onOrbit

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Fleischmann Planetarium
University of Nevada - Reno

The Planetarium
Community College of Southern Nevada - Las Vegas

M-82
Origins of Life

Show Times:
Origins: 6 pm Fri., 7:30 pm Fri. & Sat.
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Sky Watch

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Return to Flight, Part 2

(NASA) The launch window for STS-121 opens on July 1. NASA is preparing to send Discovery back to the International Space Station. This first launch window extends until July 19. Speculation is that the actual date of the launch will be towards the end of this window. It could even be bumped into a similar window in August. NASA is being particularly careful with this mission.

The crew of space shuttle Discovery will continue to test new equipment and procedures that increase the safety of space shuttles during the STS-121 mission to the International Space Station. It will also perform maintenance on the space station and deliver more supplies and cargo for future station expansion.

Discovery will bring a third crewmember to the station, European Space Agency Astronaut Thomas Reiter. This will be the first three-person crew since the Expedition 6 crew returned to Earth May 4, 2003. Without the space shuttle to ferry equipment to the station after the Columbia accident, only two people could be supported onboard until the necessary provisions were in place.

Discovery will carry the Italian-built Multi-Purpose Logistics Module (MPLM) Leonardo, with more than two tons of equipment and supplies aboard.

This will be the fourth trip to the station for Leonardo, the first of three Italian-built MPLMs. Equipment and supplies no longer needed on the station will be moved to Leonardo before it is unberthed on Flight Day 10 and put back into Discovery's cargo bay for return to Earth.

Steve Lindsey, an Air Force colonel, will command Discovery. He is making his fourth spaceflight, and second as commander. The pilot will be Navy Cmdr. Mark Kelly, making his second flight.

Others aboard, in addition to Reiter, will be mission specialists Mike Fossum, Stephanie Wilson, Piers Sellers and Navy Cmdr. Lisa Nowak. This will be the first spaceflight for Fossum, Wilson and Nowak. Sellers is making his second spaceflight.

Reiter will remain on the station, working with the station crew under a contract between ESA and the Russian Federal Space Agency.

Two 6½-hour spacewalks are scheduled for Sellers and Fossum on the fifth and seventh days of the mission. The first spacewalk will test the 50-foot robotic arm boom extension as a work platform. They will also begin maintenance of the station’s Mobile Transporter (MT) by safing or replacing a cable cutter unit to allow the station’s mobile robotic system to be translated in support of the second spacewalk.

During the second spacewalk the crew will replace the detached cable on the MT, which was inadvertently cut, and its reel assembly. They will also install a spare part for the station’s thermal control system for future use.

Inspections of the orbiter’s heat shield with a 50-foot-long Orbiter Boom Sensor System are scheduled for before Discovery arrives at the station and again near the end of the mission, on the day before and the day of undocking from the space station.

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Editor: Dr. Dale Etheridge, CCSN Planetarium Director • Graphic Design: Denise MacRae
Circulation Manager: Daisy Pritchard
Happy Sweet Sixteen, Hubble Telescope!

(NASA/STScI) To celebrate the Hubble Space Telescope’s 16 years of success, the two space agencies involved in the project, NASA and the European Space Agency (ESA), released this image (also on cover) of the magnificent starburst galaxy, Messier 82 (M82). This mosaic image is the sharpest wide-angle view ever obtained of M82. The galaxy is remarkable for its bright blue disk, webs of shredded clouds, and fiery-looking plumes of glowing hydrogen blasting out of its central regions.

Throughout the galaxy's center, young stars are being born 10 times faster than they are inside our entire Milky Way Galaxy. The resulting huge concentration of young stars carved into the gas and dust at the galaxy’s center. The fierce galactic superwind generated from these stars compresses enough gas to make millions of more stars.

In M82, young stars are crammed into tiny but massive star clusters. These, in turn, congregate by the dozens to make the bright patches, or "starburst clumps," in the central parts of M82. The clusters in the clumps can only be distinguished in the sharp Hubble images. Most of the pale, white objects sprinkled around the body of M82 that look like fuzzy stars are actually individual star clusters about 20 light-years across and contain up to a million stars.

The rapid rate of star formation in this galaxy eventually will be self-limiting. When star formation becomes too vigorous, it will consume or destroy the material needed to make more stars. The starburst then will subside, probably in a few tens of millions of years.

Located 12 million light-years away, M82 appears high in the northern spring sky in the direction of the constellation Ursa Major, the Great Bear. It is also called the "Cigar Galaxy" because of the elliptical shape produced by the oblique tilt of its starry disk relative to our line of sight.

The observation was made in March 2006, with the Advanced Camera for Surveys’ Wide Field Channel. Astronomers assembled this six-image composite mosaic by combining exposures taken with four colored filters that capture starlight from visible and infrared wavelengths as well as the light from the glowing hydrogen filaments.

NASA, ESA, and The Hubble Heritage Team (STScI/AURA) • Hubble Space Telescope ACS/WFC
The Dancing Moons

(NASA/JPL) In their orbital ballet, Janus and Epimetheus swap positions every four years, one moon moving closer to Saturn, the other moving farther away. The two recently changed positions (the swap occurring on January 21, 2006), and Janus will remain the innermost of the pair until 2010, when they will switch positions again.

Although the moons appear to be close in the image, they are not. Janus (113 miles across at right) is about 25,000 miles farther away from Cassini than Epimetheus (72 miles across, at left) in this view. In fact, even when they are at their closest, tugging at each other and swapping orbital positions, they are never closer than about 9,000 miles.

The image was taken in visible light with the Cassini spacecraft narrow-angle camera on March 20, 2006 at a distance of approximately 281,000 miles from Epimetheus and 306,000 miles from Janus. The image scale is 3 kilometers (2 miles) per pixel on both moons.

The Cassini-Huygens mission is a cooperative project of NASA, the European Space Agency and the Italian Space Agency. The Jet Propulsion Laboratory, a division of the California Institute of Technology in Pasadena, manages the mission for NASA’s Science Mission Directorate, Washington, D.C. The Cassini orbiter and its two onboard cameras were designed, developed and assembled at JPL. The imaging operations center is based at the Space Science Institute in Boulder, Colo.
**Hubble Snaps Baby Pictures of Jupiter's "Red Spot Jr."**

(NASA/STScI) NASA's Hubble Space Telescope is giving astronomers their most detailed view yet of a second red spot emerging on Jupiter. For the first time in history, astronomers have witnessed the birth of a new red spot on the giant planet, which is located half a billion miles away. The storm is roughly one-half the diameter of its bigger and legendary cousin, the Great Red Spot. Researchers suggest that the new spot may be related to a possible major climate change in Jupiter's atmosphere.

Dubbed by some astronomers as "Red Spot Jr.," the new spot has been followed by amateur and professional astronomers for the past few months. But Hubble's new images provide a level of detail comparable to that achieved by NASA's Voyager 1 and 2 spacecraft as they flew by Jupiter a quarter-century ago.

Before it mysteriously changed to the same color as the Great Red Spot, the smaller spot was known as the White Oval BA. It formed after three white oval-shaped storms merged during 1998 to 2000. At least one or two of the progenitor white ovals can be traced back to 90 years ago, but they may have been present earlier. A third spot appeared in 1939. (The Great Red Spot has been visible for the past 400 years, ever since earthbound observers had telescopes to see it).

When viewed at near-infrared wavelengths (specifically 892 nanometers, a methane gas absorption band) Red Spot Jr. is about as prominent in Jupiter's cloudy atmosphere as the Great Red Spot. This may mean that the storm rises miles above the top of the main cloud deck on Jupiter just as its larger cousin is thought to do. Some astronomers think the red hue could be produced as the spots dredge up material from deeper in Jupiter's atmosphere, which is then chemically altered by the Sun's ultraviolet light.

Researchers think the Hubble images may provide evidence that Jupiter is in the midst of a global climate change that will alter its average temperature at some latitudes by as much as 10°Fahrenheit. The transfer of heat from the equator to the planet's south pole is predicted to nearly shut off at 34° southern latitude, the latitude where the second red spot is forming. The effects of the shut-off were predicted by Philip Marcus of the University of California, Berkeley (UCB) to become apparent approximately seven years after the White Oval collisions in 1998 to 2000.

Two teams of astronomers were given discretionary time on Hubble to observe the new red spot.

The image on the left, acquired April 8, 2006 with Hubble's Advanced Camera for Surveys (high-resolution channel), shows that the second red spot has a small amount of pale clouds in the center. A strong convective event, which is likely a thunderstorm, is visible as a bright white cloud north of the oval, in the turbulent clouds that precede the Great Red Spot. As the oval continues its eastward drift and the Great Red Spot moves westward, they should pass each other in early July. This contrast-enhanced image was taken in blue and red light. The group that performed this observation was led by Amy Simon-Miller...
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Hubble’s Advanced Camera for Surveys (wide field channel) took the image on the right of the entire disk of Jupiter on April 16. The second red spot appears at southern latitudes, below the center of Jupiter's disk. The new spot is approximately the size of Earth's diameter. The image was taken in visible light and at near-infrared wavelengths, and does not represent Jupiter's true colors. The red color traces high-altitude haze blankets: the equatorial zone, the Great Red Spot, the second red spot, and the polar hoods. The Hubble group that conducted this observation is led jointly by Imke de Pater (UCB Astronomy) and Philip Marcus (UCB Mechanical Engineering). Other team members are Michael Wong (UCB Astronomy), Xylar Asay-Davis (UCB Mechanical Engineering), and Christopher Go, an amateur astronomer with the Astronomical League of the Philippines.

Hubble Provides Spectacular Detail of a Comet's Breakup

(NASA/STScI) NASA’s Hubble Space Telescope is providing astronomers with extraordinary views of comet 73P/Schwassmann-Wachmann 3, which is falling apart right before our eyes. Recent Hubble images have uncovered many more fragments than have been reported by ground-based observers. These observations provide an unprecedented opportunity to study the demise of a comet nucleus.

Amateur and professional astronomers around the world have been tracking for years the spectacular disintegration of 73P/Schwassmann-Wachmann 3. As it plunged toward a June 6th swing around the Sun, the comet passed Earth on May 12th, at a distance of 7.3 million miles, or 30 times the distance between Earth and the Moon.

The comet is currently comprised of a chain of over three dozen separate fragments, named alphabetically, stretching across several degrees on the sky. (The Sun and Moon each have an apparent diameter of about $\frac{1}{2}$ of a degree.) Ground-based observers have noted dramatic brightening events associated with some of the fragments (as shown in the bottom frame) indicating that they are continuing to break-up and that some may disappear altogether.

Hubble caught two of the fragments, B and G, (top frames) shortly after large outbursts in activity. Hubble also photographed fragment C (not shown), which was less active. The resulting images reveal that a hierarchical destruction process is taking place, in which fragments are continuing to break into smaller
chunks. Several dozen "mini-fragments" are found trailing behind each main fragment, probably associated with the ejection of house-sized chunks of surface material that can only be detected in these very sensitive and high-resolution Hubble images.

Sequential Hubble images of the B fragment, taken a few days apart, suggest that the chunks are pushed down the tail by outgassing from the icy, sunward-facing surfaces of the chunks, much like space-walking astronauts are propelled by their jetpacks. The smaller chunks have the lowest mass, and are accelerated away from the parent nucleus faster than the larger chunks. Some of the chunks seem to dissipate completely over the course of several days.

Deep-freeze relics of the early solar system, cometary nuclei are porous and fragile mixes of dust and ices. They can be broken apart by gravitational tidal forces when they pass near large bodies (for example, Comet Shoemaker-Levy 9 was torn to pieces when it skirted near Jupiter in 1992, prior to plunging into Jupiter's atmosphere two years later). They can also fly apart from rapid rotation of the nucleus, break apart because of thermal stresses as they pass near the Sun, or explosively pop apart like corks from champagne bottles due to the outburst of trapped volatile gases.

"Catastrophic breakups may be the ultimate fate of most comets," says planetary astronomer Hal Weaver of the Johns Hopkins University Applied Physics Laboratory, who led the team that made the recent Hubble observations and who used Hubble previously to study the fragmentations of comets Shoemaker-Levy 9 in 1993-1994, Hyakutake in 1996, and 1999 S4 (LINEAR) in 2000. Analysis of the new Hubble data, and data taken by other observatories as the comet approaches the Earth and Sun, may reveal which of these breakup mechanisms are contributing to the disintegration of 73P/Schwassmann-Wachmann 3.

German astronomers Arnold Schwassmann and Arno Arthur Wachmann discovered this comet during a photographic search for asteroids in 1930, when the comet passed within 5.8 million miles of the Earth (only 24 times the Earth-Moon distance). The comet orbits the Sun every 5.4 years, but it was not seen again until 1979. The comet was missed again in 1985 but has been observed every return since then.

During the fall of 1995, the comet had a huge outburst in activity and shortly afterwards four separate nuclei were identified and labeled "A", "B", "C", and "D", with "C" being the largest and the presumed principal remnant of the original nucleus. Only the C and B fragments were definitively observed during the next return, possibly because of the poor geometry for the 2000-2001 apparition. The much better observing circumstances during this year's return may be partly responsible for the detection of so many new fragments, but it is also likely that the disintegration of the comet is now accelerating. Whether any of the many fragments will survive the trip around the Sun remains to be seen.

Besides Weaver, the other members of the Hubble observing team are: Carey Lisse (JHU/APL), Philippe Lamy (Laboratoire d'Astronomie Spatiale, France), Imre Toth (Hungarian Academy of Sciences), William Reach (IPAC/Caltech), and Max Mutchler (STScI).

The Astronomical Society of Nevada
The ASN normally meets on the 2nd Tuesday of each month at 6:30 pm at the Fleischmann Planetarium.
Call 775-324-4814 for information.
http://www.astronomynv.org/

The ASN has a Las Vegas Chapter.
For information see:
http://www.astronomynv.org/vegas/
**The Astronomy Store**

The CCSN Planetarium
open 5 pm to 9 pm Friday
& 3 pm to 9 pm Saturday

The Astronomy Store features items for sale that are of interest to the patrons of The Planetarium. We carry a wide variety of novelties, toys and observing aids with a space or astronomical theme. When patrons obtain their tickets to planetarium shows, they can also purchase a variety of astro-nomically oriented items. *Friends of The Planetarium* receive a 10% discount.

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**The Las Vegas Astronomical Society**


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**NASA's Chandra Finds Black Holes Are "Green"**

(NASA/CXC) Black holes are the most fuel efficient engines in the Universe, according to a new study using NASA's Chandra X-ray Observatory. By making the first direct estimate of how efficient or "green" black holes are, this work gives insight into how black holes generate energy and affect their environment.

The new Chandra finding shows that most of the energy released by matter falling toward a supermassive black hole is in the form of high-energy jets traveling at near the speed of light away from the black hole. This is an important step in understanding how such jets can be launched from magnetized disks of gas near the event horizon of a black hole.

"Just as with cars, it's critical to know the fuel efficiency of black holes," said lead author Steve Allen of the Kavli Institute for Particle Astrophysics and Cosmology at Stanford University, and the Stanford Linear Accelerator Center. "Without this information, we cannot figure out what is going on under the hood, so to speak, or what the engine can do."

Allen and his team used Chandra to study nine supermassive black holes at the centers of elliptical galaxies. These black holes are relatively old and generate much less radiation than quasars, rapidly growing supermassive black holes seen in the early Universe. The surprise came when the Chandra results showed that these "quiet" black holes are all producing much more energy in jets of high-energy particles than in visible light or X-rays. These jets create huge bubbles, or cavities, in the hot gas in the galaxies.

The efficiency of the black hole energy-production was calculated in two steps: first...
Artist's illustration shows a large area where gas is first attracted to the black hole, a region about a million times larger than the black hole's event horizon. [NASA/CXC/M.Weiss]

_Chandra_ images of the inner regions of the galaxies were used to estimate how much fuel is available for the black hole; then _Chandra_ images were used to estimate the power required to produce the cavities.

"If a car was as fuel-efficient as these black holes, it could theoretically travel over a billion miles on a gallon of gas," said coauthor Christopher Reynolds of the University of Maryland, College Park.

New details are given about how black hole engines achieve this extreme efficiency. Some of the gas first attracted to the black holes may be blown away by the energetic activity before it gets too near the black hole, but a significant fraction must eventually approach the event horizon where it is used with high efficiency to power the jets. The study also implies that matter flows towards the black holes at a steady rate for several million years.

"These black holes are very efficient, but it also takes a very long time to refuel them," said Steve Allen who receives funding from the Office of Science of the Department of Energy.

This new study shows that black holes are green in another important way. The energy transferred to the hot gas by the jets should keep hot gas from cooling, thereby preventing billions of new stars from forming. This will place limits on the growth of the largest galaxies, and prevent galactic sprawl from taking over the neighborhood.

This set of _Chandra_ images shows hot gas located in the nine different elliptical galaxies studied in this new work. Each of these galaxies shows evidence for cavities in the hot gas that were created by jets from the central black holes. [NASA/CXC/Stanford U./S.Allen et al.]

**Galaxies Don Mask of Stars in New Spitzer Image**

(NASA/SSC) A pair of dancing galaxies appears dressed for a cosmic masquerade in a new image from NASA's _Spitzer Space Telescope_.

The infrared picture shows what looks like
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Shows available for all grade levels are offered Monday thru Friday at both the Fleischmann Planetarium and the CCSN Planetarium.
For information, call 702-651-4505 in Las Vegas or 775-784-4812 in Reno.

two icy blue eyes staring through an elaborate, swirling red mask. These "eyes" are actually the cores of two merging galaxies, called NGC 2207 and IC 2163, which recently met and began to twirl around each other.

The "mask" is made up of the galaxies' twisted spiral arms. Dotted along the arms, like strings of decorative pearls, are dusty clusters of newborn stars. This is the first time that clusters of this type, called "beads on a string" by astronomers, have been seen in NGC 2207 and IC 2163.

"This is the most elaborate case of beading we've seen in galaxies," said Dr. Debra Elmegreen of Vassar College in Poughkeepsie, N.Y. "They are evenly spaced and sized along the arms of both galaxies."

Elmegreen is lead author of a paper describing the Spitzer observations in the May 1 issue of the Astrophysical Journal.

Astronomers say the beads were formed when the galactic duo first met. "The galaxies shook each other, causing gas and dust to move around and collect into pockets dense enough to collapse gravitationally," said Dr. Kartik Sheth of NASA's Spitzer Science Center at the California Institute of Technology in Pasadena. Once this material condensed into thick bead-like clouds, stars of various sizes
began to pop up within them. Spitzer’s infrared camera was able to see the dusty clouds for the first time because they glow with infrared light. The hot, young stars housed inside the clouds heat up the dust, which then radiates at infrared wavelengths. This dust is false-colored red in the image, while stars are represented in blue.

The Spitzer data also revealed an unusually bright bead adorning the left side of the "mask." This dazzling orb is so packed full of dusty materials that it accounts for five percent of the total infrared light coming from both galaxies. Elmegreen's team thinks the central stars in this dense cluster might have merged to become a black hole.

NGC 2207 and IC 2163 are located 140 million light-years away in the Canis Major constellation. The two galaxies will meld into one in about 500 million years, bringing their masquerade days to an end.

Black Hole Web Site
(NASA/STScI) What would it be like to orbit a black hole, or even to fall into one? You can find out by exploring the world of black holes in an award-winning Web site created by a team led by Roeland van der Marel, an astronomer at the Space Telescope Science Institute in Baltimore, Md.

The Web site won the top prize for 2005 in the Pirelli INTERNETional Award competition, the first international multimedia contest for the communication of science and technology on the Internet. The award covers interactive audio visual formats such as flash animations, CD-ROMs, and Web sites.

Awards are given in five categories: physics, chemistry, mathematics, life sciences, and information and communications technology. Van der Marel’s Web site won the award for physics and also beat the other category winners to claim the top prize. His team created the black holes Web site with the help of a NASA education and public outreach grant.

The award-winning interactive Web site is entitled Black Holes: Gravity's Relentless Pull. The public-friendly site, filled with animations and graphics, rescues black holes from the realm of science fiction and puts them back into the domain of science. The site can be explored on Hubblesite (http://hubblesite.org/go/blackholes), the Internet home of Hubble Space Telescope news.

"Our goal is to show that even the most mysterious of things can be understood with the combined application of human thinking and powerful technology," van der Marel explains. "We want to convey the importance of scientific thought and hope to instill, especially in the younger generation of viewers, an appreciation for learning and an interest in science."

Van der Marel and his collaborators received their prize during a ceremony May 16 in Rome, Italy. The winning team also consists of Gijs Verdoes Kleijn, formerly of the Institute and now at the University of Groningen in the Netherlands, and Educational Web Adventures of St. Paul, Minn., led by David Schaller, which was responsible for the design and development of the Web site.

An international jury selected the Pirelli award winners from 1,000 entries from more than 50 countries. The jury included Riccardo Giacconi, winner of the 2002 Nobel Prize in physics and former Institute director. Launched in 1996, the award is sponsored by the same Italian company that makes Pirelli tires.

Van der Marel is an expert on black holes and the structure of galaxies. His research, which includes using the Hubble telescope to study galaxies, has contributed to the discovery that supermassive black holes exist in the centers of most galaxies. He earned a doctorate in astronomy in 1994 from Leiden University in the Netherlands. In 1997, he received a fellowship at the Space Telescope Science Institute, the Hubble telescope's science operations center. He is now a member of the Institute's science staff and is also an adjunct associate professor at nearby Johns Hopkins University.
Give a Star

A popular service of The CCSN Planetarium lets you dedicate a star to a loved one. For a donation of $35, we will provide an attractive certificate that proclaims your dedication of the star of your choice to any other person. The certificate will have a chart of the constellation containing the star and complete information about the star. Accompanying the certificate will be The Sky Challenger, which contains a series of adjustable charts of the sky as seen from North America to help you find your star. A donation of $100 will give you an exclusive dedication. Call 651-4138 or 651-4505 for further information.

6: The Philosophiae Naturalis Principia Mathematica (usually referred to as The Principia) was published by Sir Isaac Newton in 1687. This massive work described the laws of physics as developed by Newton.

7: Spanish explorer Francisco Vasquez de Coronado’s expedition reached the Zuni pueblo in New Mexico in 1540.

10: Telstar I, the first private communications satellite was launched this day in 1962.

11: Skylab, the United States’ first orbiting space station, was destroyed as it reentered the atmosphere over the Indian Ocean in 1979. Skylab was launched in 1973 and hosted three crews for a total mission time of six months.

14: Mariner 4 was the first spacecraft to reach the planet Mars. It returned the first close-up photographs of the Red Planet in 1965 during its close flyby.

15: In the first joint US/USSR space project, an Apollo spacecraft and a Soyuz spacecraft were launched into low earth orbit in 1975 headed towards a rendezvous and docking (see the 17th). The American crew was Thomas Stafford, Vance Brand and Deke Slayton. The Soviet crew was Alexei Leonov and Valeriy Kubasov.

16: Apollo 11, the first mission to land men on the moon was launched in 1969.

17: The first rendezvous and docking of two spacecraft from different nations occurred in 1975 as part of the Apollo-Soyuz Test Project.

19: Edward Pickering was born in 1846.

20: Nils Adolf Eric Nordenskjöld completed the first Northwest Passage across North America in 1879.

20: Neil Armstrong and Buzz Aldrin became the first men on the moon during the Apollo 11 landing in 1969. Michael Collins remained aboard the Command Module in orbit around the moon.

20: The Viking 1 lander returned the first pictures from the surface of Mars in 1976.

21: Virgil Grissom flew Liberty Bell 7 for 15 minutes on the second and final suborbital flight in the Mercury program. The spacecraft sank shortly after splashdown.

23: J. Stuart completed the first north to south crossing of Australia in 1862.

24: A captured German V-2 rocket became the first rocket to be launched from Cape Canaveral, Florida, in 1950.

29: The National Advisory Committee on Aeronautics (NACA) was reorganized and became the National Aeronautics and Space Administration (NASA) in 1959.

31: Ranger 7 returned the first close-up photographs of the surface of the moon as it crashed into the lunar surface in 1964.
All times are Pacific Daylight Time. Rise and set times are for the astronomical horizon at Las Vegas or Reno as noted.

**The Moon**

*Mercury.* Mercury is too close in direction to the sun to be easily seen for most of the month. Inferior conjunction occurs on July 18 when it will pass between the earth and the sun. By the end of the month, Mercury will be in the morning sky before sunrise.

*Venus.* Venus is visible in the morning sky rising about 2 hours before the sun. Look for the waning crescent moon to rise just to the left of Venus on the morning of July 23. Through a small telescope at low to moderate power, Venus exhibits a gibbous phase. By late August, Venus will be too close in direction to the sun to be visible as it move around the far side of the sun.

*Mars.* Mars is moving eastward in Leo. It is becoming increasingly more difficult to observe as it sets in the west shortly after the sun. Conjunction on the far side of the sun will occur on October 23.

*Jupiter.* Jupiter, in Libra, rises before sunset and is high in the southern sky by mid-evening. On the evening of July 6, Jupiter will be above the waxing gibbous moon. Jupiter presents a spectacular view in a small telescope. Even with binoculars, its four major moons (discovered by Galileo) can be easily seen.

*Saturn.* Saturn, near Mars in Cancer, is too close in direction to the sun to be visible. Conjunction occurs on August 7 when Saturn passes on the far side of the sun.

*Uranus.* Uranus, in Aquarius, is rising shortly before midnight at mid-month. The waning gibbous moon rises just after Uranus on the evening of July 14.

*Neptune.* Neptune, in Capricornus, rises over an hour before Uranus. It can be viewed between midnight and dawn. The nearly full moon is just south of Neptune on July 12.

*Pluto.* Pluto is in the constellation of Serpens Cauda. Since it passed opposition (opposite the sun in the sky) on June 16, it is in the sky most of the night. The best time to view Pluto would be near midnight when it is highest. A telescope of at least 12” diameter from a dark sky environment is usually required to see this faint planet. It appears star-like in all but the very largest telescopes.

**The Planets**

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**The Moon**

Each day the moon rises about one hour later than the day before. The New Moon (not visible) is in the direction of the sun and sets with the sun. The first quarter moon rises at about noon and sets near midnight. The full moon is opposite the sun in the sky and rises at sunset and sets at sunrise. The last quarter moon rises near midnight and sets near noon. Perigee is when the moon is closest to the earth and apogee is when it is farthest. The distance varies by ±6% from the average.

- **First quarter** July 3 9:37 am pdt
- **Full Moon** July 10 8:02 pm
- **Last quarter** July 17 12:13 pm
- **New Moon** July 24 9:31 pm
- **First quarter** Aug. 2 1:46 am
- **Apogee** July 1 1:14 pm pdt
- **Perigee** July 13 10:36 am
- **Apogee** July 29 6:03 am
The Sun
Las Vegas

<table>
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<th>Date</th>
<th>Sunrise</th>
<th>Sunset</th>
<th>Day</th>
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<td>5:30 am pdt</td>
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The Sun
Reno

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Meteor Shower

The Delta Aquarid meteor shower reaches its peak on the night of July 27/28. The number of meteors visible varies from 15 to 35 per hour. The stream of material causing this shower is relatively broad. The earth enters the stream around July 15 and leaves it in mid-August. The new moon will not interfere with observations near the date of maximum.

Meteors are best seen after midnight where the sky is clear and dark. This means the observer must get away from city lights. For the Las Vegas area, you need to get at least 30 miles away from the city. Excellent observing sites can be found near Lake Mead, Red Rock Canyon or Valley of Fire. For the Reno area, Pyramid Lake, about 40 miles north of Sparks, is a good location.

Meteors from a shower can be seen anywhere in the sky. Because the particles causing the meteors are traveling on parallel paths, you can trace back the path of each meteor to a common place in the sky. This place is called the radiant for the shower. The radiant for this shower is near the star Delta Aquarii in the zodiacal constellation of Aquarius.

While the Delta Aquarid shower is rather bland, next month we will have what is usually the best meteor shower of the year. Now is the time to start planning for the Perseid shower which will peak on the night of August 11/12. Unfortunately, the Perseids will be impeded by a nearly full moon this year.

It is called the Perseid shower because the meteors seem to radiate out from the constellation of Perseus. The particles that cause the meteors are from Comet Swift-Tuttle of 1862. Since this comet travels on a very elongated orbit, the debris from this comet strikes the earth’s atmosphere at very high velocities. This produces bright meteors that travel rapidly across the sky. Some meteors of this shower are seen to fragment or explode.

Aphelion

As the earth travels around the sun, its distance from the sun changes slightly. This year, our distance from the sun will be greatest (aphelion) on July 3 at 4:00 pm. The distance of the center of the earth from the center of the sun will be 152,095,750 kilometers or 94,507,920 miles. Over a year, our distance from the sun varies by ±1.7% from the average which is called the Astronomical Unit (AU). The AU has a length of 149,597,870 km or 92,955,810 miles. This is usually rounded to 93 million miles or 150 million kilometers for a simple approximations.
The CCSN Planetarium and The Fleischmann Planetarium are units of the Nevada System of Higher Education.

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**Now Playing**

<table>
<thead>
<tr>
<th>In Las Vegas</th>
<th>In Reno</th>
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<tr>
<td><strong>Origins of Life</strong> and <strong>Sky Watch</strong></td>
<td><strong>Black Holes</strong> and <strong>The Human Body</strong></td>
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<tr>
<td><em>Saturday Matinee</em></td>
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<td><em>Secret of the Cardboard Rocket</em></td>
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**Contact us at:**

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3200 E. Cheyenne Avenue  
North Las Vegas, NV  89030-4296  
[http://www.ccsn.edu/planetarium/](http://www.ccsn.edu/planetarium/)

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