Galactic Observer

John J. McCarthy Observatory

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Gaslight District

the birth of a star is hailed in the brightness of its surrounding dust and gas . . . But why the patch of darkness in the center? Find out

more inside, page 19

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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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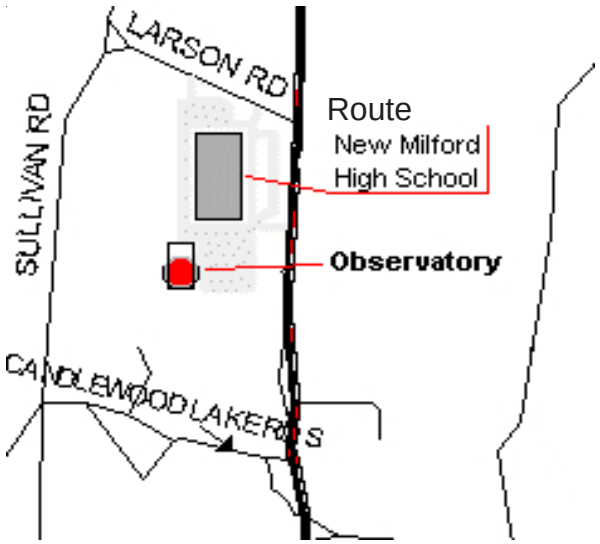


In This Issue

"Out the Window on Your Left" 4
Rupes Recta 5
The Twins Experiment 5
Red Planet Marathon 6
Status Report on New Horizons 8
Arrive at Ceres 9
Triple Moon Transit 10
Monitoring Planet Earth 11
Titan 11
Curiosity at Work 13
Astrophotography 13
Twist of Fate 14
March History 14
More March History 15
Zodiacal Light 15
March Nights 158
Sunrise and Sunset 15
Jupiter and its Moons 15
Transit of Jupiter's Red Spot 16
Astronomical and Historical Events 16
References on Distances 18
International Space Station and Iridium Satellites 28
Solar Activity 18
Image Credits 16
Front Page Notes 16
Second Saturday Stars 17
Graphic Calendar 18

March Calendar and Space Exploration Almanac

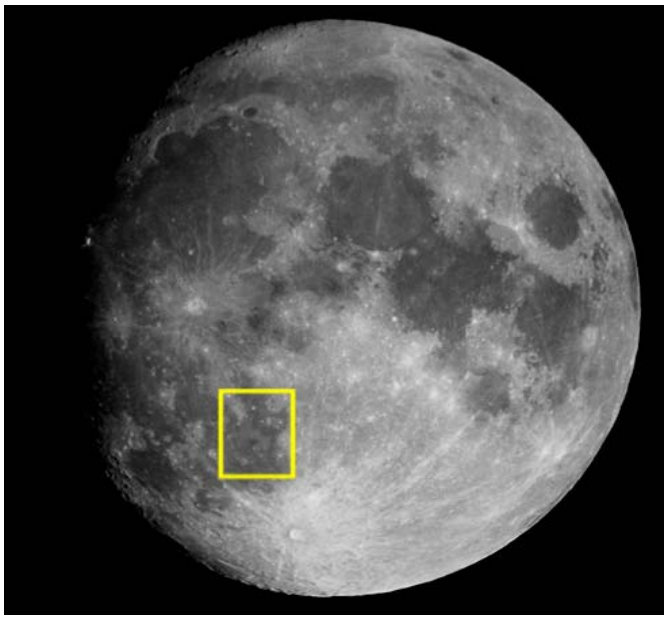
A two-day old Moon joins Venus and Mars in the western sky, shortly after sunset on a frigid (8°) evening in February.

At the time of the photo, Venus was approximately 132.4 million miles away and moving towards the Earth on its inside orbit. Mars was approximately 204.5 million miles away and falling behind the Earth on its outside orbit.

The Moon was approximately 223 thousand miles away at the time.

"Out the Window on Your Left"

IT'S BEEN MORE THAN 45 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 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).

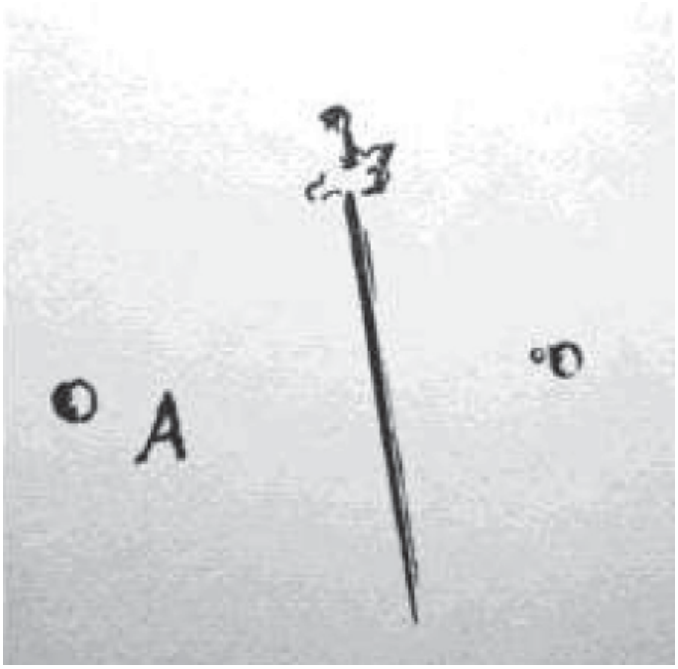


Lunar mare or "seas" are actually expansive low-lying plains formed by ancient lava flows

The Sea of Clouds (Mare Nubium) fills our window on the Moon this month. The most striking feature in this ill-defined impact basin is Rupes Recta (commonly called the Straight Wall or Railway). The dark line that slices more than 60 miles (100 km) through the remains of an ancient, unnamed crater traces a fault, where the ground on the shadowed side has collapsed. Western portions of the ancient crater, sometimes referred to "Ancient Thebit," have also been erased by lava flows, similar to the flooding at Sinus Iridum or in the crater Fracastorius.

The eastern side of the fault is approximately 1,500 to 1,600 feet (450 to 500 meters) higher than the western side. The slope of the rise (from west to east) is approximately 20°. Rupes Recta is best viewed when the fault is near the terminator, a day or two after first quarter or before third quarter Moon.

The first known observer of the fault was Christiaan Huygens (1629-1595). Huygens used a 123-foot (focal length) refractor to view and sketch the fault line, comparing the formation to a sword, with the fault

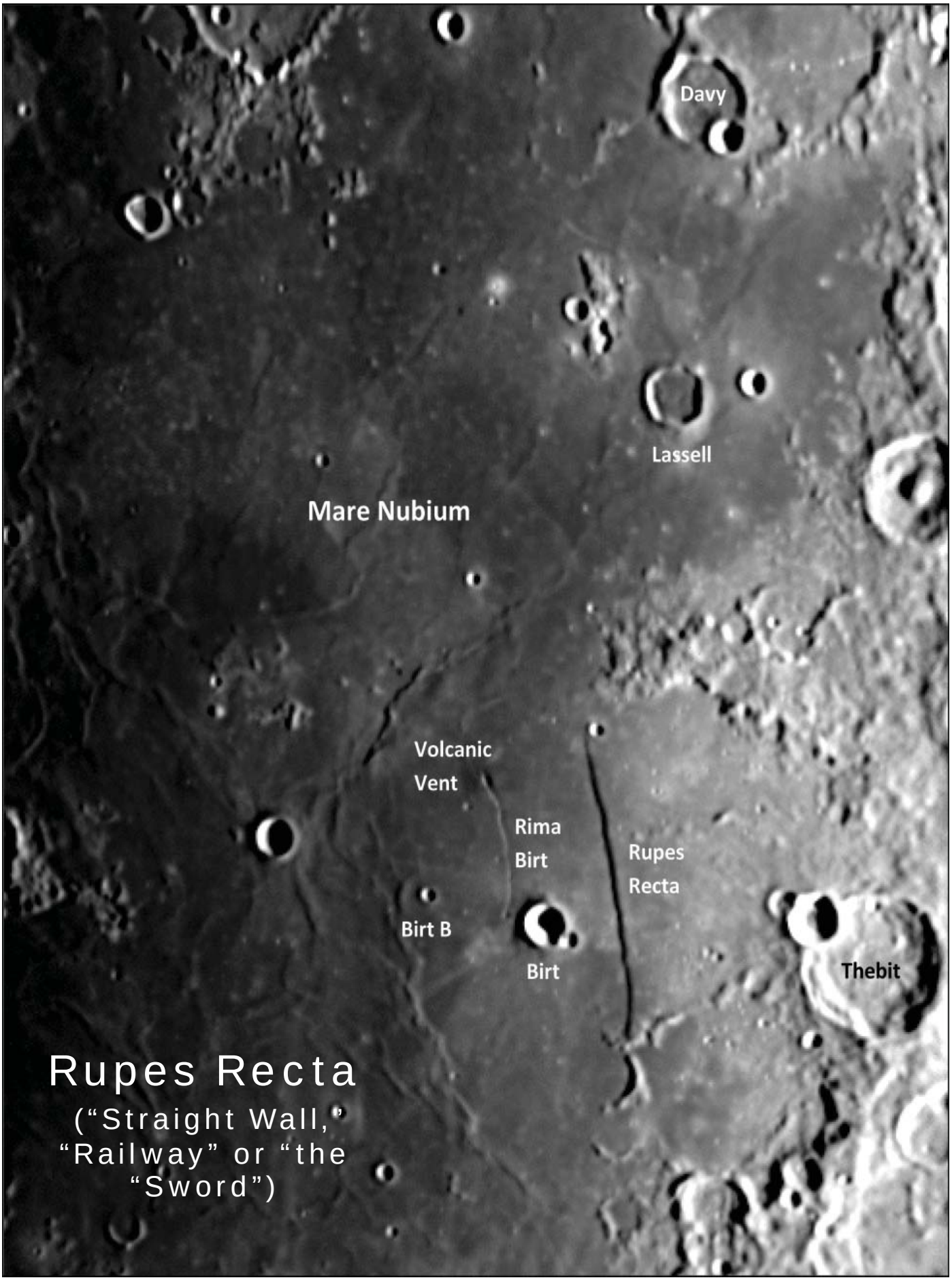


Inverted drawing of upes Recta by Christiaan Huygens circa 1686

line as the blade and the curved ridges at the southern end, the handle. He also recorded Schröter's Valley, the largest sinuous rille on the Moon, and the Hyginus rille through smaller telescopes.

The crater Birt lies to the west of the fault line. Rima Birt, a sinuous rille that runs parallel to Rupes Recta, is nearby and ends adjacent to the crater. The rille begins in the north, in a pit on top of a shallow dome. The pit appears to be a volcanic vent, likely active over 3.4 billion years ago and the possible source of nearby lava flows.

A false color image of Birt E crater, a possible source for lava that created Rima Birt,3.4 million years ago. Source: NASA/GSFC/Arizona State University.



Rupes Recta

("Straight Wall," "Railway" or "the "Sword")

The Twins Experiment

The crew of the next Expedition to the International Space Station (ISS) will include U.S. astronaut Scott Kelly and Russian cosmonauts Mikhail Kornienko and Gennady Padalka. Kelly and Kornienko will remain on the ISS for 12 months, twice as long as a typical mission. The extended duration is part of an investigation into the long-term effects of microgravity on the human body. The crew will be ferried to the ISS aboard a Soyuz rocket. The launch, scheduled for March 27th, will be from the Baikonur Cosmodrome in Kazakhstan.

Researchers are anticipating that the investigation will provide additional insight into the health challenges of long-duration space flight, for example, to Mars. Areas of research include:

- Changes in physical performance
- Behavioral health and the psychological effects of long-duration spaceflight including confinement
- Visual impairment possibly due to pressure changes in the brain and spinal fluid in a weightless environment
- Changes to the immune system
- Atherosclerosis (hardening and narrowing of the arteries)
- Human factors (for example, retention of fine motor skills and training, decision making, alertness and reasoning)
- Changes in the major organs, muscle and brain over time
- Changes in the digestive system and organisms within the gastrointestinal tract

There is another, unique aspect to the investigation: Scott Kelly has an identical twin. Mark Kelly, a retired astronaut (in 2011), has volunteered to be part of the study as a control subject. Mark will be monitored on the ground throughout the mission and after Scott returns from space. In studying the twins, researchers may be able to detect very subtle changes in an individual with the same genetic makeup after a year in space.

Red Planet Marathon

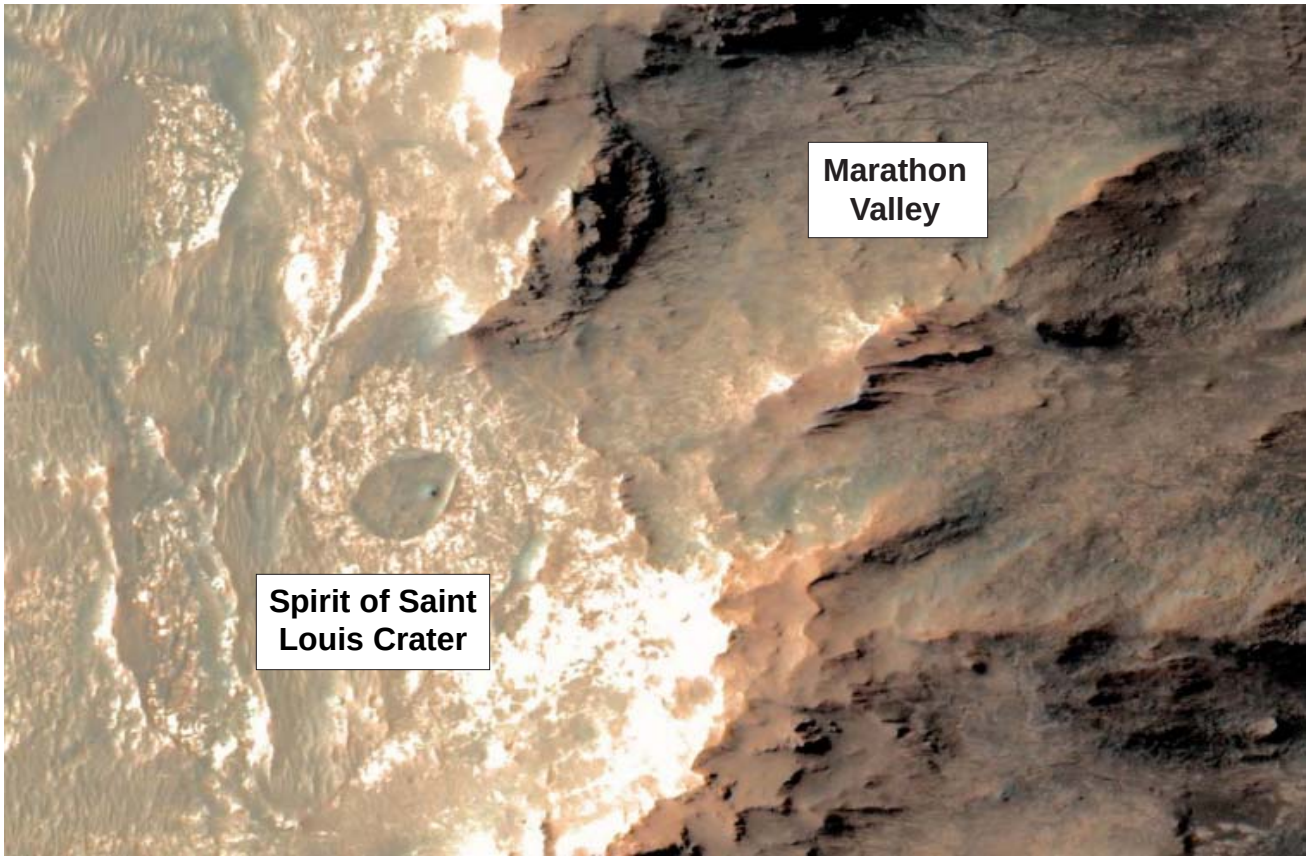
An Olympic marathon distance is 26.219 miles (42.195 kilometers). While top athletes can cover this distance in almost 2 hours on Earth, they wouldn't last a minute on the harsh surface of Mars with its cold, thin, and dusty atmosphere. The Mars Exploration Rover Opportunity has been operating in this environment for over 11 years. During this time, the 384 pound (174 kg), 4.9 foot (1.5 m) tall robotic field geologist has driven over 26 miles on its 10 inch (26 cm) wheels while it explores Meridiani Planum. Opportunity will pass the 26.219 mile finish line on its way to Marathon Valley, an opening in the western wall of Endeavour crater and a site identified from orbit as being rich in clay-like minerals.

NASA image of the Mars Exploration Rover being positioned on its landing platform in the Payload Hazardous Servicing Facility in preparation for launch in 2004

Opportunity isn't stopping and resting on its laurels. Despite recent problems with its flash memory that have prevented the rover from retaining data once the rover is powered down at night, Opportunity is fully capable of performing its mission.

Controllers and mission planners at the Jet Propulsion Laboratory (JPL) have been successful in operating the rover using only its volatile memory. Data gathered by Opportunity's instruments is transmitted to the Mars Odyssey and Mars Reconnaissance Orbiter at the end of each Martian day before the rover enters its "sleep" cycle with the setting sun. The orbiters then transmit the information to Earth.

The JPL team has been working to restore flash memory functionality by restricting Opportunity's ability to write to the troubled memory sectors. If successful, Opportunity will return to normal operation. The renewed capability to retain and store data overnight, and for even longer durations, will minimize the loss of data should the orbiters not be available to receive Opportunity's transmissions on a regular basis.



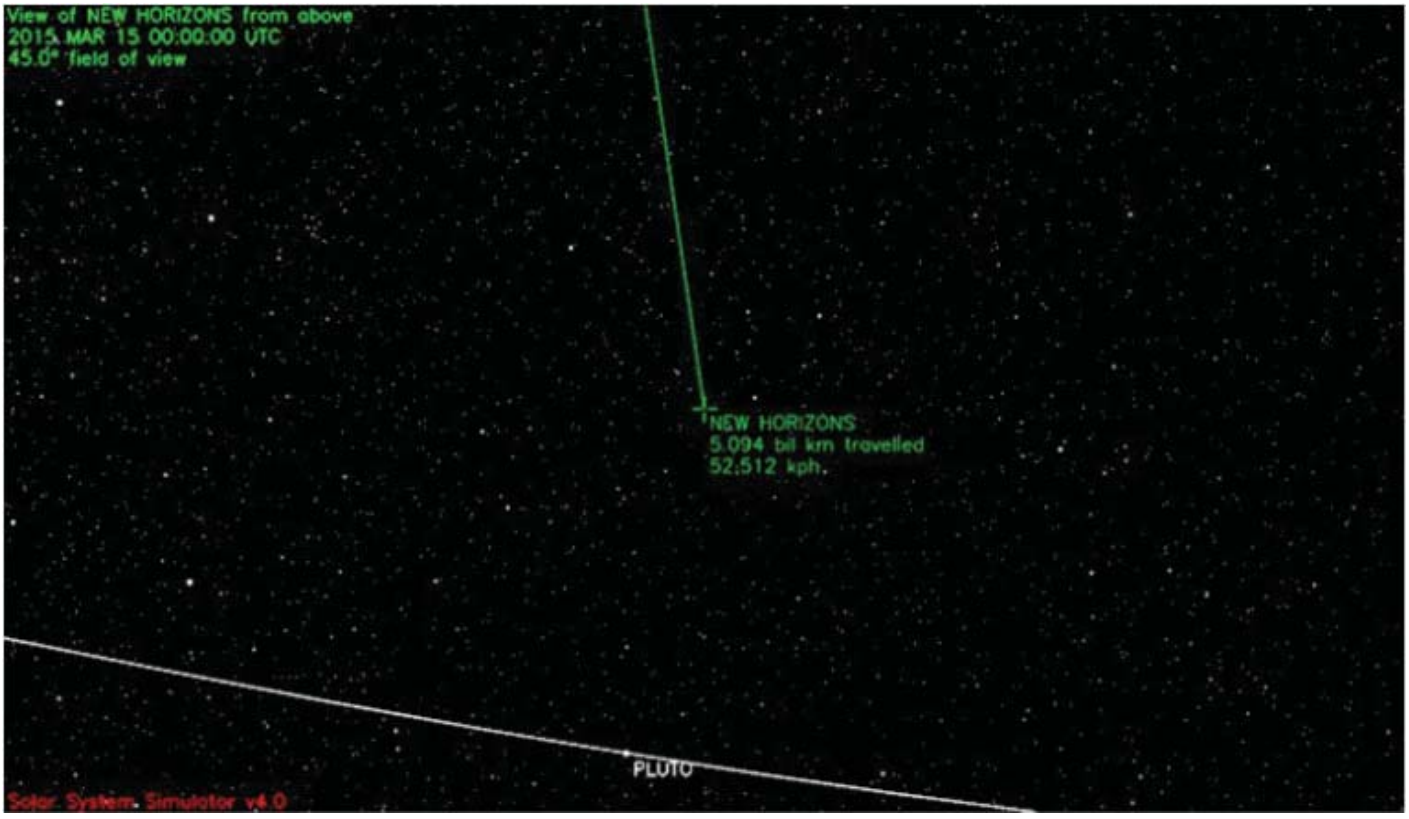
Western Wall of Endeavour Crater and Marathon Valley, Opportunity's Winter Destination
Image Credit: NASA/JPL-Caltech/Univ. of Arizona

Status Report on New Horizons

On February 4th, the birthday of astronomer and Pluto discoverer Clyde Tombaugh, NASA released new photos taken by the New Horizon's spacecraft. The photo (right) was taken on January 27th by New Horizon's telescopic Long-Range Reconnaissance Imager and shows the dwarf planet with its largest moon, Charon. The photo was taken from a distance of 126 million miles (203 million km) and is being used to refine the spacecraft's approach to, and its passage through, the congested Plutonian system. Pluto has five known moons, two of which were discovered after New Horizon's launch in 2006 (and two in the year prior to launch)—so there may be more, as yet undiscovered, moons or cosmic flotsam to avoid.

New Horizons will make its closest approach to Pluto on July 14th before heading out into the Kuiper Belt.

Pluto and its moon Charon (Credit: NASA/Johns Hopkins University Applied Physics Laboratory/ Southwest Research Institute)



New Horizon's Position on Mar. 15th JPL's Solar System Simulator http://space.jpl.nasa.gov/

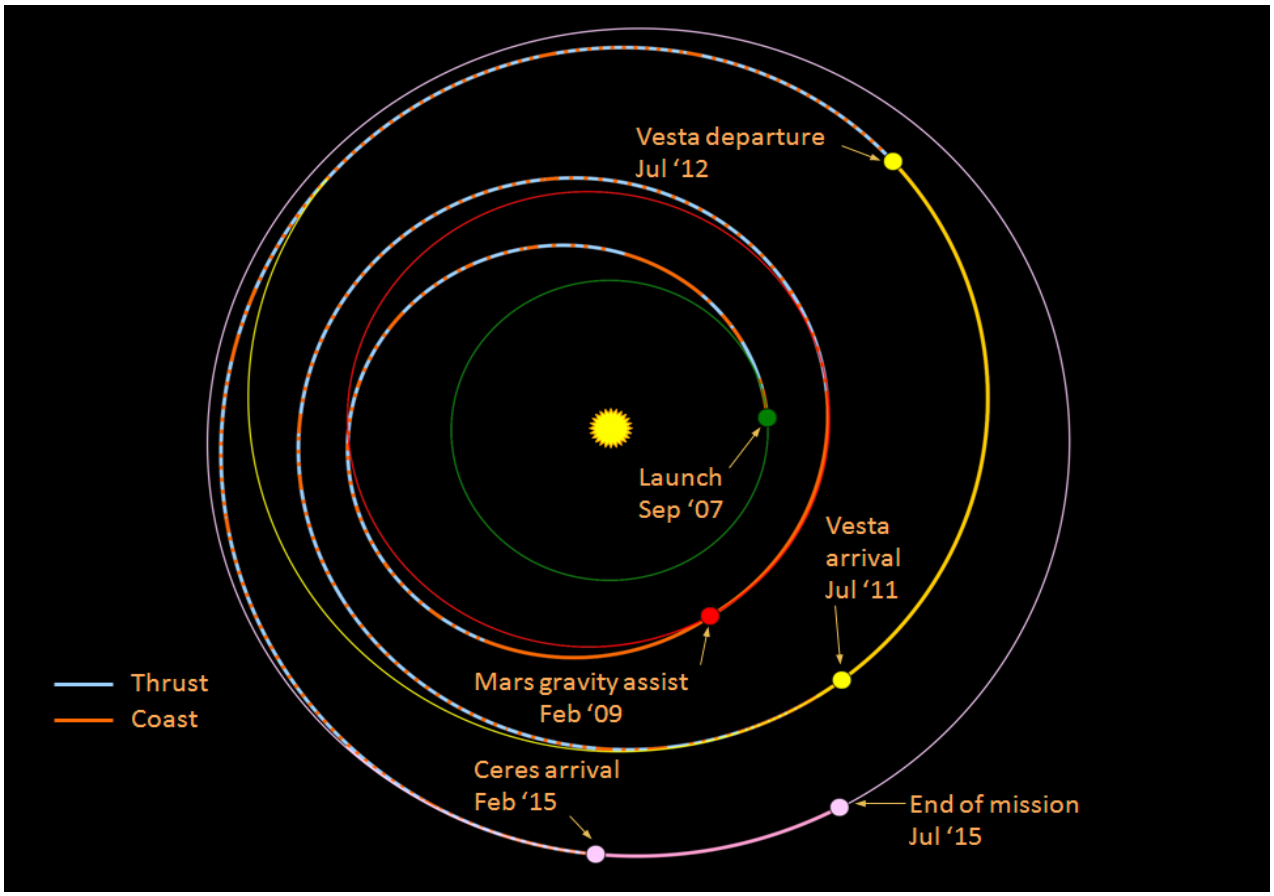
Arrival at Ceres

After a year of exploring the asteriod Vesta, the Dawn spacecraft restarted its ion engines in September 2012, left orbit, and started its journey to the dwarf planet Ceres. Two and one-half years later, Dawn will reach its final destination. For the past several months Dawn has been slowing closing the distance to its target as they travel together around the Sun at nearly 39,000 mph (64,000 kph). Dawn will slip into orbit on March 6th, looping in behind the planet.

Shortly after Dawn left Vesta, the second of its four reaction wheels (used to stabilize or turn the spacecraft in zero gravity) failed. The spacecraft was designed to use its reaction wheels to point its cameras at Ceres or its main antenna at Earth. Without the use of the reaction wheels (extreme case), the spacecraft would have to use its reaction control system (fueled by hydrazine propellant) to execute orbital maneuvers and orientate its instruments. For this contingency, mission controllers have been working on conserving hydrazine during the spacecraft's deep space cruise.

Dwarf Planet Ceres imaged on February 12 from from 52,000 miles (83,000 km). Image Credit: NASA/JPL-Caltech/UCLA/ MPS/ DLR/ IDA/PSI

While Dawn arrives in early March, close-up images of Ceres may have to wait until April. This is because Dawn's trajectory brings the spacecraft in behind the dwarf planet. This would place the Sun in the spacecraft's camera's field of view. While diminished in brilliance at Ceres distance, the Sun could damage the camera's sensitive detector. Dawn will enter its first observational orbit by the end of April. By then, the alien landscape of the dwarf planet will fill the camera's field of view. In its lowest orbit, Dawn will be traveling 230 miles (375 km) above the planet's surface.

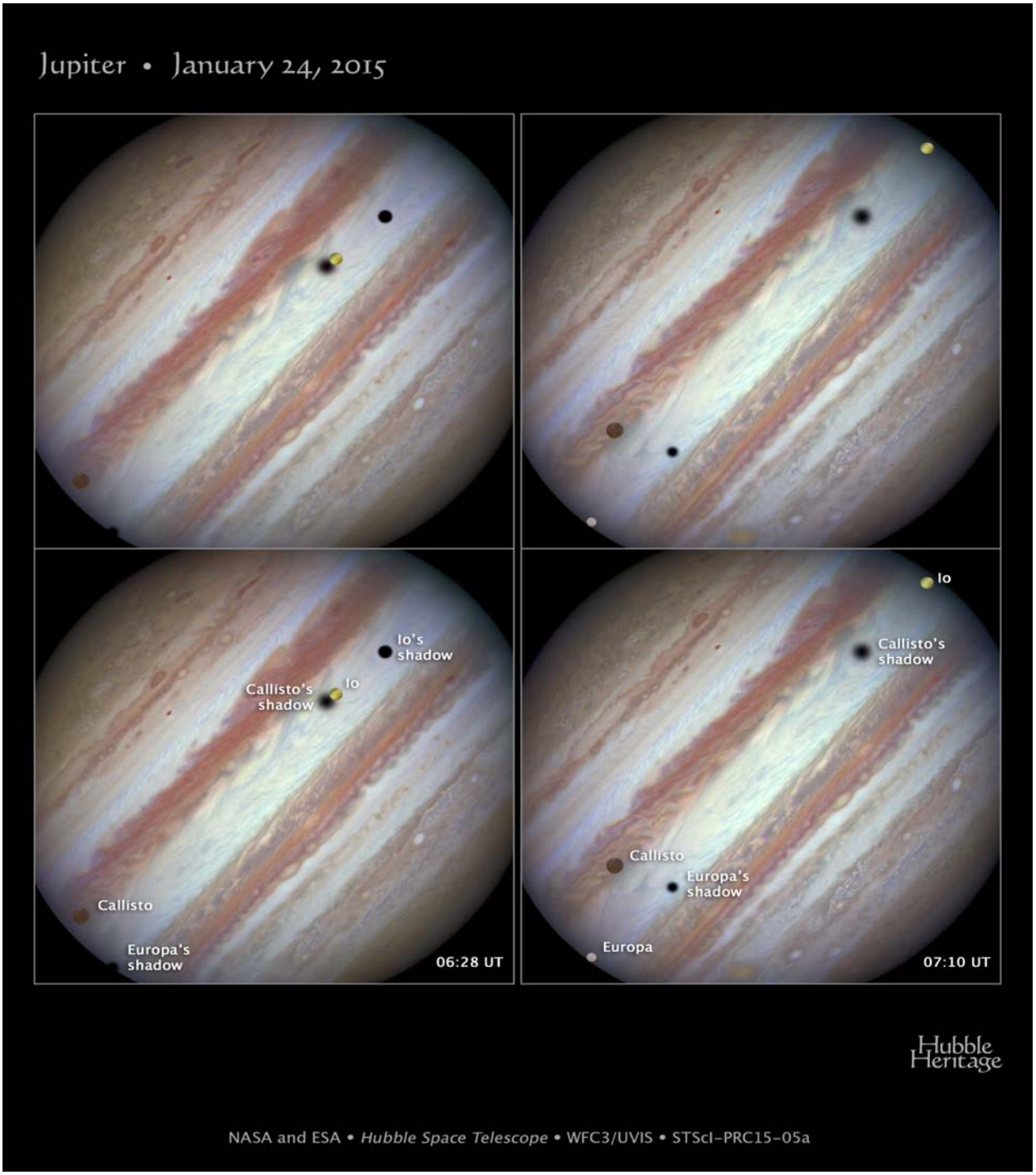


Dawn baseline interplanetary trajectory for primary mission. Dashed lines represent orbits of Mars, Vesta, and Ceres. Source: NASA

Triple Moon Transit

Had the late night skies been clear on January 23, 2015 (they were not in the northeastern U.S.), observers of the planet Jupiter would have been treated to a rare event: shadows of three of Jupiter's largest moons crossing the planet's disk. High above the Earth's atmosphere, NASA's Hubble Space Telescope had an unobstructed view of the triple moon transit. The series of images (next page) captures Io, Europa, and Callisto (and the shadows cast upon the cloud tops); crossing in front of the gas giant (Ganymede was not part of the conjunction).

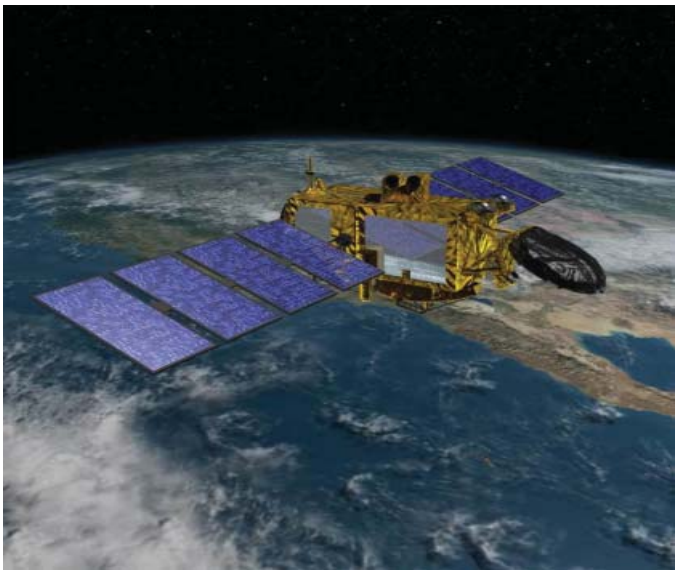
The three moons are distinctive in their coloring. Volcanic Io appears yellow in the visible light image from Hubble's Wide Field Camera 3. Outermost and heavily cratered Callisto has a brownish hue. Europa's absence of color is due to its icy smooth, highly reflective surface. Io, Europa, and Callisto have orbital periods of 1.8, 3.6 and 16.7 days, respectively. While transits of individual moons are common, multiple transits are rare. Observers in the U.S. will have to wait until December 2032 for another triple transit.



Monitoring Planet Earth

In mid-2015, a Space X Falcon 9 rocket is scheduled to launch the latest in a series of satellites and instruments designed to monitor the changing conditions on planet Earth. The Jason 3 satellite, a NASA/ European collaboration, is an ocean monitoring mission. Its instruments will measure variations in the ocean's surface over the globe to within 1.3 inches (3.3 cm), or better.

Global and regional changes in the sea level provide critical information on circulation patterns and ocean temperature. Jason 3 is the fourth satellite in a series of ocean monitoring satellites starting with the TOPEX/ Poseidon satellite mission in 1992 and continuing with the Jason 1 and 2 missions launched in 2001 and 2008, respectively.



Artist Drawing of Jason 3 over California
Courtesy NASA/JPL-Caltech

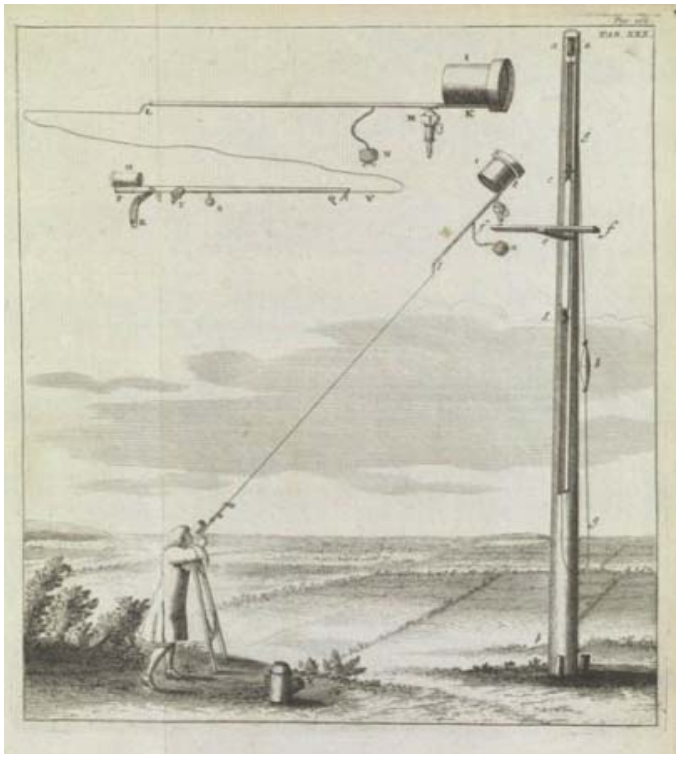
Titan

Dutch astronomer Christiaan Huygens was a keen observer, recording details on the Moon that wouldn't be "rediscovered" for another century (for example, the discovery of the great lava channel Vallis Schröteri by Johann Schröter in 1787 was recorded more than a hundred years earlier by Huygens in 1686). Huygens was also the first to recognize that Saturn was surrounded by a flat ring and that our view of the ring would change over Saturn's orbital period.

Christiaan and his brother Constantijn constructed dozens of telescopes for their observing campaigns. Early telescope lenses were prone to an optical defect known as "spherical aberration," where light rays passing through different parts of the lens did not converge to a single focal point. Astronomers found that the impact of this defect could be minimized by constructing telescopes

Christiaan Huygens

Constantijn Huygens



An observer at one of Huygens's tubeless telescope where the objective lens was mounted on a ball and socket joint that rides up and down a tall pole and the eyepiece is connected to the objective by only a wire or string.

with a long focal length (exceeding a hundred feet). Unfortunately, these leviathans required massive support structures, were difficult to use and vibrated with the slightest breeze.

Huygens largest telescope had a focal length over 200 feet (65 meters). To minimize the weight and increase image stability, he devised a tubeless or aerial telescope. A wire connected the mirror and eyepiece which the observer would pull taut while moving at a steady rate around the mirror support pole to compensate for the Earth's rotation. The design was not without problems as on dark nights the lens was almost impossible to see.

In 1655, Huygens discovered Saturn's largest moon Titan. He initially recorded the discovery as an anagram until he could be sure of his discovery. Huygens

referred to the moon as Luna Saturni. The surface of Titan would remain hidden from our view for more than 350 years until the arrival of the Cassini spacecraft in 2004. In December 2004, Cassini released the Huygens probe which parachuted down on the frozen surface of Titan on January 14, 2005. The probe was able to transmit data back to the orbiter for more than an hour before its battery was exhausted.

In the ten years since the Huygens probe landed, Cassini has been scanning Titan, the second largest moon in the solar system and the only moon with a thick atmosphere, with its radar and recording the pull of the moon's gravity on the spacecraft during each pass. While the Huygens landing site was a dry river bed, there are large seas of liquid methane and ethane on the moon, the largest ones with depths exceeding 500 feet. The seas are replenished by rainfall produced by the condensation of vapors rising from the surface, a cycle not unlike the water cycle on Earth.

Nitrogen is the primary constituent of Titan's dense atmosphere (>95%), with methane contributing the remaining 5%. The molecules are split apart in the upper atmosphere by the Sun's ultraviolent light and recombine to form various organic compounds. This process is responsible for the orange haze or smog that obscures our view of the moon's surface. Titan's atmosphere extends 370 miles (600 km) above its surface, significantly higher than Earth's atmosphere. Conditions in Titan's atmosphere, although colder, have been compared with Earth's, before life appeared.

Surface of Titan Credit: ESA/NASA/ JPL/University of Arizona

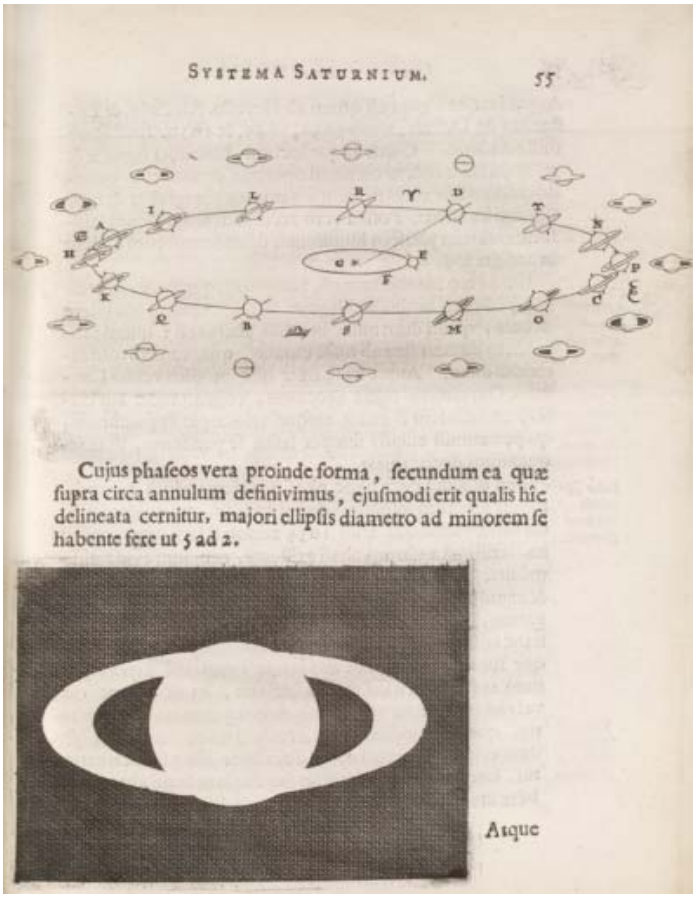


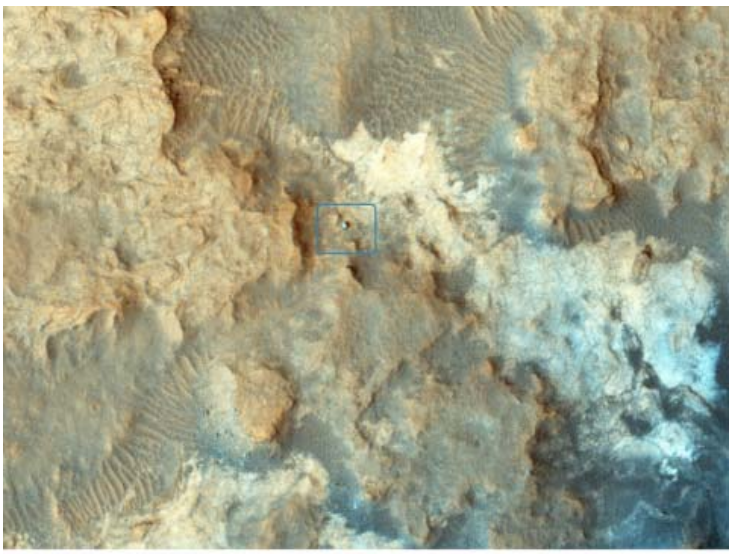
Diagram illustrating Saturn's changing appearance from Earth, as the two planets orbit the Sun, and Saturn's rings at their greatest inclination.
Source: *Systema Saturnium,* by Christiaan Huygens

The Huygens probe imaged a dynamic world as it fell through the cloud decks. Titan has vast fields of gigantic sand dunes 0.6 to 1.2 miles (1 to 2 km) wide, hundreds of miles (km) long and around 300 feet (100 meters) high. Surface features akin to drainage channels were also seen, converging into river beds and emptying onto the flood plains. The features give the moon an Earth-like appearance.

Gravity measurements suggest the presence of a subterranean ocean. A liquid water/ammonia ocean is theorized to be 35 to 50 miles (55 to 80 km) below the moon's surface. The ocean makes Titan one of the few places in our solar system that could harbor life.

Curiosity at Work

NASA's Mars Reconnaissance Orbiter photographed the Mar Science Laboratory (Curiosity) exploring the foothills of Mount Sharp in Gale Crater. The area contains sedimentary rock and evidence of an ancient, shallow lake.



Photos Credit: NASA/JPL-Caltech/University of Arizona

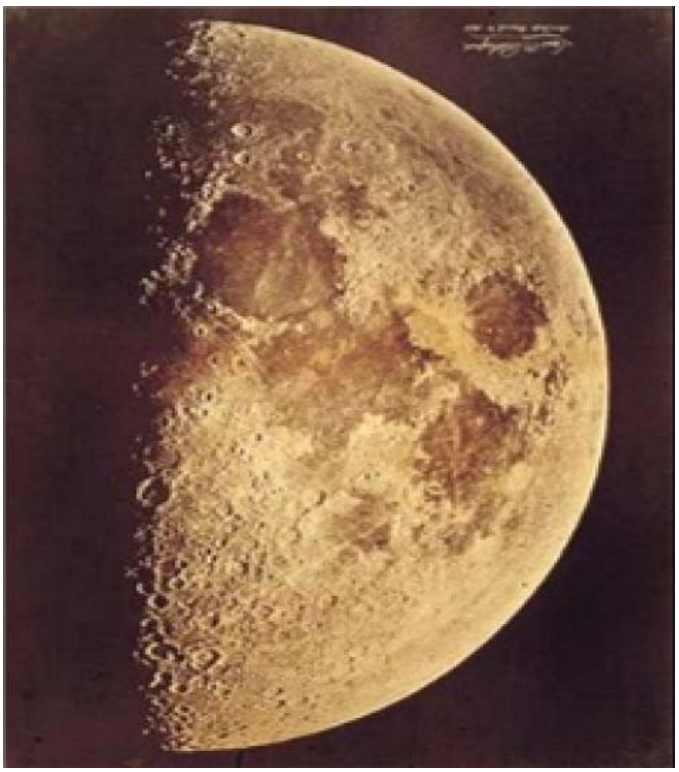
Astrophotography

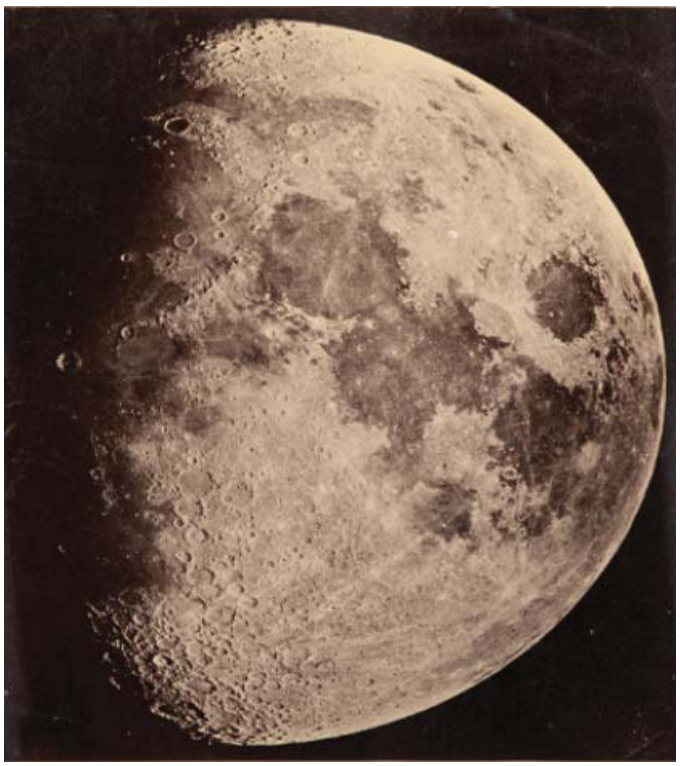
Photography was born in the early 1800s with the development of light sensitive emulsions that could capture and retain an image. Early attempts at photography involved toxic chemicals (e.g., mercury fumes), hour long exposures, and subjects that didn't move or that could maintain a static pose. As the technology advanced and exposure rates became manageable, photographers became more creative and photography found more applications. One of those applications was astrophotography, or the imaging of celestial objects. A common target was the bright Moon, with its short exposure times.

A pioneer in the field of astrophotography was Lewis Rutherfurd. Trained as a lawyer, he was also an amateur scientist. In 1849, Rutherfurd decided to dedicate his studies to astronomical photography and spectroscopy. In doing so, he had an observatory built at his home at 11th Street and 2nd Avenue in New York City, complete with an 11¼ inch refractor telescope constructed by Henry Fitz and modified under Rutherfurd's guidance for photography. He began his work in astrophotography in 1858, capturing a negative of the full moon later that summer.

His images of the Moon, with graduated exposures to compensate for the uneven brightness, were unrivaled in detail for over a century. His image (below left) of the first quarter Moon was taken on March 4th, 1865. The waxing gibbous (below right) was taken two days later on the 6th.

In 1868, Rutherfurd acquired a 13 inch refractor with a correcting lens specifically designed for photography. With it, in 1870, he acquired a series of unparalleled photos of the Sun that displayed exquisite details of sun spots, faculae and the photosphere. Before he died in 1892, Rutherfurd donated his negatives of sun, moon and stars to Columbia College.





Twist of Fate

On March 3, 1969, a Saturn V rocket carried the crew of Apollo 9 into Earth orbit for the first manned flight test of the lunar module. The ten day mission was the most complex mission that had been conducted with two manned spacecraft, including the evaluation and testing of the first spacecraft designed to operate solely outside the Earth's atmosphere, a spacewalk, rendezvous and docking exercises, and the test firing of the lunar module's descent engine. The successes of Apollo 9 paved the way for the lunar landing missions that followed.

A fish-eye camera view of the interior of the Apollo Lunar Module Mission Simulator at the Kennedy Space Center. In the foreground is mission commander James McDivitt; in background is Russell Schweickart, lunar module pilot. Source: NASA.

A year earlier, the crew of Apollo 9 (astronauts James McDivitt, David Scott and Russell Schweickart) had been assigned to Apollo 8, with the same mission objectives.

The Apollo 11 crew (mission commander Neil Armstrong, command module pilot Michael Collins, and lunar module pilot Buzz Aldrin) leaves Kennedy Space Center's Manned Spacecraft Operations Building during the pre-launch countdown.

However, by mid-year 1968, it was clear that the lunar lander, due to numerous manufacturing and technical concerns, would not be ready for a year-end flight. With a growing concern that the Soviets were ready to begin flying their new Soyuz spacecraft again (after a fatal accident on its first flight), NASA decided to send Apollo 8 on a flight around the Moon without the lunar lander. McDivitt considered the mission no more than a publicity stunt and turned it down, opting to switch with the Apollo 9 crew in anticipation that the lunar lander would then be available for that flight. McDivitt's decision would ultimately determine who would be the first to walk on the Moon, as the backup crew for Apollo 8 would become the prime crew for Apollo 11. With the crew switch, Pete Conrad went from the commander of Apollo 11 to the commander of Apollo 12 and from the first to the third person to walk on the Moon.

March History

On March 16, 1926, in Auburn, Massachusetts, Robert Goddard launched the first liquid fueled rocket on a flight that lasted only 2½ seconds. A graduate of Worcester Polytechnic Institute, despite discharging a powder rocket from the basement of the physics building, the significance of Goddard's feat is compared by space flight historians to the first aircraft flight at Kitty Hawk. Among his achievements, Goddard was first to prove that rockets would work in a vacuum and to mathematically explore the practicality of using rocket propulsion to reach high altitudes and even the Moon (1912). While he was eventually banished from the fields of Auburn by the fire marshal, the site is commemorated by markers on what is now the Pakachoag Golf Course. The next time you are driving on the Massachusetts Turnpike towards Boston and points north, look to your left as you pass Exit 10. Just beyond the large shopping mall is where history was made.

Credit: NASA photo showing Dr. Goddard with his a liquid oxygen-gasoline rocket "Nell" in its launching frame

More March History

Caroline Herschel was born in Hanover, Germany on March 16, 1750, the fifth of six children. Her four brothers were brought up to be musicians like their father, a talented musician and bandmaster. Caroline's mother saw no need for a girl to be educated and preferred that Caroline become a house servant to the rest of the family. Unfortunately, Caroline contracted typhus at age 10. It permanently stunted her growth (she was just over four feet tall as an adult), further convincing her mother that she wouldn't amount to much.

Caroline's brother William escaped to England during the French occupation of Hanover in 1757. Her father Isaac, who had left to fight the French, returned home in poor health. Caroline lived at home as a servant until his death in 1767. Against her mother's will, she then left Hanover to join her brother William in England.

William Herschel was an accomplished musician although he gained considerable fame with his hobby as an astronomer and telescope maker. His reputation as a craftsman allowed him to quit his job as a musician and concentrate on astronomy. Caroline became her brother's apprentice, helping him design and build larger and more powerful telescopes. She also assisted her brother in recording his observations, sitting in a window and writing by candlelight while her brother called out what he saw through the telescope's eyepiece.

Astronomy became a full-time occupation when William discovered the planet Uranus in 1781 and received an annual endowment from King George III. When her brother was away, Caroline would use her own telescope to sweep the sky looking for comets. On August 1, 1786, Caroline discovered her first comet, the first comet to be discovered by a woman. Between 1786 and 1797 she would discover eight comets, as well as a number of deep sky objects.

With the marriage of William to Mary Pitt in 1788 and the birth of their son John in 1792, Caroline became involved in the education of her nephew. Under his father's and aunt's tutelage, John would become the first astronomer to thoroughly survey the southern hemisphere. Following William's death in 1822, Caroline continued to assist John in his astronomical work.

Caroline catalogued every discovery she and William made. Two of her catalogues are still in use today. She lived to be 98 and was recognized by the King of England, the Royal Astronomical Society, the King of Prussia and the King of Denmark for her life-long scientific achievements. After her death, Caroline Herschel was honored by the astronomical community by the naming of a lunar crater after her (C. Herschel) and an asteroid (281) Lucretia (her middle name).

Zodiacal Light

The solar system is filled with tiny dust particles from the passing of comets and collisions of asteroids. The dust orbits in the same plane as the Earth and the other planets. Shortly before sunrise and just after sunset, sunlight can be seen reflecting off this disk of debris. Called the zodiacal light, it is best observed when the ecliptic (the apparent path of the Sun and planets) is nearly perpendicular to the horizon (on spring evenings and autumn mornings). The best time to glimpse the zodiacal light is when the Moon is absent from the evening sky (for example, between March 13rd and 20th).

March Nights

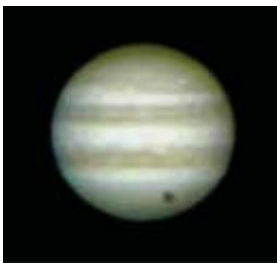
March, the month named for the planet Mars, denotes the end of the long winter nights. The Sun crosses the celestial equator at 6:45 pm (EDT) on the 20th marking the Vernal Equinox and the beginning of the spring season in the northern hemisphere. If you have the opportunity to be in the Yucatan on this day, take a trip out to Chichen Itza to watch the Sun cast the shadow of a plumed serpent on the pyramid of Kukulcan.

Sunrise and Sunset

Sun	Sunrise	Sunset
March 1st (EST)	06:29	17:44
March 15th (EDT)	07:06	19:00
March 31st (EDT)	06:39	19:18

Jupiter and its Moons

Jupiter reached Opposition on February 6th and is still well placed in the evening sky in March. As one of the brightest star-like objects in the night sky, Jupiter can be found in the constellation Cancer.



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 6 pm and midnight).

Date	Moon	Transit Begins	Transit Ends
2nd	Ganymede	9:05 pm	12:44 am (3rd)
3rd	Io	11:02 pm	1:19 am (4th)
7th	Europa	6:08 pm	9:02 pm
12th	Io	7:25 pm	9:42 pm
*14th	Europa	8:44 pm	11:38 pm
19th	Io	9:19 pm	11:37 pm
21st	Europa	11:21 pm	2:14 am (22nd)
26th	Io	11:14 pm	2:14 am (27th)

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 8 pm to midnight local time:

Date	Transit Time	Date	Transit Time
2nd	9:32 pm	19th	8:34 pm
4th	11:11 pm	21st	10:13 pm
7th	8:40 pm	23rd	11:51 pm
9th	10:18 pm	26th	9:21 pm
11th	11:57 pm	28th	10:59 pm
14th	9:26 pm	31th	12:38am
16th	11:04 pm		

Astronomical and Historical Events

1st History: Soviet spacecraft Venera 13 lands on Venus and records first color panoramic views of the surface (1982)

1st History: discovery of Saturn's moon *Helene* by Pierre Laques and Jean Lecacheux from the Pic du Midi Observatory in the French Pyrenees; named after Helen of Troy (1980)

1st History: Soviet spacecraft Venera 3 lands (crashes) on Venus, becoming first spacecraft to impact the surface of another planet (1966)

2nd History: launch of the Rosetta spacecraft (2004); rendezvoused with Comet 67 P/Churyumov-Gerasimenko in May 2014, sending a lander to its surface in November 2014

2nd History: launch of Pioneer 10, a Jupiter flyby mission (1972)

3rd History: Chinese National Space Agency announces the Chang'e lunar exploration program (2003)

3rd History: launch of Apollo 9 with astronauts James McDivitt, David Scott and Russell Schweikart in the first manned flight test of the lunar module (1969)

3rd History: launch of the Pioneer 4 spacecraft towards the Moon; first U.S. spacecraft to escape the Earth's gravity (1959)

5th Full Moon (Full Worm Moon)

5th Moon at apogee (furthest distance from Earth)

5th Kuiper Belt Object 2013 FZ27 at Opposition (47.963 AU)

5th History: Soviet spacecraft Venera 14 lands on Venus and uses a screw drill to obtain a surface sample that was determined to be similar to oceanic basalts on Earth (1982)

5th History: flyby of Jupiter by the Voyager 1 spacecraft (1979)

6th The Dawn spacecraft arrives at the Dwarf Planet Ceres

6th Asteroid 7 Iris At Opposition (8.5 Magnitude)

6th History: launch of the Kepler telescope from Cape Canaveral Air Force Station aboard a Delta II rocket (2009); designed to survey nearby stars for Earth-size and smaller planets; as of February 2014, there are 1,075 confirmed exoplanets orbiting 813 stars

6th History: flyby of Comet Halley by Vega 1, a Soviet spacecraft (1986)

7th History: John Herschel born, first astronomer to survey the southern hemisphere (1792)

8th Daylight Saving - Set Clock Ahead 1 Hour (United States)

Astronomical and Historical Events (continued)

8th History: maiden voyage of Europe's first unmanned cargo ship to the International Space Station; the Jules Verne was launched from Kourou, French Guiana aboard an Ariane 5 rocket; in addition to delivering supplies to the ISS, the cargo ship contained a manuscript by the 19th century French author and science fiction pioneer with computations of distances from Earth to several astronomical destinations, as well as to the center of the planet (2008)
8th History: flyby of Comet Halley by Susei, a Japanese spacecraft (1986)
8th History: discovery of rings around Uranus by NASA's airborne observatory (1977)
9th History: flyby of Comet Halley by Vega 2, a Soviet spacecraft (1986)
9th History: launch of the Soviet spacecraft Sputnik 9, with dog Chernushka (1961)
9th History: Yuri Gagarin born; first person to orbit the Earth in 1961 (1934)
10th History: Mars Reconnaissance Orbiter arrives at Mars (2006)
10th History: flyby of Comet Halley by Sakigake, a Japanese spacecraft (1986)
11th History: launch of Pioneer 5 into solar orbit between the Earth and Venus; confirmed the existence of interplanetary magnetic fields (1965)
11th History: Urbain Leverrier born, mathematician and astronomer, predicted existence of Neptune (1811)
13th Last Quarter Moon
13th History: flyby of Comet Halley by Giotto, a European Space Agency spacecraft (1986)
13th History: discovery of Saturn's moon *Calypso* by Dan Pascu, P.K. Seidelmann, William Baum and D. Currie (1980)
13th History: Percival Lowell born, established observatory in Flagstaff, AZ to observe Schiaparelli's Martian "canali" and look for other signs of life (1855)
13th History: William Herschel discovers the planet Uranus; originally named Georgium Sidus by Herschel in honor of his patron, King George III of England (1781)
14th **Second Saturday Stars - Open House at McCarthy Observatory**
14th Distant flyby of Saturn's moons Helene and Calypso by the Cassini spacecraft
14th History: Stardust passes within 112 miles (181 km) of the nucleus of Comet Tempel 1 (2011)
14th History: John J. McCarthy Observatory issued Observatory Code Number 932 by the Minor Planet Center of the International Astronomical Union (2001)
14th History: Albert Einstein born, developed theories of mass to energy conversion and the curvature of space and time in large gravitational fields (1879)
14th History: Giovanni Schiaparelli born, director of the Milan Observatory and first to describe faint features on Mars as "canali" (1835)
15th History: San Juan Capistrano Meteorite Fall; the largest piece (50.5 g) penetrated the aluminum roof of a carport in a mobile-home park (1973)
16th Scheduled flyby of Saturn's largest moon Titan by the Cassini spacecraft
16th History: third and final flyby of Mercury by the Mariner 10 spacecraft (the last of the Mariner probes); Mariner 10 was also the first spacecraft to use solar radiation pressure on its solar panels and the antenna for attitude control during flight (1975)
16th History: launch of Gemini 8 with astronauts Neil Armstrong and David Scott; first docking with another space vehicle, an unmanned Agena stage (1966)
16th History: launch of the first Titan II Intercontinental Ballistic Missile, also used as the launch vehicle for the manned Gemini spacecraft in the early 1960's (1962)
16th History: Robert Goddard launches first liquid-fuel rocket in Auburn, MA (1926)
16th History: Caroline Herschel born (1750)
17th History: launch of the Gravity Recovery And Climate Experiment (GRACE) spacecraft (2002)
17th History: launch of Vanguard 1, 4th artificial satellite and oldest still orbiting Earth (1958)

Astronomical and Historical Events (continued)

17th History: Galileo Galilei publishes "Sidereus Nuncius" (Starry Messenger), the first scientific treatise based on observations made through a telescope; it described Galileo's early observations of the Moon, the stars, and the moons of Jupiter (1610)
18th History: MESSENGER enters orbit around Mercury (2011)
18th History: New Horizons spacecraft (on its way to Pluto) crosses the orbit of Uranus (2011)
18th History: explosion during launch of a Vostok rocket carrying a military spy satellite kills 48 members of the Soviet Missile Troop; likely cause of explosion was an oxygen peroxide leak caused by the poor quality of the rocket's fuel filters (1980)
18th History: Alexei Leonov performs first spacewalk from Soviet Voskhod spacecraft (1965)
19th Moon at perigee (closest distance from Earth)
19th History: flyby of the Moon by the Japanese spacecraft Hiten (1990)
19th History: Tenham meteorite fall; fragments of a large meteor rain down on a remote area of western Queensland, Australia (1879)
19th History: Moon flyby by the Hiten spacecraft; Japan's first lunar flyby, orbiter and surface impactor (1990)
20th New Moon
20th Vernal Equinox (beginning of the Spring season in the northern hemisphere) at 6:45 pm EDT
21st Dwarf Planet 136472 Makemake at Opposition (51.526 AU); discovered on March 31, 2005 by Michael E. Brown, Chad Trujillo and David Rabinowitz
21st History: launch of Ranger 9, Moon impact mission; transmitted the highest resolution imagery obtained to that date before impacting the floor of Alphonsus crater on the 24th (1965)
22nd History: launch of space shuttle Atlantis (STS-76), third mission to Russian space station Mir and transfer of the first American woman, Shannon Lucid, to the station (1996)
23rd History: launch of Gemini 3 with astronauts Virgil Grissom and John Young, first manned Gemini flight (1965)
23rd History: Wernher von Braun born, German rocket scientist and leader of the U.S. moon program (1912)
23rd History: first photograph of the Moon taken by American astronomer J.W. Draper (1840)
25th History: launch of the IMAGE spacecraft, first mission dedicated to mapping the Earth's magnetosphere (2000)
25th History: close approach of Comet Hyakutake (0.10 AU) to Earth (1996)
25th History: launch of Soviet spacecraft Sputnik 10 with dog Zvezdochka (1961)
25th History: Christiaan Huygens discovers *Titan*, Saturn's largest moon (1655)
26th History: John Draper takes first photograph of the Moon (1840),
27th First Quarter Moon
27th Scheduled launch of a Soyuz spacecraft from the Baikonur Cosmodrome in Kazakhstan to the International Space Station with members of the next expedition crew including astronaut Scott Kelly and Russian cosmonaut Mikhail Kornienko who will spend a year in space
27th History: launch of the Soviet atmospheric probe and lander Venera 8 to Venus (1972)
27th History: launch of Mariner 7, Mars flyby mission (1969)
27th History: President Eisenhower approves the military lunar program to be managed by the Advanced Research Projects Agency (1958)
28th History: flyby of Comet Halley by the ICE spacecraft (1986)
28th History: Heinrich Olbers discovers the asteroid 2 *Pallas* (1802)
29th History: First flyby of Mercury by the Mariner 10 spacecraft (1974)
29th History: Heinrich Olbers discovers the asteroid 4 *Vesta* (1807)
31st History: launch of Soviet spacecraft Luna 10, first man-made object to go into orbit around another planetary body; detected evidence of mass concentrations on the Moon called "mascons" (1966)

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.*

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Front page design and graphic calendars: Allan Ostergren

Second Saturday Stars poster: Sean Ross, Ross Designs

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

Front Page

Shortly after its upgrade and overhaul in December 1999, the Hubble space telescope returned images of a nebula 1500 light years away in the constellation Orion, NGC 1999. First documented in 1785 by Sir William Herschel and his sister Caroline, it is considered a reflection nebula, because its gas and dust emits no light, and is only visible in the radiance from a nearby star (V380 Orionis). The only question was why the center of the image, which resembles a giant meat pounder, is black. At the time, it was thought that the region was a cold, dense cloud of gas and dust that blocked the light emanating from the star.

A decade later, an answer—and perhaps more questions—may have been provided by Herschel (the space telescope). Infrared readings from Herschel indicated that the black region of NDC 1999 was simply empty space. The implication, to ESA astronomers, was that jets of gas from other star formations, or perhaps radiation from an older nearby star, might have cleared the region.

Source: NASA/ESA and the Hubble Heritage Team (STScI)

For more information, go to *http://heritage.stsci.edu/2000/10/caption.html* and *http://www.nasa.gov/mission_pages/herschel/herschel20100511.html*

Second Saturday Stars

FREE EVENT

Every Month at the

John J. McCarthy Observatory

Behind the New Milford High School

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March 14th

8:00 - 10:00 pm

SPACESHIP EARTH

- Refreshments
- Family Entertainment
- Activity Center
- Stars & Planets
- Rain or shine

Map

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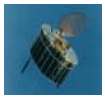
March 2015

Celestial Calendar

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1  Soviet spacecraft Venera 3 crashes on Venus (1966) Venera 13 makes successful landing (1982) Saturn's moon Helene discovered by Pierre Laques and Jean Lecheux (1980) 	**2** Launch of Pioneer 10 Jupiter flyby mission (1972)   Launch of Rosetta spacecraft to comet 67 P/ Churyumov-Gerasimenko (2004)	**3**  Launch of Apollo 9; first test of lunar module (1969) ESA's Mars Express spacecraft close flyby of Martian moon Phobos (2010) 	**4**  Giovanni Schiaparelli, born, first to describe Martian "canali" (1835)	**5** Moon at apogee (farthest from Earth)   Soviet spacecraft Venera 14 lands on Venus (1982) launch of the Air Force's second robotic space plane (X-37B) from the Cape Canaveral Air Force Station   Voyager 1 flyby of Jupiter (1979)	**6**  Flyby of comet Halley by Soviet Vega 1 spacecraft (1986) Launch of Kepler telescope, to search for exoplanets (2009)   Dawn spacecraft arrives at the dwarf planet Ceres	**7**  John Herschel born, first astronomer to survey southern hemisphere (1792)
8 Daylight Saving Time  Flyby of Comet Halley by Japanese Suisei spacecraft (1986) Discovery of Uranus' rings by NASA Airborne Observatory (1977)   Maiden voyage of the Jules Verne, Europe's first unmanned cargo ship to International Space station (2008)	**9** Flyby of comet Halley by Vega 2, Soviet spacecraft (1986)   Sputnik 9, with dog Chernushka (1961) Yuri Gagarin born - first to orbit Earth (1934) 	**10**  Flyby of Comet Halley by Japanese Sakigake spacecraft (1986)  Mars Reconnaissance Orbiter arrives at Mars (2006)	**11** Urbain Leverrier born - Predicted existence of Neptune (1811)   Launch of Pioneer 5 into solar orbit to study interplanetary magnetic fields (1965)	**12**  Simon Newcomb born - Canadian-American astronomer, studied planetary motion (1855)	**13** Percival Lowell born (1855)   Discovery of Uranus by William Herschel (1781) Flyby of Comet Halley by ESA spacecraft, Giotto (1986) 	**14** Albert Einstein born (1879)   Giovanni Schiaparelli born, first to observe Martian "canali" (1835) JJMO earns Observatory Code 932 from IAU's Minor Planet Center for tracking of asteroid Geographos (2001)   2nd Saturday Stars Open House McCarthy Observatory
15  Abbé Nicolas Louis de Lacaille born, French astronomer, catalogued southern hemisphere stars and constellations (1713) San Juan Capistrano Meteorite Fall (1973) 	**16**  Robert Goddard First liquid fuel rocket (1926) First Titan 2 ICBM (1962)   Caroline Herschel born. first woman astronomer (1750)	**17**  Vanguard 1 artificial satellite (1958) Publication of *Sidereus Nuncius* on Galileo's astronomical observations (later taken on 2008 Hubble repair mission) (1610) 	**18** Alexei Leonov First Spacewalk (1965) Soviet Vostok rocket explodes during launch, killing 48 (1980)	**19** Moon at Perogee (Closest to Earth) Moon flyby by Japan's Hiten orbiter and impactor (1990)	**20** Vernal Equinox 6:45 PM EDT	**21** Launch of Ranger 9 Moon impact mission (1965)
22 Shannon Lucid, first American woman on Russian Space Station (1996)	**23** Launch of Gemini 3 (Grissom, Young) (1965) Wernher von Braun born (1912) First photo of Moon by J.W. Draper (1840)	**24** Planet Pluto (now *dwarf* planet) officially named by Lowell Observatory, on suggestion of Oxford schoolgirl, Venetia Burney (1930)	**25** Comet Hyakutake 1996 Christiaan Huygens, discovers Saturn's oonTitan (1655) Launch of IMAGE spacecraft, first to study Earth's magnetosphere (2000)	**26** John Draper takes first photograph of the Moon (1840) French mathematician and discoverer of Neptune, Urban Jean Joseph Le Verrier, proposes existence of a new planet Vulcan within orbit of Mercury (1859)	**27** Eisenhower approves military lunar program (1958) Launch of Mariner 7 Mars flyby mission (1969)	**28** Flyby of Halley's Comet by ICE spacecraft (1986)
29 First flyby of Mercury by the Mariner 10 spacecraft (1974) Heinrich Olbers discovers the asteroid 4 Vesta (1807) 	**30** Bernhard Voldemar Schmidt born - German astronomer and inventor of the Schmidt telescope, known for its high definition and wide field of view (1879)	**31** Launch of Soviet spacecraft Luna 10, first to orbit Moon (1966)				

Phases of the Moon

March 5 March 13

March 20 March 27