column; it last published in September, and will return again in November.

ASTRONOMICAL NOTES -- ON & OFF THE WEB…

2006 TRANSIT OF MERCURY

Mark your calendar: On Wednesday, Nov 8th, the planet Mercury will pass directly in front the Sun. The transit begins at 11:12 am PST and lasts for almost five hours. Good views can be had from the Americas, Hawaii, Australia and all along the Pacific Rim. What will it look like? During the transit, Mercury's tiny disk—jet black and perfectly round—will glide slowly across the face of the Sun. Only a speck of the Sun's surface is actually covered, so the Sun remains as dangerous as ever to look at. But with a proper filter and a little imagination, the Transit of Mercury can be a marvelous experience. There are many ways to safely observe the Sun, e.g., through eclipse glasses or by means of a pinhole projector. In this case, nothing beats a telescope equipped with a

sun-safe H-alpha filter. H-alpha filters are narrowly tuned to the red glow of solar hydrogen. They reveal the Sun as a boiling inferno, cross-crossed by dark magnetic filaments and peppered with sunspots. Warning: The sight of Mercury navigating this starscape could be mind blowing. Teachers, call your local astronomy club and ask if they have such a solar telescope. Amateur astronomers love to show off the heavens, and someone will probably volunteer to bring their 'scope to your classroom for the transit. (You can also view the transit online at the SOHO web site--no telescope required.)

Here's something to think about while watching the transit: Mercury is fantastically mysterious. More than half of the planet is unknown to us. When Mariner 10 flew by in the mid-70s, it managed to photograph only 45% of Mercury's cratered surface. What lies on the other side? More craters? Or something totally unexpected? You're free to speculate, because the next spacecraft to visit Mercury, NASA's MESSENGER probe, won't enter orbit until 2011. One of Mercury's greatest secrets is the mystery-material at its poles. Radars on Earth have pinged Mercury and received a strong echo from polar craters. A favorite explanation is ice. While Mercury's daylit surface heats up to 400o C, the temperature in deep, dark polar craters dips below -200o C. If an icy comet landed in one of those craters (or made one of those craters), the comet's ices, vaporized by impact, might re-freeze and stick around. As skeptics like to say, however, "it's just a theory," one of many that MESSENGER will check. Another puzzle is Mercury's wrinkles. Geologists call them "lobate scarps." Like wrinkles on a raisin, the scarps are thought to be a sign of shrinkage. Mercury may actually be collapsing in on itself as its massive iron core cools and contracts. To check this idea, MESSENGER will map Mercury's magnetic field, which springs from the core. If the core is collapsing, the collapse may leave telltale signs in the planet's magnetism. MESSENGER will also look for lobate scarps on the uncharted side of Mercury to see if this is truly a global phenomenon. The answers are years away. Meanwhile, we watch and wonder, and Nov. 8th is a good day for that.

HUBBLE FINDS EXTRASOLAR PLANETS FAR ACROSS GALAXY

The Hubble Space Telescope has discovered 16 extrasolar planet candidates orbiting a variety of distant stars in the central region of our Milky Way galaxy. The planet bonanza was uncovered during a Hubble survey called the Sagittarius Window Eclipsing Extrasolar Planet Search (SWEEPS). Hubble looked farther than has ever successfully been searched before for extrasolar planets. Hubble peered at 180,000 stars in the crowded central bulge of our galaxy 26,000 light-years away. That is one-quarter the diameter of the Milky Way's spiral disk. This tally is consistent with the number of planets expected to be uncovered from such a distant survey, based on previous exoplanet detections made in our local solar neighborhood. Hubble's narrow view covered a swath of sky no bigger in angular size than two percent the area of the full moon. When extrapolated to the entire galaxy, Hubble's data provides strong evidence for the existence of approximately six billion Jupiter-sized planets in the Milky Way.

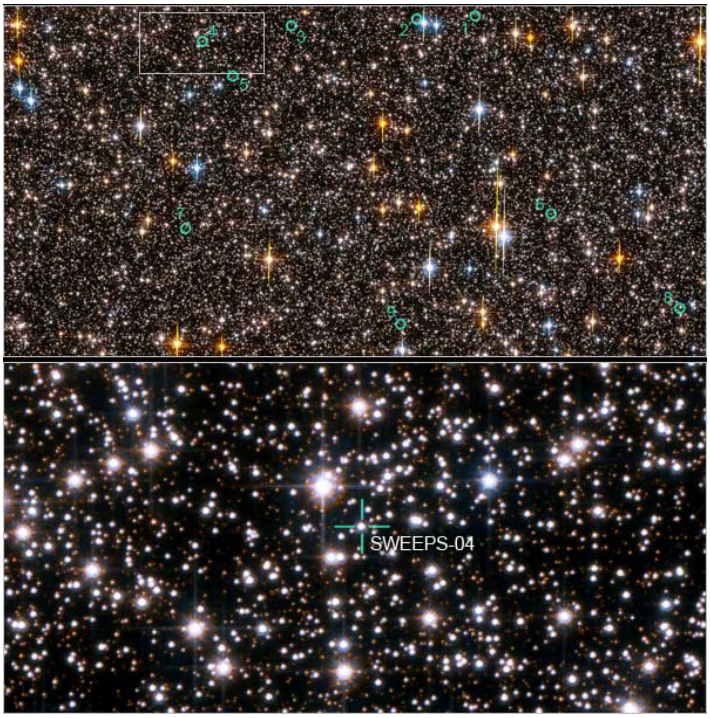
Five of the newly discovered planets represent a new extreme type of planet not found in any nearby searches. Dubbed Ultra-Short-Period Planets (USPPs), these worlds whirl around their stars in less than one Earth day. "*Discovering the very short-period planets was a big surprise*," said team leader Kailash Sahu. "*Our discovery also gives very strong evidence that planets are as abundant in other parts of the galaxy as they are in our solar neighborhood*." Hubble could not directly view the 16 newly found planet candidates. Astronomers used Hubble's Advanced Camera for Surveys to search for planets by measuring the slight dimming of a star due to the passage of a planet in front of it, an event called a transit. The planet would have to be about the size of Jupiter to block enough starlight, about one to 10 percent, to be measurable by Hubble. The planets are called candidates, because astronomers could only obtain follow-up mass measurements for two of them due to the distance and faintness of these systems. Following an exhaustive analysis, the team ruled out alternative explanations such as a grazing transit by a stellar companion that could mimic the predicted signature of a true planet. The finding could more than double the number of planets spied with the transit technique to date. There is a tendency for the planet candidates to revolve around stars more abundant in elements heavier than hydrogen and helium, such as carbon. This supports theories that stars rich in heavy elements have the necessary ingredients to form planets. The planet candidate with the shortest orbital period, named SWEEPS-10, swings around its star in 10 hours. Located only 740,000 miles from its star, the planet is among the hottest ever detected. It has an estimated temperature of approximately 3,000 degrees Fahrenheit. "*This star-hugging planet must be at least 1.6 times the mass of Jupiter, otherwise the star's gravitational muscle would pull it apart*," said SWEEPS team member Mario Livio. "*The star's low temperature allows the planet to survive so near to the star*."

"*Ultra-Short-Period Planets seem to occur preferentially around normal red dwarf stars that are smaller and cooler than our sun*," Sahu explained. "*The apparent absence of USPPs around sun-like stars in our local neighborhood indicates that they might have evaporated away when they migrated too close to a hotter star*." There is an alternative reason why Jupiter-like planets around cooler stars may migrate in closer to the star than such planets around hotter stars. The circumstellar disk of gas and dust out of which they formed extends in closer to a cooler star. Since the discovery of the first "hot Jupiter" around another star in 1995, astronomers have realized this unusual type of massive planet must have spiraled in close to its parent star from a more distant location where it must have formed. The inner edge of a circumstellar disk halts the migration.

Planetary transits occur only when the planet's orbit is viewed nearly edge-on. However, only about 10 percent of hot Jupiters have edge-on orbits that allow the planet to be observed transiting a star. To be successful, transit surveys must view a large number of stars at once. The SWEEPS transit survey covered a rich field of stars in the Sagittarius Window. The term "window" implies a clear view into the galactic center, but much of the galactic plane is obscured by dust. Hubble monitored 180,000 stars for periodic, brief dimming in a star's brightness. The star field was observed over a continuous seven-day period Feb. 23-29, 2004.

To ensure the dimming was caused by an object orbiting a star, the team used Hubble to detect from two to 15 consecutive transits for each of the16 planet candidates. Two stars in the field are bright enough that the team could make an independent confirmation of a planet's presence by spectroscopically measuring a slight wobble in the star's motion due to the gravitational pull of an unseen companion. They used the European Southern Observatory's Very Large Telescope, located on Mount Paranal in Chile, to measure a slight wobble in the star. One of the planetary candidates has a mass below the detection limit of 3.8 Jupiter masses. The other candidate is 9.7 Jupiter masses, which is below the minimum mass of 13 Jupiter masses for a brown dwarf. A brown dwarf is an object that forms like a star but does not have enough mass to shine by nuclear fusion. Since

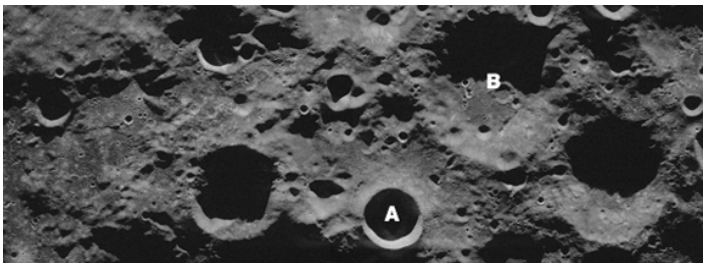
the stars are so faint and the field of view is so densely packed with stars, measuring the slight wobble in the star's motion using spectroscopy to confirm most of the planet candidates is not feasible. Future telescopes such as the James Webb Space Telescope will provide the needed sensitivity to confirm most of the planet candidates. The SWEEPS program is an important proof-of-concept for the future Kepler Mission, scheduled for launch in 2008. The Kepler observatory will continuously monitor a region of the Milky Way galaxy to detect transiting planets around mostly distant stars. Kepler will be sensitive enough to detect possibly hundreds of Earth-size planet candidates in or near the habitable zone, the distance from a star where liquid water could feasibly exist on a planet's surface.



For images and more information about this research. visit: http://www.nasa.gov/hubble

RESEARCHERS FIND NO EVIDENCE OF ICE ON THE MOON

Alas, the moon is not for winter sports. Never mind the difficulty of a triple axel in a bulky spacesuit (though the diminished gravity might help) -- ice, it turns out, is hard to come by up there. That's the latest word from astronomers who used high-resolution radar-mapping techniques to look for ice deposits at the lunar poles. The researchers, led by Donald Campbell, analyzed radar transmitted to the moon from the Arecibo Observatory in Puerto Rico and received 2.5 seconds later at the Robert C. Byrd Green Bank Telescope in West Virginia. Using 20-meter resolution, 13-centimeter wavelength radar, they looked at areas around the lunar south pole where earlier low-resolution images had indicated a high circular polarization ratio (CPR) -- a possible signature of low-temperature water ice. They found similar high CPR values. But they also found that those values are not confined to areas that stay cold enough to sustain ice; they occurred in sunlit areas as well, where temperatures can reach 243 degrees Fahrenheit (117 degrees Celsius) and ice would evaporate rapidly. That indicates that scattered rocks associated with young impact craters are more likely the causes of the high CPR. Accessible ice would be a valuable resource for any long-term human presence on the moon, but reserves could only exist in deep, permanently shaded craters at the poles, where the temperature doesn't rise above about -280 F (-173 C), Campbell said. Previous data had given the search for lunar ice a boost, including 1992 radar data indicating ice deep in craters at the poles of Mercury, 1996 radio data from the moon taken by the Clementine orbiter and the Lunar Prospector Orbiter's 1998 discovery of an elevated amount of hydrogen at the lunar poles. But the elevated hydrogen level could come from other sources -- solar wind, perhaps -- and subsequent radar data has failed to show any evidence of ice deposits.



Campbell says the new data should close the door on the debate. "*This is much higher resolution than we've ever done before*," said Campbell. "*We put the nail in the coffin in terms of the fact that these high CPRs are correlated with presence of rocky, blocky material around young impact craters. The assumption of many people is that high CPRs must indicate the presence of water ice. What we're saying is, that might not be the case. "There is always the possibility that concentrated deposits exist in a few of the shadowed locations not visible to radars on Earth*," he added. "*But any current planning for landers or bases at the lunar poles should not count on this*." http://www.news.cornell.edu/stories/Oct06/campbell.lunarice.html

DOES PLUTO'S ATMOSPHERE GO THROUGH FAST-FREEZE?

A study of Pluto's bright frosts suggests that the way the planet cools down is rapid and disorganized. Pluto's surface is bright because its atmosphere periodically condenses onto the surface. Theory suggested that, as Pluto cools, the traces of methane should condense first, followed by nitrogen ice as Pluto's surface grows colder. The study showed two surprising results: that most of Pluto's nitrogen ice contains dissolved methane and that the area covered by pure methane ice patches is roughly the same as the areas covered by the nitrogen methane mixture. The fact that methane ice is mixed in with the nitrogen suggests that the freeze-out process happens quickly and haphazardly.

Dr Eliot Young said, "*Regardless of its status as a planet or dwarf planet, Pluto is still a fascinating target for planetary scientists. Its surface is constantly changing as different parts of the sphere move into and away from direct light and material evaporates and condenses. At present, we really don't have a clear idea about exactly how this happens or how atmospheric circulation works on Pluto. But as the New Horizons mission is already on its way, we need to make use of the nine years of its journey to find out what to expect when it gets there*."

Pluto's surface has a patchy covering of nitrogen ice, methane and hydrocarbon mud. As Pluto moves around its orbital path, the change in distance from the Sun leads to dramatic changes in the density of Pluto's atmosphere. When the intensity of sunlight on the surface frost increases, more particles evaporate and Pluto's atmosphere becomes thicker. A temperature increase of just 1.5 degree Celsius causes Pluto's atmosphere to double in density. Pluto is now moving away from the Sun and gets 6% less light than when it was at its closest approach in 1989.

Dr Young says "*At some point there will be a downturn, but at present Pluto still seems to be getting warmer. It's like finding that it's warmest at three in the afternoon instead of at lunchtime. The temperature rise may be flattening out, but we'll have to wait until next year before we can make some more observations and find out for sure*." The scientists used a technique called stellar occultation, in which they analyzed the light from a star as Pluto passed in front to work out Pluto's density profile. The observations were made with the Keck and Subaru Telescopes in Hawaii. The next opportunities to use the technique will be in March and July next year. http://meetings.copernicus.org/epsc2006/

WIDE-EYED TELESCOPE FINDS STARS THAT WINK

Astronomers have found two new planets deep in space -- using a budget search technique which hunts for stars that "wink". The team is part of an international collaboration which found the two new Jupiter sized planets around stars over 1000 light years away in the constellation of Andromeda, and about 500 lights years away in Delphinus. Professor Andrew Collier Cameron and team are using wide angle lenses and cameras comparable in operation to household digital cameras to survey million of stars across large tracts of the night sky. They recently joined forces with astronomers to pick out which "winks" were being caused by planets. By pinpointing those stars which "winked" at them, and measuring the gravitational pull of the unseen objects causing the winks, the astronomers were able to show that a transient dip in the brightness of an observed star was caused by an orbiting planet passing in front of it. The duration and depth of the dip in the light curve allowed them to measure the radius of the planets.

These planets are the first to be found during the SuperWASP (Wide Angle Search for Planets) program and their discovery is being hailed as a significant breakthrough in the search for new planets orbiting distant stars. The telescopes take repeated images of hundreds of thousands of stars in one snapshot, building up a record of how each star's brightness varies with time. By searching through the data for stars which 'wink', candidates for those harboring planets are identified. By repeatedly observing the same patches of sky, over and over again with the telescopes and measuring accurately the brightness of all the stars detected, the astronomers build up 'light curves' of all the objects to monitor how their brightness varies. For those stars with planets in orbit around them, and in which the orbits are seen almost edge-on, dips in brightness (about 1%) occur when the planet passes in front of the star. In effect, the stars are winking to tell us they have planets. The duration and depth of the dip in the light curve allow the radius of the planet to be measured. While no telescope could actually see planets around other stars directly, the passage or transit of the planet across the face of star can block out about 1% of the parent star's light, so the star becomes slightly fainter for a few hours. In our own solar system a similar phenomenon occurred on 8th June 2004, when Venus transited across the Sun's disk.

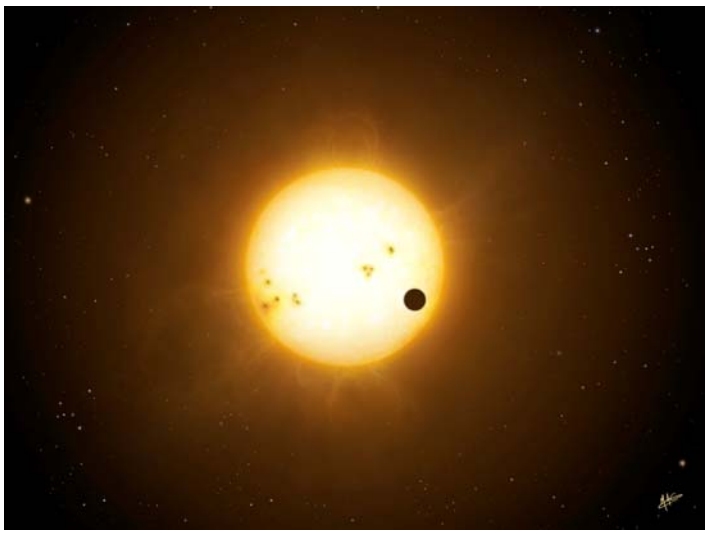
In only a dozen or so of the known systems, has a planet been observed to pass in front of its star. Although the number of known 'transiting exoplanets' is still very small, they hold the key to the formation of planetary systems, and an understanding of the origin of our own Earth. They are the only planets whose sizes and densities can be determined reliably. The stars around which the new planets are orbiting are both similar to the Sun. One is a little hotter, brighter and bigger, whilst the other is a little cooler, fainter and smaller. The larger star, in the constellation of Andromeda, is over 1,000 light years away. The smaller star, in the constellation of Delphinus, is only about 500 light years distant. Although both stars are too faint to be seen with the naked eye, they are easily detectable with a small telescope. The planets themselves are of a type known as 'hot Jupiters'. They are both giant gas planets, like Jupiter, the largest planet in our solar system, but they are much closer to their parent stars. Whilst Jupiter is nearly 800 million km from the Sun and orbits it once every 12 years, WASP-1b is only 6 million km from its star and orbits once every 2.5 days, WASP-2b is only 4.5 million km from its star and orbits once every 2 days. The very close orbits mean that these planets must be even hotter than the planet Mercury in our solar system, which is nearly 60 million km from the Sun and has a surface temperature of over 400 C. WASP-1b's temperature is estimated to be over 1800 C. Both planets show signs that they are losing their atmospheres to space. Named WASP-1b and WASP-2b, the planets are among the hottest ever found. Their atmospheres are slowly being whipped away into space by the searing radiation from their parent stars.

The SuperWASP (Wide Angle Search for Planets) project operates two camera systems -- one in La Palma in the Canary Islands and one at Sutherland Observatory, South Africa. These telescopes have a novel optical design comprising eight scientific cameras, each resembling in operation a household digital camera, and collectively attached to a conventional telescope mount. SuperWASP has a field-of-view some 2000 times greater than a conventional astronomical telescope. The instruments run under robotic control and are housed in their own customized building.

The eight individual cameras on each mount are small by telescope standards -- the lenses are just 11cm in diameter -- but coupled with state-of-the-art detectors and a sophisticated, automated data analysis pipeline, they are capable of producing images of the entire sky, several times per night, and detecting several hundred thousand stars in a single snap-shot. One nights' observing with SuperWASP generates a vast amount of data, up to 60 GB -- about the size of a typical modern computer hard disk (or 100 CD-ROMs). These data are then processed using sophisticated software and stored in a database at the University of Leicester.

These candidate stars are then observed individually to confirm the planet detection, using the famous telescope at Observatoire de Haute-Provence where the first historic exoplanet discovery was made in 1995 by team members Michel Mayor and Didier Queloz. Confirmation of the new finds came when the SOPHIE instrument at the Observatoire de Haute-Provence was able to detect a slight wobble in each star's motion as the planets orbited around them. Together the two types of observation confirmed the existence and nature of the planets. Approximately 200 planets around other stars are now known, but almost all of them were discovered using large telescopes costing tens of millions of pounds. This requires laborious study of one star at a time, in the hope of finding stars with planets around them. In contrast, the SuperWASP telescopes look at hundreds of thousands of stars at a time, allowing all those with transiting planet candidates to be identified in one go.

As planets orbit around their host stars, the star itself is tugged around in a small orbit by the pull of the planet. This tiny 'wobble' is detected using the Doppler effect. The spectrum of the star contains many absorption lines produced in the star's atmosphere.



* Artist's impression of a 'hot Jupiter' during transit - copyright: Mark A. Garlick.

These spectral lines occur at characteristic, accurately known wavelengths. However, as the star moves under the influence of the orbiting planet, so the spectral lines shift backwards and forwards in wavelength by tiny amounts. The SOPHIE spectrograph allows these tiny wavelength shifts to be measured very accurately.

In the case of the two planets discovered here, the measured Doppler shifts amount to less than 0.0003 nanometers in wavelength, which corresponds to speeds of less than 200 meters per second. Similar transits to those observed by SuperWASP could also be produced by low mass stars, so it is essential to measure the Doppler shift in order to 'weigh' the transiting object and distinguish between the two possibilities. The analysis of the Doppler shift allows the planetary nature of the transiting companion to be secured and its true mass to be determined. Combined with the radius determination, it provides the density of the planet, which is crucial information for the study of internal structure of exoplanets. Astronomical images - http://www.superwasp.org/

PLANETS PREFER SAFE NEIGHBORHOODS

A star must live in a relatively tranquil cosmic neighborhood to foster planet formation, say astronomers using the Spitzer Space Telescope. A team of scientists came to this conclusion after watching intense ultraviolet light and powerful winds from O-type stars rip away the potential planet-forming disks, or protoplanetary disks, around stars like our sun. At up to 100 times the mass of the sun, O stars are the most massive and energetic stars in the universe. They are at least a million times more powerful than the sun. According to Zoltan Balog, lead author of the team's paper, the super-sensitive infrared eyes of Spitzer are ideal for capturing the "photoevaporation" of these planet-forming disks. In this process, immense output from the O star heats the disks that are surrounding nearby sun-like stars so much that gas and dust boil off (much like the evaporation of boiling water), and the disk can no longer hold together. Photon (or light) blasts from the O star then blow away the evaporated material, potentially stripping the sun-like stars of their ability to form planets.

"*We can see that these systems take on a cometary structure as they are being blown away and destroyed*," Balog said. "*No other telescope has ever captured the photoevaporation of a protoplanetary disk in this much detail*," added Kate Su, a co-author. The photoevaporation process is very similar to the one that forms the tail of a comet as it swings by the inner solar system, only a lot more violent and on a far larger scale, Su said. "*Every time a particle of light from the O star hits a dust grain in the nearby protoplanetary disk, the light particle pushes the dust grain away from its host star*," Su said. "*This is very similar to how comet tails form*." "*Unfortunately these sun-like stars just got a little too close to the fire*," George Rieke said.

Ultimately, the astronomers hope to determine whether all stars have planets, and if not, how a star loses the ability to form them. The Spitzer findings will help astronomers understand what regulates the process of planet formation. Team members say that originally they were looking for "diskless stars" in their survey, stars that had ventured too close to an O star and no longer had any disk left. With so many O stars in the region, they didn't expect that a protoplanetary disk would survive for very long. However, they found something different ? stars that had recently blundered into the hostile neighborhood of an O star and were still in the process of losing their disks. "*To see protoplanetary disks in an area where no one expected to see one is very exciting*," Balog said. "*But to see a disk in the process of evaporating is even more thrilling*." The potential planet forming disk (or protoplanetary disk) of a sun-like star is being violently ripped away by the powerful winds of a nearby hot O-type star in this image from NASA's Spitzer Space Telescope. At up to 100 times the mass of sun-like stars, O stars are the most massive and energetic stars in the universe. In a process called "photoevaporation," immense output from the O star heats up the nearby protoplanetary disk so much that gas and dust boil off, and the disk can no longer hold together. Photon (or light) blasts from the O star then strip the potential planet forming disk off its neighbor star by blowing away evaporated material. The system is located about 2,450 light-years away in the star forming cloud

IC 1396. http://www.spitzer.caltech.edu http://www.ipac.caltech.edu/

BLACK HOLE MUSICAL: EPIC BUT OFF-KEY

A gigantic sonic boom generated by a supermassive black hole has been found with the Chandra X-ray Observatory, along with evidence for a cacophony of deep sound. This discovery was made by using data from the longest X-ray observation ever of M87, a nearby giant elliptical galaxy. M87 is centrally located in the Virgo cluster of galaxies and is known to harbor one of the Universe's most massive black holes. Scientists detected loops and rings in the hot, X-ray emitting gas that permeates the cluster and surrounds the galaxy. These loops provide evidence for periodic eruptions that occurred near the supermassive black hole, and that generate changes in pressure, or pressure waves, in the cluster gas that manifested themselves as sound. "*We can tell that many deep and different sounds have been rumbling through this cluster for most of the lifetime of the Universe*," said William Forman.

The outbursts in M87, which happen every few million years, prevent the huge reservoir of gas in the cluster from cooling and forming many new stars. Without these outbursts and resultant heating, M87 would not be the elliptical galaxy it is today. "*If this black hole wasn't making all of this noise, M87 could have been a completely different type of galaxy*," said team member Paul Nulsen, "*possibly a huge spiral galaxy about 30 times brighter than the Milky Way*." The outbursts result when material falls toward the black hole. While most of the matter is swallowed, some of it was violently ejected in jets. These jets are launched from regions close to the black hole (neither light nor sound can escape from the black hole itself) and push into the cluster's gas, generating cavities and sound which then propagate outwards.

Chandra's M87 observations also give the strongest evidence to date of a shock wave produced by the supermassive black hole, a clear sign of a powerful explosion. This shock wave appears as a nearly circular ring of high-energy X-rays that is 85,000 light years in diameter and centered on the black hole. Other remarkable features are seen in M87 for the first time including narrow filaments of X-ray emission -- some over 100,000 light years long -- that may be due hot gas trapped by magnetic fields. Also, a large, previously unknown cavity in the hot gas, created by an outburst from the black hole about 70 million years ago, is seen in the X-ray image. "*We can explain some of what we see, like the shock wave, with textbook physics*," said team member Christine Jones. "*However, other details, like the filaments we find, leave us scratching our heads*." Sound has been detected from another black hole in the Perseus cluster, which was calculated to have a note some 57 octaves below middle C. However, the sound in M87 appears to be more discordant and complex. A series of unevenly spaced loops in the hot gas gives evidence for small outbursts from the black hole about every 6 million years. These loops imply the presence of sound waves, not visible in the Chandra image, which are about 56 octaves below middle C. The presence of the large cavity and the sonic boom gives evidence for even deeper notes -- 58 or 59 octaves below middle C -- powered by large outbursts.:

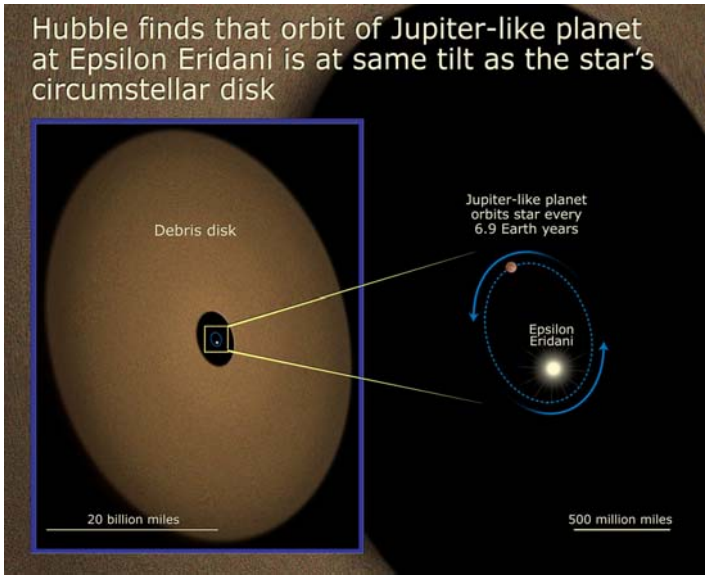
http://chandra.harvard.edu and http://chandra.nasa.gov

HUBBLE OBSERVATIONS CONFIRM THAT PLANETS FORM FROM DISKS AROUND STARS

The Hubble Space Telescope, in collaboration with ground-based observatories, has at last confirmed what philosopher Emmanuel Kant and scientists have long predicted: that planets form from debris disks around stars. More than 200 years ago, the philosopher Emmanuel Kant first proposed that planets are born from disks of dust and gas that swirl around their home stars. Though astronomers have detected more than 200 extrasolar planets and have seen many debris disks around young stars, they have yet to observe a planet and a debris disk around the same star. Now, the HST, in collaboration with ground-based observatories, has at last confirmed what Kant and scientists have long predicted: that planets form from debris disks around stars. The Hubble observations by G. Fritz Benedict and Barbara E. McArthur show for the first time that a planet is aligned with its star's circumstellar disk of dust and gas. The planet, detected in year 2000, orbits the nearby Sun-like star Epsilon Eridani, located 10.5 light-years from Earth in the constellation Eridanus. The planet's orbit is inclined 30 degrees to Earth, the same angle at which the star's disk is tilted. The planets in our Solar System share a common alignment, evidence that they were created at the same time in the Sun's disk. But the Sun is a middle-aged star - 4.5 billion years old - and its debris disk dissipated long ago. Epsilon Eridani, however, still retains its disk because it is young, only 800 million years old.

The Hubble observations also helped Benedict's team determine the planet's true mass, which they calculate as 1.5 times Jupiter's mass. Previous estimates measured only the lower limit, at 0.7 the mass of Jupiter. The planet, called Epsilon Eridani b, is the nearest extrasolar planet to Earth. It orbits its star every 6.9 years. "*Because of Hubble, we know for sure that it is a planet and not a failed star*," McArthur explained. Some astronomers have argued that a few of the known extrasolar planets could be brown dwarfs because their precise masses are not known. If an object is less than 10 Jupiter masses, it is a planet, not a brown dwarf. McArthur was part of an earlier team who discovered Epsilon

Eridani b. They detected the planet using the radial-velocity method, which measures a star's subtle motion toward and away from Earth to find unseen companions. Epsilon Eridani is a young and active star, so some astronomers claimed that what appeared as a planet-induced wobble of the star could have been the actions of the star itself. Turbulence in the atmosphere may have produced apparent velocity changes that were intrinsic to the star and not due to a planet's influence.



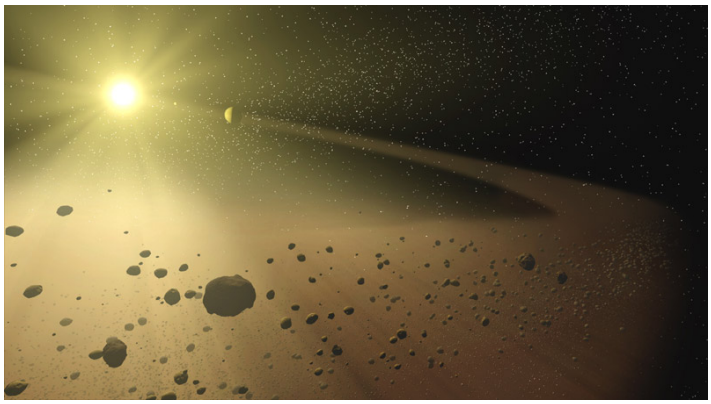
The current Benedict-McArthur team calculated the planet's mass and its orbit by making extremely precise measurements of the star's location as it wobbled on the sky, a technique called astrometry. The slight wobbles are caused by the gravitational tug of the unseen planet, like a small dog pulling its master on a leash. The team studied over a thousand astrometric observations from Hubble collected over three years. The astronomers combined these data with other astrometric observations made at the University of Pittsburgh's Allegheny Observatory. They then added those measurements to hundreds of ground- based radial-velocity measurements made over the past 25 years at European Southern Observatory in Chile, McDonald Observatory at the University of Texas, Lick Observatory at the University of California Observatories, and the Canada-France-Hawaii Telescope in Hawaii. This combination allowed them to accurately determine the planet's mass by deducing the tilt of its orbit. If astronomers don't know how a planet's orbit is tilted with respect to Earth, they can only estimate a minimum mass for the planet. If only the radial velocity wobble along the line of sight is known, the planet's mass could be significantly larger if the orbit were tilted to a nearly face-on orientation to Earth. The star would only move toward and away from Earth slightly, even though it had a massive companion. "*You can't see the wobble induced by the planet with the naked eye*," Benedict said. "*But Hubble's fine guidance sensors are so precise that they can measure the wobble. We basically watched three years of a nearly seven-year-long dance of the star and its invisible partner, the planet, around their orbits. The fine guidance sensors measured a tiny change in the star's position, equivalent to the width of a Euro coin 1200 km away*."

Epsilon Eridani has long captivated the attention of science fiction writers, as well as astronomers. In 1960, years before the first extrasolar planet was detected, astronomer Frank Drake listened for radio transmissions from inhabitants of any possible planets around Epsilon Eridani as part of Project Ozma's search for intelligent extraterrestrial life. In the fictional "Star Trek" universe, Epsilon Eridani is considered by some fans to be the parent star for the planet Vulcan, Mr. Spock's home. No Vulcan or any other alien could live on this gas giant planet. If moons circled the planet, they would spend part of their orbit close enough to Epsilon Eridani to have surface temperatures like that of Earth, and possibly liquid water. However, the planet's looping, "roller-coaster" orbit also would carry the moons far away from the star, a distance equal to Jupiter's 800-million-kilometre separation from the Sun, where oceans would freeze. If a moon were massive enough, like Saturn's giant moon Titan, it could have a sufficiently dense atmosphere that would retain heat. Such an atmosphere would suppress wide swings in surface temperatures, like covering up with a heavy blanket on a cold night. This could make such a moon potentially habitable for life as we know it, Benedict said. Although Hubble and other telescopes cannot image the gas giant planet now, they may be able to snap pictures of it in 2007, when its orbit is closest to Epsilon Eridani. The planet may be bright enough in reflected sunlight to be imaged by Hubble, other space-based cameras, and large ground-based telescopes. http://www.spacetelescope.org/news/html/heic0613.html

ASTEROIDS, COMETS, PLANETS: CUT FROM SAME CLOTH?

Could all of the asteroids, comets, and planets in our Milky Way galaxy be made of a similar mix of dusty components? After analyzing the dust particles of a variety of comets with the Spitzer Space Telescope, the Deep Impact spacecraft and the internationally funded Infrared Space Observatory, Dr. Carey Lisse suspects that the answer is yes. "*Comets are the stepping stones to planets*," said Lisse. "*With these missions, astronomers know more about comets today than ever before, and we're still only beginning to scratch the surface*." According to Lisse, the Deep Impact mission, which sent an 820-pound impactor into the path of a hurtling comet about 5 by 8 kilometers (3 by 5 miles) wide, provided a "Rosetta stone" for studying solar system formation in the universe. The collision, on July 4, 2005, unleashed a plethora of pristine particles that had been locked in the core of comet Tempel 1 since the dawn of our solar system. From its lofty perch in space, Spitzer was in the perfect position to scrutinize the cometary material ejected from comet Tempel 1. The sensitive telescope's spectrometer instrument detected dust particles finer than human hair, and discovered the presence of silicates (crushed rock or sand), carbonates (chalk), smectite (clay), metal sulfides (like fool's gold), amorphous carbon (soot) and polycyclic aromatic hydrocarbons (carbon-rich molecules found on barbecue grills and in automobile exhaust on Earth). Scientists have determined that comet Tempel 1 is a loosely assembled icy dirtball with the consistency of talcum powder. "*The impactor was able to go 20 to 30 meters into the comet and release material that hadn't been baked or boiled by the comet's previous trips around the sun*," said Lisse. Lisse and his team later compared their Tempel 1 data to observations of comet Hale Bopp made by the Infrared Space Observatory in 1997. Although Hale Bopp did not show any of the iron-rich olivine silicates found in Tempel 1, team members did find many chemical similarities, like ice made of water, carbonates, sulfides, polycyclic aromatic hydrocarbons and other types of silicates. They then looked at the Infrared Space Observatory's observations of a distant solar system called HD 100546, which many scientists believe is undergoing planet formation, and again found many of the materials observed in Hale Bopp and Tempel 1. However, unlike the comets, HD 100546 didn't contain some of the most primitive rock-forming elements. "*Although there are some particle variations, our team has found that Tempel 1, Hale Bopp and HD100546 share many of the same basic chemical compounds*," said Lisse. "*We think the differences we see are due to the effect*

of active planet formation, nebular shocks, and collisions in the HD100546 planet-forming disk."



In a new extension of this work, Lisse recently teamed with Dr. Charles Beichman to study HD69830, a star surrounded by a disk of dusty material and three Neptune-sized planets. Previously, Beichman and his colleagues suspected the disk could be an asteroid belt. Now, the astronomers have used Lisse's models of planetary body ingredients to confirm that the disk is an asteroid belt, and to show that it may have been created by the destruction of an icy asteroid about 70 kilometers across (43 miles). This is similar to what happened in our own solar system millions of years ago. In addition, the new analysis reveals that the asteroid belt is twice as far out as previously believed, beyond the known planets. "*I am thrilled by these findings. This is one of the first steps to realizing that our solar system may be similar to other solar systems in the universe*," he said.
www.spitzer.caltech.edu/spitzer
http://www.jpl.nasa.gov/news/features.cfm?feature=1199

JUPITER'S LITTLE RED SPOT GROWING STRONGER

The highest wind speeds in Jupiter's Little Red Spot have increased and are now equal to those in its older and larger sibling, the Great Red Spot, according to observations with the Hubble Space Telescope. The Little Red Spot's winds, now raging up to approximately 400 miles per hour, signal that the storm is growing stronger, according to the team that made the Hubble observations. The increased intensity of the storm probably caused it to change color from its original white in late 2005, according to the team. "*No one has ever seen a storm on Jupiter grow stronger and turn red before*," said Amy Simon-Miller, lead author of a paper describing the new observations. "*We hope continued observations of the Little Red Spot will shed light on the many mysteries of the Great Red Spot, including the composition of its clouds and the chemistry that gives it its red color*." Although it seems small when viewed against Jupiter's vast scale, the Little Red Spot is actually about the size of Earth, and the Great Red Spot is around three Earth diameters across. Both are giant storms in Jupiter's southern hemisphere powered by warm air rising in their centers. The Little Red Spot is the only survivor among three white-colored storms that merged together. In the 1940s, the three storms were seen forming in a band slightly below the Great Red Spot. In 1998, two of the storms merged into one, which then merged with the third storm in 2000. In 2005, amateur astronomers noticed that this remaining, larger storm was changing color, and it became known as the Little Red Spot after becoming noticeably red in early 2006. The new Hubble observations by the team reveal that winds in the Little Red Spot have grown stronger compared to previous observations. In 1979, Voyager 1 and 2 flew by Jupiter and recorded that top winds were only about 268 miles per hour in one of the "parent" storms that merged to become the Little Red Spot. Nearly 20 years later, the Galileo orbiter revealed that top wind speeds were still the same in the parent storm, but winds in the Great Red Spot blew at up to 400 miles per hour. The team used Hubble's new Advanced Camera for Surveys instrument to discover that top wind speeds in both storms are now the same, because this instrument has enough resolution to track small features in these storms, revealing their wind speeds.

Scientists are not sure why the Little Red Spot is growing stronger. One possibility is a change in size. These storms naturally fluctuate in size, and their winds spin around their central core of rising air. If the storm were to become smaller, its spiraling winds would increase the same way spinning ice skaters turn faster by pulling their arms closer to their bodies. Another possibility is that it's the only survivor. "*The lack of other large storms in the same latitude on Jupiter leaves more energy to feed the Little Red Spot*," said Simon-Miller.

According to the team, the increased intensity of the Little Red Spot probably explains why it changed color. It is likely to be behaving like the Great Red Spot for two reasons: it has the same wind speed and the team's color analysis showed that it really is the same color as the Great Red Spot. It's probably pulling up gaseous material from far below that changes color when exposed to ultraviolet radiation in sunlight. The question remains whether the storm is pulling up something that it wasn't before, because its increased intensity allows it to reach deeper, or whether it is pulling up the same material but the higher winds allow the storm to hold it aloft longer, increasing the time it is exposed to solar ultraviolet light and turning it red. The team could confirm exactly what the red material is if they are able to use a technique called spectroscopy in future observations of the Little Red Spot. Spectroscopy is an analysis of the light given off by an object. Each element and chemical gives a unique signal - brightness at specific colors or wavelengths. Identifying these signals reveals an object's composition. However, spectroscopy of Jupiter's atmosphere is complicated because it has many chemicals that could turn red if exposed to ultraviolet light. "*We need to simulate different possible Jupiter atmospheres in a lab so we can discover what spectrometric signals they give. We will then have something to compare with the actual spectrometric signal*," said Simon-Miller.
http://www.nasa.gov/centers/goddard/news/topstory/2006/little_red_spot.html

SATURN'S MOONS MAY BE CREATING NEW RINGS

Cassini scientists are on the trail of the missing moons of Saturn. A recent observation by the spacecraft leads them to believe that they will find the moons near newly discovered rings around the planet. During an unprecedented opportunity, with the sun poised behind Saturn, Cassini scientists discovered two new rings and confirmed the presence of two others. The new rings are associated with one or more small moons and share their orbits with the moons, while scientists suspect a moon is lurking near a third ring. "*Just like the old maxim that says where there's smoke, there's fire, at Saturn, where there's a new ring, there's bound to be a moon*," said Jeff Cuzzi, Cassini interdisciplinary scientist. Under the cover of Saturn's shadow in mid-September, the entire ring system became visible, and never-before-seen microscopic particles began to appear. A single, faint new ring at the orbits of two moonlets, Janus and Epimetheus, was discovered. A second ring was found a week later. It is narrow and overlies the orbit of the tiny moon Pallene, which Cassini discovered back in 2004. A third and fourth ring are visible in the Cassini Division, the big gap in Saturn's main ring system.

Curiously, these rings were not seen in images from the Voyager spacecraft. "*We are hot on the trail of these possible elusive moonlets*," said Joe Burn, Cassini imaging scientist. "*Finding the moons and learning about their interactions with the rings will help us understand how the moons formed and perhaps how the Saturn system formed*."

When viewed by Cassini's infrared instrument, one of the rings in the Cassini Division has unusual coloring and brightening, a trait it shares with fresh, faint rings like the F ring, or those in the Encke Gap in Saturn's outer A ring. Saturn's smallest moons have weak gravity and cannot retain any loose material on their surfaces. When these moons are struck by rapidly moving interplanetary meteoroids, this loose material is blasted off their surfaces and into Saturn orbit, creating diffuse rings along the moons' orbital paths. Collisions among several moonlets, or clumps of boulder-sized rubble, might also lead to debris trails. For instance, Saturn's G ring seems not to have any single moon large enough to see; it might have formed from a recent breakup of a moon. The unusual viewing geometry provided other insights into the changing nature of Saturn's rings. In addition to the dazzling images, data from Cassini's visual and infrared mapping spectrometer also show distinct color differences, indicating variations in composition and in microscopic particles in the Cassini Division, the diffuse E- and G-rings, lying outside the main rings, and the D ring, which is the ring closest to Saturn.

"*These tiny grains are like spices -- even a little bit of material can alter the ring's character*," said Matt Hedman, another Cassini scientist at Cornell. Color variation in the rings might imply particles are being sorted by size. "*We expected to see things we haven't seen before, but we are really, really puzzled by these new images of Saturn's main ring system*," said Phil Nicholson, Cassini visual and infrared spectrometer team member. "*The rings appear very different, with none of their usual calling card of water-ice features. There are hints that other material besides ice might finally be detected within the rings*." "*The main rings show a neutral color, while the C ring is reddish, and the D and E rings are quite blue*," added Nicholson. "*We don't quite understand if these variations are due to differences in particle size or composition, but it's nice to be surprised every once in a while*." http://www.nasa.gov/cassini

SATURN'S RINGS SHOW EVIDENCE OF MODERN-DAY COLLISION

Scientists with the Cassini mission have spied a new, continuously changing feature that provides circumstantial evidence that a comet or asteroid recently collided with Saturn's innermost ring, the faint D ring. Imaging scientists see a structure in the outer part of the D ring that looks like a series of bright ringlets with a regularly spaced interval of about 30 kilometers (19 miles). An observation made by the Hubble Space Telescope in 1995 also saw a periodic structure in the outer D ring, but its interval was then 60 kilometers (37 miles). Unlike many features in the ring system that have not changed over the last few decades, the interval of this pattern has been decreasing over time. "*This structure in the D ring reminds us that Saturn's rings are not eternal, but instead are active, dynamical systems, which can change and evolve*," said Dr. Matt Hedman, Cassini imaging team associate. When Cassini researchers viewed the D ring along a line of sight nearly parallel to the ringplane, they observed a pattern of brightness reversals: a part of the ring that appears bright on the far side of the rings appeared dark on the near side of the rings, and vice versa. This phenomenon would occur if the region contains a sheet of fine material that is vertically corrugated, like a tin roof. In this case, variations in brightness would correspond to changing slopes in the rippled ring material. Both the changes over time and the "corrugated" structure of this region could be explained by a collision of a comet or meteoroid into the D ring, which then kicked out a cloud of fine particles. This cloud might have inherited some of the tilt of the colliding object's path as it slammed into the rings. An alternate explanation could be that the object struck an already inclined moonlet, shattering it to bits and leaving its debris in an inclined orbit. In either case, the researchers speculate the aftermath of such a collision would be a ring slightly tilted relative to Saturn's equatorial plane. Over a period of time, as the inclined orbits of the ring particles evolve, this flat sheet of material would become a corrugated spiral that appears to wind up like a spring over time, which is what was observed. Based on observations between 1995 and 2006, scientists reconstructed a timeline and estimated that the collision occurred in 1984.

SOME SUPER-EARTHS FORM IN SUPER SNOWSTORMS

The 200 known planets that orbit other stars exhibit incredible variety. Among them are a handful of worlds that weigh between 5 and 15 times Earth. Astronomers believe these "super-Earths" are rocky iceballs rather than gas giants like Jupiter. While theorists can explain how such worlds form around Sun-like stars, the discovery of super-Earths around tiny red dwarf stars was surprising. New research suggests that some super-Earths build up rapidly when local temperatures drop and ices condense out of the surrounding gas. "*We believe that some super-Earths form during a cosmic 'snowstorm.' Only this snowstorm envelops the whole planet and lasts millions of years*," said astronomer Scott Kenyon.

All planets form within a disk of gas and dust surrounding a newborn star. Rocky planets form close to the star, where it is warm, while icy and gaseous planets form farther out, where it is cold. When it was young, the Sun was relatively stable, leading to a natural progression of small, rocky worlds in the hot inner solar system and large, gaseous worlds in the cold outer solar system. In contrast, planetary systems around small red dwarf stars undergo dramatic changes in their early history. As the young star evolves, it dims. The warm inner disk starts to freeze, creating conditions where water and other volatile gases condense into snowflakes and ice pellets. "*It's like a massive cold front that sweeps inward toward the star*," explained first author Grant Kennedy. "*The ices add mass to a growing planet, and also make it easier for particles to stick together. The two effects combine to produce a planet several times the size of Earth*." The disks that surround small red dwarf stars tend to contain less material than the disk that formed the solar system. Without the "snowstorms"

in these smaller disks, there is not enough material to make super-Earths.

Although astronomers have discovered a few super-Earths orbiting red dwarf stars, it may be tough to find worlds hospitable to humans. All of the known super-Earths are icy worlds with no liquid water. Red dwarf stars are so dim and cool that their warm "habitable zones" are very close to the star, where there is very little planet-forming material. "*It's difficult to make anything larger than Mercury or Mars in the habitable zone of a red dwarf*," said Kenyon.

The astronomers presented a paper that is also posted online at http://arxiv.org/abs/astro-ph/0609140 . The team now plans to conduct detailed numerical simulations to derive typical timescales for the formation of super-Earths around red dwarf stars. http://www.cfa.harvard.edu/press/pr0627.html online at http://www.cfa.harvard.edu/press/pr0627image.html .

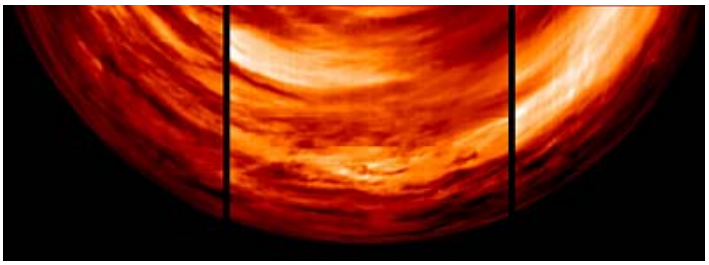
First Pictures Of Asteroid Reveal Bizarre System

The first detailed images of a binary asteroid system reveal a bizarre world where the highest points on the surface are actually the lowest, and the two asteroids dance in each other's gravitational pull. A binary asteroid is a system where two asteroids orbit around one another, like a mini Earth-moon system, said Daniel Scheeres, professor of aerospace engineering. The new results are scheduled to appear Oct. 12 in the journal Science in a pair of papers by Scheeres and Dr. Steven Ostro. The radar images of asteroid KW4 (the official full designation is 66391 1999 KW4) were obtained in May 2001, when the asteroid passed 4.8 million kilometers from Earth. Previously, KW4 was classified as a potentially hazardous asteroid (PHA) because of the proximity of the asteroid's orbit to Earth's orbit. The new observations show that there is no chance of KW4 hitting Earth within at least the next 1,000 years, Scheeres said. "*The KW4 results have profound consequences for ideas about mitigation of the asteroid collision hazard*," Scheeres said. The observations show that the larger object is spinning in its orbit so fast that it has been flattened into a kind of flying saucer shape, said Scheeres. Because of this, the mountainous region along the center of the asteroid actually forms the lowest part on the asteroid. In fact the asteroid is spinning so fast that the equatorial ridge is very close to lifting off the surface and spinning into space, he said. Another interesting finding is that the two bodies in the asteroid system are orbiting so closely that they are caught in each other's gravitational pull. "*They are so close together that when one rotates it affects the other's movements*," Scheeres said.

Based on the observations, the KW4 binary asteroid appears to have formed either from tidal disruption during a close pass by the Earth or from sunlight shining on it, so that it spins so fast that it eventually broke into two pieces. The odd shapes of asteroids cause them to sometimes spin faster and faster when illuminated by the sun, acting a bit like a solar sail, Scheeres said. This is called the YORP effect. The recent findings also confirm that the asteroids are only floating piles of rubble held together by gravity and not a solid mass. http://www.ns.umich.edu/htdocs/releases/story.php?id=986

Complex Meteorology at Venus

In its relentless probing of Venus's atmosphere, ESA's Venus Express keeps revealing new details of the Venusian cloud system. Meteorology at Venus is a complex matter, scientists say. New night-side infrared images gathered by the Ultraviolet, Visible and Near-Infrared Mapping Spectrometer (VIRTIS) in July 2006, clearly show new details of a complex cloud system. A composite of three infrared images acquired by VIRTIS, was taken on 22 July when the spacecraft was flying around the apocenter of its orbit (point of maximum distance from the planet surface) at about 65 000 kilometers altitude. Venus was in the night side. Using its capability to observe at 1.7-micrometre wavelength, VIRTIS could probe at about 15-20 kilometers altitude, below the thick cloud deck situated at about 60 kilometers from the surface. The thermal radiation coming from the oven-hot surface of Venus is represented by the intensity of the colors: the brighter the color (towards white), the more radiation comes from the surface, so the less cloudy the region in the line of sight between the view and the spacecraft is.



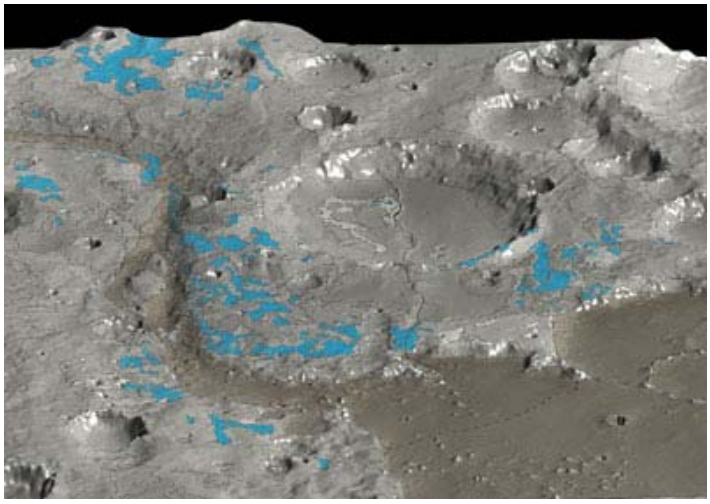
The edge of the images, taken at a time interval of about 30 minutes from each other, do not precisely match. This is due to the fact that clouds on Venus move very rapidly and constantly vary their shape. Venus's atmosphere is certainly the most dynamic among the terrestrial planets that have one, taking only four days to completely rotate around the planet. "*Clouds at Venus present repetitive patterns and recurrent features, but they are very variable in position both on short and long time scales*," said Giuseppe Piccioni who, with Pierre Drossart, is the instrument co-Principal Investigator. "*This makes meteorology a very complex matter for this planet*." Since the thermal radiation from the surface of Venus is in practice modulated by the presence of the clouds, taking the negative of the image it is possible to see directly the clouds structure on the night side, and so study its morphology and dynamics. This was done for this other night-side image, acquired by VIRTIS on 29 July around apocenter from a distance of about 65 000 kilometers from the

surface. The 2.3-micrometre wavelength used for this image brought the 'view' again down below the cloud deck. The large cloud visible in the centre of the image and extending toward the bottom-right part is about 2000 kilometers long and 500 kilometers wide. This cloud presents the familiar and peculiar shape of clouds at Venus. They are usually elongated due to the very high-speed winds reaching up the formidable velocity of 360 kilometers per hour and being caused by the 'super-rotation' of the atmosphere. http://www.esa.int/SPECIALS/Venus_Express/SEM65OV74TE_0.html

MARS EXPRESS AND THE STORY OF WATER ON MARS

For a number of decades now, astronomers have wondered about water on Mars. Thanks to Mars Express, much of the speculation has been replaced with facts. Launched on 2 June 2003, Mars Express has changed the way we think of Mars. Since the Viking missions of the 1970s, planetary scientists have changed their perception of water on Mars several times, passing from the picture of a dry planet to that of a warmer and wetter one. Mars Express's data are now shading a new light on the complex issue of the evolution of water on the Red Planet.

"*We are re-writing the history of Mars*," says Gerhard Neukum,. "*The big picture of a warm wet Mars is not completely correct. Any warm wet period lasted only a few hundred million years. By four thousand million years ago, it was over*," he adds. Three instruments on Mars Express have been at the centre of this revolution in thought. One is the Mars Advanced Radar for Subsurface and Ionospheric Sounding (MARSIS) which probed beneath the surface of Mars to depths of thousands of meters. This is the first time such investigations have taken place. "*MARSIS has shown that many of the upper layers of Mars contain water ice*," says Jeffrey Plaut who is the co-Principal Investigator on the MARSIS experiment.



The scientists detected abundant water ice in the Martian polar regions and also received a surprise from some of the very first results that MARSIS returned. When the radar passed over the mid northern latitudes of Chryse Planitia, the signals showed a buried impact crater, below the surface. Inside this impact structure was a thick layer of possibly water-ice-rich material. "*We are finding reservoirs of ice that have never been seen before*," says Plaut, "*But we are still puzzling out when and where the water on Mars was liquid*." "*The last MARSIS observations have been done on the South Pole*," adds Giovanni Picardi.". "*The quality of the preliminary results of the advanced analysis we are still performing are really exciting and promising, with respect to the main scientific objectives of our experiment*." The objectives include the detection of subsurface water.

The OMEGA Visible and Infrared Mineralogical Mapping Spectrometer has taken giant steps towards answering that question. OMEGA detects minerals on the surface of Mars. Three in particular reveal the history of Martian water. "*We have demonstrated that water could have been stable on Mars's surface but not for very long*," says Jean-Pierre Bibring. OMEGA detected clay-like minerals that form during long-term exposure to water, but only in the oldest regions of Mars. That suggested water flowed during the first few hundred million years of the planet's history only. When these bodies of water were lost, water then occasionally burst from inside the planet but quickly evaporated. During the evaporation they made sulphates, the second mineral that OMEGA detected. When even this stopped and the remaining water on Mars became permanently frozen, then the atmosphere gradually turned the soil red by creating the third mineral OMEGA detected, ferric oxide.

Mars has been like this for thousands of millions of years. "*It is remarkable that, for the first time, we have identified where and when liquid water might have been present on Mars. It is not where one thought of before*," says Bibring.

The images from the High Resolution Stereo Camera (HRSC) point towards the same conclusions. They show the Martian surface in the most exquisite detail, revealing features just 10 meters across. They clearly show extremely old Martian regions that have been eroded by flowing water. The pictures also show a huge valley, Kasei Valles, carved by a gigantic Martian glacier that persisted for a thousand million years during the time when the temperature of Mars had dropped too low for liquid water to flow across the surface. "*We see a clear link between volcanic regions and water flows*," says Neukum. Wherever there has been volcanic activity on Mars, it has melted water inside Mars and let it flow to the surface. Some of these flows are recent - geologically speaking. "*At the foot of Olympus Mons, HRSC sees evidence for water flows that have happened within the last 30 million years*," says Neukum. http://www.esa.int/esaCP/SEMADOV74TE_Life_0.html

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 October's StarGazer:

****** 2006 TRANSIT OF MERCURY**
****** ASTRO CALENDAR**
****** SEASON STAR PARTY INFO**
****** OBSERVER'S INFORMATION**
****** WIDE-EYED TELESCOPE FINDS STARS THAT WINK**
****** RESEARCHERS FIND NO EVIDENCE OF ICE ON THE MOON**
****** PLANETS PREFER SAFE NEIGHBORHOODS**
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****** HUBBLE OBSERVATIONS CONFIRM THAT PLANETS FORM FROM DISKS AROUND STARS**
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****** JUPITER'S LITTLE RED SPOT GROWING STRONGER**
****** SATURN'S MOONS MAY BE CREATING NEW RINGS**
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****** SOME SUPER-EARTHS FORM IN SUPER SNOWSTORMS**
****** COMPLEX METEOROLOGY AT VENUS**
****** FIRST PICTURES OF ASTEROID REVEAL BIZARRE SYSTEM**
****** MARS EXPRESS AND THE STORY OF WATER ON MARS**

The next EAS Meeting is 3:00 P.M. Saturday October 21st at the Everett Public Library Auditorium.