At 63 light years from Earth, exoplanet HD 189733b would appear ideal for a warp drive vacation, except for the weather - temperatures over 1000 degrees Celsius and raining glass driven by 7000 Kilometer winds. This artist's impression is based on successive observations of the planet's orbit of its host star, not from an AAA guidebook.

For more information, go to http://sci.esa.int/hubble/52045-hubble-spots-azure-blue-planet-heic1312/.

Source: NASA, ESA, M. Kornmesser
Galactic Observer

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http://www.mccarthyobservatory.org
International Observe the Moon Night

Earth viewed from the Moon on the 12th, as generated by the JPL Solar System Simulator
http://space.jpl.nasa.gov/

Moon viewed from the Earth on the 12th, as generated by the NASA/Goddard Space Flight Center Scientific Visualization Studio, Moon Phase and Libration 2013
http://svs.gsfc.nasa.gov/vis/a000000/a004000/a004000/
“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 space-faring nation. Still, 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).

Sir Frederick William Herschel was a German-born British astronomer (1738–1822), best known for his discoveries of the planet Uranus, two of its moons (Titania and Oberon), and two of Saturn’s moons (Enceladus and Mimas). He also discovered and catalogued thousands of double stars, star clusters and nebula through his home-built telescopes, initially as an amateur, and later as the “King’s Astronomer” to King George III.

While an exceptionally devoted and keen observer, Herschel occasionally engaged in wild speculation, both privately in his journals and in open letters to colleagues. In April 1787, Herschel reported having seen three active volcanoes on the Moon in a letter to the Royal Society of London. The volcanoes were observed by Herschel on the nights of April 19th and 20th, one and two days, respectively, past the New Moon. The brightest, described as “an eruption of fire, or luminous matter” was in the vicinity of Aristarchus crater. The French astronomer, Joseph Jérôme Lalande, a frequent correspondent with Herschel, dismissed the observations as reflections of Earthlight. Following Lalande’s rebuff, Herschel made no further public assertions regarding lunar volcanism (quite possibly since Lalande had previously suggested that Uranus be named Herschel in honor of its discoverer.)

Today, while the Moon is not known to have active volcanoes, observers still report transient lunar phenomena (or TLPS), most notably in the vicinity of the Aristarchus plateau. These short-lived, bright features are thought to be caused by the outgassing of subsurface gas deposits, supported by the detection of radon gas by NASA’s Lunar Prospector spacecraft in the vicinity of the Aristarchus crater (and Kepler crater). The gas clouds would be illuminated by sunlight (or Earthlight), making them visible to an observer.

Less credible were Herschel’s private musings on lunar life, cities and forests (and even life on the Sun). Journal entries describe his observations of forests of vegetation in Mare Humorum (Sea of Moisture) and contemplation of how massive such vegetation would need to be to be visible from Earth. Herschel also surmised that the Moon’s craters were actually towns and cities, built and occupied by Lunarians. Fortunately, he kept these sentiments to himself.

A series of sketches of imagined life on the Moon, published in the New York Sun in 1835, were falsely attributed to Herschel. A slightly more credible novel by Edgar Allen Poe described a hot air balloon trip to the Moon. Source: Wikipedia.
Volcanoes and Forests

- Aristarchus Plateau
- Mare Humorum
International Observe the Moon Night

October 12th is the fourth annual International Observe the Moon Night (InOMN). The event was first inspired by public outreach events held in August 2009 by the Lunar Reconnaissance Orbiter (LRO) and Lunar CRater Observation and Sensing Satellite (LCROSS) educational teams at the Goddard Space Flight Center in Greenbelt, Maryland and at the Ames Research Center in Moffett Field, California, respectively. In 2010, the Lunar and Planetary Institute and Marshall Space Flight Center joined Goddard and Ames in a world-wide event to raise public awareness of lunar science and exploration. Additional information on scheduled events can be found on http://observethemoonnight.org/.

This year, observers will be treated to an 8-day old Moon, with sunrise (the terminator) crossing Mare Imbrium (Sea of Showers), just west of the Apennine Mountains and the landing site of Apollo 15.
Uranus at Opposition

Uranus reaches Opposition on the 3rd, rising with the setting Sun and visible all night. It was the first planet to be discovered in the age of the telescope, although it can be seen with the naked eye under ideal conditions. The seventh planet from the Sun had been observed on several occasions in 1690 by English astronomer John Flamsteed (and mistaken for a star) and between 1750 and 1769 by French astronomer Pierre Lemonnier before it was “discovered” by William Herschel in 1781, although he reported his discovery as a new comet. It wasn’t until other observers had established a nearly circular orbit for the new object, and the absence of any cometary features, that Herschel conceded that he had discovered a planet.

Herschel attempted to honor his patron, King George III, by naming the new planet Georgium Sidus or George’s Star; however, the name was not well received outside of England. A name from mythology was eventually agreed upon, although Uranus (also known as Ouranos), is the only planet named after a Greek rather than Roman deity. Uranus was known as the god of the sky and son of Gaia. He was also the father of Cronus (Saturn), and grandfather of Zeus (Jupiter).

Uranus has several unique characteristics. Its axis is tilted more than 90°, quite possibly the result of an ancient impact, so at times during its orbit around the Sun, one pole or the other is pointed towards the Sun. Its magnetic field is also tilted from its rotational axis and is offset from the planet’s center.

While its year is long, its day is short, spinning rapidly every 17 hours and 14 minutes. Seasons during the 84 year long orbit are 21 years in length, with significant portions of the planet in perpetual light or darkness. Closer to the Sun than Neptune, Uranus is the coldest planet in the solar system (Neptune generates more internal heat). While primarily composed of hydrogen and helium, it has more methane in its atmosphere than the gas giants Jupiter and Saturn, as revealed in its bluish tint. Uranus and Neptune both have icy mantles and are sometimes referred to as ice giants.

Uranus has a low density; only Saturn is less dense. Like Saturn, Uranus has a ring system - although they are much darker, as compared to Saturn’s bright ice rings. Twenty-seven moons have been discovered in orbit around Uranus, only five of significant size. Its largest moon, Titania, is less than 1,000 miles in diameter, less than half that of Earth’s moon. Unlike most moons in the solar system which are named after mythological characters, the moons of Uranus are named after characters from the works of William Shakespeare and Alexander Pope.

In 2006, the Hubble Space Telescope photographed a new pair of rings and two new, small moons orbiting the planet. The rings and one of the moons are so far from the planet that they are considered a "second ring system."
Nova in Delphinus

A classical nova (Latin for “new”) occurs when a white dwarf star in a binary system accumulates enough material (hydrogen) from its companion star to produce a thermonuclear explosion on its surface. The explosion causes a brief, but dramatic, increase in the star’s brightness. The process can be repeated again and again as the white dwarf accumulates addition hydrogen. Novae that brighten to be visible to the naked eye occur every 10 years on average.

Koichi Itagaki of Yamagata, Japan, discovered this type of nova in an image he had taken on August 14th (the star not being visible in a similar image taken the previous night). The 17th magnitude star brightened by a factor of 100,000, reaching 4.5 magnitude before slowly fading.

Illustration Credit: NASA/CXC/M.Weiss

Credit: American Association of Variable Star Observers
Nova Delphini 2013 Imaged on August 23, 2013

30 sec guided exposure, Nikon D-80, 50 mm
Quest for a Reusable Single Stage to Orbit Rocket

Twenty years ago, a prototype of a reusable, single-stage-to-orbit space vehicle took to the skies of New Mexico. The DC-X (Delta Clipper Experimental) was a proof-of-concept vehicle constructed by McDonnell Douglas in conjunction with the Department of Defense’s Strategic Defense Initiative Organization. The first flight lasted only 59 seconds, but conceptually demonstrated the spacecraft’s ability to take off and return in a vertical configuration.

The vehicle and technology were transferred to NASA in 1996. Its successor, the DC-XA, was an upgraded version, with an improved control system. On June 8, 1996, the vehicle set an altitude and duration record, flying to a height of more than 10,000 feet during 142 seconds of flight. Unfortunately, the vehicle was severely damaged on its next (and last) flight when a fire, fed by a cracked liquid oxygen tank, engulfed a toppled vehicle after a landing strut failed. Political wrangling within NASA, pressure from competitors, and budget cuts ultimately led to the program’s cancellation.

Since that time, there have been attempts to resurrect the reusable single-stage-to-orbit space vehicle, with mixed success. Several of the engineers who worked on the DC-X went on to work for Blue Origin.

Blue Origin, owned by Amazon.com founder and businessman Jeff Bezos, is developing reusable, suborbital and orbital launch vehicles that can take off and land vertically. The first in a planned series of “New Shepard” launch vehicles, designated “Goddard,” has been tested at a remote facility in western Texas. A sub-scale version of the vehicle made its first flight in 2006.

In 2012, the company demonstrated a pad escape by ejecting a full-scale crew capsule from the launch vehicle. The capsule reached an altitude of 2,300 feet before safely returning to Earth by parachute.

Blue Origin is currently working on a new vehicle capable of carrying crew and cargo into space. Once in space, the crew module will separate from the propulsion module and return to the launch site (a powered landing). The crew capsule will return by parachute. Both components are designed for reuse.
Masten Space Systems, Inc. (Masten) is another company working on a reusable vertical takeoff and vertical landing vehicle. Their current vehicle (Xaero) is capable of carrying small payloads to an altitude of approximately 18 miles. The next generation vehicle, Xogdor, will be capable of attaining an altitude of 60 miles.
A newcomer to the competition, but no less qualified, is Space X. Known for its Falcon rocket boosters and ISS servicing missions, Space X is also tinkering with a vertical launch vehicle, code name “Grasshopper.” On August 13, 2013, Grasshopper flew to an altitude of approximately 800 feet before moving laterally 300 feet and returning back to the launch pad. Standing 106 feet high and powered by a single Merlin 1D engine, the rocket uses many of the Falcon’s components. Space X plans to move to the White Sands Missile Range in New Mexico for high altitude, high speed testing. Ultimately, the lessons learned from Grasshopper will be used to develop reusable versions of the Falcon 9 and Falcon Heavy boosters.

**Eclipse Watching on Mars**

The Mars rover Curiosity took a break from its exploration of Gale crater on August 17th to record Phobos (the larger of the two Martian moons), passing in front of the Sun. The three images (below) were taken three seconds apart and show the irregular shaped moon traversing the solar disk. The observations will be used to refine Phobos’ orbit.
Comet Watching on Mars

Earth-bound viewers will have to wait until late November or early December for optimal views of comet ISON, as it heads for a close encounter with the Sun. Martian observers, however, will have a front row seat as ISON passes within 6.5 million miles (10.4 million km) of the Red Planet on October 1st, six times closer than its closest approach to Earth (assuming it survives).

Martian Invasion

In the late 1930s, a critically acclaimed New York drama company was founded by Orson Welles and John Houseman (with total monetary assets of $100). Together, they produced “The Mercury Theatre on the Air.” The first show was broadcast on CBS radio in July 1938. Originally without a sponsor, the program was picked up by Campbell’s Soup after the October 30th broadcast of H.G. Wells’ “War of the Worlds.” Orson Welles’ adaptation incorporated simulated news bulletins of a Martian invasion during a seemingly ordinary broadcast of a local orchestra. Many listeners panicked, fearing a real Martian invasion and the reported destruction of Grovers Mill, New Jersey. While the production was strongly denounced for its deceptive tactics, it did propel the 23 year old Welles on his way to fame and fortune.

You can download the complete radio broadcast at http://www.mercurytheatre.info/. 
Autumnal Conjunctions

A setting crescent moon and the planet Venus (captured on September 8\textsuperscript{th}) will once again be near the western horizon on the nights of October 7\textsuperscript{th} and 8\textsuperscript{th}, although the separation between the two celestial bodies will be greater.
On Its Way

It came out of the trees along the southwest horizon, glowing like a hot ember, and then disappeared. It materialized again several seconds later, continuing along an eastern trajectory, arcing through a star-studded sky, leaving a lingering, ghostly trail.

The clear night sky along the east coast on September 6th provided spectators the opportunity to witness the launch of NASA’s Lunar Atmosphere and Dust Environment Explorer (LADEE) spacecraft aboard a Minotaur 5 rocket from Wallops Island, Virginia. Bound for the Moon, the five stage rocket was clearly visible from Connecticut around 11:30 p.m. The launch was picture perfect with all five stages performing as expected. The 844 pound spacecraft successfully separated from the rocket and started its month long journey and rendezvous with the Moon.

The image (below) was a 10 second exposure showing the firing of the third stage as the rocket streaked across the southern sky (as seen from New Milford, Connecticut).

The Solar Cycle

The Sun’s activity waxes and wanes on an eleven year cycle. One measure of activity is the number of sunspots on the side of Sun facing Earth. The abundance correlates with the total solar irradiance (brightness summed across all wavelengths), solar wind pressure and solar radio emissions. As with weather on Earth, solar weather can be unpredictable.
The current Solar Cycle 24 was originally expected to begin in 2008. Instead of the activity increasing, the Sun defied expectations and headed into a deeper minimum. There were no sunspots observed on 266 of that year’s 366 days (73%) (the least active period since 1913). A comparable spotless period (71%) followed in 2009. Solar activity returned in 2010 with only 14% of the days without a visible sunspot, followed by a near continuous parade of sunspots across the solar disk in 2011 and 2012. As we await solar maximum, solar activity is now at an unanticipated low level. Clearly, our understanding of our nearest star is incomplete.

Imagination and Vision

One hundred and fourteen years ago (1899), on a quiet October afternoon in Worcester, Massachusetts, a 17 year old Robert Goddard climbed a tall cherry tree in the backyard to trim some dead limbs. From high in the tree, he looked out upon the horizon and imagined how wonderful it would be to create a means of traveling to the planet Mars. Twenty-seven years later, in 1926, Goddard would launch the world’s first liquid fuel rocket from a field in nearby Auburn. Today he is considered one of the founding fathers of modern rocketry.

October Nights

As the nights grow longer and cooler our view of the night sky begins to change. Summer evenings showcase our own galaxy, the Milky Way. The center of our spiral galaxy is in the direction of the constellation Sagittarius, which appears in the southern sky throughout the summer. In the autumn, as Sagittarius disappears into the west, the stars forming the Great Square of Pegasus rise in the east. Following Pegasus is the Andromeda Galaxy, one of the most distant objects that can be seen with the unaided eye at approximately 2.5 million light years (14.7 million trillion miles). With the rising of Andromeda, we begin to look outward to the outer arms of our own galaxy and to other galaxies far, far away.

Sunrise and Sunset

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<tr>
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<tr>
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<tr>
<td>Oct 15th</td>
<td>07:06</td>
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<td>Oct 31st</td>
<td>07:25</td>
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Astronomical and Historical Events

1st History: NASA created by the National Aeronautics and Space Act (1958)
2nd History: opening of the Hayden Planetarium (1935)
3rd Uranus at Opposition; rising with the setting Sun and visible all night
3rd History: launch of the fifth Mercury flight, piloted by astronaut Walter Schirra (1962)
3rd History: fall of the Zagami Martian meteorite in Katsina Province, Nigeria; the meteorite is classified as a Shergottite and is the largest single individual Mars meteorite ever found at 40 pounds (1962)
3rd History: fall of the Chassigny Martian meteorite in Haute-Marne province, France; the meteorite is distinctly different from other Martian meteorites (shergottites and nakhlites) and is classified as its own subgroup – “chassignites” (1815)
4th New Moon
4th History: Japanese lunar probe “Selenological and Engineering Explorer” (SELENE) enters lunar orbit; also known as Kaguya, the spacecraft was designed to study the geologic evolution of the Moon (2007)
4th History: SpaceShipOne rockets to an altitude of almost 70 miles to win the $10 million Ansari X Prize (2004)
4th History: launch of Luna 3; Soviet spacecraft was first to photograph the far side of the Moon (1959)
4th History: launch of Sputnik 1, world’s first artificial satellite (1957)
5th History: Robert Goddard born, founding father of modern rocketry (1882)
6th History: Asteroid 2008 TC3 discovered by astronomers on Mt. Lemmon less than 24 hours before exploding over the Sudan. The McCarthy Observatory submitted the last accepted observation. Fragments of the asteroid were eventually recovered. (2008)
6th History: launch of the space shuttle Discovery and the solar polar orbiter spacecraft Ulysses (1990)
7th Kuiper Belt Object 303775 (2005 QU182) at Opposition (49.284 AU)
8th Kuiper Belt Object 19308 (1996 TO66) at Opposition (46.104 AU)
8th History: discovery of Supernova 1604 (Kepler’s Nova) (1604)
Astronomical and Historical Events for July (continued)

9th Mercury at its Greatest Eastern Elongation; apparent separation from the Sun in the evening sky (25°)
9th Draconids Meteor Shower peak (produced by debris from Comet Giacobini-Zinner)
9th History: LCROSS impacts crater Cabeus near the Moon’s south pole in search of water (2009)
9th History: Peekskill meteorite fall; 27 pound meteorite hits a 1980 Chevy Malibu sitting in its driveway in Peekskill, NY (1992)
10th Moon at perigee (closest distance to Earth)
10th History: inauguration of the Very Large Array, one of the world’s premier astronomical radio observatories; located west of Socorro, New Mexico (1980)
10th History: enactment of the Outer Space Treaty: 1) prohibited placement of nuclear and other weapons of mass destruction in orbit, on the Moon or other celestial body and 2) limited the use of the Moon and other celestial bodies to peaceful purposes (1967)
10th History: discovery of Neptune’s moon Triton by William Lassell (1846)
11th First Quarter Moon
11th History: NASA’s historic 100th space shuttle flight as Discovery carries the Z1 Truss (first piece of the ISS structural backbone) into space (2000)
11th History: Magellan spacecraft burns up in the Venusian atmosphere after completing its mission to map the planet with its imaging radar (1994)
11th History: launch of first manned Apollo mission (Apollo 7) with astronauts Schirra, Eisele and Cunningham (1968)
11th History: launch of WAC Corporal, first man-made object (16 foot rocket) to escape Earth’s atmosphere (1945)
12th Second Saturday Stars and the International Observe the Moon Night at the McCarthy Observatory (7:00 p.m.)
12th Kuiper Belt Object 202421 (2005 UQ513) at Opposition (47.544 AU)
12th History: launch of Voskhod 1; Soviet spacecraft was first to carry multiple (3) cosmonauts (a pilot, scientist and physician) into space. Due to the cramped conditions the crew flew without spacesuits, ejection seats, or an escape tower (1964)
12th History: first Symposium on Space Flight held at the Hayden Planetarium in New York City; participants included Wernher von Braun, Willy Ley, and Fred L. Whipple; topics included an orbiting astronomical observatory, survival in space, circumlunar flight, a manned orbiting space station, and the question of sovereignty in outer space (1951)
13th History: launch of Shenzhou 6, China’s second manned spacecraft (2005)
13th History: launch of Explorer 7; spacecraft measured solar X-rays, energetic particles, and cosmic rays (1959)
13th History: formation of the British Interplanetary Society by Phillip Cleator in Liverpool (1933)
14th Scheduled flyby of Saturn’s largest moon Titan by the Cassini spacecraft
14th History: three main belt asteroids discovered by the McCarthy Observatory while searching for NEOs. 2003 TG10 (its provisional name) was subsequently named after Monty Robson (115449 Robson), the founder and director of the observatory (2003)
14th History: launch of Shenzhou 5, first Chinese manned spacecraft (2003)
14th History: Air Force Captain Chuck Yeager breaks the sound barrier in the Bell X-1 rocket plane (called “Glamorous Glennis” as a tribute to his wife). The plane reached a speed of 700 miles per hour after being launched from the bomb bay of a Boeing B-29 (1947)
15th Dwarf Planet Eris (formally 2003 UB313 and/or Xena) at Opposition; first Kuiper Belt object discovered to be larger than Pluto (95.476 AU)
15th History: launch of the Cassini spacecraft to the planet Saturn (1997)
16th History: launch of GOES 1, first weather satellite placed in geosynchronous orbit (1975)
17th Comet 2P/Encke closest approach to Earth (0.478 AU)
18th Full Moon (Full Hunter’s Moon)
Astronomical and Historical Events for July (continued)

18th History: launch of the space shuttle Atlantis (STS-34) and Galileo spacecraft to Jupiter (1989)
18th History: discovery of Chiron by Charles Kowal; Chiron has the characteristics of both a comet and an asteroid. These types of objects are called Centaurs after a mythological being that are half human/half horse (1977)
18th History: Soviet spacecraft Venera 4 enters the atmosphere of Venus; first probe to analyze the environment (in-situ) of another planet (1967)
18th History: discovery of Asteroid 8 Flora by John Hind (1847)
19th History: Kuiper Belt Object 55636 (2002 TX300), discovered by the Palomar Mountain Near-Earth Asteroid Tracking (NEAT) program in 2002, at Opposition (41.087 AU)
19th History: launch of IBEX (Interstellar Boundary Explorer) to explore the interactions between the solar wind and the interstellar medium at the edge of our solar system (2008)
19th History: Soviet spacecraft Venera 9 touches down on Venus and transmits first pictures (black and white) of its surface (1975)
19th History: launch of the Soviet spacecraft Zond 8; moon flyby mission (1970)
19th History: discovery of asteroid 577 Rhea by Max Wolf (1905)
21st Orionids meteor shower peak (produced by debris from Comet Halley)
21st Scheduled launch of India’s Mars Orbiter “Mangalyaan” from the Satish Dhawan Space Center, Sriharikota, India
21st History: opening of the Yerkes Observatory in Williams Bay, Wisconsin; home of the world’s largest refractor with its 40-inch objective lens manufactured by Alvan Clark and Sons (1897)
22nd History: launch of Chang’e-1, Chinese lunar orbiter, from the Xichang Satellite Launch Center in the southwestern province of Sichuan (2007)
22nd History: launch of Chandrayaan-1, India’s first mission to the Moon (2008)
23rd History: first time female commanders led orbital missions at the same time: Pamela Melroy commanded space shuttle Discovery (STS-120) to the ISS while Peggy Whitson led the Expedition 16 team aboard the ISS in the installation of a new orbital node (2007)
23rd Kuiper Belt Object 15760 (1992 QB1); first resident of the Kuiper Belt found beyond Pluto at Opposition (40.188 AU)
23rd History: first time female commanders led orbital missions at the same time: Pamela Melroy commanded space shuttle Discovery (STS-120) to the ISS while Peggy Whitson led the Expedition 16 team aboard the ISS in the installation of a new orbital node (2007)
24th History: discovery of Uranus’ moons Umbriel and Ariel by William Lassell (1851)
25th History: launch of the twin Solar Terrestrial Relations Observatories (STEREO A and B); 3-D studies of the Sun and coronal mass ejections (2006)
25th History: Soviet spacecraft Venera 10 touches down on Venus 2,200 km from its twin Venera 9; lands on a flat boulder that was determined to be similar in composition to basalt on Earth (1975)
25th History: launch of Deep Space 1; first of a series of technology demonstration probes developed by NASA’s New Millennium Program; propulsion was provided by a xenon ion engine that operated for a total of 16,265 hours (1998)
26th History: discovery of Saturn’s moon Iapetus by Giovanni Cassini (1671)
26th Last Quarter Moon
27th History: first test flight of the Saturn I rocket (1961)
27th History: first test flight of the Ares I-X rocket; a two minute powered suborbital flight (2009)
28th History: launch of Prospero spacecraft, Great Britain’s first space launch (1971)
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
All other non-credited photos were taken by the author: Bill Cloutier
FREE EVENT
Every Month at the
John J. McCarthy Observatory
Behind the New Milford High School
860.946.0312
www.mccarthyobservatory.org

October 12th
7:00 - 9:00 pm

ENJOYING A
LUNAR SUNRISE

Refreshments
Family Entertainment
Activity Center
Stars & Planets
Rain or shine
### October 2013 Celestial Calendar

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<tr>
<th>6</th>
<th>Launch of space shuttle Discovery and solar orbiter spacecraft Ulysses (1990)</th>
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<td>11</td>
<td>Launch of V sokhod 1, Soviet spacecraft, first manned mission (1966)</td>
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<td>12</td>
<td>Launch of Explorer 7 spacecraft (1959)</td>
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<tr>
<td>13</td>
<td>Launch of Pioneer Venus orbiter completes mission and begins fiery plunge into Venusian atmosphere (1992)</td>
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<tr>
<td>14</td>
<td>Dwarf Planet Eris (formally 2003 UB115) at Opposition (May 2014)</td>
</tr>
<tr>
<td>15</td>
<td>Launch of Cassini spacecraft to planet Saturn (1997)</td>
</tr>
<tr>
<td>16</td>
<td>Launch of Voyager 1, first spacecraft to escape Earth's atmosphere (1980)</td>
</tr>
<tr>
<td>17</td>
<td>Launch of Voyager 2, second spacecraft to escape Earth's atmosphere (1986)</td>
</tr>
<tr>
<td>18</td>
<td>Launch of Delta 4, first rocket to carry multiple components (1964)</td>
</tr>
<tr>
<td>19</td>
<td>Launch of Probes to outer planets (1979)</td>
</tr>
<tr>
<td>20</td>
<td>Discovery of asteroid 577 Wolf (1905)</td>
</tr>
<tr>
<td>21</td>
<td>Opening of the Yerkes Observatory, Wisconsin, with world's largest refractor lens (40&quot;) (1897)</td>
</tr>
<tr>
<td>22</td>
<td>Launch of the Soviet spacecraft Luna 12 to take high-resolution photos of the Moon's surface from lunar orbit (1966)</td>
</tr>
<tr>
<td>23</td>
<td>Launch of India's first Moon mission Chandrayaan-1 (2008)</td>
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<tr>
<td>25</td>
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</tr>
<tr>
<td>28</td>
<td>Launch of Prospero, Britain's first space mission (1971)</td>
</tr>
<tr>
<td>29</td>
<td>Launch of space shuttle Discovery (STS-95) with astronaut and former senator John Glenn (1998)</td>
</tr>
<tr>
<td>30</td>
<td>Discovery of asteroid 577 Wolf (1905)</td>
</tr>
<tr>
<td>31</td>
<td>First rocket engine tests that spawned the Jet Propulsion Laboratory (1936)</td>
</tr>
</tbody>
</table>

### Phases of the Moon

- **Oct 4**: Full moon
- **Oct 11**: New moon
- **Oct 18**: First quarter moon
- **Oct 28**: Last quarter moon