

Galactic Observer

John J. McCarthy Observatory

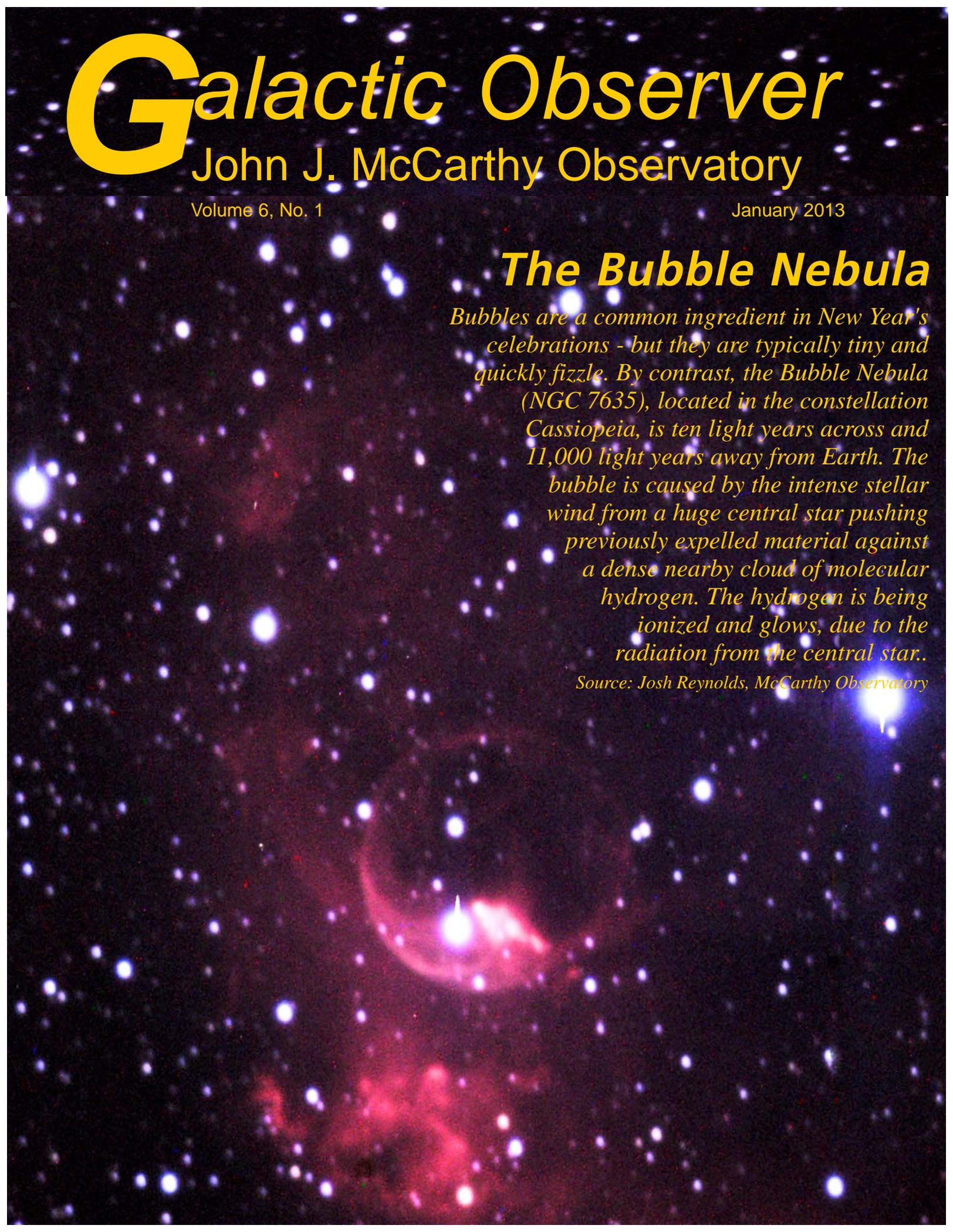
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January 2013

The Bubble Nebula

Bubbles are a common ingredient in New Year's celebrations - but they are typically tiny and quickly fizzle. By contrast, the Bubble Nebula (NGC 7635), located in the constellation Cassiopeia, is ten light years across and 11,000 light years away from Earth. The bubble is caused by the intense stellar wind from a huge central star pushing previously expelled material against a dense nearby cloud of molecular hydrogen. The hydrogen is being ionized and glows, due to the radiation from the central star..

Source: Josh Reynolds, McCarthy Observatory



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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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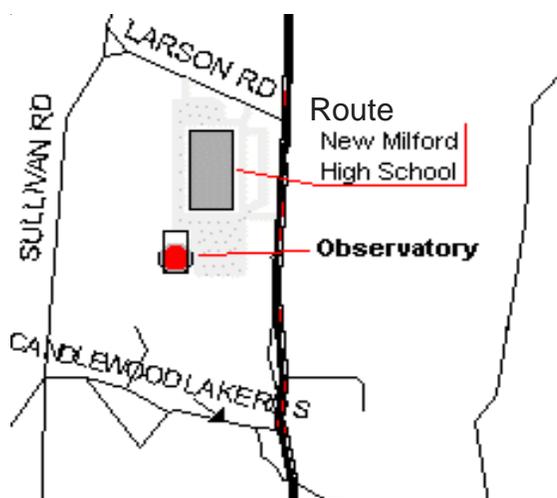
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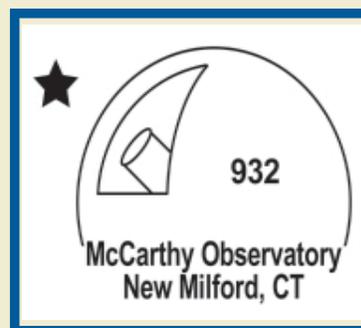
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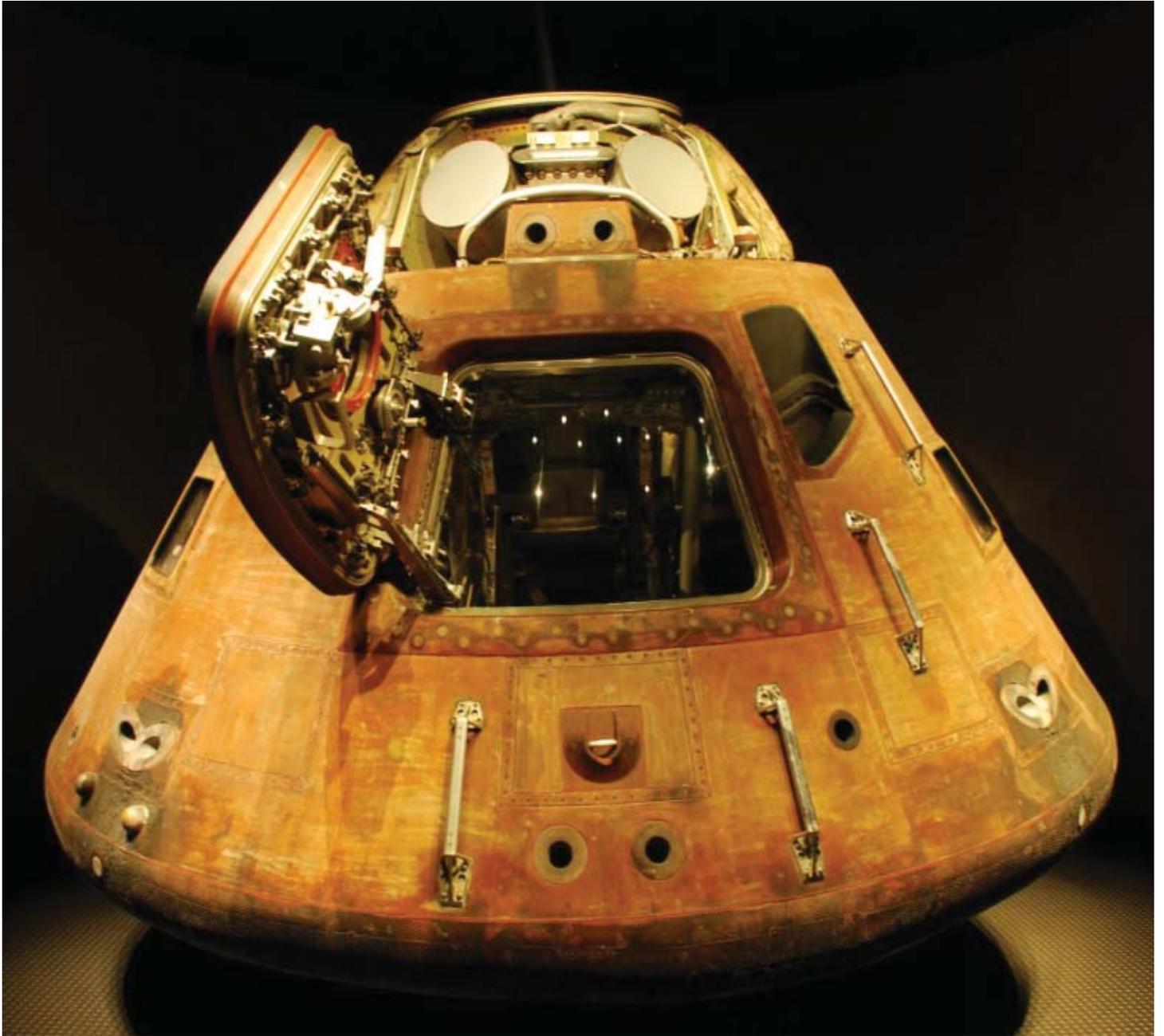


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January Astronomy Calendar and Space Exploration Almanac



Apollo 14 Command Module *Kitty Hawk* that carried Commander Alan Shepard, Command Module Pilot Stuart Roosa, and Lunar Module Pilot Edgar Mitchell to the Moon for the third landing in the Lunar Module *Antares*.

The Command Module is on display at the Saturn V Center building at the Kennedy Space Center.

“Out the Window on Your Left”

It's been over 40 years since we left the last foot print 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 space-faring 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 view this month is of the western limb. The Moon was almost full when the image on the following page was taken, however, there are still some noteworthy details on the limb. While we can only see 50% of the Moon's surface at any instant, it is possible to view up to 59% of the total surface over time. This is due to lunar libration or an oscillation of the Moon as viewed from Earth. The oscillation is caused by the Moon's elliptical orbit, its axial tilt of 1.5° , its orbital tilt of 5° with respect to the Earth, and the position of the observer on Earth.

Lunar longitude is based upon a prime meridian (0°) that runs down the Earth-facing center of the Moon. Objects to the west of the meridian have a longitudinal coordinate of 0° to 90° W and objects to the east, 0° to 90° degrees E. Libration is most noticeable when features normally beyond the limb (greater than 90° degrees longitude) come into view. While not a favorable libration when the image was

taken, there are some craters that are rarely discerned by the casual observer on the western limb.

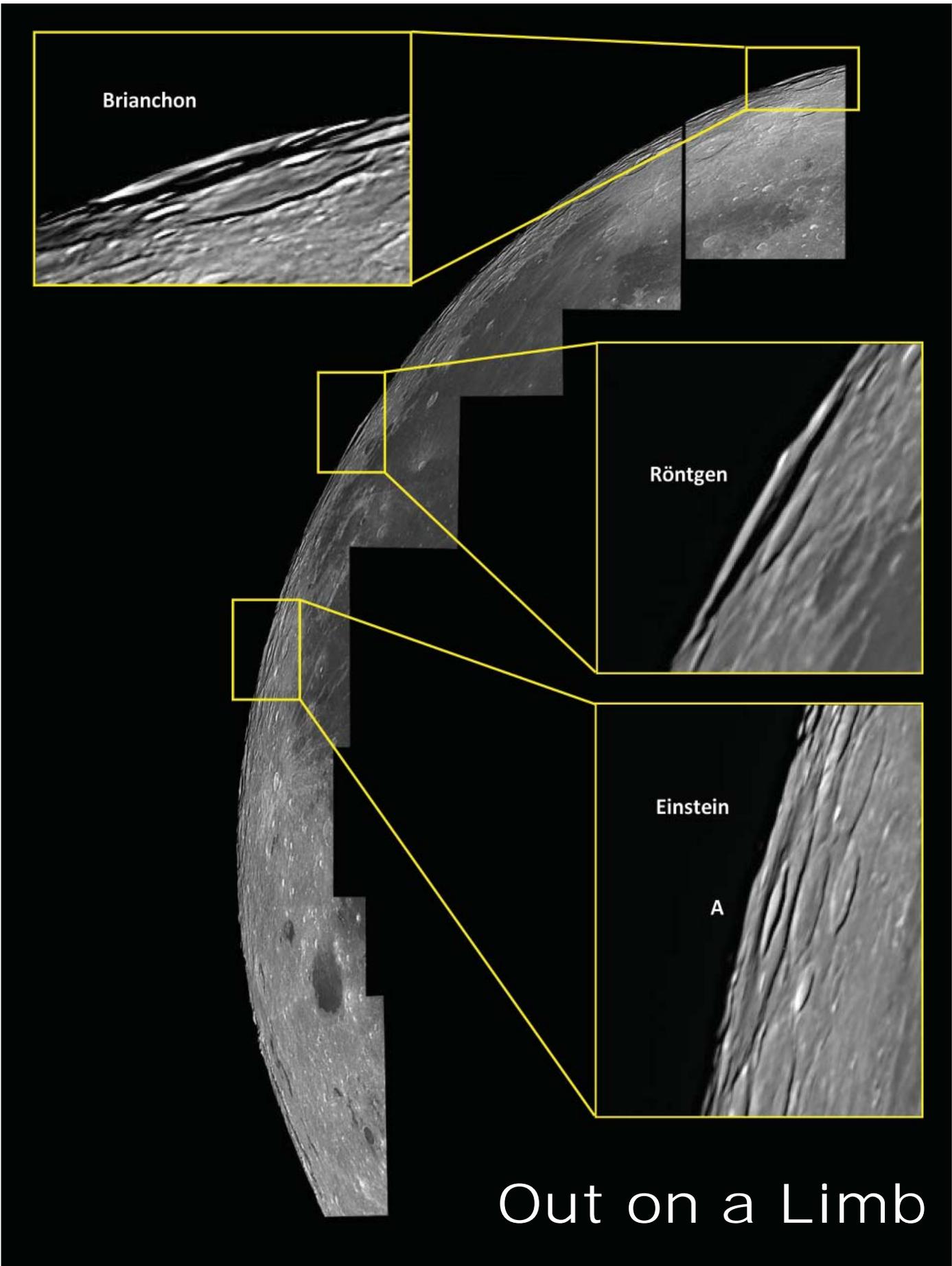
Einstein is a formable impact feature at 105 miles (170 km) in diameter. The center of the crater is located at longitude 88.5° W, with its outer rim extending to 91° W. The larger crater is punctuated in its center by a smaller crater, Einstein A (32 mile, 51 km). North of Einstein is Röntgen, a 78 mile (126 km) diameter crater. With a center longitude of 91.4° W, this crater can be classified as being on the “far side.” A small crater (8 to 10 miles in diameter) on its western rim can be seen in profile as a bright, raised area.

Traveling northward along the limb, a crater less than 300 miles from the north pole is visible. Brianchon, approximately 85 miles (137 km) in diameter, is an older crater as evidenced by the numerous secondary craters along its battered rim and shallow floor. The orthographic map of the lunar north pole (<http://target.lroc.asu.edu/da/qmap.html>) provides details of this polar crater only seen from orbit. The crater is located approximately 400 miles west of the 1.5 mile (2.5 km) high mountain where the twin GRAIL spacecrafts were intentionally crashed.



Einstein crater was formed some 4.8 billion years ago. The smaller Einstein A, at right of center, betrays its relative youth by its surface position, its raised rim, and more uniform shape.

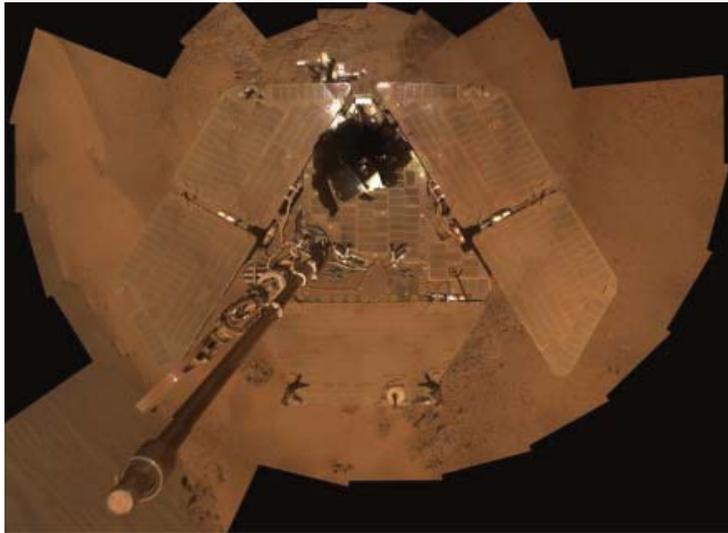
Image Credit: Lunar Orbiter IV 188 H1+H2 & 188 M



The Energizer Rover

While the exploits of NASA's latest Mars robotic explorer, Curiosity, dominates the inter-planetary headlines, another Mars explorer goes on about its business as it has for almost nine years without much fanfare.

On January 24, 2004, the Mars Exploration Rover Opportunity entered the Martian atmosphere after a six month journey and bounced along the Martian surface before coming to rest in Eagle crater. Twenty-two miles later, Opportunity is exploring the hills along the rim of the ancient crater Endeavour (14 miles, 22 km in diameter). The crater was targeted by orbiting spacecraft due to the presence of clay materials that likely formed during Mars' wet past. As can be seen in the self-portrait, Opportunity is blending into its surroundings with the dust accumulated on its solar panels.



Curiosity Update

NASA's Mars rover Curiosity spent the holidays in Yellowknife Bay, a shallow depression within Gale Crater. The nuclear powered roving science laboratory was set down on the floor of the crater on August 5, 2012. Its ultimate destination is Mount Sharp, a 3 mile (5 km) high layered mound located near the center of the crater.

Since touchdown at Bradbury Landing, Curiosity has supplied daily weather reports, measured surface radiation levels, and collected other atmospheric data. In its first two months of exploration, Curiosity found remnants of an ancient stream bed and evidence of a fast moving stream. Soil analyzed by the lab's suite of instruments detected water, sulfur and chlorine-containing substances.

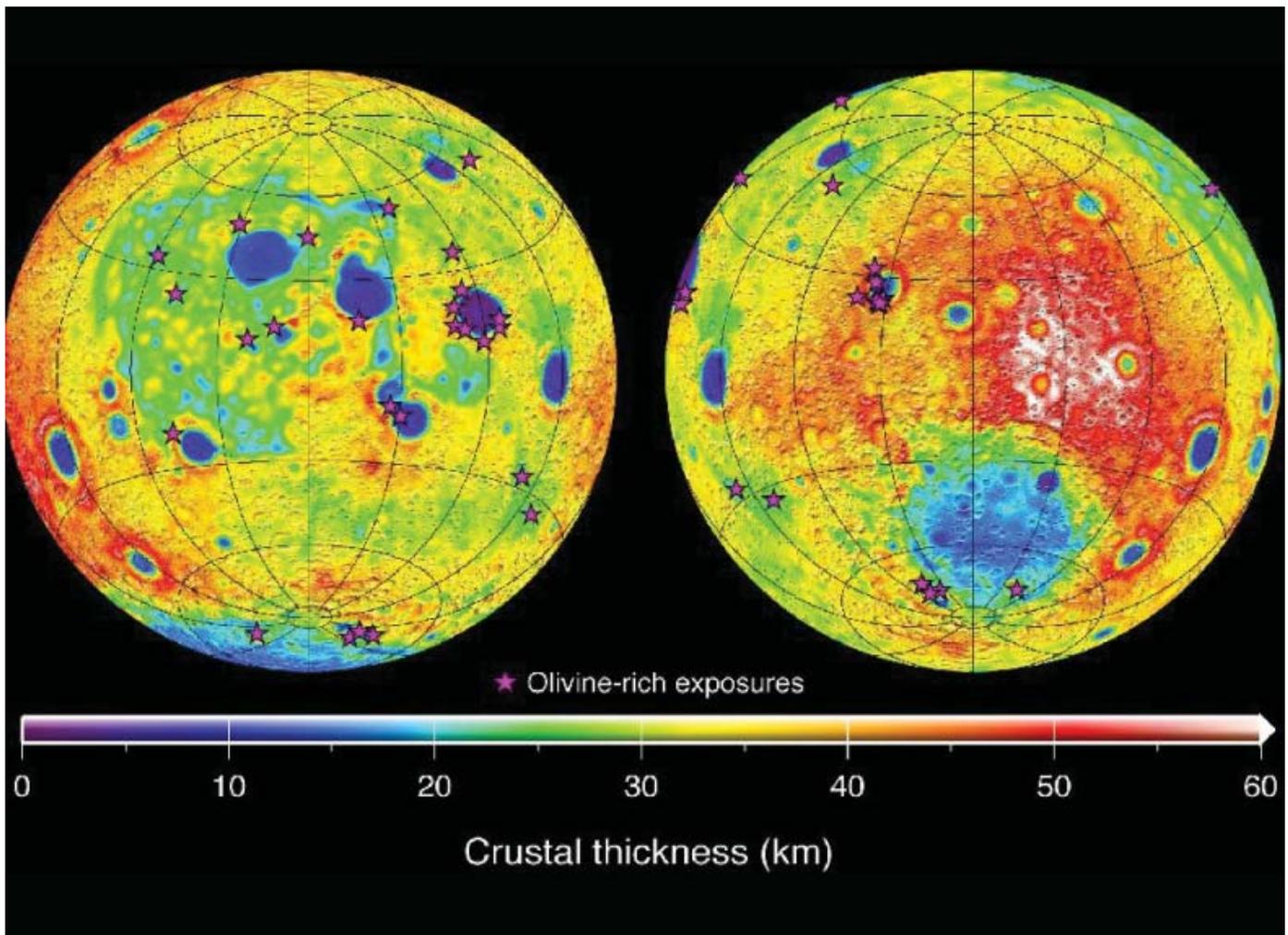


GRAIL

After almost a year in orbit, the GRAIL mission came to end when the twin spacecraft, low on fuel, were deliberately crashed into a mountain near the north pole (NASA named the impact site after the late astronaut Sally K. Ride). In that year in orbit, Ebb and Flow, formation flying in a polar orbit just 34 miles (55 km) above the lunar surface, created a high resolution gravity map of the Moon. The map revealed interior structures not visible on the surface, including a network of magma dikes.

Investigators also found a thinner lunar crust with a lower density than expected. The crust, with an average thickness between 21 and 27 miles (34 and 43 km), was thinnest in and around impact basins (less than 0.6 mile (1 km) within the Crisium and Moscoviense impact basins). The purple stars denote areas that the Japanese orbiter Kaguya detected the mineral olivine. This mineral is typically associated with the lunar mantle and may have been brought to the surface by cataclysmic impacts.

Most surprising was the low density of the lunar highlands. While not inconsistent with some of the samples returned by the Apollo astronauts, the overall low crustal density indicates a fractured and porous stratum. This, in turn, suggests that the Moon's crust was battered and pulverized by bombardments to a depth of several miles and, possibly as deep as the upper layers of the mantle.



January History

The month of January has been a difficult one for both the American and Soviet space programs. Untimely deaths set back both the American and Soviet moon programs. The two space shuttles that have been lost were also launched in January.

Sergei Korolyov, the “Chief Designer” of the Soviet space program, died on January 14, 1966 from a botched medical procedure. Korolyov co-founded the Moscow rocketry organization in the 1930s before being thrown into prison during the peak of Stalin’s purges. He spent a year in the Kolyma gold mine, the most dreaded part of the Gulag in Siberia before he was recalled to Moscow to aid the Red Army in developing new weapons. Korolyov went on to lead the Soviet space effort. Unfortunately, the Soviet

Moon program died with Korolyov in 1966. While the race continued for some time after his death, his N-1 moon rocket never made a successful flight.

In January of 1967, after a successful Gemini program, NASA was moving forward with testing the new Apollo spacecraft. On the afternoon of the 27th, Gus Grissom, Ed White and Roger Chaffee were sealed inside the Apollo 1 command module sitting on top of an unfueled Saturn rocket in a simulated countdown. The

command module had been plagued with problems and was in a state of constant redesign. At 6:31 pm, a spark from a damaged wire ignited the pure oxygen atmosphere in the spacecraft. Within seconds the temperature reached 2,500°. The astronauts never had a chance to undo the bolts of the hatch before they were asphyxiated. Following



their deaths, the spacecraft was completely redesigned. Lessons learned from this accident served to make the spacecraft much safer and contributed to the success of the six moon landings.

Twenty-two years ago, on January 28, 1986, the United States lost its first space shuttle, the Challenger. Due to the low temperature on the launch pad, a rubber-like O-ring used to seal the joints of the solid rocket boosters failed to seat and stop the hot gasses from escaping. The gas produced a blowtorch-like flame that penetrated the external tank filled with liquid oxygen and hydrogen. The tank exploded 73 seconds after liftoff, destroying the shuttle and killing all seven crew members. Among the crew was Christa McAuliffe, a New Hampshire teacher.

Christa graduated from Framingham State College (Framingham, Massachusetts) in 1970. Following her death, the college established *The Christa McAuliffe Center* on the campus as a means to continue the educational mission which was Christa's life's work.

On February 1, 2003, a second space shuttle, the Columbia, was lost. The Columbia was the oldest shuttle in the fleet, having been first flown in 1981 by astronauts John Young and Robert Crippen. On its 28th flight, Columbia broke apart during reentry at an altitude of some 200,000 feet and a speed of 12,500 miles per hour. The shuttle and its crew of seven had just completed a 16 day science mission. The most likely cause of the accident was damage to a seal on the left wing from a piece of insulating foam that broke loose from the external fuel tank at launch, striking the wing. The resulting gap in the wing allowed the superheated atmosphere to penetrate the wing during reentry and destroy the spacecraft.

The Columbia accident ultimately led to the decision to stop flying the space shuttle once the International Space Station was complete and to develop a safer manned vehicle.

January Nights

January nights can be clear and cold with frigid blasts of polar wind. They also present an opportunity to see stars at every stage in their life cycle, from birth (Orion Nebula) to fiery demise (Crab supernova remnant).

If you are out observing the open star clusters Pleiades or Hyades in the constellation Taurus, don't overlook the red giant Aldebaran. This star is receding from us more rapidly than any other 1st magnitude star in the sky. It was the brightest star in the sky some 320,000 years ago when it was 21½ light years from Earth. Moving away, Aldebaran is currently 65 light years in distance and the thirteenth brightest star in the sky.

Jupiter and its Moons

Jupiter reached Opposition on December 2nd and is still well placed in the evening sky in January. As one of the brightest star-like objects in the night sky, Jupiter can be found in the constellation Taurus.

One of the more interesting and easier events to observe through a telescope is the projection of a shadow from one of Jupiter's moons on the Jovian disk as the moon passes in front of (or transits) the planet. The photo on the right shows the shadow of Ganymede on the Jovian disk. On nights of good visibility the following events should be visible through a moderately-sized telescope (between approximately 5 pm and midnight).

Date	Moon	Transit Begins	Transit Ends
1 st	Io	7:00 pm	9:10 pm
7 th	Europa	5:10 pm	7:34 pm
8 th	Io	8:55 pm	11:06 pm
10 th	Ganymede	5:40 pm	7:52 pm
14 th	Europa	7:46 pm	10:10 pm
15 th	Io	10:50 pm	1:01 am (16 th)
17 th	Io	5:19 pm	7:30 pm
17 th	Ganymede	9:41 pm	11:54 pm
21 st	Europa	10:22 pm	12:46 am (22 nd)
24 th	Io	7:15 pm	9:26 pm

Transit of Jupiter's Red Spot

The Red Spot is a large cyclone in the upper Jovian atmosphere. The rapid rotation of this gas giant (10 hours) may be responsible for the longevity of this storm, which has been observed for over 300 years. The Red Spot will cross the center line of the planetary disk on the following evenings during the hours between 5 pm to midnight local time (EST):

Date	Transit Time	Date	Transit Time
2 nd	9:07 pm	16 th	10:40 pm
4 th	10:45 pm	19 st	8:10 pm
5 th	6:37 pm	21 st	9:48 pm
7 th	8:15 pm	24 th	7:18 pm
9 th	9:53 pm	26 th	8:57 pm
10 th	5:45 pm	28 th	10:35 pm
12 th	5:23 pm	29 th	6:27 pm
14 th	9:01 pm		

Sunrise and Sunset

Sun	Sunrise	Sunset
January 1 st (EST)	07:20	16:35
January 15 th	07:18	16:49
January 31 st	07:06	17:09

Astronomical and Historical Events

- 1st Asteroid 9 Metis at Opposition (8.5 Magnitude)
- 1st History: GRAIL-B spacecraft enters lunar orbit (2012)
- 1st History: Giuseppe Piazzi discovers the first asteroid, now dwarf planet, Ceres (1801)
- 2nd Earth at Perihelion; closest approach to the Sun (0.983 AU)
- 2nd History: flyby of Comet Wild 2 by the Stardust spacecraft (2004)
- 2nd History: launch of the Soviet spacecraft Luna 1; first probe to fly by the Moon (1959)
- 3rd Quadrantids meteor shower peaks; radiates from the constellation Boötes (name from an obsolete constellation called Quadrans Muralis)
- 3rd History: exploration rover Spirit lands on Mars in Gusev Crater; operational for six years before getting bogged down in loose soil at a winter haven called Troy (2004)
- 3rd History: Stephen Synnott discovers Uranus' moons Juliet and Portia (1986)
- 4th Last Quarter Moon
- 4th History: Isaac Newton born; inventor of the reflecting telescope, described universal gravitation, compiled the laws of motion, and invented calculus (1643)
- 5th History: discovery of Jupiter's moon Elara by Charles Perrine (1905)
- 6th History: launch of the Lunar Prospector spacecraft; detected signs of water ice in permanently shadowed craters, mapped surface composition and Moon's gravity field and detected outgassing events in the vicinity of craters Aristarchus and Kepler (1998)
- 6th History: La Criolla (Argentina) meteorite fall (1985)
- 7th History: launch of Surveyor 7, the last of the unmanned Surveyor spacecrafts; soft-landed near Tycho crater; first probe to detect a faint glow on lunar horizon - thought to be sunlight reflected from electrostatically levitated moon dust (1968)
- 7th History: discovery and first recorded observations of Jupiter's four largest moons by Galileo Galilei (1610)
- 8th History: launch of Japanese spacecraft Sakigake with mission to rendezvous with Comet Halley; measured the solar wind and magnetic field (1985)
- 8th History: launch of Luna 21 and the Lunokhod 2 moon rover (1973)
- 8th History: Stephen Hawking born (exactly 300 years after the death of Galileo); discovered that black holes could emit radiation - subsequently known as Hawking radiation (1942)
- 10th Moon at perigee (closest distance from Earth)
- 10th History: U.S. Army first bounces radio waves off the Moon (1946)
- 11th New Moon
- 11th History: the Lunar Prospector spacecraft enters lunar orbit for a nineteen month chemical mapping mission (1998)
- 11th History: William Herschell discovers Uranus' moons Titania and Oberon (1787)
- 12th Second Saturday Stars - Open House at the McCarthy Observatory
- 12th History: launch of the Deep Impact spacecraft for a flyby of Comet Tempel 1; a small "impactor" was later released from the main spacecraft for a July 4th collision with the comet's nucleus (2005)
- 12th History: Sergei Pavlovich Korolyov born, Chief Designer of the Soviet space program (1907)
- 13th History: Stephen Synnott discovers Uranus' moons Desdemona, Rosalind and Belinda (1986)
- 13th History: discovery of the Martian meteorite EETA 79001 in Antarctica; second largest Martian meteorite recovered after Zagami (1980)
- 14th Kuiper Belt Object 20000 Varuna at Opposition (42.669 AU)
- 14th History: first of three flybys of the planet Mercury by the Messenger spacecraft (2008)
- 14th History: landing of the Huygens probe on Saturn's largest moon Titan (2005)
- 15th History: Stardust spacecraft returns samples of Comet P/Wild 2 (2006)
- 15th History: launch of the spacecraft Helios 2, solar orbiter (1976)
- 15th History: Lunokhod 2, the second of two Soviet unmanned lunar rovers, lands in Le Monnier crater; covered a total distance of 23 miles in almost five months of exploring the floor of the crater and its southern rim (1973)

Astronomical and Historical Events for August (continued)

- 16th History: final launch of space shuttle Columbia (STS-107); lost on re-entry (2003)
- 18th First Quarter Moon
- 18th Kuiper Belt Object 208996 (2003 AZ84) at Opposition (44.126 AU)
- 19th History: launch of the New Horizons spacecraft to Pluto; due to arrive in July 2015 (2006)
- 19th History: discovery of the Martian meteorite SAU 090, a basaltic shergottite, in Oman (2002)
- 19th History: Johann Bode born, popularized an empirical law on planetary distances originally developed by J.D. Titius, known as "Bode's Law" or "Titius-Bode Law" (1747)
- 20th History: Rich Terrile discovers Uranus' moons Cordelia and Ophelia (1986)
- 19th History: discovery of Saturn's moon Janus by the Voyager 1 spacecraft (1980)
- 21st History: launch of the rocket Little Joe-1B and a rhesus monkey named "Miss Sam" in a successful test of the Mercury capsule's escape system (1960)
- 21st History: John Couch Adams born, astronomer and mathematician who was the first person to predict the position of a planet beyond Uranus (1792)
- 22nd Moon at Apogee (furthest distance from Earth)
- 22nd History: launch of Apollo 5, the first Lunar Module flight (1968)
- 23rd History: Brad Smith discovers Uranus' moon Bianca (1986)
- 24th History: discovery of the Martian meteorite Dhofar 019 in Oman (2000)
- 24th History: launch of Japan's Hiten spacecraft; first use of a low-energy transfer to modify an orbit and the first demonstration of a transfer to the Moon requiring no change in velocity for capture (1990)
- 24th History: exploration rover Opportunity lands on Mars at Meridiani Planum; still operational and currently exploring Endeavour Crater (2004)
- 24th History: flyby of Uranus by the Voyager 2 spacecraft (1986)
- 25th History: launch of the Infrared Astronomical Satellite (IRAS); first space telescope to survey of the entire sky at infrared wavelengths (1983)
- 25th History: launch of the U.S. Moon orbiter Clementine (1994)
- 25th History: Joseph Lagrange born; mathematician who discovered five special points in the vicinity of two orbiting masses where a third, smaller mass can orbit at a fixed distance from the larger masses. The L1 Lagrange Point of the Earth-Sun system is the current home of the Solar and Heliospheric Observatory Satellite (SOHO).
- 26th Full Moon
- 26th History: discovery of Saturn's moon Epimetheus by the Voyager 1 spacecraft (1980)
- 26th History: launch of the International Ultraviolet Explorer (IUE); space telescope and spectrographs; designed to take ultraviolet spectra (1978)
- 27th History: fire in the Apollo 1 spacecraft kills astronauts Gus Grissom, Edward White and Roger Chaffee (1967)
- 27th History: Philibert Melotte discovers Jupiter's moon Pasiphae (1908)
- 28th History: final launch of the space shuttle Challenger (STS-51L); lost on lift-off (1986)
- 28th History: Johannes Hevelius born; leading observational astronomer of the 17th century published detailed maps of the moon and determined the rotational period of the sun (1611)
- 31st History: launch of Apollo 14; third manned moon landing with astronauts Alan Shepard, Stuart Roosa and Edgar Mitchell (1971)
- 31st History: launch of Soviet Moon lander Luna 9; first spacecraft to land and to transmit photographs from the Moon's surface (1966)



The Apollo 14 landing site (star), located about 30 miles north of the 57 mile diameter Fra Mauro crater

References on Distances

- The apparent width of the Moon (and Sun) is approximately one-half a degree ($\frac{1}{2}^\circ$), 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

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Page 1 "The Bubble Galaxy" - taken with the SBIG ST10 cam on the Meade 16, RGB filters 6.3 reducer using JJMO equipment - image done by Josh Reynolds.

Second Saturday Stars poster: Sean Ross, Ross Designs

All other non-credited photos were taken by the author: Bill Cloutier

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

January 12th

7:00 - 9:00 pm

**DAWN, Vesta
& the
HED meteorites**



Refreshments
Family Entertainment
Activity Center
Stars & Planets
Rain or shine

S.Ross



Map

