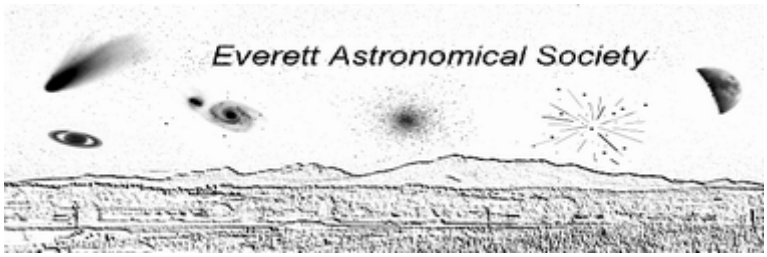
Volume MMV. No. 3



The Stargazer

March 2005

President: Mark Folkerts	(425) 486-9733	folkerts at seanet.com	***The Stargazer***
VP & Librarian: Mike Locke	(425) 259-5995	mlocke at lionmts.com	**P.O. Box 12746**
Treasurer: Carol Gore	(360) 856-5135	janeway7C at aol.com	**Everett, WA 98206**
Newsletter co-editor: Bill O'Neil	(774) 253-0747	wonastrn at seanet.com	
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

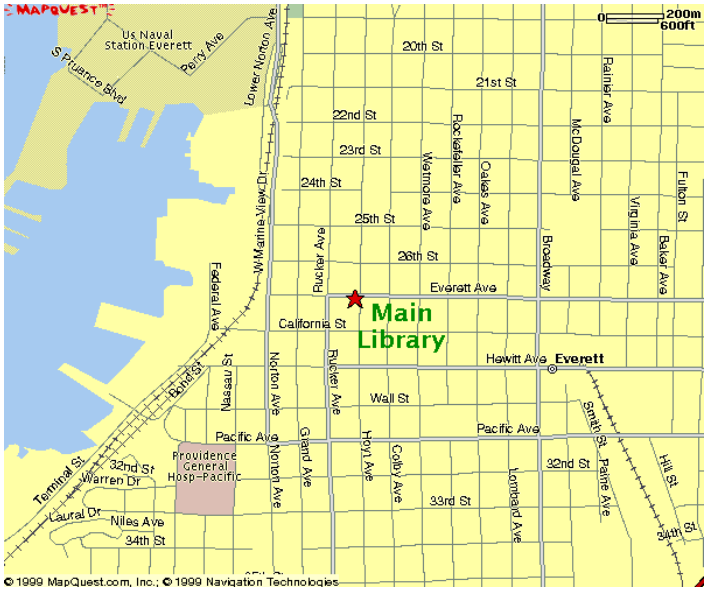
EAS BUSINESS…

NEXT EAS MEETING - SATURDAY MARCH 19TH AT 4:00 PM AT THE EVERETT PUBLIC LIBRARY, IN THE AUDITORIUM (DOWNSTAIRS)

★ March meeting topic – documentary "If We Had No Moon"

Map and directions to the **EAS meeting at the Everett Public**

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



The Main Library is located at:
2702 Hoyt Avenue
Everett, WA 98201

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

Scheduled Meeting Dates:

Mar 19 - EAS MEETING - Saturday 4:00 PM at Everett Public Library
Apr 15/16 - Astronomy Day Public Star Party
Apr 16 - Astronomy Day
Apr 30 - EAS MEETING - Saturday 4:00 PM at Everett Public Library

MEMBER NEWS

★ **NOTE NEW MEETING TIME AND PLACE – EVERETT LIBRARY !!!**
★ ASTRONOMY DAY – APRIL 16
★ ASTRONOMY DAY STAR PARTY – April 15th and 16th

CLUB STAR PARTY INFO

Upcoming star party schedule:

ASTRONOMY DAY STAR PARTY – April 15th and 16th – Harborview Park – Dusk to 11:30 pm

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.

$$ - FINANCIAL HEALTH - $$

The club maintains a $500+ balance. We try to keep approximately a $500 balance to allow for contingencies. Emailing a digital copy of the newsletter has been suggested to reduce printing and postage costs, and speed up delivery, please email Mark if electronic copy would be OK for you.

CLUB SCOPES

SCOPE	LOAN STATUS	WAITING
10-INCH DOBSONIAN	ON LOAN	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

March 2005

Mar 12 - Mercury Greatest Eastern Elongation (18 Degrees)
Mar 19 - EAS MEETING - Saturday 4:00 PM at Everett Public Library
Mar 20 - Vernal Equinox, 12:33 UT – First day of Spring in N hemisphere
Mar 26 - Moon occults Jupiter
Mar 27 - Easter Sunday
Mar 30 - Mercury passes 4.2 degrees from Venus

April 2005

Apr 01 - Mars occults PPM 237883 (8.7 Magnitude Star)
Apr 03 - Daylight Saving - set clock ahead 1 Hour (North America)
Apr 03 - Jupiter at opposition
Apr 08 - New Moon
Apr 09 - Potential Saturday EAS star party night, location TBD
Apr 08 - Hybrid solar eclipse (Visible From Pacific, Central America)
Apr 09 - Moon occults Venus
Apr 11-17 - Astronomy Week
Apr 15, 16 - Astronomy Day Public Star Parties – Harborview Park
Apr 16 - Astronomy Day – Everett Public Library – 10 am – 5 pm
Apr 22 - Lyrids meteor shower peak
Apr 22 - Moon occults Jupiter
Apr 24 - Lunar eclipse
Apr 26 - Mercury at Greatest Western Elongation (27 degrees from Sun)
Apr 30 - EAS MEETING - Saturday 4:00 PM at Everett Public Library

May 2005

May 05 - Eta Aquarids Meteor Shower Peak
May 6-8 - Olympic Astronomy club – Dry Falls Spring Star Party
May 07 - Potential Saturday EAS star party night, location TBD
May 08 - New Moon
May 19 - Moon Occults Jupiter
May 21 - EAS MEETING* - Saturday 4:00 PM at Everett Public Library
May 27-29 - Riverside Telescope Makers Conference Astronomy Expo
May 27-29 - Memorial Day Weekend
May 31 - Moon Occults Mars

June 2005

Jun 04 - Potential Saturday EAS star party night, location TBD
Jun 06 - New Moon
Jun 09 - Two moon shadows visible on Jupiter for USA – 10:30 pm
Jun 13 - Pluto at opposition
Jun 16 - Moon occults Jupiter
Jun 17 - Two moon shadows visible on Jupiter for USA – 12:57 am
Jun 21 - Summer Solstice, 06:46 UT – first day of N hemisphere summer
Jun 26 - Mercury passes 1.4 degrees from Saturn
Jun 27 - Mercury passes 0.1 degrees from Venus
Jun 25 - EAS MEETING - Saturday 4:00 PM at Everett Public Library

July 2005

Jul 02 - Potential Saturday EAS star party night, location TBD
Jul 03 - Venus 0.4 deg. North of M44 Beehive cluster
Jul 04 - Deep Impact, Comet Tempel 1 impact/flyby
Jul 04 - Earth at aphelion (1.017 AU From Sun)
Jul 6-10 - Mt Bachelor Star Party
Jul 6-10 - Shingleton Star Party – Redding California
Jul 09 - Mercury Greatest Eastern Elongation (26 Degrees)
Jul 09 - Potential Saturday EAS star party night, location TBD
Jul 12 - Asteroid 3259 Brownlee closest approach to Earth (2.19 AU)
Jul 13 - Moon occults Jupiter
Jul 18 - Moon occults Antares from southern US, near for north.
Jul 21 - Largest full moon for 2005
Jul 23 - 10th Anniversary (1995), Alan Hale's & Tom Bopp's Discovery of Comet Hale-Bopp
Jul 27-29 - South Delta-Aquarids meteor shower peak
Jul 30 - EAS MEETING - Saturday 4:00 PM at Everett Public Library
Jul 30-Aug 07 Mt. Kobau Star Party – Osoyoos BC

August 2005

Aug 01 - Alpha Capricornids Meteor Shower Peak
Aug 4-6 - Table Mountain Star Party
Aug 04 - Furthest lunar apogee of 2005
Aug 05 - Neil Armstrong's 75th birthday (1930)
Aug 06 - Southern Iota Aquarids meteor shower peak
Aug 08 - Moon 1.0 right of Venus
Aug 08 - Neptune at opposition – visible all night
Aug 11 - Perseid meteor watch - Rooster Rock St Park - Columbia Gorge
Aug 12 - Perseids meteor shower peak
Aug 24 - Mercury at Greatest Western Elongation (18 degrees from Sun)
Aug 25 - Northern Iota Aquarids meteor shower peak
Aug 27 - EAS MEETING - Saturday 4:00 PM at Everett Public Library
Aug 31 - Uranus at opposition – visible all night

September 2005

Sep 01 - Uranus at opposition
Sep 01 - Venus passes 1.2 degrees from Jupiter
Sep 03 - New Moon
Sep 03 - Potential Saturday EAS star party night, location TBD
Sep 1-4 - Oregon Star Party
Sep 2-5 – Olympic Astronomy – Dry Falls Star Party
Sep 05 - Labor Day holiday
Sep 07 - Moon occults Venus
Sep 22 - Autumnal Equinox (22:23 UT) – 1st day of autumn N hemisphere
Sep 24 - EAS MEETING - Saturday 4:00 PM at Everett Public Library

October 2005

Oct 01 - Potential Saturday EAS star party night, location TBD
Oct 03 - New Moon
Oct 03 - Annular Solar Eclipse, Visible From Africa
Oct 04 - Moon occults Mercury
Oct 05 - Mercury passes 1.3 degrees From Jupiter
Oct 09 - Draconids meteor shower Peak
Oct 16 - Venus occults PPM 265560 (7.7 Magnitude Star)
Oct 17 - Partial Lunar eclipse
Oct 21 - Orionid meteor shower peak
Oct 29 - EAS MEETING - Saturday 4:00 PM at Everett Public Library
Oct 30 - Daylight Saving - set clock back 1 Hour

November 2005

Nov 01 - New Moon
Nov 05 - Potential Saturday EAS star party night, location TBD
Nov 03 - Taurids meteor shower peak
Nov 03 - Mercury at its Greatest Eastern Elongation (23 Degrees)
Nov 03 - Venus at its Greatest Eastern Elongation (47 Degrees)
Nov 07 - Mars at opposition
Nov 19 - EAS MEETING - Saturday 4:00 PM at Everett Public Library

December 2005

Dec 02 - 10th anniversary (1995), SOHO Launch
Dec 12 - Moon occults Mars
Dec 12 - Mercury at its Greatest Western Elongation (21 Degrees)
Dec 13 - Geminids meteor shower peak
Dec 21 - Winter Solstice, 18:35 UT
Dec 22 - Ursids meteor shower peak
Dec 10th or 17th – EAS Dinner - Saturday 7:00 PM

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).
Feb 24 - Pat McCarthy - Carnegie Observatories
'Old Stars in the Young Universe'
Mar 3 - TBA
Mar 10 - Tim Beers - Michigan State University
'Mining the Milky Way Galaxy with the Sloan Digital Sky Survey'

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 8:58 A.M. and 5:58 P.M. Saturday and Sunday). The short 2 minute radio show deals with current topics of interest in astronomy. The University of Washington TV broadcasts programs from NASA at 12:00 AM Monday through Friday, 12:30 AM Saturday, and 1:30 AM Sunday on the Channel 27 cable station.

EAS LIBRARY – BOOK & VIDEO LIST

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

MEMBERSHIP BENEFITS & INFORMATION

Membership in the **Everett Astronomical Society** (EAS) will give you access to all the material in the lending library. The library, which is maintained by Scott Gibson, consists of several VCR tapes, many books, magazines, and software titles. Membership includes invitations to all of the club meetings and star parties, plus the monthly newsletter, ***The Stargazer.*** In addition you will be able subscribe to ***Sky and Telescope*** for $7 off the normal subscription rate, contact the treasurer for more information. **When renewing your subscription to *Sky & Telescope* you should send your S&T renewal form along with a check made out to Everett Astronomical Society to the EAS address.** The EAS treasurer will renew your *Sky and Telescope* subscription for you. **Astronomy** magazine offers a similar opportunity to club members.

EAS is a member of the **Astronomical League** and you will receive the Astronomical League's newsletter, ***The Reflector***. Being a member also allows you the use of the club's telescopes, an award winning 10 inch Dobsonian mount reflector, built as a club project or the 60mm refractor. Contact Bob Lyons (425) 337-1510 to borrow a telescope. EAS dues are $25. Send your annual dues to the **Everett Astronomical Society**, P.O. Box 12746, Everett, WA 98206. Funds obtained from membership dues allows the Society to publish the newsletter, pay Astronomical League dues and maintain our library.

OBSERVER'S INFORMATION…

LUNAR FACTS

Mar 03	Last Quarter Moon
Mar 10	New Moon
Mar 17	First Quarter Moon
Mar 25	Full Moon
Apr 01	Last Quarter Moon
Apr 08	New Moon
Apr 16	First Quarter Moon
Apr 24	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

Jupiter is at opposition on April 3, at its best for the year.

Object	Rises	Transits	Sets	Con	Mag
Sun	**6:12 am**	**Daylight**	**6:21**	**Psc**	**-27**
Mercury	Daylight	Daylight	19:45	**Psc**	**-**
Venus	Daylight	Daylight	Daylight	Psc	-3.8
Mars	**4:04 am**	Daylight	Daylight	**Sag**	**+1.0**
Jupiter	**19:35**	**1:17 am**	**7:02**	**Vir**	**-2.3**
Saturn	Daylight	Daylight	**3:38 am**	**Gem**	**0.0**
Uranus	5:37 amt	Daylight	Daylight	Aqr	+5.9
Neptune	4:46 am	Daylight	Daylight	Cap	+8.0
Pluto	**1:04 am**	Daylight	Daylight	**Ser**	**13.9**

(times local time for Everett PST)

Transit times for Jupiter's Great Red Spot in 2005

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

'PHOTON' – ASTRONOMY EZINE

Issue 6 of 'Photon' PDF astronomy ezine is now available for download from: http://www.photonezine.com Here's what's in this issue: Book Review: Deep Sky Wonders [George Reynolds] RoboScoping! [Tom Nicolaides] The Ancient Astronomers of Newgrange [Anthony Murphy] The Sikhote-Alin Meteorite [Mark Bostick] Solstices Are Milestones of Civilization [Von Del Chamberlain] Aerial Explorations of Terrestrial Meteorite Craters - Sudbury Crater [Charles O'Dale] RTGUI Freeware for Telescope Control [Rod Mollise] Canon EOS "Digital Rebel" [Phil Harrington] Some Images Through the "Digital Rebel" [Phil Harrington] Thoughts About Astronomical Image Processing for Digital Cameras [Tom Licha] Great Astronomers [Tim Carr] Showcase [Astrophotos] Plus a peppering of short stories and anecdotes.

CONSTELLATIONS OF THE MONTH: EQUULEUS

EQUULEUS: "The Foal" as this constellation is also known, borders on the constellations of Aquarius, Delphinus, and Pegasus. It ranks 46th in overall brightness among the constellations, and contains five stars brighter than magnitude 5.5. Its central point is located at RA=21h08m and Dec.= +7.5 degrees. It is completely visible from latitudes North of -77 degrees, and completely invisible from latitudes South of -88 degrees. This constellation ranks 87th in overall size (next to smallest), taking up 71.64 square degrees, or 0.174% of the sky. Equuleus has no known meteor showers, and has no Messier objects; it also has no associated asterisms. Its midnight culmination date is August 8th, and its solar conjunction date is February 7th. Delta Equulei is a close binary system, with both members of the system being spectral type F-7 main sequence stars, and both have approximately the same visual magnitude as

well (5.2 and 5.3). This system lies only about 53 light years away, and it is thus calculated that the distance (apparent separation is 0.34") between these two stars is just slightly more than the distance between our own Sun and the planet Jupiter. The two stars in this binary association orbit each other every 5.7 years.

YOUNG ASTRONOMER'S CORNER

The Young Astronomer's Corner periodically answers some common and familiar questions, heard frequently in young astronomy circles and classrooms. We hope to answer some of your questions in this manner. If not, let us know what your questions are (by calling an Officer or the Newsletter Co-Editor, for example), and we will do our best to answer them!!!!!

QUESTION: Can you see a Constellation through a telescope?

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

QUESTION: Do astronomers study the Constellations?

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

QUESTION: Could a person travel through a black hole?

ANSWER: NO WAY!!! Remembering that humans haven't even traveled to another planet yet (!!……our own Moon yes….another planet no!!…..and definitely not to another star system similar to that of the Sun!), any person even *near* a black hole would be killed by many things even before reaching it!! Within a few hundred miles of a black hole, the very strong gravity forces would rip any living object apart. Very strong X-ray sources from around the black hole would cook you, and the surrounding heat would melt even the strongest and toughest of metals. So then, after a living creature or object was ripped apart, cooked, and liquefied, whatever remained would be slurped into the black hole forever!!! Not a very pretty picture, we're afraid!!!! The Young Astronomer's Corner will return next month with all new content.

QUESTION: What is the largest known asteroid?

ANSWER: The largest asteroid known is named Ceres. Naturally enough, it was also the first to be discovered, no doubt because it IS the largest one known. It is approximately 600 miles in diameter. Ceres is really in a class by itself: only two other asteroids are anywhere even close to approaching the size of Ceres (these two are named Pallas and Juno), and they are each listed at 'only' about 180 miles in diameter!

PLANETARY FOCUS - MERCURY

"Planetary Focus" is a column that is published periodically in the EAS "Stargazer". This month, our guest planet is Mercury, as we will be re-starting the series, with the innermost planet to the outermost. Here are the facts:

Rotation around the Sun: 88 days (earth = 365 days).

Orbit: from 0.31 to 0.47 astronomical units (AU); this is about 29-44 million miles from closest to furthest points away from the Sun. This is a very eccentric (non-circular) orbit.

Inclination of orbit: 7 degrees.

Diameter at equator: 3,048 miles.

Mass: one-sixteenth that of earth.

Density: 5.4 times that of water.

Period of rotation on its own axis: 58 days, 15 hours, 30.5 minutes (earth=24 hours).

Satellites (moons): None

Gravity: about one-third that of earth's.

Special Notes: Mercury is one of two (the other is Venus) planets closer to the Sun than the earth. It is never more than 28 degrees from the Sun, which makes it always so difficult to observe. It has a temperature range of between +450 degrees C. (when it's close to the sun), to –180 degrees C. at night. It has an almost imperceptible atmosphere, which contains very small levels of helium, oxygen, and argon, as well as some sodium and potassium. It resembles our own moon in that it is heavily cratered. Mariner 10, a U.S. probe, made close approaches to the planet in 1974 and 1975. Mercury is a rocky planet (terrestrial planet), with a probable nickel-iron core, and a silicate-rich crust.

ASTRONOMY AND TELESCOPE LINGO

ASTRONOMY LINGO: ***JUPITER-CROSSER:*** A very rare type of asteroid whose orbit crosses the orbit of Jupiter; the gravitational influence of Jupiter makes this type of orbit very short-lived.

TELESCOPE LINGO: ***RADIO HELIOGRAPH:*** A telescope designed for mapping the sun in radio wavelengths.

ASTRONOMY FUN FACTS

★ The seismometer set up by the Apollo 12 astronauts on the Moon's Ocean of Storms lasted far longer than expected, operating for almost eight years. During its time of operation, the seismometer registered almost 2,300 moonquakes and meteorite impacts: this is an average of almost one record per day.

★ The surface of Mercury very closely resembles that of the earth's moon. But there would be a huge difference if it was Mercury circling the earth instead of earth's own Moon. Mercury is about 1.5 times the diameter of the Moon, and would shine with twice the light. Mercury would also cause ocean tides about four times higher than what the earth experiences now. Surfers would ply their trade where there used to be freeways and traffic jams!!!!

★ The massive Hellas basin on Mars was hollowed out by an asteroid with a diameter of at least 100 miles. This asteroid impacted Mars at a velocity of about 36,000 mph, producing an explosion equal to 100 trillion tons of TNT! Just one (1) ton of TNT can destroy a small city block of buildings.

★ The Milky Way Galaxy is so large, that a powerful flash of light generated at one edge of the Milky Way (and traveling at 186,000 miles/second), would take 100,000 years to reach the other side!! (Another way of saying the same thing: our Milky Way Galaxy is approximately 100,000 light years across!)

★ The great comet of 1843 had a tail that stretched halfway across the sky; it was estimated to be about 500 million miles long (about Jupiter's distance from the Sun). This comet's tail, if wrapped around the Earth's equator, would circle it about 20,000 times!

★ Although it has been known for almost 2,000 years, the largest globular cluster, Omega Centauri (NGC 5139), was thought to be a single star until Edmund Halley realized it was a cluster in 1677. This globular cluster, at 620 light-years diameter, is one of the most massive in our Galaxy, with a mass perhaps equal to 500,000 Suns. The actual number of component stars exceeds 1 million, and their collective light outshines our Sun by 1,000, 000 times. With an age of 13 billion years, it may also be the oldest of the globular clusters. The orbit of this cluster has a maximum distance of 21,000 light-years from the galactic center to its closest orbital point of 6,200 light years from the galactic center. With an assumed age of 13 billion years, Omega Centauri has orbited around the Milky Way Galaxy 50 times since the birth of the Sun, 6 times since corals and starfish appeared on Earth, and once since flowering plants appeared. In just one single Omega Centauri year, Earth will have orbited the Sun 100 million times!!

★ The Earth, in the year A.D. 51, 974, may receive a return reply message from the Great M-13 globular in the constellation Hercules. This would be in response to the first extraterrestrial radio transmission from the Earth, sent from Earth toward this area of the sky in 1974 from the 1,000 foot Arecibo radio telescope during the dedication of the dish's new surface. The time it takes for the message to reach M-13 and return to Earth…..at the speed of light……..is 50,000 years. By the time the message reaches the cluster, it will have also spread out to be about as wide as it…….about 150 light-years (about 9.5 million times the Earth-Sun distance). If there are any advanced civilizations living in the M-13 vicinity at the time, they should hear the signal!!

MIRROR IMAGES

"MIRROR" IMAGES" : THIS COLUMN IS A BI-MONTHLY COLUMN AND LAST PUBLISHED IN THE DECEMBER-JANUARY ISSUE. IT WILL RETURN NEXT MONTHN .

ASTRONOMICAL NOTES -- ON & OFF THE NET…

HUBBLE WEIGHS IN ON THE HEAVIEST STARS IN THE GALAXY

Astronomers have taken an important step toward establishing an upper limit to the masses of stars. Using NASA's Hubble Space Telescope, they made the first direct measurement within our Milky Way Galaxy, and concluded stars cannot get any larger than about 150 times the mass of our sun.

The astronomers used the Hubble to probe the Arches cluster, the densest in our galaxy. The finding takes astronomers closer to understanding the complex star formation process. It also gives the strongest backing yet to the notion stars have a weight limit.

"*This is an incredible cluster that contains a rich collection of some of the most massive stars in the galaxy, yet it appears to be missing stars more massive than 150 times the mass of our sun*," said astronomer Donald Figer. "*Theories predict the more massive the cluster, the more massive the stars within it. We looked at one of the most massive clusters in our galaxy and found there is a sharp cutoff to how large a star can form*," he added. A star's weight ranges from less than one-tenth to more than 100 times the mass of our sun. Although astronomers know stars come in a variety of masses, they don't know if the bodies have a weight limit at birth. Knowing how large a star can form may offer important clues to how the universe makes them.

Astronomers have been uncertain about how large a star can get before it cannot hold itself together and blows apart. Astronomers don't know enough about the details of the star-formation process to estimate a star's upper mass. Consequently, theories have predicted stars can be anywhere between 100 to 1,000 times more massive than the sun.

Figer's finding is consistent with statistical studies of smaller-mass star clusters in our galaxy and with observations of a massive star cluster known as R136 in our galactic neighbor, the Large Magellanic Cloud. Figer used Hubble's Near Infrared Camera and Multi-Object Spectrometer to study hundreds of stars ranging from six to 130 solar masses. Although Figer did not find any stars larger than 130 solar masses, he conservatively set the upper limit at 150 solar masses. The Arches cluster is a youngster about 2 to 2.5 million years old. It resides 25,000 light-years away from Earth in our galaxy's hub, a hotbed of massive star formation. In this region huge clouds of gas collide to form behemoth stars.

Hubble's infrared camera is well suited to analyze the cluster, because it penetrates the dusty core of our galaxy. It produces sharp images, allowing the telescope to see individual stars in a tightly packed cluster. Figer estimated the stars' masses by measuring the ages of the cluster and the brightness of the individual stars. He also collaborated with Francisco Najarro. Najarro produced detailed models to confirm the masses, chemical abundances and ages of the Arches cluster stars. "Standard theories predict 20 to 30 stars with masses between 130 and 1,000 solar masses," Figer explained. "But we found none. If they had formed, we would have seen them," he added.

Figer cautions the upper limit does not rule out the existence of stars larger than 150 solar masses. His next step is to pinpoint more clusters to test his weight limit. Several telescopes, including the Spitzer Space Telescope, have been searching for new star clusters in the Milky Way.

SCIENTISTS SOLVE MYSTERY OF METEOR CRATER'S MISSING MELTED ROCKS

Scientists have discovered why there isn't much impact-melted rock at Meteor Crater in northern Arizona.

The iron meteorite that blasted out Meteor Crater almost 50,000 years ago was traveling much slower than has been assumed, H. Jay Melosh and Gareth report.

"*Meteor Crater was the first terrestrial crater identified as a meteorite impact scar, and it's probably the most studied impact crater on Earth*," Melosh said. "*We were astonished to discover something entirely unexpected about how it formed*."

The meteorite smashed into the Colorado Plateau 40 miles east of where Flagstaff and 20 miles west of where Winslow have since been built, excavating a pit 570 feet deep and 4,100 feet across - enough room for 20 football fields. Previous research supposed that the meteorite hit the surface at a velocity between about 34,000 mph and 44,000 mph (15 km/sec and 20 km/sec).

Melosh and Collins used their sophisticated mathematical models in analyzing how the meteorite would have broken up and decelerated as it plummeted down through the atmosphere. About half of the original 300,000 ton, 130-foot-diameter (40-meter-diameter) space rock would have fractured into pieces before it hit the ground, Melosh said. The other half would have remained intact and hit at about 26,800 mph (12 km/sec), he said. That velocity is almost four times faster than NASA's experimental X-43A scramjet -- the fastest aircraft flown -- and ten times faster than a bullet fired from the highest-velocity rifle, a 0.220 Swift cartridge rifle.

But it's too slow to have melted much of the white Coconino formation in northern Arizona, solving a mystery that's stumped researchers for years. Scientists have tried to explain why there's not more melted rock at the crater by theorizing that water in the target rocks vaporized on impact, dispersing the melted rock into tiny droplets in the process. Or they've theorized that carbonates in the target rock exploded, vaporizing into carbon dioxide.

"*If the consequences of atmospheric entry are properly taken into account, there is no melt discrepancy at all*," the authors wrote in Nature. "*Earth's atmosphere is an effective but selective screen that prevents smaller meteoroids from hitting Earth's surface*," Melosh said. When a meteorite hits the atmosphere, the pressure is like hitting a wall. Even strong iron meteorites, not just weaker stony meteorites, are affected. "*Even though iron is very strong, the meteorite had probably been cracked from collisions in space*," Melosh said. "*The weakened pieces began to come apart and shower down from about eight-and-a-half miles (14 km) high. And as they came apart, atmospheric drag slowed them down, increasing the forces that crushed them so that they crumbled and slowed more*."

Melosh noted that mining engineer Daniel M. Barringer (1860-1929), for whom Meteor Crater is named, mapped chunks of the iron space rock weighing between a pound and a thousand pounds in a 6-mile-diameter circle around the crater. Those treasures have long since been hauled off and stashed in museums or private collections. But Melosh has a copy of the obscure paper and map that Barringer presented to the National Academy of Sciences in 1909.

At about 3 miles (5 km) altitude, most of the mass of the meteorite was spread in a pancake shaped debris cloud roughly 650 feet (200 meters) across. The fragments released a total 6.5 megatons of energy between 9 miles (15 km) altitude and the surface, Melosh said, most of it in an airblast near the surface, much like the tree-flattening airblast created by a meteorite at Tunguska, Siberia, in 1908. The intact half of the Meteor Crater meteorite exploded with at least 2.5 megatons of energy on impact, or the equivalent of 2.5 tons of TNT.

Elisabetta Pierazzo and Natasha Artemieva have independently modeled the Meteor Crater impact using Artemieva's Separated Fragment model. They find impact velocities similar to that which Melosh and Collins propose. Melosh and Collins began analyzing the Meteor Crater impact after running the numbers in their Web-based "impact effects" calculator, an online program they developed for the general public. The program tells users how an asteroid or comet collision will affect a particular location on Earth by calculating several environmental consequences of the impact.

Related Web sites Impact Effects Calculator

http://www.lpl.arizona.edu/lmp-acteffects
http://www.lpl.arizona.edu/SIC-/impact_cratering/Enviropages/Barringer/barringerstartpage.html

IMAGES OF TITAN REVEAL ACTIVE, EARTH-LIKE WORLD

Saturn's largest and hazy moon, Titan, has a surface shaped largely by Earth-like processes of tectonics, erosion, winds, and perhaps volcanism. Titan, long held to be a frozen analog of early Earth, has liquid methane on its cold surface, unlike the water found on our home planet. Among the new discoveries is what may be a long river, roughly 1,500 kilometers long (930 miles). Scientists have also concluded that winds on Titan blow a lot faster than the moon rotates, a fact long predicted but never confirmed until now.

Tectonism (brittle fracturing and faulting) has clearly played a role in shaping Titan's surface. "*The only known planetary process that creates large-scale linear boundaries is tectonism, in which internal processes cause portions of the crust to fracture and sometimes move either up, down or sideways*," said Dr. Alfred McEwen, Cassini imaging team member. "*Erosion by fluids may accentuate the tectonic fabric by depositing dark materials in low areas and enlarging fractures. This interplay between internal forces and fluid erosion is very Earth-like*."

Cassini images collected during close flybys of the moon show dark, curving and linear patterns in various regions on Titan, but mostly concentrated near the south pole. Some extend up to 1,500 kilometers (930 miles) long. Images from the European Space Agency's Huygens probe show clear evidence for small channels a few kilometers long, probably cut by liquid methane. Cassini imaging scientists suggest that the dark, curved and linear patterns seen in the Cassini orbiter images of Titan may also be channels, though there is no direct evidence for the presence of fluids. If these features are channels, it would make the ones near the south pole nearly as long as the Snake River, which originates in Wyoming and flows across four states.

Since most of the cloud activity observed on Titan by Cassini has occurred over the south pole, scientists believe this may be where the cycle of methane rain, channel carving, runoff, and evaporation is most active, a hypothesis that could explain the presence of the extensive channel-like features seen in this region.

In analyzing clouds of Titan's lower atmosphere, scientists have concluded that the winds on Titan blow faster than the moon rotates, a phenomenon called super-rotation. In contrast, the jet streams of Earth blow slower than the rotation rate of our planet. "*Models of Titan's atmosphere have indicated that it should super-rotate just like the atmosphere of Venus, but until now there have been no direct wind measurements to test the prediction*," said Cassini imaging team member Dr. Tony Del Genio. DelGenio made the first computer simulation predicting Titan super-rotation a decade ago.

Titan's winds are measured by watching its clouds move. Clouds are rare on Titan, and those that can be tracked are often too small and faint to be seen from Earth. Ten clouds have been tracked by Cassini, giving wind speeds as high as 34 meters per second (about 75 miles per hour) to the east -- hurricane strength -- in Titan's lower atmosphere. "*This result is consistent with the predictions of Titan weather models, and it suggests that we now understand the basic features of how meteorology works on slowly rotating planets*," said Del Genio. "*We've only just begun exploring the surface of Titan, but what's struck me the most so far is the variety of the surface patterns that we're seeing. The surface is very complex, and shows evidence for so many*

different modification processes," said Dr. Elizabeth Turtle, Cassini imaging team associate.

"*Throughout the solar system, we find examples of solid bodies that show tremendous geologic variation across their surfaces. One hemisphere often can bear little resemblance to the other*," said Dr. Carolyn Porco, Cassini imaging team leader. "*On Titan, it's very likely to be this and more*."

These results are based on Cassini orbiter images of Titan collected over the last eight months during a distant flyby of the south pole and three close encounters of Titan's equatorial region. Cassini cameras have covered 30 percent of Titan's surface, imaging features as small as 1 to 10 kilometers (0.6 to 6 miles). Cassini is scheduled to make 41 additional close Titan flybys in the next three years. http://saturn.jpl.nasa.gov and http://www.nasa.gov/cassini and http://ciclops.org

VOLUNTEER NETWORK PROVIDES RINGSIDE SEAT TO SATURN

Experiencing Saturn through a telescope for the first time is a feast for the eyes. NASA's Cassini mission to Saturn is helping people savor the view by coordinating a network of people and telescopes around the globe to help others see the ringed giant.

The Cassini Saturn Observation Campaign includes more than 380 volunteers located in 44 U.S. states and 50 countries. During the past year, Saturn Observation Campaign members held nearly 800 events for more than 108,000 people from all ages and walks of life, including students, teachers and curious members of the public. "*I hosted a free public family show at our tiny school planetarium, and 150 enthusiastic viewers endured standing-room- only conditions just to get a glimpse of the program*," said Bess Amaral, Saturn Observation Campaign member from St. Mark's School of Dallas. "*The frosting on the cake was the entire group stayed for the telescope observation session of Saturn and Comet Machholz. Even though the line was huge at the observatory and the weather freezing, no one wanted to miss seeing Saturn and becoming part of astronomical history*."

On weekend evenings, on a crowded sidewalk in Pasadena, Calif., you can find a crowd of people gathered near a large telescope or two, lining up for a peek. At the front of one line is Jane Houston Jones, a devoted amateur astronomer, focusing a telescope on Saturn. Jones is the Saturn Observation Campaign coordinator for the Cassini-Huygens mission at Jet Propulsion Laboratory, also in Pasadena.

"*People are speechless when they first see Saturn with their own eyes. Everyone says 'wow,' and this means I hear 'wow' in many languages here in Pasadena*," said Jones. "*Some people can't believe they are seeing the real thing, and accuse me of placing a tiny picture in the telescope. Some people actually cry with joy. I can connect with their emotions because Saturn was the first object I looked at through my very first home-made telescope many years ago*."

When the Cassini spacecraft arrived at Saturn on June 30, 2004, the ringed planet had just disappeared from the nighttime view. But Saturn is now back in the evening skies and looks like a pale golden glow in the winter sky.

The best viewing this year will last through April 2005. In May, Saturn will dip lower in the sky, and by late June it will be lost in the glare of the setting Sun. The rings are now open wide, and even though the tilt of the rings has been decreasing since 2003, this year still offers a splendid view. With a small telescope you can see many features like the rings, the big gap between the rings and maybe even some storms or spots on the planet.

Saturn Observation Campaign members are provided with outreach resources, mission announcements, observation tips and techniques, and educational material. "*We take NASA's science from space exploration and translate it into something designed for local communities*," added Alice Wessen, manager of solar system outreach at JPL. "*Our Saturn Observation Campaign members know their backyards and NASA knows space. Together we share this experience with the community*."

The program is much more than a sidewalk road show. "*We partner schools or classes with one of our members who will help them plan an event*," added Wessen. "*First, we locate the Saturn Observation Campaign member closest to the school. Then we provide them with the materials on the mission. These activities are aligned with national science education standards and can be used in formal classroom settings*."

To contact a Saturn Observation Campaign member in your area check the Web site at http://soc.jpl.nasa.gov/member-s.cfm The site also has an online application for interested applicants, as well as prime viewing opportunities for the ringed giant planet.

MOONBEAMS SHINE ON EINSTEIN, GALILEO AND NEWTON

Thirty-five years after Moon-walking astronauts placed special reflectors on the lunar surface, scientists have used these devices to test Albert Einstein's general theory of relativity to unprecedented accuracy. The findings, which also confirm theories from Galileo Galilei and Isaac Newton, may help to explain physical laws of the universe and benefit future space missions. "*Our research with the Lunar Laser Ranging experiment probes the equivalence principle, a foundation of Einstein's general theory of relativity, with extreme accuracy*," said Dr. James Williams, a research scientist at Jet Propulsion Laboratory. Galileo established this principle in 1604 when he dropped objects of various weights and composition from Italy's Leaning Tower of Pisa. All the objects were affected equally by gravity, so they fell at the same rate.

Newton published a supporting explanation in 1687 in his Principia, and Einstein extended the principle nearly 100 years ago. Einstein's premise, called the strong equivalence principle, holds that all forms of matter accelerate at the same rate in response to gravity. This principle became a foundation of Einstein's general theory of relativity.

The Lunar Laser Ranging experiment confirms that the Moon and Earth "fall toward" the Sun at the same rate, even though Earth has a large iron core below its rocky mantle, while the Moon is mostly rocky with a much smaller core. The findings by Williams and Drs. Slava Turyshev and Dale Boggs, also of JPL, have been published in the Physical Review Letters. "*Lunar laser ranging can conduct very accurate tests of gravity and fundamental physics*," said Williams, who pointed out that small variations in gravity are difficult to study because the force is weak, unless very large masses are used. The new results of this experiment provide a bonanza for modern physics.

"*An important property of gravity is its universal effect on massive objects, despite their size and composition. This is why, as we understand more about gravity in the solar system, we learn a lot about gravitational and cosmological processes in the entire universe*," said Turyshev.

"*In addition to providing the most accurate test yet of the strong equivalence principle, our experiment also limits any possible changes in Newton's gravitational constant*," said Turyshev. The gravitational constant deals with the attraction between objects in space, and some theories suggest that this attraction would

change over time. If so, the general theory of relativity would need modification. "*This latest research shows no evidence of such a change. Both findings -- about the strong equivalence principle and the gravitational constant -- boost Einstein's theory*," added Turyshev.

Great strides have been made over the past decade in refining the theories of Einstein, Galileo and Newton. The latest findings are twice as accurate as any previous results on the strong equivalence principle, and 10 times as accurate as anything previously published on the variation of Newton's gravitational constant

The team tested the theories by beaming laser pulses to four Moon reflectors from McDonald Observatory in western Texas, and an observatory in southern France. The lunar reflectors bounced the laser beams straight back to Earth, where the roundtrip travel time was measured. Three of the reflectors were installed by the Apollo 11, 14 and 15 astronauts, and one built by France was carried on the unmanned Soviet Lunokhod 2 rover. The current Moon reflectors require no power and still work perfectly after 35 years. As NASA pursues the vision of taking humans back to the Moon, and eventually to Mars and beyond, new, more precise laser ranging devices could be placed first on the Moon and then on Mars. To guide a spacecraft to a precise location on the Moon and to navigate trips on its surface, the Moon's orbit, rotation and orientation must be accurately known. Lunar laser ranging measurements are helping future human and robotic missions to the Moon. More information about the research is available online at http://arxiv.org/abs/gr-qc/041-1113 http://funphysics.jpl.nasa.gov-/physics/index.html

GIANT PLANET BIRTH LINKED TO PRIMITIVE METEORITES

Scientists now believe that the formation of Jupiter, the heavy-weight champion of the Solar System's planets, may have spawned some of the tiniest and oldest constituents of our Solar System - millimeter-sized spheres called chondrules, the major component of primitive meteorites. The study, by theorists Dr. Alan Boss and Prof. Richard H. Durisen, is published in the March 10 issue of The Astrophysical Journal Letters.

"*Understanding what formed the chondrules has been one of the biggest problems in the field for over a century*," commented Boss. "*Scientists realized several years ago that a shock wave was probably responsible for generating the heat that cooked these meteoritic components. But no one could explain convincingly how the shock front was generated in the solar nebula some 4.6 billion years ago. These latest calculations show how a shock front could have formed as a result of spiral arms roiling the solar nebula at Jupiter's orbit. The shock front extended into the inner solar nebula, where the compressed gas and radiation heated the dust particles as they struck the shock front at 20,000 mph, thereby creating chondrules*," he explained.

"*This calculation has probably removed the last obstacle to acceptance of how chondrules were melted*," remarked theorist Dr. Steven Desch, who showed several years ago that shock waves could do the job. "*Meteoriticists have recognized that the ways chondrules are melted by shocks are consistent with everything we know about chondrules. But without a proven source of shocks, they have remained mostly unconvinced about how chondrules were melted. The associated with spiral arms in a gravitationally unstable disk at Jupiter's distance from the Sun (5 times the Earth-Sun distance), would produce a shock wave in the inner solar system (2.5 times the Earth-Sun distance, i.e., in the asteroid belt),"* Boss continued. "*It would have heated dust aggregates to the temperature required to melt them and form tiny droplets*." Durisen and his research group at Indiana have independently made calculations of gravitationally unstable disks that also support this picture.

While Boss is well known as a proponent of the rapid formation of gas giant planets by the disk instability process, the same argument for chondrule formation works for the slower process of core accretion. In order to make Jupiter in either process, the solar nebula had to have been at least marginally gravitationally unstable, so that it would have developed spiral arms early on and resembled a spiral galaxy. Once Jupiter formed by either mechanism, it would have continued to drive shock fronts at asteroidal distances, at least so long as the solar nebula was still around. In both cases, chondrules would have been formed at the very earliest times, and continued to form for a few million years, until the solar nebula disappeared. Late-forming chondrules are thus the last grin of the Cheshire Cat that formed our planetary system.

DISTANT GALAXIES SHOW MATURE UNIVERSE IN CHILDHOOD

Scientists have discovered the most distant massive structure yet detected in the Universe, a fully formed galaxy cluster containing hundreds, if not thousands, of galaxies. The discovery is evidence that the Universe's elegant hierarchal structure of stars, galaxies and clusters formed quickly after the big bang, far earlier than most astronomers thought possible just a few years ago. The discovery was made with the XMM-Newton Observatory and the European Southern Observatory's Very Large Telescope (ESO VLT) in Chile. Dr. Christopher Mullis presented this finding at a scientific meeting in Kona, Hawaii, entitled "The Future of Cosmology with Clusters of Galaxies."

"*We are quite surprised to see that exquisite structure like this could exist at such early epochs*," said Mullis. "*We see an entire network of stars and galaxies in place at just a few billion years after the big bang, like a kingdom popping up overnight on Earth*."

The newly discovered cluster is about 9 billion light years from Earth, a half billion light years farther out than the previous record holder. This means the cluster was mature when the Universe was only 5 billion years old, and that the stars and galaxies formed and assembled into a cluster within only a few billion years. The Universe is now 13.7 billion years old.

"*We have underestimated how quickly the early Universe matured into its present-day incarnation*," said Dr. Piero Rosati. "The Universe grew up fast." The scientists said this discovery might be the tip of the iceberg. Their results are based on a first peek at archived XMM-Newton data from the past four years. Other clusters undoubtedly lie hidden in the data archive waiting to be discovered, they said.

Galaxy clusters contain hundreds to thousands of galaxies gravitationally bound to each other. Our Milky Way galaxy resides in a relatively low-density region of the Universe, part of a "local group" of galaxies but apparently not bound to the nearby Virgo cluster. Scientists study the distribution and growth rate of galaxy clusters to understand the overall structure and evolution of the Universe. Most of the ordinary matter in galaxy clusters takes the form of hot, tenuous gas in between galaxies. This gas is invisible to optical telescopes but can be detected with large, orbiting X-ray observatories, such as XMM-Newton. Mullis said that a 12-hour XMM-Newton observation of a nearby galaxy revealed tantalizing evidence of a galaxy cluster far in the background. Knowing where to look, his team used the powerful ESO VLT in the Atacama Desert in Chile to find an optical counterpart. Sure enough, the team found dozens of galaxies

associated with this X-ray emission. The VLT data established the distance to the cluster, at a redshift of 1.4, corresponding to about 9 billion light years away. The galaxies were reddish, elliptical types, an indication that they were already several billion years old and filled with older red stars. The cluster itself was largely spherical, a sign that it was well formed.

Proto-clusters, which are clusters in the making, have been seen over 10 billion light years away. The new finding is the best evidence yet of when these wild proto-clusters reached maturity. The relative ease of discovery, based on archived data, implies that the team could build a large sample size of exceedingly distant clusters. This would allow scientists to directly test competing theories of structure formation and evolution. The team is currently pursuing detailed follow-up observations from both ground and space-based observatories.

"*This discovery encourages us to search for additional distant clusters using this same efficient technique*," said team member Dr. Hans Bohringer. "*It also shows great promise for experiments under construction, such as the Atacama Pathfinder Experiment. Such diligent searching will ultimately place strong constraints on fundamental parameters of the Universe*."

CASSINI IMAGES DISCOVER WINDY WAVY TITAN ATMOSPHERE

The dynamic atmosphere of Saturn's haze-enshrouded moon Titan is revealed in the first Cassini Imaging Team report on Titan. Imaging scientists, analyzing images of Titan designed to allow views of the surface and lower atmosphere, have discovered that the winds on Titan blow a lot faster than the moon rotates. In contrast, the jet stream of Earth blows a lot slower than the surface of our planet moves. Titan is a particularly slow rotator, taking 16 Earth days to make one full rotation. Yet, despite its slow period, model simulations made a decade ago predicted that winds in its atmosphere should blow faster than its surface rotates, making it, like its slowly rotating cousin Venus, one of the solar system's "super-rotators".

"*It has long been known that winds in Venus' atmosphere blow many times faster than the solid planet itself rotates*," said imaging team member Dr. Tony DelGenio of NASA's Goddard Institute for Space Studies, or GISS, in New York, who made the first computer simulation predicting Titan super-rotation a decade ago. *"Models of Titan's atmosphere have indicated that it too should super-rotate just like Venus, but until now there have been no direct wind measurements to test the prediction*," he said.

Titan's winds are measured by watching its clouds move. Clouds are a rare occurrence on Titan, and those whose motions can be tracked are often small (about 100 kilometers or 60 miles across) and faint; in other words, the clouds are too inconspicuous to be seen from Earth. The discovery of moving clouds required careful manipulation of Cassini images in which cloud features are hard to distinguish through the moon's ubiquitous haze and against the backdrop of Titan's complex bright and dark surface. DelGenio and his associate John Barbara, also of GISS, used Cassini images that had been taken through special filters designed to see through the haze to detect surface features as well as clouds. "*To discriminate clouds from surface features, I took images of the same region at different times and subtracted them from each other*," said Barbara. "*When I did this, time-variable clouds stood out as regions of changing brightness*."

Ten such clouds have been tracked, giving wind speeds as high as 34 meters per second (about 75 miles per hour) to the east - hurricane strength - at an altitude somewhere in Titan's middle and lower troposphere. "*This result is consistent with the predictions of Titan weather models, and it suggests that we now understand the basic features of how meteorology works on slowly rotating planets*," said Del Genio.

Cassini images also reveal much larger cloud streaks - 1,000 kilometers (620 miles) long - elongated generally east-west. These clouds occur at preferred locations and move at only a few meters per second. Apparently these streak clouds originate closer to Titan's surface, perhaps from places where methane is released to the atmosphere from below Titan's surface, or places where wind blows over topography.

In Titan's hazy stratosphere, it looks as though modelers may have to go back to the drawing board. Voyager images of Titan detected a faint detached haze layer above Titan's main stratospheric haze, at altitudes of 300-350 kilometers (190 to 220 miles). Cassini ultraviolet images, which are sensitive to scattering of sunlight by small particles, detect a similar detached haze layer, but at an altitude of 500 kilometers (310 miles) instead. "*The change we see in the detached haze over the 25 years since Voyager suggests that either the photochemical process that produce the hydrocarbon haze particles, or the atmospheric circulation that distributes them around the planet, may change with the seasons*," said imaging team member Dr. Bob West who designed all the Titan atmosphere imaging sequences for the Cassini mission. "*It will be a challenge for models to be able to predict how and where these detached hazes occur*," he said. Images of Titan's night side, in which high haze layers are backlit by the Sun, surprised scientists by showing evidence of an entire series of haze layers. These may be evidence of gravity waves, the atmospheric equivalent of ripples on a pond, propagating up to Titan's upper stratosphere by disturbances that originate at lower levels. If so, then analysis of the properties of these waves may yield insights into the temperature and wind profiles of Titan's stratosphere and how they change over the course of the mission.

FROM THE EDITOR'S TERMINAL

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

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

In March's Stargazer:

The next EAS Meeting is 4:00 P.M. Saturday, March 19th at the Everett Public Library Auditorium. (Note new time / location !!!)