Galactic Observer

John J. McCarthy Observatory

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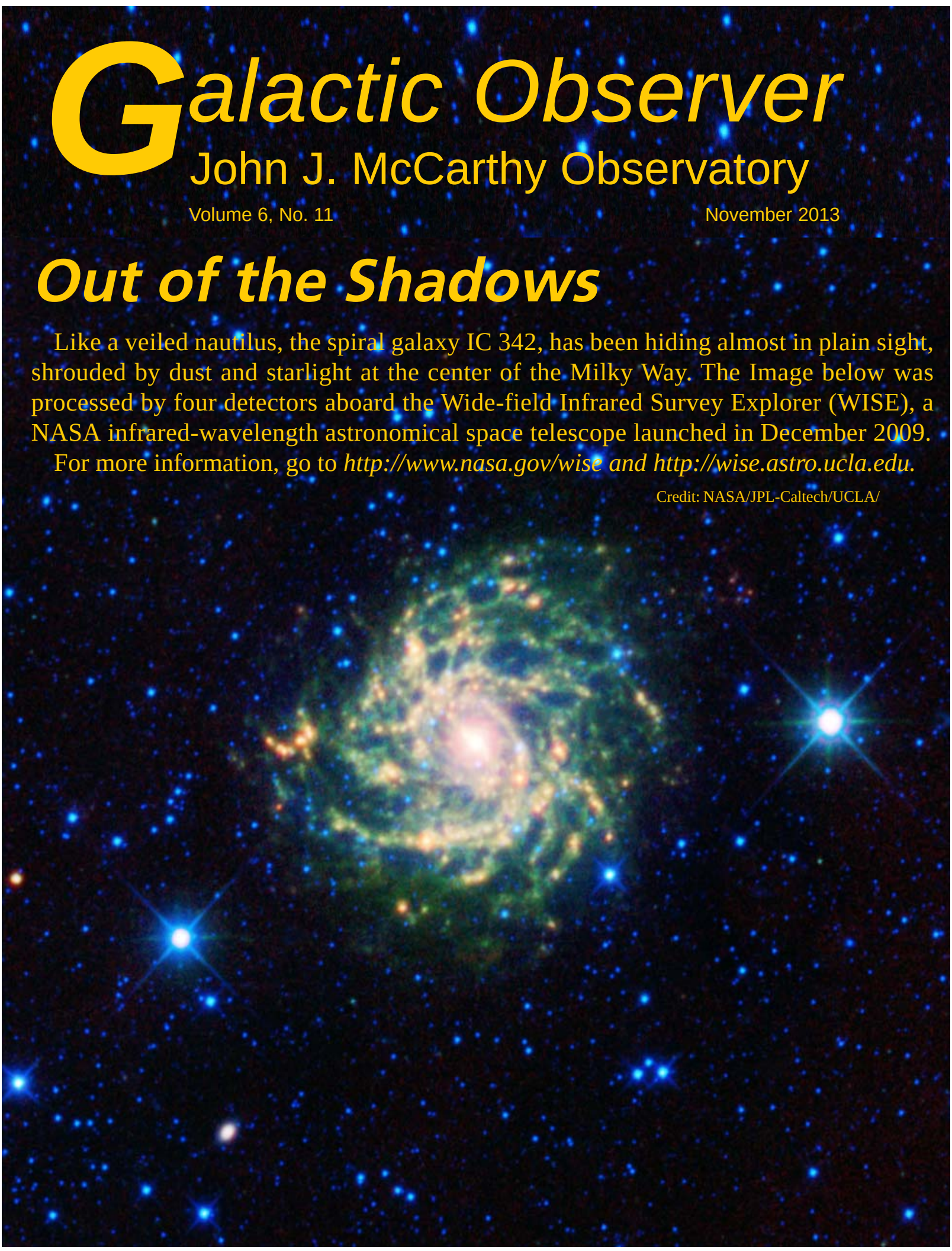
Out of the Shadows

Like a veiled nautilus, the spiral galaxy IC 342, has been hiding almost in plain sight, shrouded by dust and starlight at the center of the Milky Way. The Image below was processed by four detectors aboard the Wide-field Infrared Survey Explorer (WISE), a NASA infrared-wavelength astronomical space telescope launched in December 2009. For more information, go to *http://www.nasa.gov/wise and http://wise.astro.ucla.edu.*

Credit: NASA/JPL-Caltech/UCLA/



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It is through their efforts that the McCarthy Observatory has established itself as a significant educational and recreational resource within the western Connecticut community.

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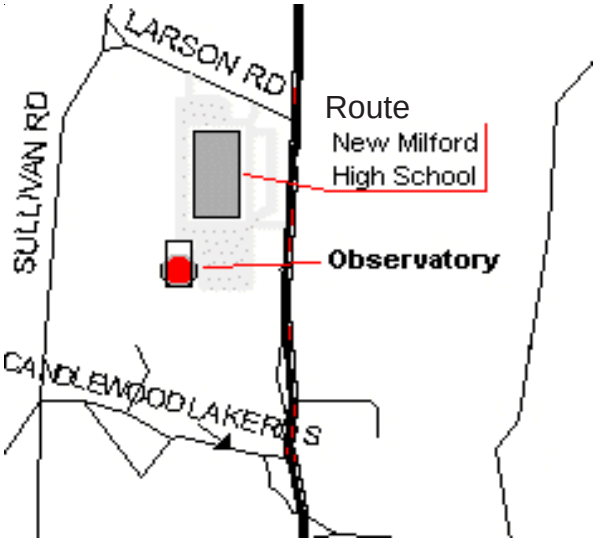
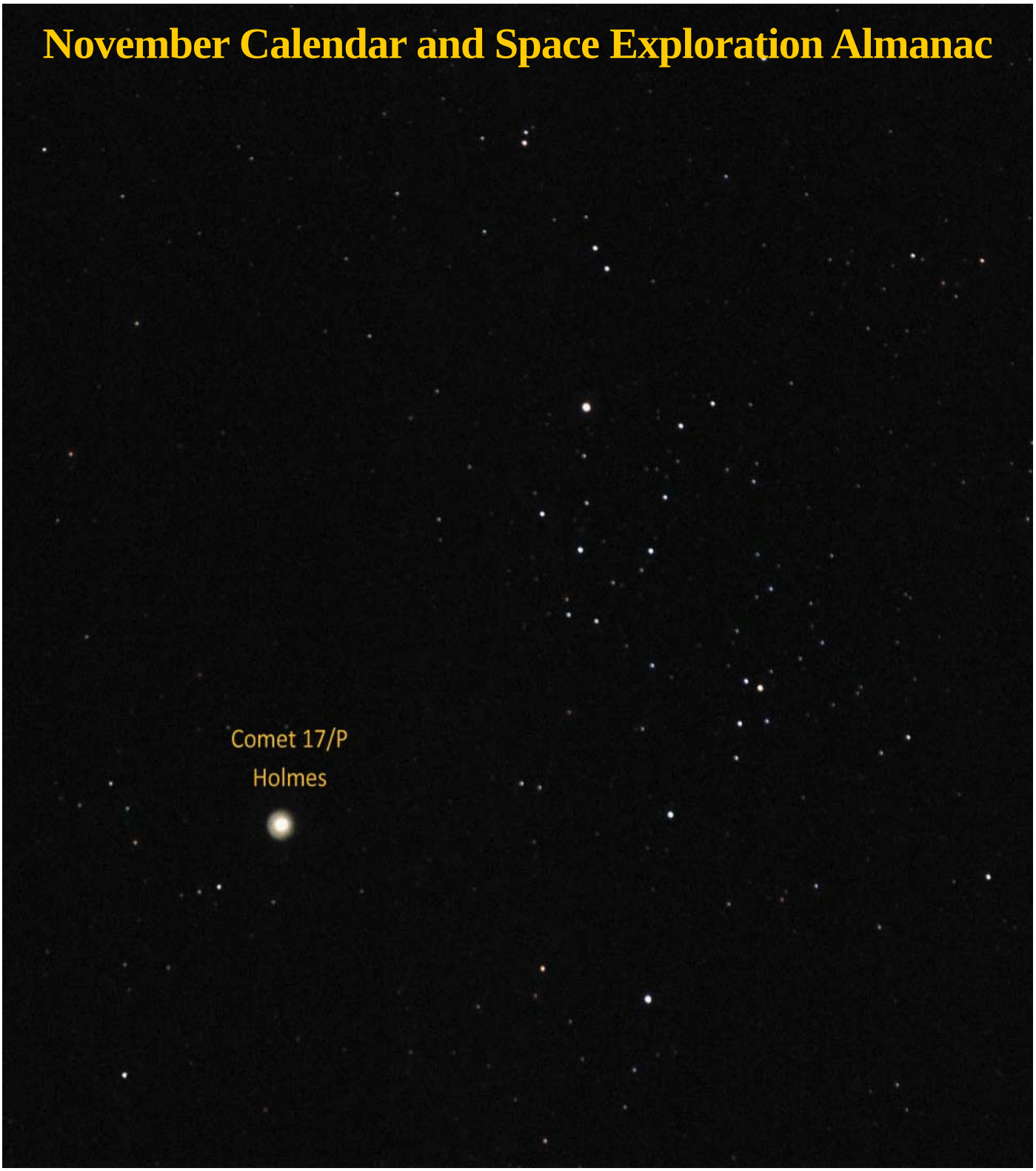


In This Issue

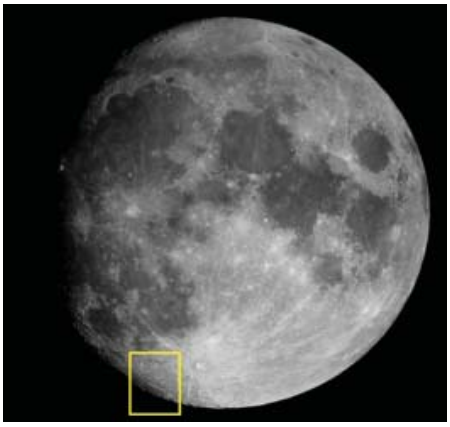
November Calendar and Space Exploration Almanac



In October 2007, Comet 17P/Holmes erupted, brightening by a factor of almost a million. Six years later, on October 20, 2013, Comet C/2012 X1 (LINEAR) increased in brightness more than one hundred fold. The brightening happened when LINEAR X1 was still four months from its closest approach to the Sun. The increase could have been caused by the rapid evaporation of volatile surface ice, exposure of ice deep within the nucleus to sunlight, or fracturing of the nucleus from the buildup of warming gases trapped within the ice. LINEAR X1 is now brighter than comet ISON which is much closer to the Sun. (Photo by Bill Cloutier)

"Out the Window on Your Left"

It's been over 40 years since we left the last footprint on the dusty lunar surface. Sadly, as a nation founded on exploration and the conquest of new frontiers, we appear to have lost our will to lead as a spacefaring nation. But, what if the average citizen had the means to visit our only natural satellite; what would they see out the window of their spacecraft as they entered orbit around the Moon? This column may provide some thoughts to ponder when planning your visit (if only in your imagination).



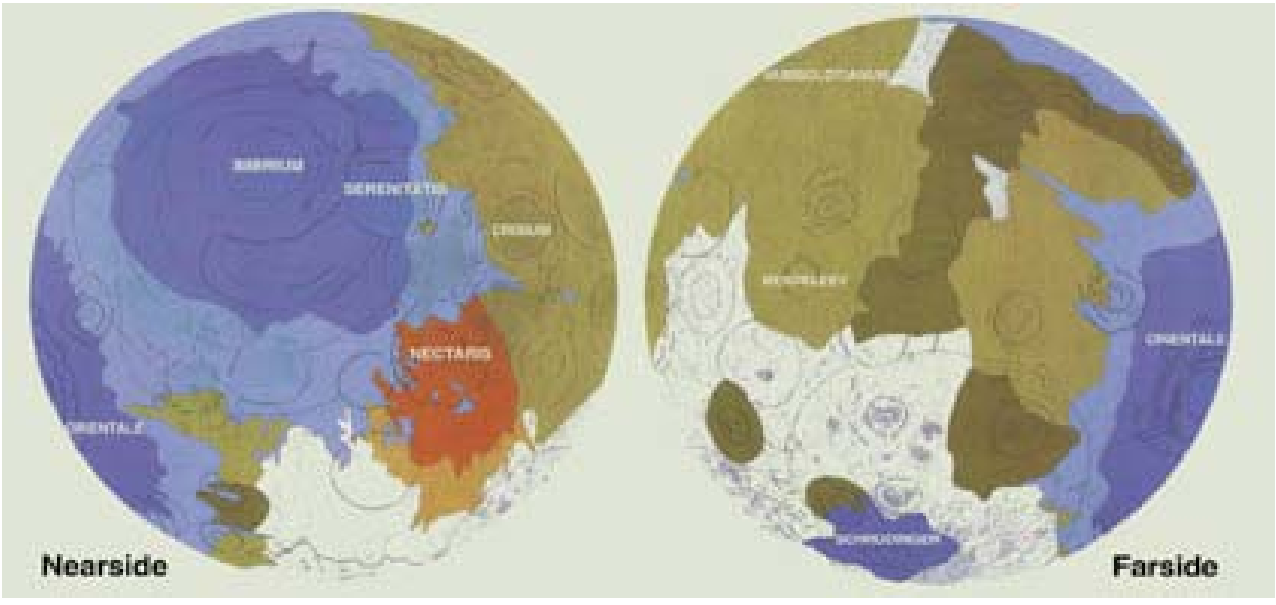
The southwestern limb of the Moon is visible in our view this month, highlighted by the elongated crater Schiller. This region is best seen from Earth 3 days before the Full Moon and again 2-3 days after the Last Quarter Moon.

Crater Schiller is located in the southern, heavily battered highlands of the Moon. This ancient impact crater is approximately 112 miles long and 44 miles wide (180 km by 70 km). It appears to have been formed by a low angle impact of multiple projectiles (or pieces of a single, fragmented projectile). Lava welling up from below has created an uneven floor, a floor peppered with small craters and debris from nearby impacts.

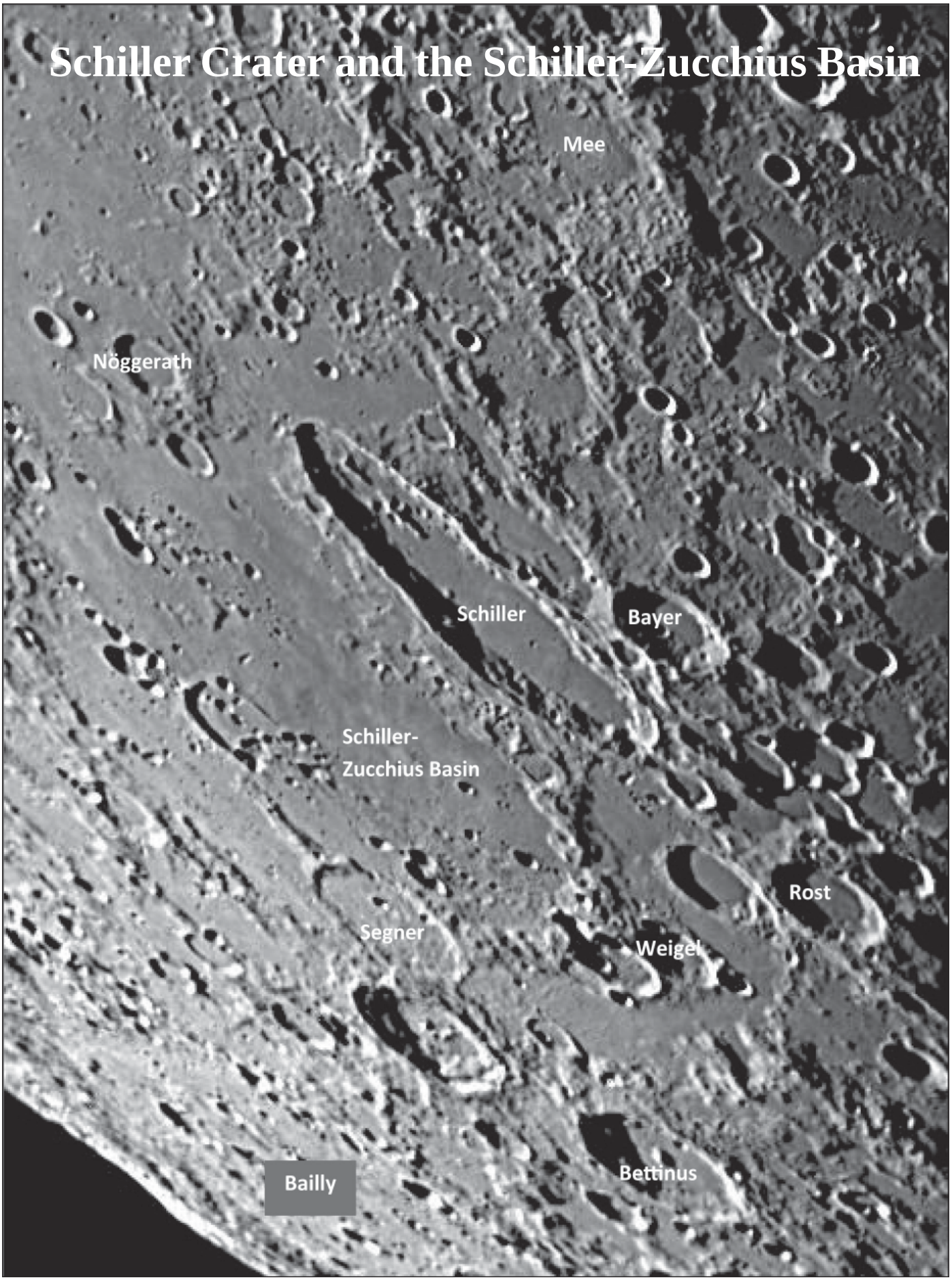
South of the crater Schiller is the ill-defined impact basin Schiller-Zucchius. A ridge running between craters Schiller and Segner appears to be a remnant of one of the basin's inner impact rings. The scarp seen running south of the crater Rost defines another ring remnant. The U.S. Geological Survey (USGS) lists the diameters of the inner and outer rings as 208 miles (335 km) and 109 miles (175 km), respectively. The USGS also identifies a smaller ring as being associated with the basin, located just to the south of Schiller. At 53 miles (85 km) in diameter, it appears in the photo on the following page as more of a depression than a raised structure.

On the bright limb is crater Bailly, one of the largest craters on the Moon. Although difficult to see due to its southern location, particularly when the Sun is high, Bailly is 186 miles (300 km) in diameter and nearly 4 miles (6 km) deep. Not just a large crater, Bailly may actually be a multi-ring (two ring) impact basin. The formation of the crater dates back to Nectarian Age, one of the earliest lunar geologic eras that ended almost 4 billion years ago.

LUNAR UPDATE: The LADEE spacecraft has entered lunar orbit. Its mission is to gather information on the lunar atmosphere, or exosphere, and the atmosphere's interaction with the dusty lunar surface. LADEE has successfully ejected its protective covers and will spend the next several weeks checking out its instruments before the spacecraft drops down into a lower orbit for its primary science phase. LADEE has already successfully demonstrated its laser communication system, a NASA first.



The Nectarian Period, about 4 billion years ago, was characterized by numerous catastrophic impacts that resurfaced the lunar landscape. Nectarian impact areas are in brown, pre-Nectarian in dark brown, and Imbrian in blue. Source: Donald Wilhelms, USGS, 1987.


Schiller Crater and the Schiller-Zucchius Basin
Mee
Nöggerath
Schiller
Bayer
Schiller-
Zucchius Basin
Rost
Segner
Weigel
Bettinus
Bailly

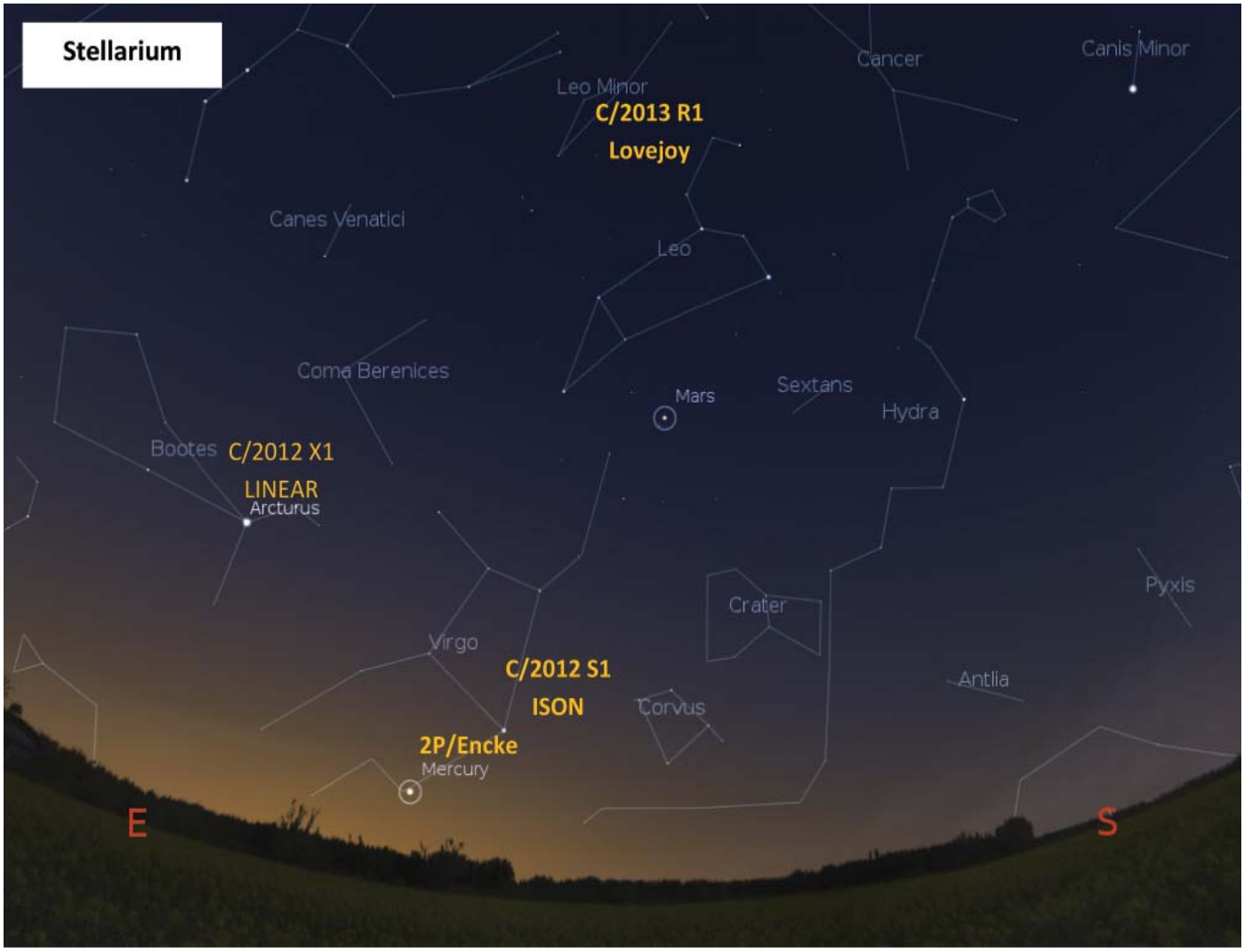
Comet Bonanza

Early risers in November may be treated to three or more bright comets. The comet with the greatest hype (e.g., "Comet of the Century") has been C/2012 S1 (ISON). It will pass within one solar diameter of the Sun on November 28th. Great expectations have been recently tempered with a slowing in its brightening as ISON begins its final approach. While images from the Hubble Space Telescope shows that the nucleus remains intact, chances are that it may not survive its close encounter with the Sun. Latest projections are that ISON, if it remains intact, may reach magnitude 3, visible to the eye, but not spectacular.

Joining ISON in the morning sky is the periodic comet 2P/Encke. It was the first periodic comet discovered after Halley's Comet. Encke is a short period comet, completing a circuit around the Sun once every three years. This year, the comet will reach its closest approach to the Sun on November 21st. Current projections are that Encke will brighten to magnitude 7, visible in binoculars, but not to the eye.

A newcomer, C/2013 R1 (Lovejoy) will join ISON and Encke in the November morning sky. Discovered in September by Australian amateur astronomer Terry Lovejoy, the comet will pass only 38.1 million miles (61.3 million km) from the Earth on November 23rd. Lovejoy will make its closest approach to the Sun on December 22nd. Lovejoy is projected to reach magnitude 5 at its brightest, a challenge visually, but an easy target for binoculars and cameras.

C/2012 X1 (LINEAR) may be this year's surprise visitor to the inner solar system with its recent outburst (see page 1). The night sky image generated by Stellarium (previous page) shows the approximate position of the four comets on the morning of November 15th around 6 am EST. An unobstructed eastern horizon will be necessary to glimpse Encke. ISON is the real unknown; only time will tell if it's a celestial boom or bust. ISON will be the subject of the Second Saturday Stars program on November 9th.



MAVEN

The United States' next mission to Mars is ready for flight with its launch window opening on November 18th. The Mars Atmospheric and Volatile EvolutioN) (or MAVEN) is the second mission in NASA's Mars Scout program (the Phoenix lander being the first). The spacecraft will be launched aboard an Atlas 5 rocket from the Cape Canaveral Air Force Station in Florida.


Image: NASA/GSFC

MAVEN is scheduled to arrive at Mars next September (2014), at which time it will begin its one Earth-year study of the red planet. The spacecraft will be placed in an elliptical orbit, allowing for both close-up and distant views of Mars. MAVEN's mission is to gather information on the upper atmosphere that may help scientists understand how the planet's once thick atmosphere was lost. The spacecraft will pass through the upper atmosphere at its closest point in its orbit (93 miles or 150 kilometers above the surface), allowing its instruments to sample and analyze this tenuous upper boundary layer. There are also five deep-dip campaigns planned that will take the spacecraft even deeper into the atmosphere. At its furthest point (more than 3,728 miles or 6,000 km above the surface), the spacecraft will image the planet in the ultraviolet portion of the spectrum.

Meanwhile, analysis by the Mars Science Laboratory (Curiosity) has provided the first direct evidence of the atmospheric loss with its measurement of argon in the atmosphere at its landing site. Atmospheric samples analyzed by Curiosity found four times as much of the lighter Argon-36 isotope than the heavy Argon-38 isotope (isotopes are variations of the same element with different numbers of neutrons). This ratio is much lower than the solar system's original ratio (5.5, as measured on Jupiter and the Sun). The lower ratio supports the preferential loss of lighter isotopes in the Martian atmosphere.

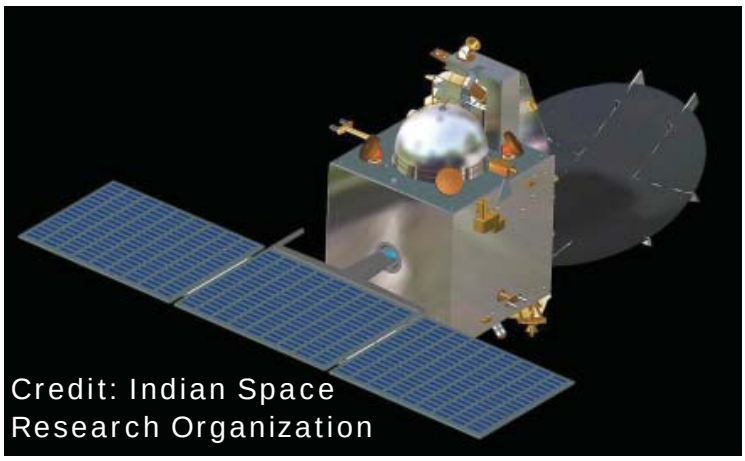
Back on Earth, analysis of gas trapped in the Lafayette meteorite (determined to have come from Mars) suggests that at least some of the original atmosphere on the red planet may be stored in the rocks on on its surface. Based on the calculated age of the meteorite, this finding would suggest that Mars was wetter and warmer in the relatively recent past.

It is hoped that the information collected by MAVEN will provide a better understanding of the evolution of Mars' atmosphere and its climate, and the implications that those changes would have had on the ability of life to gain a foothold on the red planet.

India's Interplanetary Foray

India will make it first attempt at interplanetary exploration when it launches its Mars Orbiter Mission in November. The spacecraft will be launched aboard an enhanced version of India's Polar Satellite Launch Vehicle from the Satish Dhawan Space Center, Sriharikota, India. The 2,976 pound (1,350 kilogram) orbiter, named Mangalyaan, will spend 10 months in transit before entering into a highly elliptical orbit around Mars for a six to ten month operational phase.

The Mars spacecraft's platform is similar to that of Chandrayaan 1, India's successful lunar spacecraft. The mission's primary objectives involve the demonstration of deep-space capabilities: i.e., navigation, communications, remote operations, and orbit insertion. Secondary objectives involve the study of the Martian atmosphere, surface features and geology.


Credit: Indian Space Research Organization

Leonid Meteor Shower

Almost everyone has seen "shooting stars', but not everyone knows what they are, where they come from and how best to view them. For those of you who remember that chilly November night in 2001 when the stars fell like rain, a meteor shower or meteor storm is truly unforgettable. As with that night, all you need are a comfortable chair and a warm blanket to enjoy the show.

Meteor showers occur when the Earth passes through a cloud of debris left behind by a comet. As a comet nears the Sun, the volatile gases warm and erupt along with trapped particles of rock and dust. Pushed away from the comet by the solar wind, this material forms the comet's tail. Each time a comet crosses the Earth's orbit it leaves behind a small cloud of debris. When the Earth passes through these clouds, the debris quickly heats up in the atmosphere, creating streaks of light across the night sky. The point in the sky where the meteors appear to originate is called the radiant. Meteor showers are identified by the constellation in which the radiant appears. As such, if you trace the path of the meteors in the early morning of November 17, you will notice that most seem to originate from a point in the constellation Leo, hence the name Leonids.

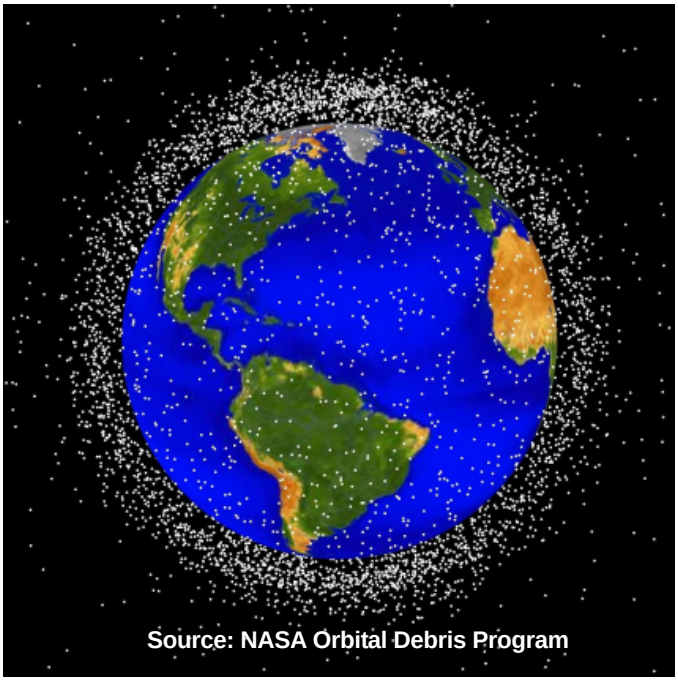
Why does the same meteor shower excite one year and disappoint the next? While comets are responsible for seeding Earth's orbit with the makings of a meteor shower, most comets are not frequent visitors to the inner solar system. Comet Tempel-Tuttle (the source of the Leonid meteors) crosses Earth's orbit once every 33 years. The resulting cloud is about 10 Earth diameters across and continues to drift along the comet's path. Most years the Earth misses these clouds altogether. In those years the meteor shower is sparse. Other years, as in 2001, the Earth can interact with several debris clouds from Comet Tempel-Tuttle. If the debris cloud is dense (containing a lot of rock and dust) the show can be spectacular. However, as debris clouds age they stretch out and become less dense. The resulting encounter produces fewer and fewer meteors.

What can we expect this year? With a Full Moon in the sky during the peak period, expect to see only the brightest fireballs.

Danger: Space Debris

More than a ton of meteoroids bombards the Earth and moon every day. Most disintegrate in the Earth's atmosphere. The moon is not so fortunate; the lunar surface is continually modified by the bombardment, as shown by the samples brought back from there by the Apollo astronauts. NASA is supporting projects that monitor the frequency of lunar impacts, anticipating that the information will be useful in designing more robust lunar structures and contingency plans for astronauts venturing out on the lunar surface.

NASA launched the Chandra X-ray Observatory in July 1999, placing it in an elliptical orbit that extends almost one-third the distance to the moon. In November 2003, the observatory's operators placed the telescope



Orbital debris in low Earth orbit
(within 2,000 km of Earth"s surface)

in a safe configuration during its passage through four meteor shower streams. Despite an extremely low probability (one in a million) that the telescope would be hit by a meteoroid, that's what apparently happened early on the morning of November 15th. Fortunately, there was no apparent damage to the more sensitive parts of the telescope.

In 2006, the right-hand payload bay door radiator of the space shuttle Atlantis was hit by space debris. The object blasted its way through the metal skin and aluminum honeycomb material inside before exiting the other side. The resulting hole missed the Freon coolant lines inside the panel and did not endanger the crew. (The radiators are only deployed once the shuttle is in space and are stored in the cargo bay during reentry) However, the impact illustrates the danger presented by space debris to spacecraft and their human occupants.

The Hubble Space Telescope's Wide Field Planetary Camera 2 was returned to Earth as part of the telescope's servicing mission in 2009 (STS-125). Attached to the camera was a large radiator (2.2 m by 0.8 m). The radiator had been in space since the camera was installed in 1993, and its large flat surface provided an excellent

NASA Photo of the Shuttle Pavload Door

measure for determining impact rates for orbital debris at the telescope's altitude (between 560 and 620 km). Initial analysis of the radiator, completed last September, found a total of 685 micrometeoroid and orbital debris impact features (larger than about 0.3 mm).

It is estimated that tens of millions of man-made objects orbit the Earth, the vast majority smaller than 1 centimeter in size. The objects come from derelict spacecraft, exploding rocket boosters, discarded motors, deterioration of man-made structures including thermal blankets and solar panels, as well as from accidental and deliberate collisions. The objects orbit the Earth in many different directions, altitudes, and velocities, traveling up to 30,000 miles an hour or 20 times faster than a rifle bullet. At these speeds, it doesn't take a very large object to inflict considerable damage to another object, including the International Space Station. The space shuttle windows were hit by small pieces of debris 32 times during an average mission. Micrometeorites are involved in approximately one-third of the collisions. The grains of sand are generally less dense than man-made debris, and therefore, relatively harmless. The remaining two-thirds do have some penetrating power and are primarily bits of aluminum, followed by paint, steel, and copper.

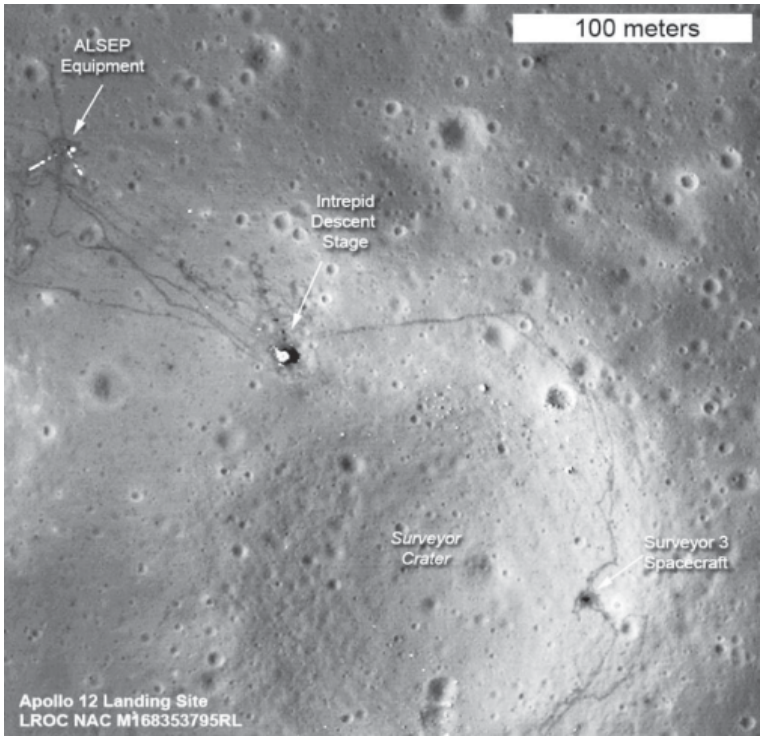
The 70 m Goldstone antenna near Barstow, CA is capable of detecting 2 mm debris at altitudes below 1,000 km.

NASA currently tracks more than 16,600 objects—most are larger than 10 centimeters (4 inches). This is double the number of objects tracked ten years ago. (There may be 500,000 debris fragments greater than one centimeter in size and over a 100 million fragments smaller than a centimeter.) While the United States and Russia are the largest contributors to the swarm of man-made objects, newer space faring nations, in particular, China, have added to the problem (most notably after China's intentional destruction of its Fengyun 1C weather satellite, the single largest debris producing event). While debris in low-Earth orbit will eventually fall back to the surface, objects higher than 800 kilometers (480 miles) can continue to circle the planet for decades and even centuries.

Until a solution can be found to cleaning up the debris (that is both technically feasible and economical), NASA has developed guidelines it hopes other nations will adopt to minimize the creation of even more debris. In the meantime, surveillance of the existing debris (only practical for the larger objects) will allow spacecraft that can maneuver to avoid future collisions, and more importantly, the loss of life. For additional information, NASA publishes the "Orbital Debris Quarterly News," complete with a "satellite box score." The newsletter (past and present) is available at http://www.orbitaldebris.jsc.nasa.gov/newsletter/newsletter.html.

November History: Apollo 12

The second manned mission to the lunar surface was launched on November 14, 1969. The mission was almost lost before it started. The Saturn V rocket booster was hit by lightning as it rose from the launch pad. Fortunately, a young flight controller in mission control (John Aaron) remembered seeing the same dizzying display of warning lights and alarms in a practice run and was able to provide the crew directions on re-establishing power and control to the spacecraft.



Credit: NASA/Goddard Space Flight Center/Arizona State

After leaving Earth orbit, the command module extracts the lunar excursion module from the third stage. The trajectory (or path) of the third stage is then modified, so as not to interfere with the lunar landing (either by placing it into orbit around the Sun or deliberately crashing it into the Moon). In what would become of interest 33 years later, the engine on the third stage burned 300 seconds too long, sending the rocket booster into a semi-stable orbit around the Earth. Two years later, it finally entered into an orbit around the Sun (by passing through a region of space controlled by the Earth and Sun).

The Ocean of Storms was the designated landing site for Apollo 12, southeast of the large crater Lansberg. Mission Commander Pete Conrad made a pinpoint landing 600 feet from the Surveyor 3 spacecraft which had landed two years earlier. The diminutive Conrad joked as he stepped out onto the lunar surface for the first time, "Whoopee! Man, that may have been one small one for Neil, but that's a long one for me."

In 2002, amateur astronomer Bill Yeung discovered a new object orbiting the Earth. Designated J002E3, the object was later determined to be artificial (from the analysis of reflected sunlight). After considerable study, it was concluded that J002E3 was most likely the third stage of Apollo 12. The object made six elongated orbits of the Earth before disappearing, presumably returning to its previous orbit around the Sun.

J002E3 was imaged from the McCarthy Observatory during three of its close approaches to Earth. Although the images are just snapshots, the tumbling motion of the booster is clearly seen as the sunlight alternately reflects off the white painted sides of the rocket and then the darkened ends.

November Nights

The late Harvard University astronomer Harlow Shapley was born in November 1885. One of his many accomplishments was accurately measuring the distance to globular star clusters and their position around the Milky Way Galaxy. While warm summer nights are usually reserved for hunting globulars, the autumnal sky contains several impressive clusters including M15 in Pegasus and M2 in Aquarius. M30 in Capricorn is also visible in the southwest sky in the evening.

On the eastern side of the Great Square of Pegasus is the constellation Andromeda. Within this constellation and visible to the unaided eye on a dark night is the Andromeda Galaxy (M31), a massive pinwheel of 500 billion suns. Larger than the Milky Way, the Andromeda Galaxy is currently rushing towards us at 75 miles per second. Fortunately, it is approximately 2½ million light years (14.7 million trillion miles) distant, so it will be some time before the two galaxies merge. Visible through a telescope are Andromeda's two companion galaxies, M32 and M110. While M32 can be mistaken for a bright star, due to its close proximity to the core of the Andromeda Galaxy, M110 is a bit easier, being further away and larger than M32.

Located not far from M31 is the Triangulum or Pinwheel Galaxy (M33). Smaller and less massive than the Milky Way, this galaxy can be a challenge to see on less than ideal nights, due to its low surface brightness. However, through a large telescope on a dark, steady night, the view looking face-on at this giant pinwheel can be spectacular. The large spiral arms of M33 are filled with star-forming regions that almost appear to be gliding through space.

Sunrise and Sunset

Sun	Sunrise	Sunset
November 1st (EDT)	07:26	17:48
November 15th (EST)	06:43	16:33
November 30th	07:00	16:25

Astronomical and Historical Events

1st Venus at its greatest eastern elongation (apparent separation from the Sun) in the evening sky (47°)
1st Kuiper Belt Object 84522 (2002 TC302) at Opposition (44.587 AU)
1st History: launch of the Wind spacecraft, designed to monitor the solar wind (1994)
2nd History: flyby of Asteroid 5535 Annefrank by the Stardust spacecraft (2002)
2nd History: first light at the 100-inch telescope on Mount Wilson (1917)
3rd New Moon
3rd Taurids Meteor Shower peak
3rd End of Daylight Savings Time - set clocks back one hour at 2 a.m.
3rd History: launch of Mariner 10 to Venus and Mercury; first mission to use the gravitational pull of one planet (Venus) to reach another (Mercury) (1973)
3rd History: launch of Sputnik 2 and a dog named Laika (1957)
4th History: Deep Impact's closest approach to the nucleus of Comet 103P/Hartley 2 (2010)
4th History: launch of the Soviet Venus lander Venera 14 (1981)
5th Scheduled launch of India's Mars Orbiter Mangalyaan from the Satish Dhawan Space Center, Sriharikota, India; India's first interplanetary probe
5th History: Chinese spacecraft Chang'e 1 enters orbit around Moon (2007)
6th Moon at perigee (closest approach to Earth)
6th Scheduled launch of a Russian Soyuz spacecraft from the Baikonur Cosmodrome, Kazakhstan, carrying the next crew to the International Space Station
7th History: launch of Mars Global Surveyor (1996)
7th History: launch of Surveyor 6 moon lander (landed two days later). On November 17th, the lander's small vernier engines were fired for 2½ seconds, lifting the lander off the lunar surface 10 to 12 feet and almost 8 feet sideways. This lunar "hop" was the first powered takeoff from the lunar surface. It also provided NASA a view of the original landing site and a baseline for acquiring stereoscopic images of its surroundings. (1967)
7th History: launch of Lunar Orbiter 2, Apollo landing site survey mission (1966)
8th History: launch of the ill-fated Phobos-Grunt spacecraft from the Baikonur Cosmodrome in Kazakhstan. Destined for the Martian moon Phobos, the spacecraft never left Earth orbit and eventually re-entered the atmosphere (2011)
8th History: meteorite hits a house in Wethersfield, Connecticut (1982)
8th History: launch of Pioneer 9 into solar orbit (1968)
8th History: launch of Little Joe rocket, qualifying flight for the Mercury spacecraft (1960)
8th History: Edmund Halley born, English astronomer who calculated the orbit and predicted the return of the comet now called Comet Halley (1656)
9th Second Saturday Stars - Open House at the McCarthy Observatory (7:00 pm)
9th History: launch of the Venus Express spacecraft; ESA Venus orbiter (2005)
9th History: launch of the first Saturn V rocket, Apollo 4 (1967)
10th First Quarter Moon
10th Comet C/2013 A1 (Siding Spring) at Opposition (3.888 AU); comet is expected to pass within 68,000 miles (110,000 kilometers) of the planet Mars on October 19, 2014
10th History: launch of Luna 17, Soviet Moon rover mission (1970)
10th History: launch of USSR spacecraft Zond 6; Moon orbit and return (1968)
10th History: Waseda Meteorite Fall; hits house in Japan (1823)
11th History: launch of Gemini 12 with astronauts James Lovell and Edwin Aldrin (1966)
11th History: Tycho Brahe discovers a new star in the constellation Cassiopeia shining as bright as Jupiter; later determined to be a supernova - SN1572 (1572)
12th History: launch of STS-2, second flight of the Space Shuttle Columbia (1981)
12th History: flyby of Saturn by the Voyager 1 spacecraft (1980)
12th History: Seth Nicholson born, American astronomer who discovered four of Jupiter's moons, a Trojan asteroid, and computed orbits of several comets and of Pluto (1891)

Astronomical and Historical Events (continued)

13th History: launch of HEAO-2, the second of NASA's three High Energy Astrophysical Observatories; renamed Einstein after launch, it was the first fully imaging X-ray space telescope (1978)
14th History: dedication of the New Milford Solar System Scale Model (2009)
14th History: Mariner 9 arrives at Mars; first spacecraft to orbit another planet (1971)
14th History: launch of Apollo 12, with astronauts Pete Conrad, Richard Gordon and Alan Bean to the moon's Ocean of Storms and near the robotic explorer Surveyor 3 (1969)
15th History: ESA's spacecraft SMART-1 enters lunar orbit; first ESA Small Mission for Advanced Research in Technology; travelled to the Moon using solar-electric propulsion and carrying a battery of miniaturized instruments (2004)
15th History: the only orbital launch of the Russian space shuttle Buran; the unmanned shuttle orbited the Earth twice before landing (1988)
16th Kuiper Belt Object 90377 Sedna at Opposition (85.454 AU)
16th History: launch of the third (and last) Skylab crew with astronauts Gerald Carr, William Pogue and Edward Gibson (1973)
16th History: launch of Venera 3, Soviet Venus lander (1965)
17th Full Moon (Full Beaver Moon)
17th Leonids Meteor Shower peak
17th History: Soviet lunar lander Luna 17 deploys first rover - Lunokhod 1 (built by the Kharkov state bicycle plant); operated for 11 months, photographing and mapping the lunar surface and analyzing the regolith (1970)
18th Scheduled launch of the Mars Atmosphere and Volatile EvolutioN (MAVEN) Mars Orbiter from the Cape Canaveral Air Force Station, Florida, to study the upper atmosphere of Mars and the loss of atmospheric gas to space over time
18th Mercury at its greatest western elongation (apparent separation from the Sun) in the morning sky (19°)
18th History: Leonids Meteor Storm (2001)
18th History: launch of the COBE spacecraft; observed diffuse cosmic background radiation (1989)
21st Comet 2P/Encke Perihelion (0.336 AU)
22nd Moon at apogee (furthest distance from Earth)
23rd Comet C/2013 R1 (Lovejoy) closest approach to Earth (38.1 million miles)
23rd History: launch of the European Space Agency's first satellite, Meteosat 1 (1977)
23rd History: launch of Tiros II weather satellite (1960)
25th Last Quarter Moon
25th Scheduled launch of a Russian Progress spacecraft from the Baikonur Cosmodrome, Kazakhstan, carrying cargo to the International Space Station
26th Kuiper Belt Object 229762 (2007 UK12) at Opposition (42.882 AU)
26th History: launch of the Mars Science Laboratory (MSL) aboard an Atlas 5 rocket from the Cape Canaveral Air Force Station (2011)
26th History: discovery of Mars meteorites SAU 005 and SAU 008 (1999)
26th History: launch of France's first satellite, Asterix 1 (1965)
26th History: launch of Explorer 18; studied charged particles and magnetic fields in and around the Earth – Moon (1963)
27th History: Soviet spacecraft Mars 2 arrives at Mars; lander crashes, becoming first human artifact to impact the surface of Mars (1971)
28th Comet C/2012 S1 (ISON) Perihelion (0.012 AU)
28th History: launch of Algeria's first satellite, Alsat 1 (2002)
28th History: launch of Mariner 4; first spacecraft to obtain and transmit close range images of Mars (1964)
29th Kuiper Belt Object 2006 QH181 at Opposition (82.060 AU)
29th History: discovery of Y000593 Mars meteorite in Antarctica (2000)
29th History: launch of Australia's first satellite, Wresat 1 (1967)
29th History: launch of Mercury 5 with Enos the chimpanzee (1961)

Astronomical and Historical Events (continued)

30th History: Sylacauga Meteorite Fall; hits woman (1954)

References on Distances

• The apparent width of the Moon (and Sun) is approximately one-half a degree (½°), less than the width of your little finger at arm's length which covers approximately one degree (1°); three fingers span approximately five degrees (5°)

• One astronomical unit (AU) is the distance from the Sun to the Earth or approximately 93 million miles

International Space Station/Space Shuttle/Iridium Satellites

Visit *www.heavens-above.com* for the times of visibility and detailed star charts for viewing the International Space Station, the Space Shuttle (when in orbit) and the bright flares from Iridium satellites.

Solar Activity

For the latest on what's happening on the Sun and the current forecast for flares and aurora, check out *www.spaceweather.com.*

Image Credits

Front page design and graphic calendars: Allan Ostergren

Second Saturday Stars poster: Sean Ross, Ross Designs

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Second Saturday Stars

FREE EVENT

Every Month at the
John J. McCarthy Observatory
Behind the New Milford High School
860.946.0312
www.mccarthyobservatory.org

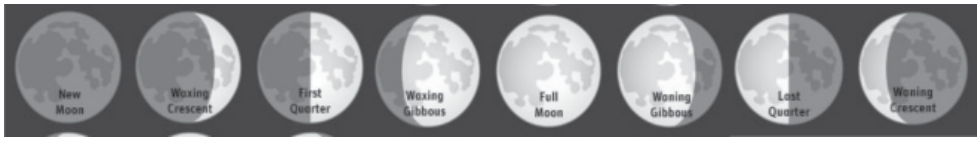
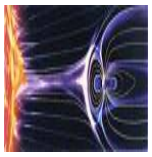
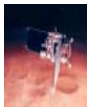
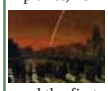
November 9th
7:00 - 9:00 pm

Winter Comets
BOOM or Bust

Refreshments
Family Entertainment
Activity Center
Stars & Planets
Rain or shine

November 2013

Celestial Calendar

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Phases of the Moon  Nov 3 Nov 10 Nov 17 Nov 25					**1**  Launch of Wind spacecraft to study solar wind (1994)	**2**  First light of Mt. Wilson 100-inch telescope - (1917) Harlow Shapley born, American astronomer, measured distances within our galaxy (1885) 
3  End of Daylight Savings Time Taurids meteor showers peak   Launch of Mariner 10 to Venus and Mercury (1973) Launch of Sputnik 2, with dog Laika (1957) 	**4**  Deep Impact closest approach to the nucleus of Comet 103/ P Hartley 2 (2010)	**5**  Fred Lawrence Whipple born, American astronomer; first to theorize of comets as "dirty snowballs" (1906)	**6** Moon at perigee (closest to Earth)   Lunar Orbiter 2 launch (1966) Charles Owen Hobaugh, NASA astronaught born (1961) 	**7**  Launch of Mars Global Surveyor (1996) Launch of Surveyor 6 Moon Lander, dry-run for later manned mission (1967) 	**8**  Launch of Little Joe rocket (1960) Meteorite hits house in Wethersfield CT (1982)   Edmund Halley born (1656)	**9**  Launch of 1st Saturn V rocket - Apollo 4 (1967)  Launch of Venus Express spacecraft; ESA Venus orbiter (2005) 2nd Saturday Stars Open House McCarthy Observatory 
10  Launch of Soviet spacecraft Zond 6 to Moon (1968) Launch of Luna 17, Soviet Moon Rover mission (1970)   Waseda meteor hits house in Japan (1823)	**11**  Tycho Brahe discovers supernova SN1572 (bright as Jupiter) (1572) Launch of Gemini 12, with astronauts Lovell and Aldrin (1966) 	**12**  Seth Nicholson born, American astronomer (1891) Space Shuttle Columbia safe re-launch, with commander Joe Engle and pilot Richard Truly (1981) 	**13**  Launch of HEAO-2 (Einstein), 1st fully-imaging x-ray telescope in space - 1978 Dawn spacecraft enters Asteroid Belt on way to Vesta and Ceres (2009) 	**14**  Launch of Apollo 12 - Conrad, Gordon, Bean, 1969 Mariner 9 arrives at Mars, 1st spacecraft to orbit another planet, 1971   The Great Comet of 1680, discovered by Gottfried Kirch over Rotterdam, and the first comet discovered by telescope. Dedication of the New Milford solar system scale model (2009) 	**15** Astronomer William Herschel born 1738   ESA Smart-1 enters lunar orbit, using solar-electric propulsion 2004 Only orbital launch of Russian Buran space shuttle in unmanned mission (1988) 	**16**  Launch of Venera 3, Soviet Venus lander (1965)  Launch of 3rd and last Skylab crew - Carr, Pogue, Gibson (1973)
17  Soviet lunar lander, Luna 17 with 1st rover, Lunakhod 1 (1970) Leonids meteor shower peak 	**18** Leonids Meteor Storm (2001) Alan Shepard born, 1st American in space and 5th to walk on Moon - 1923 Launch of the COBE spacecraft; observed diffuse cosmic background radiation (1989)	**19** Apollo 12 astronauts Charles Conrad and Alan Bean made man's second landing on the moon (1969)	**20** Launch of the Swift spacecraft, multi-wavelength observatory to study gamma wave bursts (2004)	**21** India's space program begins with the launch of a Nike-Apache sounding rocket from coconut groves in Thumba, a small fishing village in Kerala state (1963)	**22** Moon at apogee (furthest from the Earth) Dr. Guion Stewart "Guy" Bluford, Jr. born - an engineer, NASA astronaut, and the first African American in space (1942)	**23** Launch of European Space Agency's 1st satellite, Meteosat (1977) launch of Tiros II weather satellite (1960)
24 Space-walking astronauts from shuttle Columbia catch a 1 1/2 -ton satellite, and the cockpit crew used the shuttle's robot arm to return it to the cargo bay (1997)	**25** Radio signals exchanged between Viking 1 Mars Lander and Earth are slowed by sun's gravity, confirming Einstein's general theory of relativity (1976)	**26** Launch of France's first satellite, Asterix 1 (1965) Launch of Explorer 18; studied charged particles and magnetic fields in and around the Earth - Moon (1963) Discovery of Mars meteorites ALH 005 and SAU 008 (1999)	**27** Soviet spacecraft Mars 2, first human artifact to impact Martian surface (1971)	**28** Launch of Algeria's 1st satellite, Alsat 1 (2002) Launch of Mariner 4, first spacecraft to send close range images of Mars (1964) Comet C/2012 S1 (ISON) Perihelion (0.012 AU)	**29** Launch of Australia's 1st satellite, Wresat 1 1967 Launch of Mercury 5, with Enos the chimp 1961 Discovery of Y000593 Mars meteorite in Antarctica (2000)	**30** Sylicauga meteorite fall strikes Alabama woman (1954)