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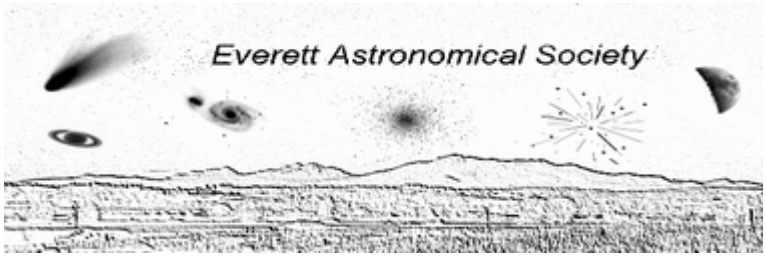

The Stargazer

September 2007

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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 22ND AT 3:00 PM AT THE EVERETT PUBLIC LIBRARY, IN THE AUDITORIUM (DOWNSTAIRS)

★★ Saturday September 22nd MEETING ★★

The program will be "The Universe – An Amazing Journey from the Sun to the Most Distant Galaxies" a thorough survey of the best of recent images from orbiting observatories (Hubble, SOHO, Trace and others) with a very rich explanation of what these beautiful pictures tell us and what is now understood about the objects – this is a really good and understandable explanation of the majority of interesting objects in the sky, many of the objects you can see through amateur telescopes. Truly excellent, and one you have probably not seen anywhere.

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: (also see the regional star parties listed in the 'Astro Calendar for 2007')

EAS Star Party - Saturday October 13 - weather permitting.

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."* Listed below are proposed dates for **planned EAS star parties** at my [Ron Tam's] place, depending upon the weather, of course.

Oct 13 - Saturday
Nov 10 - Saturday

Other dates may be available, but these coincide with times around the new moon, and any conflicts we may have.

Please also join the EAS mail list, 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 Jim Bielaga at (425) 337-4384 for info or check the EAS website.) Members contact Jim Bielaga for scope borrowing.

$$ - FINANCIAL HEALTH - $$

The club maintains a $950+ balance. We try to keep approximately a $500 balance to allow for contingencies. .

CLUB SCOPES

SCOPE	LOAN STATUS
10-INCH WARD DOBSONIAN	ON LOAN
10-INCH SONOTUBE DOBSONIAN	AVAILABLE
8-INCH DOBSONIAN	AVAILABLE

EAS members: contact VP James Bielaga at (425) 337-4384 or jamesbielaga at aol.com to borrow a scope.

EAS MEMBER NEWS

Attention EAS Members – 10% Discount for all Everett Astronomical Society Members at Aurora Astro Products

"Show your club membership card at Jim Bielaga's new astronomy store 'Aurora Astro Products' and receive a 10% discount on all purchases. This is an exclusive discount to E.A.S. members only.

I am proud to be able to offer this discount to Everett club members, and thanks for the support you have shown me on

opening my new store. Also I have made great friends and learned a lot being a club member since 1991.

- Clear Skies, Jim Bielaga"

Does Anyone know about the history of the EAS ???

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.

ASTRO CALENDAR FOR 2007

September 2007

Sep 08 - Saturday, EAS Star party at Ron Tam's
Sep 13-16- SAS annual Star Party - Brooks Memorial State Park
Sep 14 - Saturday, EAS Star party at Ron Tam's
Sep 14-16 - Klickitat County Star Party - http://www.klickitatstarparty.net/
Sep 14-15 - Orion Nebula Star Party -
http://www.seattleastro.org/orionnebsp.html
Sep 22 - EAS Meeting – Everett Public Library Auditorium - 3:00pm
Sep 23 - Autumnal Equinox (09:51 UT)
Sep 8-16 Merritt Star Quest - http://www.merrittastronomical.com/

October 2007

Oct 09 - Draconids Meteor Shower Peak
Oct 13 - Saturday, EAS Star party at Ron Tam's
Oct 14 - Dwarf Planet 136199 Eris Closest Approach To Earth (95.8AU)
Oct 12-14 - Klickitat County Star Party - http://www.klickitatstarparty.net/
Oct 21 - Orionids Meteor Shower Peak
Oct 31 - Halloween

November 2007

Nov 03 - Taurids Meteor Shower Peak
Nov 04 - End Daylight Saving time - Set Clock Back 1 Hour (US)
Nov 10 - Saturday, EAS Star party at Ron Tam's
Nov 12 - Dwarf Planet Ceres Closest Approach To Earth (1.832 AU)
Nov 17 - Leonids Meteor Shower Peak
Nov 22 - Thanksgiving Holiday

December 2007

Dec 07 - 35th Anniv (1972), Apollo 17 Launch (Last Mission to Moon)
Dec 13 - Geminids Meteor Shower Peak
Dec 22 - Winter Solstice, 22:06 UT
Dec 22 - Ursids Meteor Shower Peak
Dec 24 - Mars at opposition
Dec 25 - Christmas Holiday

UW Astronomy Speakers 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, (or 11:30 in C520).
www.astro.washington.edu/dept/colloquium.html

ON THE AIRWAVES - KSER 90.7 - 'IT'S OVER YOUR HEAD'

"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 MEMBERSHIP BENEFITS & INFORMATION

EAS Benefits -
Membership in the **Everett Astronomical Society** (EAS) includes invitations to all of the club meetings and star parties, plus the monthly newsletter, ***The Stargazer.*** Currently, a 10% discount is also being offered to EAS members for purchases at Aurora Astro Products in Everett

Magazine Discounts –
In addition you will be able subscribe to ***Sky and Telescope*** for $7 off the normal subscription rate, contact the treasurer (Carol Gore) for more information.
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 Carol Gore will renew your *Sky and Telescope* subscription for you. **Astronomy** magazine offers a similar opportunity to club members.)

Membership in the Astronomical League -
EAS is a member of the **Astronomical League** and you will receive the Astronomical League's quarterly newsletter magazine, ***The Reflector***.

EAS Club Telescope Borrowing -
Being a member also allows you the use of the club's telescopes, including an award winning 10 inch Dobsonian mount reflector, a second 10" dob, or and 8" Dobsonian. Contact Jim Bielaga (425) 337-4384 to borrow a telescope.

10% Discount on Purchases at 'Aurora Astro Products' in Everett -
EAS members are currently offered a 10% discount for all purchases of any telescopes, accessories, or other items at Aurora Astro Products, when they show their EAS membership card.

EAS Library -
Membership will give you access to all the material in the lending library. The library, which is maintained by Mike Locke, consists of VCR tapes, DVDs, many books, magazines, and software titles. 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 lockemi at comcast.net, to borrow or donate any materials. See list here: http://members.tripod.com/everett_astronomy/eas_library.htm

Joining or Renewing with the EAS -

EAS dues are $25 / year per family. Funds obtained from membership dues allows the EAS to publish the Stargazer newsletter, pay Astronomical League dues, pay insurance, host a web site, and maintain our library. If it has been a year since you paid your dues, please re-subscribe to keep the club financially solvent, and to continue to receive membership benefits. http://members.tripod.com/everett_astronomy/application.htm

Send your annual dues renewals to the
Everett Astronomical Society
P.O. Box 12746, Everett, WA 98206.

OBSERVER'S INFORMATION…

LUNAR FACTS

Sep 19	First Quarter Moon
Sep 26	Full Moon
Oct 03	Last Quarter Moon
Oct 11	New Moon
Oct 19	First Quarter Moon
Oct 26	Full Moon
Nov 01	Last Quarter Moon
Nov 09	New Moon
Nov 17	First Quarter Moon
Nov 24	Full Moon
Dec 01	Last Quarter Moon
Dec 09	New 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	Sets	Con	Mag
Sun	06:54am	19:09	Vir	-27.5
Mercury	09:15am	19:45	Vir	+0.0
Venus	03:41am	17:19	Leo	-4.5
Mars	**22:46am**	**14:48**	**Tau**	**+0.0**
Jupiter	**13:13**	**22:12**	**Oph**	**-2.0**
Saturn	04:31am	18:23	Leo	+0.7
Uranus	**18:41**	**05:56am**	**Aqr**	**+5.7**
Neptune	**17:41**	**03:32am**	**Cap**	**+7.8**
Pluto	**14:06**	**23:36am**	**Sag**	**+14.0**

(times local time for Everett PDT)

Observing Jupiter's Moons – Java tool
http://skytonight.com/observing/objects/javascript/jupiter

Transit times for Jupiter's Great Red Spot in 2007
http://skytonight.com/observing/objects/planets/3304091.html

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

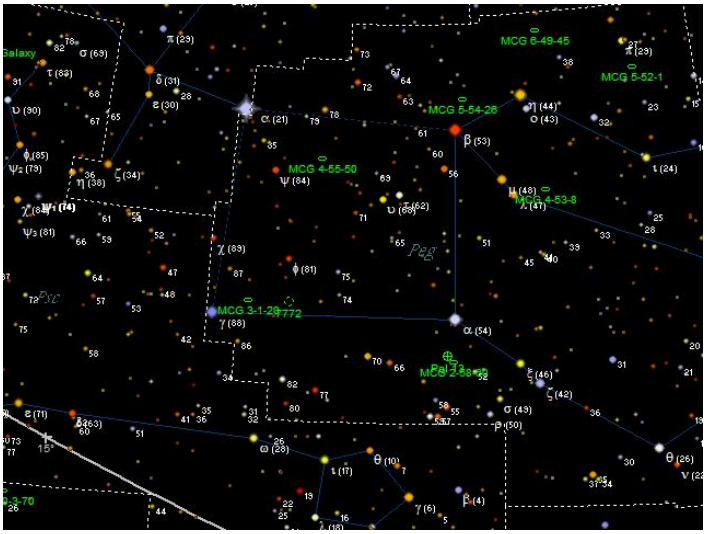
ISS Visibility –
http://spaceflight.nasa.gov/realdata/sightings/SSapplications/Post/SightingData/Seattle.html

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

CONSTELLATIONS OF THE MONTH - PEGASUS

PEGASUS: (The Winged Horse): With a midnight culmination date of September 1st, Pegasus is well-placed for late summer and Fall viewing. Pegasus borders on the constellations of Andromeda, Aquarius, Cygnus, Delphinus, Equuleus, Lacerta, Pisces, and Vulpecula, and contains the well-known asterism of The Great Square (composed of the famous stars of Markab, Scheat, Algenib, and Alpheratz), and the lesser known asterisms of The Baseball Diamond and another dipper known as The Large Dipper (as opposed to the Big Dipper of Ursa Major).

Pegasus ranks 75th in overall brightness among the constellations, but 7th in size: it takes up approximately 1120.8 square degrees of the sky (2.717%). Pegasus contains two known meteor showers: the Xi Pegasids (July 9) and the Pegasids (November 12).



Pegasus contains one Messier object: M-15. M-15 is the most easily found deep-sky object in Pegasus for amateur astronomers, and is a bright (7th magnitude) globular cluster. M-15 is the only known globular cluster containing a planetary nebula (Pease 1 - almost 15th magnitude; one second of arc in diameter). M-15 is located 40,000 light-years away from Earth, and itself has a diameter of 12 minutes of arc. M-15 contains many variable stars, and is one of the richest globulars with respect to variable stars, most of which are RR Lyrae stars. M-15 is a very unusual globular cluster for several reasons: in addition to the planetary nebula and the high concentration of variable stars as mentioned above, M-15 also is an intense X-ray source, leading astronomers to speculate that it contains a central black hole, which is postulated to be the cause of one of the most concentrated and bright cores of any of the globular clusters in the night sky.

Pegasus is completely visible from latitudes North of –54 degrees, and completely invisible from latitudes South of –88 degrees. It has 57 stars brighter than magnitude 5.5, and its central point is at RA=22h39m, Dec.= +19 degrees. The solar conjunction date

of Pegasus is March 2nd. Pegasus contains many other interesting objects as well as M-15. A few of them are listed as follows: AG Pegasi (one of the brightest symbiotic stars, containing both a Wolf-Rayet star and an M-giant star); NGC-7331 (10th magnitude Sb-type spiral galaxy); NGC-7217 (a magnitude 10.2, Sb-type nearly face-on spiral with relatively high surface brightness); NGC-7332 (11th magnitude elliptical (E7) galaxy with a visible lens-shape); NGC-7448 (11.7 magnitude Sc spiral exhibiting a bright nucleus encircled by a irregular dim haze); NGC-7479 (11th magnitude, beautiful barred spiral); and NGC-7619 and NGC-7626 (two of the brighter members, and both ellipticals, of the Pegasus-I galaxy cluster). Perhaps the next famous deep-sky object of Pegasus after M-15 is actually a combination of five galaxies – Stephan's Quintet. The brightest member (magnitude 12.7 spiral) of the Quintet is NGC-7320; the others are all 13th magnitude galaxies: NGC-7317 (elliptical), NGC-7318-A (peculiar elliptical), NGC-7318-B (peculiar barred spiral), and NGC-7319 (peculiar barred spiral). This assemblage of galaxies all lie along the same line of sight; however, while the brightest of the five (NGC-7320) lies 13 megaparsecs away, the remaining four all lie at a distance of 90 megaparsecs!!

There are some other interesting facts about Pegasus which should not be overlooked for the amateur astronomer. The first object in the New General Catalog (NGC-1), lies within Pegasus. NGC-1 is a faint, 13th magnitude galaxy which shows minimal detail in most amateur scopes. A good test of vision and darkness for a dark-sky observing site is to count the stars within the Great Square; 30-50 stars have been reported, and the closer towards 40 or 50 stars, obviously the better the observing. Finally, the constellation of Pegasus contains a good example of what is known as a "shared star": Alpha Andromedae had been known as Delta Pegasi on some ancient maps, but was assigned to Andromeda permanently by the IAU in 1928; i.e., it was "shared" by more than one constellation before 1928. Be sure to make the wonders of Pegasus an integral part of your Fall observing.

YOUNG ASTRONOMER'S CORNER

TOPIC: Are all the stars the same?: This is a repeat, but modified, column from September, 1998. There is often confusion regarding the fact that all stars indeed are not the same: there are many different properties of stars, such as temperature, that distinguish one from the other. As a result of this confusion, this column is worth repeating periodically for all new "Young Astronomers" readers, as well as a refresher for those who may have questions about this topic.

If you've studied any Astronomy in school, perhaps you've seen the letters OBAFGKM, all in a row and listed exactly like that. What does this mean??? Perhaps you recall that in several previous Young Astronomer's Corners we've talked about the fact the even though most stars look like white dots from earth, there ARE some that are unusual looking, even from earth. Vega and Sirius are very bright and bluish-white, while Arcturus and Betelgeuse are yellowish-orange, even to the naked eye. These are OBVIOUSLY different, even without the aid of binoculars or telescopes. What's causing this distinct difference? By looking closely at the light from these stars, such as through an instrument utilizing a slit and a prism (a spectroscope; you've probably seen the resulting "rainbow of light" when light passes through a crystal, or even through millions of raindrops, forming (you guessed it!) ….a rainbow!!), we can see that the pattern formed is a continuous spectrum of colors (the different wavelengths of light, or 'colors'), on which are superimposed darker (absorption) and brighter (emission) lines. Believe it or not, this is a tremendous amount of information (i.e., star color) that relates closely to the surface temperature of the star, and, as a result, enables astronomers to figure out many basic properties of the star itself. The traditional way to remember the letters above are "Oh Be A Fine Girl (or Guy) Kiss Me"; these letters are still used today. The colors of the stars closely relate to the surface temperatures and chemical makeup of the stars, which frequently relate to the mass and life cycle stage of the star. Red Giants, Blue Supergiants, Red Dwarfs, White Dwarfs, and various and sundry Yellow Stars all have their place in a spectroscopic chart of the stars, and the color / temperature of the star can be charted against the absolute magnitude (brightness) of the star to learn much about its stage of evolution, or where it is in its life cycle. That is, its age and relative size and temperature, and what chemicals it is composed of (different chemicals in the stars "give off" different colors upon analysis of their starlight), can be compared to other stars in the sky. On such a chart, the "O" in our saying above generally corresponds to the hotter and younger stars, while the "M" generally corresponds to older, cooler stars. Our own sun, if viewed from very far away outside our own solar system, would be an unspectacular yellow dwarf "G" star. But all things are relative, because from earth, the sun is by far the most spectacular natural object around, and we cannot live without it! So then, with respect to temperature and color, size and mass, magnitude or brightness, chemical composition or makeup, and life-stage and age, one star can be VERY different from another….that is, they are NOT all the same!

ASTRONOMY AND TELESCOPE LINGO

ASTRONOMY LINGO: Free-Fall Time: The time it would take for a system to collapse in upon itself under the force of gravity, if it were not supported by either its own internal pressure or system rotation

TELESCOPE LINGO: PZT (Photographic Zenith Tube): A specially designed telescope used for the accurate determination of time of transit by fundamental stars (stars that have precise positions and proper motions listed for a given epoch; these positions are determined by recording meridian transit times at several observatories). The zenith distance of these stars as they transit is also determined by the PZT. Positions of the stars are recorded on a photographic plate.

ASTRONOMY "FUN FACTS"

★★ The oldest moon rock found during the Apollo missions was estimated to be 4.6 billion years old, dating it back to the time when the Earth and Moon were formed. This rock is now the oldest rock on earth, and was already approximately 1 billion years old before the first single-celled organisms appeared on Earth.

★★ Because of the lack of a lunar atmosphere (and consequent wind erosion), footprints left on the Moon by Apollo astronauts will remain intact and visible for at least 10 million years(!!), as long as they remain undisturbed by visitors during that time!!

★★ Total eclipses of the Sun are a dying breed. Due to tidal influences found within the solar system, the Moon is slowly but surely spiraling further and further away from Earth. At some point in the (albeit far-off) future, the Moon's disk will never completely cover the Sun's disk (which causes totality). Future eclipse viewers will only see a "ring of fire" around the moon, just like the annular ("ring") eclipses seen today when the Moon is furthest from Earth (i.e., at apogee).

PLANETARY FOCUS - JUPITER

"Planetary Focus" is a periodic column that is published occasionally in the EAS "Stargazer". If you have a favorite planet that you would like similar information and/or statistics on, please contact newsletter co-editor Bill O'Neil. This month we are talking about: **Jupiter**. Try to observe this beautiful bright planet, and its moons, located in south-southwest skies in the constellation of Ophiuchus, before it sets about midevening.

Rotation around the Sun: every 11.86 years

Orbit: from 4.95 (closest or 'perihelion') to 5.46 (furthest or 'aphelion') Astronomical Units (AU)*; this is an orbit that varies between approximately 460 and 508 million miles from the sun. (*Note: One AU equals approximately 93 million miles).

Inclination of Orbit to Ecliptic: 1.3 degrees.

Mean Orbital Velocity: 13.06 km/sec.

Diameter at Equator: 142,985 kilometers (or 88,865 miles).

Mass: 317.83 (approximately 318 times more massive than earth); (5.9742 x (10 e24 (10 to the 24th power)) kilograms = 1 Earth Mass).

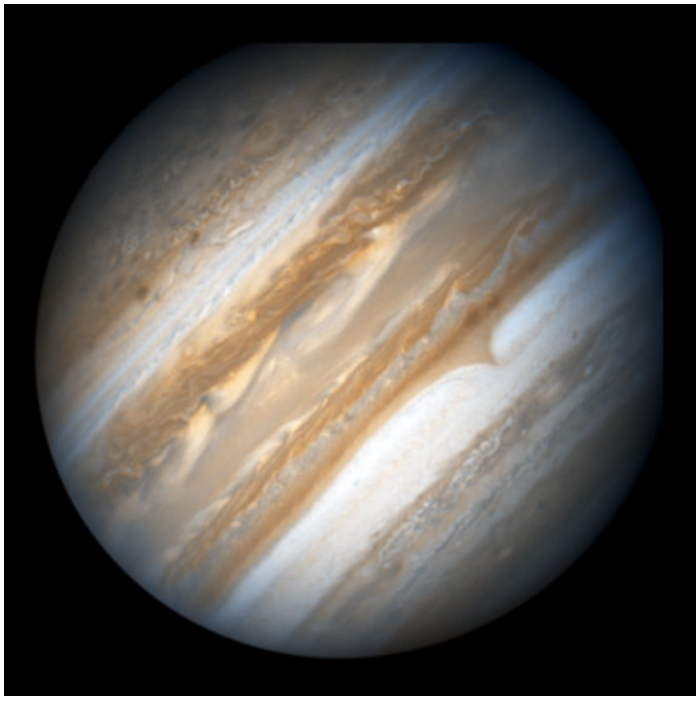
Density: 1.3 times that of water (global density).

Surface Gravity (Earth = 1): 2.54

Period of Rotation on its own axis: approximately 9 hours, 55 minutes.

Axis tilt: 3.12 degrees.

Satellites (moons): 16, as well as planetary rings.



New Horizons spacecraft image of Jupiter in 2007

Special Notes About Jupiter: Jupiter is the largest planet in the solar system. Its rotation period is shorter than that of any other planet (less than 10 hours); this leads to a polar diameter (133,718 kilometers), much shorter than the equatorial diameter. Jupiter's mass is more than twice that of all the other planets combined. A density of only 1.3 times that of water however, suggests that it is mostly composed of the lighter elements of hydrogen and helium. At opposition (approximately every 13 months), Jupiter shines at an apparent magnitude of –2.5, and has an apparent diameter of 47 arc seconds. Among the 16 moons of Jupiter are the four famous Galilean satellites (Io, Europa, Ganymede (the largest moon in the entire solar system), and Callisto), all discovered in 1610 by Galileo (and independently by Simon Marius). These Galilean moons (see below) are bright enough to be seen with binoculars.

Although not as famous or readily visible as Saturn's, Jupiter also has a ring system; they were discovered as the Voyager 1 probe moved inside of the orbit of one of the other 12 moons of Jupiter (Amalthea) in 1979. Jupiter has a series of wind-driven bands of light clouds (zones) and dark clouds (belts) that cross the disc of the planet parallel to the equator. Within these belts and zones, irregular streaks and spots are seen, including the Great Red Spot, which has been observed from earth since the 17th century; most of these spots and streaks are far more transitory or temporary, however. Several probes have flown by and investigated Jupiter's atmosphere and structure. These include Pioneer 10 and 11, the Voyager probes, and the Ulysses, and Galileo probes. Cloud zones and belts predominate below about +/- 45 degrees latitude. The lighter colored zones appear to be comprised of ammonia crystals, and are higher clouds lifted by convection of warmer gases; the darker belts are comprised of lower clouds of descending gas flows, and appear to be comprised of hydrogen, sulfur compounds, ammonium hydrosulphide, and possibly organic compounds formed in photochemical reactions.

Jupiter is about 90% hydrogen and 10% helium with lower percentages of methane, water, ammonia, other trace compounds, and "rock" (core). This is similar to the composition of the primordial Solar System Nebula from which the entire solar system was formed. The rapid rotation of Jupiter produces the colorful cloud systems. Our knowledge of the innermost aspects of Jupiter (and the other gas planets) is very indirect. Jupiter's core is most likely silicate rock and iron, and above this is the vast bulk of the planet in the form of liquid metallic hydrogen. Outside of this is a layer of molecular hydrogen and helium, followed by the outermost hydrogen and helium atmosphere, with traces of other compounds as mentioned above. Liquid metallic hydrogen consists of ionized protons and electrons (like the interior of the Sun but at a far lower temperature). At the temperature and pressure of Jupiter's interior, hydrogen is a liquid, not a gas; it is also an electrical conductor and the source of Jupiter's immense magnetic field; this magnetic field is about 19,000 times stronger than the earth's. Jupiter radiates about twice as much heat as it receives from the sun, indicating an internal reservoir of heat energy left over from its creation. This energy may play a part in Jupiter's dynamic zonal and belted cloud (weather) systems (by contributing to convection and very high winds, for example). This energy flow, the planet's rapid rotation, and a greenhouse effect, help to minimize temperature variations in various regions of the planet. Jupiter also emits radio waves (by several mechanisms), but is not massive enough to undergo nuclear fusion reactions like the sun; Jupiter would have to be about 80 times more massive than it is for this to happen.

Briefly, Jupiter's Galilean Moons are very interesting in their own right. Europa (the smallest) is smaller than the earth's moon; it is a smooth moon with an icy crust, which is crisscrossed by streaks and cracks. Callisto is the faintest and outermost of these famous moons, and is heavily rayed and cratered. Callisto is believed to have a thick crust of ice and rock, beneath which is thought to be water; this moon also has several systems of concentric ring mountain formations. Ganymede, the largest moon in the entire solar system, is also the brightest of these four Galilean moons. The main surface features on Ganymede are darker cratered

areas, and lighter, geologically younger areas with long parallel grooves (sulci); these two features intermingle, and give Ganymede a very elaborate surface appearance; there are areas of exposed ice and long parallel mountain ridges. Finally, Io (the innermost) has intense volcanic action, and volcanoes have been seen to eject material over very extensive areas on this moon; Io is the most volcanically active body known in the solar system. Io orbits within Jupiter's magnetosphere, and its volcanic activity is thought to result from the heating gained by interaction with Jovian tidal forces. Erupted material (such as sulfur and hydrogen) escapes into the Jovian magnetosphere and is ionized; it forms a ring or torus centered on Io. This ionized matter may affect several phenomena on Jupiter, including aurorae and radio bursts. One very famous surface feature of Jupiter should be mentioned: The Great Red Spot. This oval spot is located about 22 degrees south of Jupiter's equator. It is an immense high pressure storm (anticyclone), much colder and higher than surrounding clouds. It has been noted that the Great Red Spot (GRS) rotates in a counterclockwise manner with a rotation period of about six days. The north winds on the spot are blowing to the west; the south winds to the east; these outer perimeter winds can reach velocities of over 250 mph. The GRS has been observed for over 300 years (first observed by Robert Hooke in 1664), with variations in size, brightness, and color. At its greatest observed dimensions, the GRS can be as large as 40,000 by 14,000 kilometers. Color varies from pale pinkish beige to bright red; these color changes have been attributed to chemical changes, such as the conversion of phosphene into red phosphorous. Try to enjoy this beautiful planet when visible anytime, but most especially, as for any superior (outside) planet, at opposition.

"MIRROR IMAGES" - SUPERGIANT STARS

"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.

Class of Object: Starburst Galaxies: An active galaxy is one that emits very large amounts of energy from a very compact central source; because of this, they are also known as active galactic nuclei (AGN). Although also emitting large amounts of energy, starburst galaxies are distinguished from AGNs in that the former has the energetic activity spread out over an area of at least a kiloparsec in size, as opposed to the AGN, which have a tiny, compact central energy source. Starburst galaxies are galaxies in which massive star formation is currently taking place, and infrared luminosities are considerably larger than optical luminosities (sometimes by a factor of 50 or more); starburst luminosities are comparable to the bolometric (all-wavelength) luminosities of quasars, but starbursts are generated by a different mechanism. The widespread occurrence of starburst galaxies was only established when the IRAS satellite (Infrared Astronomical Satellite, launched and operated in 1983) revealed thousands of them. Starburst galaxies are basically spiral galaxies within which star formation cannot be sustained for very much of the galaxy's life; it is believed that one mechanism for the burst of star formation may be the gravitational interaction of a companion galaxy. UV radiation of the new stars is absorbed by dust in enveloping molecular clouds around these new star formations, and is re-radiated as infrared, the primary luminosity.

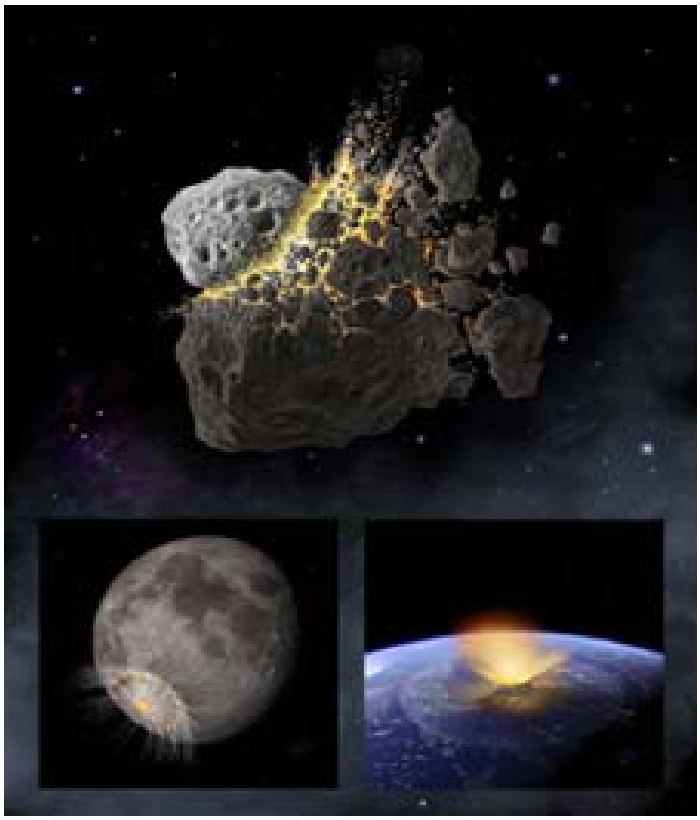
Representative Northern Hemisphere Object: M-82 (NGC-3034): This irregular galaxy has long been known as a probable active starburst galaxy because of its disturbed optical appearance. In the constellation of Ursa Major (and well-known to amateur astronomers as one member of the beautiful telescopic pair of M-81 (Sb spiral) and M-82; in 20x80 binoculars, they appear in a single field of view, separated by 38'), M-82 is an edge-on irregular galaxy with a very high surface brightness. M-82 has an integrated magnitude of 9.3, spans 8.0' x 3.0' across, and shows a highly condensed nucleus at higher powers. M-82 is at about the same distance as M-81 (about 7 million light years), but has a larger spectral redshift (322 km/sec) than that of M-81 (88 km/sec.).

Representative Southern Hemisphere Object: NGC-253: In the constellation of Sculptor, NGC-253 lies 3.5 degrees northeast of the South Galactic Pole. NGC-253 shines at magnitude 7.1, and spans 25.1 x 7.4 arc minutes across. Next to M-31 (the Andromeda Galaxy) and the Magellanic Clouds, NGC-253 is considered one of the finest galaxies for small telescopes, and overall a superb telescopic object. Even though NGC-253 is large, its surface brightness is very high, leading to its telescopic reputation. NGC-253 lies at a distance of about 10 million light years, and is about ¾ the size of the Milky Way Galaxy. Anglo-Australian Telescope photographs reveal very numerous H-II and star cluster regions of NGC-253, also known as the "Silver Coin Galaxy".

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

LARGE ASTEROID BREAKUP LIKELY SOURCE OF IMPACTOR THAT CAUSED MASS EXTINCTION 65 MILLION YEARS AGO

New research reveals a large asteroid breakup to be the likely source of the impactor that caused a mass extinction event on Earth 65 million years ago. The impactor believed to have wiped out the dinosaurs and other life forms on Earth some 65 million years ago has been traced back to a breakup event in the main asteroid belt. A joint U.S.-Czech team from Southwest Research Institute (SwRI) and Charles University in Prague suggests that the parent object of asteroid (298) Baptistina disrupted when it was hit by another large asteroid, creating numerous large fragments that would later create the Chicxulub crater on the Yucatan Peninsula as well as the prominent Tycho crater found on the Moon. The team of researchers combined observations with several different numerical simulations to investigate the Baptistina disruption event and its aftermath. A particular focus of their work was how Baptistina fragments affected the Earth and Moon. At approximately 170 kilometers in diameter and having characteristics similar to carbonaceous chondrite meteorites, the Baptistina parent body resided in the innermost region of the asteroid belt when it was hit by another asteroid estimated to be 60 kilometers in diameter. This catastrophic impact produced what is now known as the Baptistina asteroid family, a cluster of asteroid fragments with similar orbits. According to the team's modeling work, this family originally included approximately 300 bodies larger than 10 kilometers and 140,000 bodies larger than 1 kilometer.



Once created, the newly formed fragments' orbits began to slowly evolve due to thermal forces produced when they absorbed sunlight and re-radiated the energy away as heat. According to Bottke, "*By carefully modeling these effects and the distance traveled by different-sized fragments from the location of the original collision, we determined that the Baptistina breakup took place 160 million years ago, give or take 20 million years*." The gradual spreading of the family caused many fragments to drift into a nearby "dynamical superhighway" where they could escape the main asteroid belt and be delivered to orbits that cross Earth's path. The team's computations suggest that about 20 percent of the surviving multi-kilometer-sized fragments in the Baptistina family were lost in this fashion, with about 2 percent of those objects going on to strike the Earth, a pronounced increase in the number of large asteroids striking Earth. Support for these conclusions comes from the impact history of the Earth and Moon, both of which show evidence of a two-fold increase in the formation rate of large craters over the last 100 to 150 million years. As described by Nesvorny, "*The Baptistina bombardment produced a prolonged surge in the impact flux that peaked roughly 100 million years ago. This matches up pretty well with what is known about the impact record*." Bottke adds, "*We are in the tail end of this shower now. Our simulations suggest that about 20 percent of the present-day, near-Earth asteroid population can be traced back to the Baptistina family*."

The team then investigated the origins of the 180 kilometer diameter Chicxulub crater, which has been strongly linked to the extinction of the dinosaurs 65 million years ago. Studies of sediment samples and a meteorite from this time period indicate that the Chicxulub impactor had a carbonaceous chondrite composition much like the well-known primitive meteorite Murchison. This composition is enough to rule out many potential impactors but not those from the Baptistina family. Using this information in their simulations, the team found a 90 percent probability that the object that formed the Chicxulub crater was a refugee from the Baptistina family. These simulations also showed there was a 70 percent probability that the lunar crater Tycho, an 85 kilometer crater that formed 108 million years ago, was also produced by a large Baptistina fragment. Tycho is notable for its large size, young age and its prominent rays that extend as far as 1,500 kilometers across the Moon. Vokrouhlicky says, "*The probability is smaller than in the case of the Chicxulub crater because nothing is yet known about the nature of the Tycho impactor*." This study demonstrates that the collisional and dynamical evolution the main asteroid belt may have significant implications for understanding the geological and biological history of Earth. As Bottke says, "*It is likely that more breakup events in the asteroid belt are connected in some fashion to events on the Earth, Moon and other planets. The hunt is on*!" http://www.swri.org/press/2007/asteroid.htm

MARS ROVERS SURVIVE SEVERE DUST STORMS, READY FOR NEXT OBJECTIVES

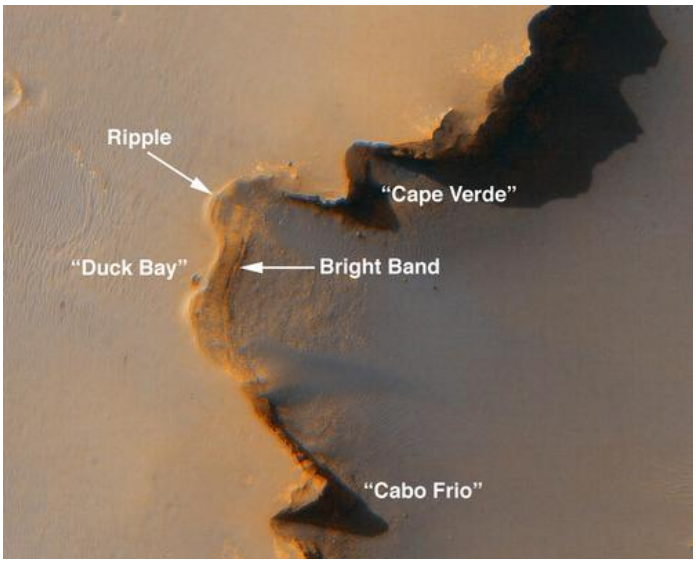
Two months after sky-darkening dust from severe storms nearly killed the Mars exploration rovers, the solar-powered robots are awake and ready to continue their mission. Opportunity's planned descent into the giant Victoria Crater was delayed, but now the rover is preparing to drive into the half-mile diameter crater as early as Sept. 11. Spirit, Opportunity's rover twin, also survived the global dust storm. The rovers are 43 months into missions originally planned to last three months. On Sept. 5, Spirit climbed onto its long-term destination called Home Plate, a plateau of layered bedrock bearing clues to an explosive mixture of lava and water. "*These rovers are tough. They faced dusty winds, power starvation and other challenges -- and survived. Now they are back to doing groundbreaking field work on Mars. These spacecraft are amazing*," said Alan Stern. Victoria Crater contains an exposed layer of bright rocks that may preserve evidence of interaction between the Martian atmosphere and surface from millions of years ago, when the atmosphere might have been

different from today's. Victoria is the biggest crater Opportunity has visited. Martian dust storms in July blocked so much sunlight that researchers grew concerned the rovers' daily energy supplies could plunge too low for survival. Engineers at JPL put Opportunity onto a very low-energy regimen of no movement, few observations and reduced communication with Earth. Skies above both rovers remain dusty but have been clearing gradually since early August. Dust from the sky has been falling onto both rovers' solar panels, impeding their ability to collect energy from the sun. However, beneficial wind gusts removed some of the new buildup from Opportunity almost as soon as it accumulated.

Opportunity drove to the lip of Victoria Crater in late August and examined possible entry routes. This week, Opportunity has been driving about 130 feet toward its planned entry point. The route will provide better access to a top priority target inside the crater: a bright band of rocks about 40 feet from the rim. "*We chose a point that gives us a straight path down, instead of driving cross-slope from our current location*," said Paolo Bellutta, a JPL rover driver plotting the route. "*The rock surface on which Opportunity will be driving will provide good traction and control of its path into the crater*." For its first foray into the crater, Opportunity will drive just far enough to get all six wheels in; it will then back out and assess slippage on the inner slope. "*In addition to the drives to get to the entry point, we still need to conduct checkouts of two of Opportunity's instruments*." The rover team plans to assess if dust has impaired use of the microscopic imager. If that tool is working, the team will use it to observe whether a scanning mirror for the miniature thermal emission spectrometer (Mini-TES) can function accurately. This mirror is high on the rover's camera mast. It reflects infrared light from the landscape to the spectrometer at the base of the mast, and it also can be positioned to close the hole in the mast as protection from dust. The last time the spectrometer was used, some aspects of the data suggested the instrument may have been viewing the inside of the mast instead of the Martian landscape. "*If the dust cover or mirror is no longer moving properly, we may have lost the ability to use that instrument on Opportunity*," said Steve Squyres, principal investigator for the rovers' science instruments. "*It would be the first permanent loss of an instrument on either rover. But we'll see*." The instrument already has provided extensive valuable information about rocks and soils in the Meridiani region where Opportunity works. "*Mini-TES has told us a lot about the rocks and soils at Meridiani, but we've learned that the differences among Meridiani rocks are often too subtle for it to distinguish*," Squyres said. "*The same instrument on Spirit, at Gusev Crater, has a much more crucial role for us at this point in the mission because there is such diversity at Gusev*." Researchers will rely heavily on a different type of instrument, Opportunity's alpha particle X-ray spectrometer, for analysis of rocks at the bright-band target layer in the crater.

Mars Exploration Rover Opportunity finished the last step of a test in-and-out maneuver checking wheel slippage at the rim of Victoria Crater. Then the rover immediately drove back into the crater as the start of a multi-week investigation on the big bowl's inner slope. Opportunity started with just two of its six wheels inside the rim of Victoria Crater and ended the day's driving about six meters (20 feet) inside the rim. The mission's first destination inside the crater is a light-toned layer of exposed rock that may preserve evidence of interaction between the Martian atmosphere and surface from millions of years ago. Victoria exposes a taller stack of ancient rock layers than any crater Opportunity has previously visited during the rover's nearly 44 months on Mars. The mission was originally planned for three months. "*We want to maintain a safe egress route out of the crater for Opportunity, and by completing the back-up drive over the sand ripple at the rim, we have confirmed that we have one*," said John Callas, Mars rover project manager. "*Opportunity is now exploring the interior of Victoria Crater*."

This image shows the site where Opportunity will carefully roll down into Victoria Crater on Mars. This particular alcove, nicknamed "Duck Bay," has gradual slopes of about 15 to 20 degrees and exposed bedrock, making it the safest place for the rover to enter the crater.



Rover drivers plan to avoid a rippled portion of terrain near the rim of the crater, and to steer Opportunity down the smoothest bedrock with the gentlest slopes. This enhanced-color view was taken by the High Resolution Imaging Science Experiment camera onboard Mars Reconnaissance Orbiter spacecraft http://www.nasa.gov/rovers

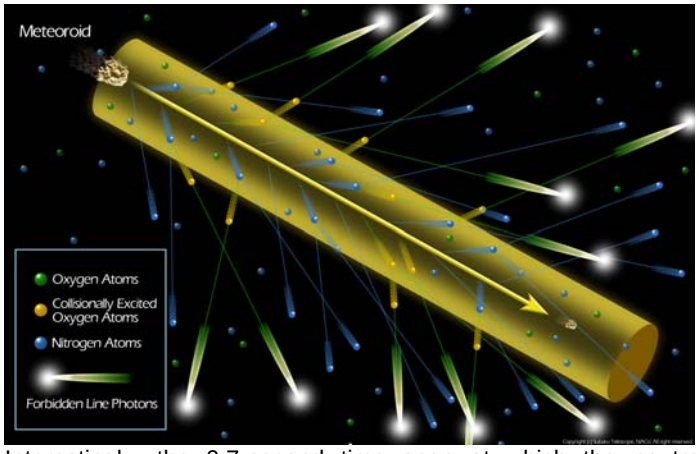
MEASURING METEOR TUNNELS IN EARTH'S ATMOSPHERE

When meteors flash through Earth's atmosphere, they bore tunnels through the air, leaving behind narrow meteor tracks that are heated by the collision of the fast-moving incoming object with atoms of highly diluted atmospheric gases. Most meteoroids are bits of space debris the size of a grain of sand. The width of the tracks they make has long been known to be narrower than a meter, but until recently, more precise measurements have been impossible to make.

Researchers have evaluated the diameters of the heated tunnels left behind as typical sporadic meteors as penetrated the upper atmosphere, scattering atmospheric atoms and releasing photons of light. The team compared the number of special photons produced as a meteoroid collided with the atmospheric atoms and found a typical column width as narrow as a few millimeters across. This is the first time the width of a meteor track column has been precisely measured using a physical analysis of the light emitted during the event. The study was the result of an observation run at Subaru telescope on the nights of 12-15 August, 2004. During that time, observers imaging the Andromeda galaxy using Suprime-Cam noticed a number of meteoroid tracks traversing the field of view of the camera. As M31 is fairly close to the radiant of the Perseid meteor shower (which peaked just before the start of the observation) observers took a detailed look at the tracks. Since Subaru telescope focuses at infinity, meteors shining at 75 miles above Earth's surface are considerably out of focus. Artificial satellites orbiting at altitudes 300 to 12,000 miles) are also out of focus, but not as

much. The angular size distribution of all the measured tracks during the observation indicates a distinct separation of meteors from satellites is feasible just from their track widths. Satellite tracks often show periodic luminosity variation since the rotation of their solar panel produces the change in their reflected light. Some of the meteors show sudden outbursts while penetrating the atmosphere.

During the 19 hour-long CCD exposures, there were 13 meteor tracks. Only one was from the radiant of the Perseid meteor shower. Another was associated with the Aquarid meteor shower. Most of the remaining meteor tracks were from sporadic meteoroids. The actual size of meteoroids studied in the current observation was estimated to be between 0.1 and 1 millimeters (from their luminosity). The physical analysis of the tracks was carried out by team member Masanori Iye, who took a close look at "forbidden line" photons of neutral oxygen atoms radiating at 558 nanometers (nm). These special photons are generated when a high-speed meteoroid (or atoms hit and accelerated by the meteoroid) collide directly with the neutral oxygen atoms. The collision "excites" the oxygen atoms (in other words, the state of the electron orbiting around the oxygen nucleus is elevated to a higher energy orbit). At 0.7 seconds after the collision, on average, the atoms drop back down to their normal state. In this process, they release the special 558-nm "forbidden line" photons. Typical meteoroid spectra show that these special "forbidden line" photons make up about 10% of the total photons measured through the yellow V-band filter. Therefore, by measuring the number of total photons recorded in the CCD images of meteor tracks, one can calculate the total number of forbidden photons. This requires the same number of collisions of neutral oxygen atoms. Since the density of the neutral oxygen atoms at 75 miles is known, and the speed of meteoroids can be estimated, it is possible to calculate the cross section of the column to produce the same number of collisions. Calculations for four meteor events observed in V-band yielded the column diameter of a few millimeters.



Interestingly, the 0.7-second time span at which the neutral oxygen recover their ordinary state by releasing the "forbidden line" photons is an extremely long time for atomic processes, and the excited oxygen atoms hover about 300 meter away from the collision column during that time. Therefore, the width of the "forbidden line" trail ([OI] wake) is much wider than the main body width of the meteors as derived in the present study. By focusing Subaru to the altitude of meteors, one can make highly sensitive imaging observation of faint meteors and further study the population of micro-meteoroids. Separate 21-hour-long imaging observations at the Subaru Deep Field during the time when no known meteor showers appear gave similar meteor event rates. This supports the interpretation that the meteors evaluated in this research were mostly sporadic ones and not Perseids.

A model of a meteoroid shows it entering the upper atmosphere at 75 miles at high speed and colliding with nitrogen atoms (in blue) and oxygen atoms (in green) and scattering them. Neutral oxygen atoms directly hit by the meteoroid or by accelerated nitrogen or oxygen atoms are "collisionally excited" (in orange). Such excited neutral atoms return to ordinary state on average 0.7 sec after the collision by emitting a 558-nm "forbidden line" photon. By counting the number of these special forbidden line photons, astronomers were able to derive for the first time the number of associated collisions and evaluated the width of the collision tunnel bored by the meteoroid.
http://subarutelescope.org/Pressrelease/2007/09/10/index.html
http://subarutelescope.org/

BIZARRE PLANET-MASS OBJECT ORBITING NEUTRON STAR

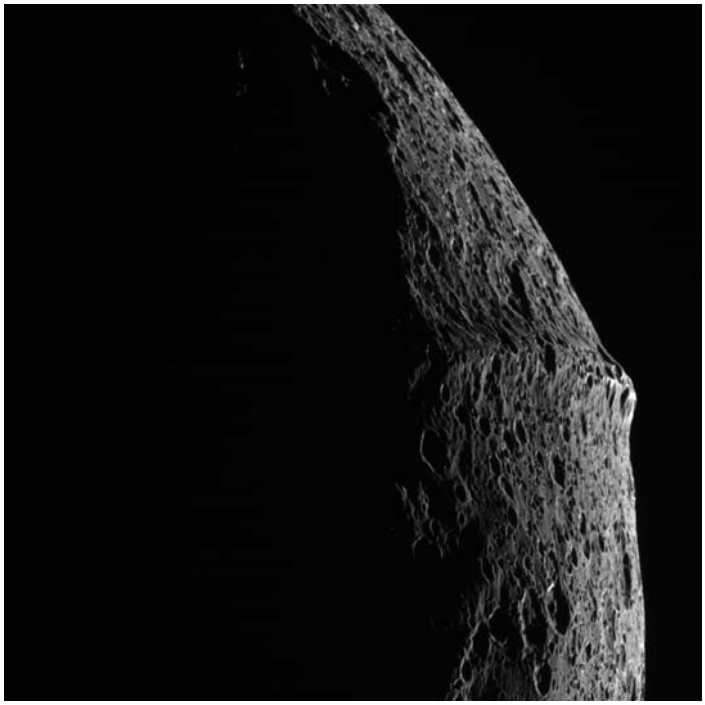
Using Swift and Rossi X-ray Timing Explorer (RXTE) satellites, astronomers have discovered one of the most bizarre planet-mass objects ever found. The object's minimum mass is only about 7 times the mass of Jupiter. But instead of orbiting a normal star, this low-mass body orbits a rapidly spinning pulsar. It orbits the pulsar every 54.7 minutes at an average distance of only about 230,000 miles (slightly less than the Earth-Moon distance). "*This object is merely the skeleton of a star*," says co-discoverer Craig Markwardt. "*The pulsar has eaten away the star's outer envelope, and all the remains is its helium-rich core*." Hans Krimm discovered the system on June 7, when Swift's Burst Alert Telescope picked up an outburst of X rays and gamma rays in the direction of the galactic center. The source was named SWIFT J1756.9-2508 for its sky coordinates in the constellation Sagittarius. RXTE began observing SWIFT J1756.9 on June 13 with its Proportional Counter Array (PCA). After analyzing the PCA data, Markwardt realized that the object was pulsing in X rays 182.07 times per second, which told him that it was a rapidly spinning pulsar. These so-called millisecond pulsars are neutron stars that spin hundreds of times per second, faster than a kitchen blender. Normally, the spin rate of neutron stars slows down as they age, but much like we can pull a string to "spin up" a top, gas spiraling onto a neutron star from its companion can maintain or even increase its fast spin. In the case of SWIFT J1756.9-2508, Markwardt detected subtle modulations in the X-ray timing data that revealed a low-mass companion tugging the pulsar toward and away from Earth. His calculations show that the companion has a minimum mass about 7 times that of Jupiter. Because we don't know the orbital inclination of the system, the companion's actual mass is unknown, but it is extremely unlikely to exceed 30 Jupiters. Astronomers led by Deepto Chakrabarty also observed the system with RXTE, before it faded to invisibility on June 21. Chakrabarty's group reached identical conclusions.

The system is only the eighth millisecond pulsar that is observed to be accreting mass from a companion. Only one other such system has a pulsar companion with such a low mass. The companion in this system, XTE J1807-294, also has a minimum mass of about 7 Jupiters. "*Given that we don't know the exact mass of either companion, ours could be the smallest*," says Krimm. The system probably formed several billion years ago, when it consisted of a very massive star and a smaller star with perhaps 1 to 3 solar masses. The more massive star evolved quickly and exploded as a supernova, leaving behind the neutron star. The smaller star eventually started to puff up en route to becoming a red giant, and the two objects became embedded in the extended stellar envelope. This drained orbital energy, causing the two stars to draw ever nearer, while simultaneously ejecting the envelope. Today, the two objects are so close to

each other than the neutron star's powerful gravity produces a tidal bulge on its companion, siphoning off gas that flows into a disk that surrounds the neutron star. The flow eventually becomes unstable and dumps large quantities of gas onto the neutron star, causing an outburst like the one observed in June. Evolution models by Christopher Deloye suggest that the low-mass companion is helium-dominated. "*Despite its extremely low mass, the companion isn't considered a planet because of its formation*," says Deloye. "*It's essentially a white dwarf that has been whittled down to a planetary mass*." After billions of years, little remains of the companion star, and it remains unclear whether it will survive. "*It's been taking a beating, but that's part of nature*," adds Krimm. With an estimated distance of roughly 25,000 light-years, the system is normally too faint to be detected at any wavelength, and is only visible during an outburst. SWIFT J1756.9 has never been seen to erupt until this June, so as Markwardt points out, "*We don't know how long it will slumber before it wakes up again*." http://www.nasa.gov/centers/goddard/news/topstory/2007/millisecond_pulsar.html

SATURN'S IAPETUS - YIN-AND-YANG OF THE SOLAR SYSTEM

Scientists on the Cassini mission to Saturn are poring through hundreds of images returned from the Sept. 10 flyby of Saturn's two-toned moon Iapetus. Pictures returned show the moon's yin and yang--a white hemisphere resembling snow, and the other as black as tar. Images show a surface that is heavily cratered, along with the mountain ridge that runs along the moon's equator. Many of the close-up observations focused on studying the strange 20-kilometer high (12 mile) mountain ridge that gives the moon a walnut-shaped appearance. "*The images are really stunning*," said Tilmann Denk, Cassini imaging scientist, who was responsible for the imaging observation planning. "*Every new picture contained its own charm. I was most pleased about the images showing huge mountains rising over the horizon. I knew about this scenic viewing opportunity for more than seven years, and now the real images suddenly materialized*."

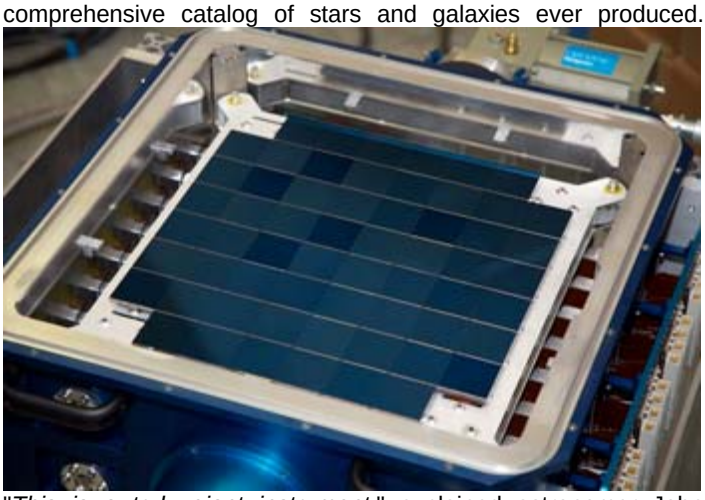


This flyby was nearly 100 times closer to Iapetus than Cassini's 2004 flyby, bringing the spacecraft to about 1,640 kilometers (1,000 miles) from the surface. The moon's irregular walnut shape, the mountain ridge that lies almost directly on the equator and Iapetus' brightness contrast are among the key mysteries scientists are trying to solve. "*There's never a dull moment on this mission*," said Bob Mitchell. "*We are very excited about the stunning images being returned. There's plenty here to keep many scientists busy for many years*." "*Our flight over the surface of Iapetus was like a non-stop free fall, down the rabbit hole, directly into Wonderland! Very few places in our solar system are more bizarre than the patchwork of pitch dark and snowy bright we've seen on this moon*," said Carolyn Porco, imaging team leader. The return of images and other data was delayed due to a galactic cosmic ray hit which put the spacecraft into a precautionary state called safe mode. This occurred after the spacecraft had placed all of the flyby data on its data recorders and during the first few minutes after it began sending the data home. The data flow resumed later that day and concluded on Wednesday. The spacecraft is operating normally and its instruments are expected to return to normal operations in a few days.

"*Iapetus provides us a window back in time, to the formation of the planets over four billion years ago. Since then its icy crust has been cold and stiff, preserving this ancient surface for our study*," said Torrence Johnson, imaging team member. Cassini's multiple observations of Iapetus will help to characterize the chemical composition of the surface; look for evidence of a faint atmosphere or erupting gas plumes; and map the nighttime temperature of the surface. These and other results will be analyzed in the weeks to come. http://saturn.jpl.nasa.gov http://www.nasa.gov/cassini http://ciclops.org . http://www.jpl.nasa.gov/news/news.cfm?release=2007-101

WORLD'S LARGEST DIGITAL CAMERA INSTALLED ON MAUI TELESCOPE

The world's largest and most advanced digital camera has been installed on the Pan-STARRS-1 (PS1) telescope on Haleakala, Maui. Built at the University of Hawaii at Manoa's Institute for Astronomy, the gigapixel camera will capture images that will be used to scan the skies for killer asteroids, and to create the most comprehensive catalog of stars and galaxies ever produced.



"*This is a truly giant instrument*," explained astronomer John Tonry, who led the team that developed the new camera. "*It allows us to measure the brightness of the sky in 1.4 billion places simultaneously. We get an image that is 38,000 by 38,000 pixels in size, or about 200 times larger than you get in a high-end consumer digital camera. It's also extremely sensitive: in a typical observation we will be able to detect stars that are 10 million times fainter than can be seen with the naked human eye*." The camera is a key component of the Pan-STARRS project, which is

designed to search the sky for objects that move or vary. When fully operational, each patch of sky visible from Hawaii will be photographed automatically at least once a week.

Powerful computers at the Maui High Performance Computer Center will scrutinize each image for the minuscule changes that could signal a previously undiscovered asteroid. Other computers will combine the data from several images, calculate the orbit of the asteroid, and send warning messages if the asteroid has any chance of colliding with Earth during the next century. The silicon chips at the heart of the camera contain advanced circuitry that makes instantaneous corrections for any image shake caused by Earth's turbulent atmosphere. The image area, which is about 16 inches (40 cm) across, contains 60 identical silicon chips, each of which contains 64 independent imaging circuits. Splitting the image area into about 4,000 separate regions in this way has three advantages: data can be recorded more quickly, "dazzling" of the image by a very bright star is confined to a small region, and any defects in the chips only affect only a small part of the image area. So much data will be produced by the camera that the team has had to develop novel ways to handle the deluge. Electronics engineer Peter Onaka led the team that designed an ultrafast 480-channel control system, while a group led by astronomer Eugene Magnier developed the software that is able to analyze the thousands of gigabytes of data that the camera will produce each night. http://pan-starrs.ifa.hawaii.edu/public/ http://pan-starrs.ifa.hawaii.edu/public/design-features/cameras.html
http://www.ifa.hawaii.edu/info/press-releases/GPC/GPCInternet.mov
http://www.ifa.hawaii.edu/info/press-releases/GPC/gigapixel_camera-8-07.html

ASTRONOMERS WILL TRACE PLANET FORMATION WITH NEON

Astronomers have observed neon in disks of dust and gas swirling around sunlike stars for the first time. Astronomers who collaborated in the observations say that neon could show which stars retain their surrounding dust-and-gas disks needed to form planets and which stars might already have formed planets. "*When I saw the neon, I couldn't believe it. I was just amazed*," said astronomer Ilaria Pascucci. "*We were not expecting to see neon around low-mass stars like our sun*." Pascucci is co-investigator on a Spitzer Space Telescope Legacy project called "Formation and Evolution of Planetary Systems", known as FEPS, headed by Michael Meyer. The project used an infrared spectrometer to conduct a sensitive search for planet-forming gas around 35 young, solar analog stars. Neon showed up in disks of four sunlike stars in Spitzer's FEPS data. The discovery was a surprise because "*we didn't realize that solar analog stars could radiate enough high-energy (X-ray and ultraviolet) light to ionize neon*," Pascucci said. "*Astronomers have used ionized neon for years to study massive star formation, novae and the galactic center, all places where the environment is energetic and harsh, so it was a surprise to find this neon emission from planet-forming stars like the sun*," Meyer said. "*It serves as a valuable reminder that the environment in which the planets formed was harsh, too, in a way. And it could turn out to be an important tracer of remnant gas in circumstellar disks - a kind of 'vacancy/no vacancy' sign for planets*." Neon -- a gas commonly used in outdoor advertising signs since the 1920s -- is one of the few chemical elements that doesn't chemically react to form molecules or condense into solid particles. There's not much of it in Earth's atmosphere, only about 18 parts per million. Nor is it plentiful in gas whirling around stars, Pascucci said. But when a neon atom absorbs high-energy X-ray or ultraviolet light, it "ionizes," or becomes electrically charged, and gives off infrared light at specific wavelengths. The Spitzer telescope saw the spectral line at 12.8 microns, one of neon's infrared signatures. So although neon isn't an abundant gas, it is pure, and it radiates infrared light at specific wavelengths when it ionizes, making it useful for tracing planet formation. Most gas in the disk surrounding a star is swept up by the central star itself. Much of the remaining gas becomes so hot and energetic that it "photoevaporates," or escapes the star system's powerful gravity and evaporates into space. Scientists suspect that if too much gas photoevaporates too quickly, a star has missed its chance to form gas- giant planets. Scientists believe that planets form when dust particles in the disk around a star begin to stick together and continue to grow by clumping, or "accreting," over millions of years. Some of these planetary building blocks smash together, eventually creating rocky planets like Earth or the cores of gas-giant planets like Jupiter. Ever-larger planetary cores exert greater gravity. If a core becomes massive enough, its gravity becomes powerful enough to pull in gas from the protoplanetary disk, creating an atmosphere. Gas in the disk may also play a crucial role in making planets suitable for life, Pascucci said. The gas may help to circularize the orbits of planets as they form, as well as provide atmospheres for rocky Earthlike planets and gas-giant planets. Both the orbit of a planet and its atmosphere play an important role in stabilizing climate, a big factor in whether complex life can form and survive. Astronomers may be able to trace the gas that is needed to circularize the orbits of Earthlike planets in the terrestrial planet region with neon, she added. Pascucci will make future observations that use neon to track gas content in disks around young stars at different stages of planet formation using Spitzer and the VLT, in Chile. "*We'll use the Spitzer to look for neon in disks around slightly older systems than we've studied so far*," Pascucci said. "*Because neon is tracing a very tiny amount of gas mass, we want to see how the gas dissipates with time*." Some of the gas lines are strong enough that astronomers will be able to see the spectra from the ground with the VLT. Pascucci and her colleagues will study 15 candidate objects using the VLT in February 2008. The ground-based telescope is far less sensitive to infrared light than is Spitzer, but it is 50 times higher velocity resolution than the space telescope. By clocking the speed of the gas, the VLT should be able to locate where the gas is within a disk. "*The two studies are very complementary*," Pascucci said. "*Once we know for a sample of stars where the gas emission is coming from (using the VLT), we then can extrapolate to other stars which Spitzer can see. "Nobody thought about observing these types of lines from the ground before they were detected by Spitzer. At least, I wasn't thinking about detecting neon*," she added.
http://feps.as.arizona.edu
http://www.spitzer.caltech.edu/Media/happenings/20070912/

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 at least two weeks prior to the next upcoming scheduled EAS meeting. If you wish to contribute an article or suggestions to ***The Stargazer*** please contact Mark Folkerts by email or by telephone (425) 486-9733 or co-editor Bill O'Neil, at (774) 253-0747.

The Star Gazer
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In September's StarGazer:

****** ASTRO CALENDAR – STAR PARTY SCHEDULE – WESTERN US 2007 STAR PARTIES**
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****** YOUNG ASTRONOMER'S CORNER**
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****** ASTRONOMERS FIND BIZARRE PLANET-MASS OBJECT ORBITING NEUTRON STAR**
****** SATURN'S MOON IAPETUS IS THE YIN-AND-YANG OF THE SOLAR SYSTEM**
****** WORLD'S LARGEST DIGITAL CAMERA INSTALLED ON MAUI TELESCOPE**
****** ASTRONOMERS WILL TRACE PLANET FORMATION WITH NEON**

The next EAS Meeting is 3:00 P.M. Saturday September 22nd at the Everett Public Library Auditorium.