Snake River Skies

The Newsletter of the Magic Valley Astronomical Society

November 2020

Membership Meeting
See President's Message for November

Centennial Observatory
Due to the impossibility of maintaining proper social distance within the confined space of the observatory dome, the observatory is currently closed until further notice. See President's Message.

Faulkner Planetarium
See inside for Details

www.mvastro.org

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Magic Valley Astronomical Society is a member of the Astronomical League

M-51 imaged by
Rick Widmer &
Ken Thomason
Herrett Telescope - Shotwell Camera

MVAS President's Message

A VERY HAPPY END OF DAYLIGHT SAVINGS TIME! AS YOUR VICE-PRESIDENT, I GET THE HONOR OF VISITING WITH YOU THIS MONTH. THE FALL SEASONS' MONTHS ARE UPON US WITH COOLER TEMPERATURES AND THE OFTEN EXCELLENT VIEWIING WITH CLEARER SKIES. IT'S ESPECIALLY GOOD FOR VIEWING THROUGH TELESCOPES, BINOCULARS AND CAMERA LENSES. IT IS ONE OF MY FAVORITE TIMES FOR GALAXIES, SUCH AS M31, M33 AND NGC 891, ALONG WITH RICH OPEN CLUSTERS IN PERSEUS, CASSIOPEIA, AND ANDROMEDA.

WHEREAS COVID-19 CONTINUES TO MAINTAIN ITS PRESENCE IN THE MAGIC VALLEY, TAKING ADEQUATE SAFETY PRECAUTIONS IS AN UTMOST CONCERN. WE AT MVAS TAKE THIS SERIOUSLY AND HAVE ATTEMPTED TO PROVIDE INFORMATIVE AND INFORMATIONAL MEETINGS VIRTUALLY, VIA ZOOM. WHILE THIS METHOD MAY NOT APPEAL TO SOME OF US, IT HAS STILL PROVIDED A GOOD AND TIMELY WAY TO DO SO. PERSONALLY, I HAVE LEARNED TO USE THIS TOOL AND WHILE IT DOESN'T OFFER ALL THE BENEFITS OF FACE-TO-FACE COMMUNICATION, IT IS STILL A VIABLE OPTION. (IF ANY OF YOU WOULD LIKE A WALK-THROUGH ON HOW TO USE ZOOM, PLEASE CONTACT ME) AS A SIDE NOTE, YOU CAN ACCESS ZOOM THROUGH YOUR DESK TOP, LAP TOP, IPAD OR SMART PHONE. IPHONES AND MOST OF THE NEWER ANDROIDS WILL WORK WELL WITH ZOOM.

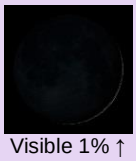
A FEW THINGS OF NOTE CONCERNING OUR RECENT ELECTIONS, VIA EMAIL, THE CURRENT BOARD WAS RE-ELECTED TO SERVE FOR THE COMING YEAR, 2021: ROB MAYER, PRESIDENT; GARY LEAVITT, VICE-PRESIDENT; JIM TUBBS, TREASURER AND JAY HARTWELL AS SECRETARY.

THE NOVEMBER MVAS MEETING SCHEDULED FOR NOV 14, WILL FEATURE THE YEAR IN PICTURES. AND DUE TO COVID, IT WILL BE HELD VIA ZOOM AT 7PM. THE BOARD HAS DISCUSSED OUR ANNUAL CHRISTMAS PARTY (SCHEDULED FOR DEC 12), BUT HAS NOT YET DECIDED ON ITS DISPOSITION. WE WILL SEND OUT AN EMAIL AS SOON AS IT'S DETERMINED HOW TO PROCEED ON THIS MATTER. AS MENTIONED EARLIER, THE HERRETT CENTER HAS REOPENED. BUT, AGAIN, PRECAUTIONS DUE TO COVD-19 REQUIRE LIMITATIONS ON THOSE PLANNING ON ATTENDING THE OBSERVATORY. ONLY GROUPS WHO ARRIVE TOGETHER CAN PROCEED TO THE OBSERVATORY ONE GROUP AT A TIME. TELESCOPE TUESDAYS WILL STILL BE CONDUCTED THE 2ND AND 4TH TUESDAYS NOVEMBER THRU FEBRUARY. ALSO NOTE THAT DUE TO THE RETURN TO STANDARD TIME, THE OBSERVATORY WILL BE OPENED FOR TELESCOPE TUESDAYS AND FOR THE 2ND SATURDAY OF EACH MONTH STAR PARTY. TELESCOPE TUESDAY TIMES WILL BE FROM 5PM TO 9PM. CHRIS SAID HE WOULD ENTERTAIN THE SATURDAY NOVEMBER 14TH STAR PARTY ON THE GROUND OUTSIDE, WEATHER AND VOLUNTEERS PERMITTING. TIME 7PM TO 9PM. NOT MIDNIGHT. A PREVIOUS EMAIL STRING DISCUSSED NEXT SUMMER'S CLUB OUTDOOR ACTIVITIES, PRIMARILY HAGERMAN FOSSIL BEDS AND ALBION CITY OF THE ROCKS. STILL UNDER DISCUSSION ARE THE DATES. FOR HAGERMAN IT LOOKS LIKE EITHER JUNE 5TH OR JUNE 12TH. AND FOR COR, EITHER THE WEEKEND OF JULY 2-3 OR JULY 9-10. MORE ON THAT LATER.

THE BEST TO ALL OF YOU FOR A VERY HAPPY AND SAFE THANKGIVING,
GARY LEAVITT, VP MAGIC VALLEY ASTRONOMICAL SOCIETY.

Calendar

November 2020

Sun	Mon	Tue	Wed	Thu	Fri	Sat
1 Cold Moon  Visible 99.4% Age: 15.54 Days	2 End Daylight Saving Time On Sunday 	3	4	5	6 BSU 1st Friday Astronomy Event Information on page 3	7
8 Last Quarter Moon  Visible: 51% ↓ Age: 22.09 Days	9	10 Centennial Observatory Telescope Tuesday 	11 Veterans Day Remembrance Day 	12	13	14 MVAS General Meeting see president's msg. for details Centennial Observatory Public Star Party 6p - 9p
15 New Moon  Visible 1% ↑ Age: .32 Days	16	17 Leonid meteor shower peaks 	18	19 Waxing Crescent Moon Jupiter & Saturn Visible 	20	21
22 First Quarter Moon  Visible 53% ↑ Age: 7.66 Days	23	24 Centennial Observatory Telescope Tuesday 	25	26 Thanksgiving Day 	27	28
29	30 Penumbral Lunar Eclipse Frost Moon (full)  Visible 100% Age: 14.85 Days					

Be Careful – Be Safe – Get Out There – Explore Your Universe

Special Announcement

Boise State Physics
First Friday Astronomy

Friday, Nov 6th

A Practical Guide to Time Travel

Prof. Barbara Ryden
Dept. of Astronomy
The Ohio State University

Online lecture begins 7:30pm MT

http://www.astrojack.com/ffa-time-travel

Donate at **give.boisestate.edu/astronomy**

November Celestial Calendar by Dave Mitsky

All times, unless otherwise noted, are UT (subtract 7 hours and, when appropriate, 1 calendar day for MDT)

11/1 Daylight Saving Time (DST) ends today; asteroid 8 Flora (magnitude +8.1) is at opposition in the constellation of Cetus at 6:00; Mercury is 4.0 degrees northeast of the first-magnitude star Spica (Alpha Virginis) at 20:00
11/2 Mercury is at perihelion (0.3075 astronomical units from the Sun) at 3:00; the Moon is 5.8 degrees southeast of the bright open cluster M45 (the Pleiades or Subaru) in Taurus at 12:00; Jupiter and Saturn are at heliocentric conjunction (longitude 301.8 degrees) at 19:00; the equation of time is at a maximum of 16.49 minutes at 21:00
11/3 The Moon is 4.5 degrees north of the first-magnitude star Aldebaran (Alpha Tauri) at 6:00; Mercury is stationary, with prograde (direct) or eastern motion to resume, at 8:00
11/4 The Moon is at the ascending node (longitude 80.3 degrees) at 3:00; the Moon is 7.5 degrees south of the first-magnitude star Castor (Alpha Geminorum) at 15:00
11/5 The Moon is 0.2 degrees north of the bright open cluster M35 in Gemini at 2:00; the peak of the Southern Taurid meteor shower (a zenithal hourly rate of 10 per hour) is predicted to occur at 6:00
11/6 The Moon is 3.8 degrees south of the first-magnitude star Pollux (Beta Geminorum) at 20:00
11/7 The Moon is 2.5 degrees north-northeast of the bright open cluster M44 (the Beehive Cluster or Praesepe) in Cancer at 22:00
11/8 Asteroid 3 Juno is in conjunction with the Sun at 9:00; Last Quarter Moon occurs at 13:46
11/9 The Curtiss Cross, an X-shaped illumination effect located between the craters Parry and Gambart, is predicted to be visible at 2:21; the Moon is 4.4 degrees north-northeast of the first-magnitude star Regulus (Alpha Leonis) at 14:00
11/10 Mercury is at greatest western elongation (19.1 degrees) at 17:00
11/12 The peak of the Northern Taurid meteor shower (a zenithal hourly rate of 15 per hour) is predicted to occur at 5:00; Mercury is at its northernmost latitude from the ecliptic plane (7.0 degrees) at 8:00
11/13 Mars and Uranus are at heliocentric conjunction (longitude 38.8 degrees) at 0:00; the Moon is 2.8 degrees north-northeast of Venus at 1:00; the Moon is 6.4 degrees north-northeast of Spica at 8:00; the Moon is 1.6 degrees northeast of Mercury at 23:00
11/14 The Moon is at perigee, subtending 33' 23" from a distance of 357,837 kilometers (222,350 miles), at 11:43
11/15 New Moon (lunation 1211) occurs at 5:07; Mars is stationary at 19:00
11/16 The Moon is 5.5 degrees north-northeast of the first-magnitude star Antares (Alpha Scorpii) at 9:00; Venus is 3.8 degrees north-northeast of Spica at 20:00
11/17 The Moon is at the descending node (longitude 260.1 degrees) at 0:00; the peak of the Leonid meteor shower (a zenithal hourly rate of 15 per hour) is predicted to occur at 12:00
11/19 The Moon is 2.5 degrees southeast of Jupiter at 10:00; the Moon, Jupiter, and Saturn lie within a circle with a diameter of 3.8 degrees at 13:00; the Moon is 2.8 degrees southeast of Saturn at 16:00
11/21 Venus is at its northernmost latitude from the ecliptic plane (3.4 degrees) at 10:00; the Moon is at a maximum libration for the year (9.4 degrees) at 20:00; the Sun is at an ecliptic longitude of 240 degrees at 21:00
11/22 First Quarter Moon occurs at 4:45; the Lunar X (Purbach or Werner Cross), an X-shaped clair-obscur illumination effect involving various rims & ridges between the craters La Caille, Blanchinus, and Purbach, predicted to occur at 14:54
11/23 The Sun enters the constellation of Scorpius (ecliptic longitude 241.1 degrees) at 0:00; the Moon is 4.2 degrees southeast of Neptune at 16:00
11/26 The Moon is 4.5 degrees southeast of Mars at 1:00
11/27 The Moon is at apogee, subtending 29' 26" from a distance of 405,894 kilometers (252,211 miles) at 0:29; the Moon 3.1 degrees southeast of Uranus at 20:00
11/28 The Moon is 5.8 degrees southeast of M45 at 19:00; the Sun enters the constellation of Ophiuchus (ecliptic longitude 248.1 degrees) at 20:00
11/29 Neptune is stationary, with prograde or eastern motion to resume, at 9:00
11/30 A penumbral eclipse of the Moon begins at 7:32; Full Moon, known as the Beaver or Frost Moon, occurs at 9:30; the Moon is 4.5 degrees north of Aldebaran at 12:00

Happy Birthdays in November

Nov 2nd Harlow Shapley (1885-1972)
Nov 8th Edmond Halley (1656-1742)
Nov 9th Carl Sagan (1935-1996)
Nov 15th William Herschel (1738-1822)
Nov 17th August Ferinand Möbius (1790-1868)
Nov 19th Eleanor F Helin (1932-2009)
Nov 20th Edwin Hubble (1889-1953)
Nov 21st Linda A Morabito (1953-now)
Nov 22nd Alan Stern (1957-now)
Nov 23rd Debra Elmegreen (1952-now)
Nov 27th Anders Celsius (1701-1744) . . . . . Johann Euler (1734-1800)
Nov 29th Christian Doppler (1803-1853)
Nov 29th Ernest William Brown (1866-1938)

The Sun, the Moon, & the Planets

The Moon is 15.0 days old, is 100.0% illuminated, subtends 29.7 arc minutes, and resides in Aries on November 1st at 0:00 UT. The Moon reaches its greatest northern declination on November 6th (+24.8 degrees) and its greatest southern declination on November 18th (-24.7 degrees). Longitudinal libration is at a maximum of +7.5 degrees on November 20th and a minimum of -7.4 degrees on November 8th. Latitudinal libration is at a maximum of +6.8 degrees on November 24th and a minimum of -6.7 degrees on November 11th. Favorable librations for the following lunar features occur on the indicated dates: Lacus Veris on November 5th, Crater Shaler on November 8th, Crater Schickard on November 11th, and Crater Vestime on November 21st. The Moon is at perigee (a distance of 56.11 Earth-radii) on November 14th and at apogee (a distance of 63.64 Earth-radii) on November 27th. New Moon occurs on November 15th. Large tides will take place for several days thereafter. The fourth lunar eclipse of the year, the 58th of Saros 116, occurs on November 30th. This penumbral eclipse will be fully visible from northwestern Europe, the North Atlantic Ocean, most of North America, Central America, the Pacific Ocean, and parts of Asia. Greatest eclipse occurs near the Hawaiian Islands at 9:42:52 UT1. See page 48 of the November 2020 issue of Sky & Telescope and http://www.eclipsewise.com/oh/ec2020.html#LE2020Nov30N for additional information on the eclipse. Consult http://www.lunar-occultations.com/iota/iotandx.htm for information on lunar occultation events. Visit https://saberdoesthestars.wordpress.com/2011/07/05/saber-does-the-stars/ for tips on spotting extreme crescent Moons and http://www.curtrenz.com/moon06.html for Full Moon data. Consult http://time.unitarium.com/moon/where.html or download http://www.ap-i.net/avl/en/start for current information on the Moon. Visit https://www.fourmilab.ch/earthview/lunarform/maria.html?fbclid=IwAR0L-CYMauWi6Hhc09wUanCBQeDKNEw3gVJBHRwr0QEcodMJtNWK1OLMxYk for a list of lunar maria and https://upload.wikimedia.org/wikipedia/commons/thumb/3/36/Moon_names.jpg/600px-Moon_names.jpg?fbclid=IwAR1zUN--tW5jgxQPVOfp_6PpRtvXjprmsdrR531bAAjotCZImsof8HUNAKI for a simple map of the Moon showing the most prominent maria. See https://svs.gsfc.nasa.gov/4768 for a lunar phase and libration calculator and https://quickmap.lroc.asu.edu/?extent=-90,-27.218173,90,27.218173&proj=10&layers=NrBsFYBoAZIRnpEBmZcAsjYIHYFcAbAyAbwF8BdJUTBbSfI0yq8iioA for the Lunar Reconnaissance Orbiter Camera (LROC) Quickmap. Click on https://www.calendar-12.com/moon_calendar/2020/november for a lunar phase calendar for this month. Times and dates for the lunar crater light rays predicted to occur this month are available at http://www.lunar-occultations.com/rlo/rays/rays.htm

The Sun is located in Libra on November 1st at 0:00 UT. It moves into Scorpius on November 23rd and Ophiuchus on November 28th.

Brightness, apparent size, illumination, distance from the Earth in astronomical units, and location data for the planets and Pluto on November 1st: Mercury (magnitude +1.6, 9.0", 14% illuminated, 0.75 a.u., Virgo), Venus (magnitude -4.0, 13.1", 81% illuminated, 1.27 a.u., Virgo), Mars (magnitude -2.1, 20.1", 98% illuminated, 0.47 a.u., Pisces), Jupiter (magnitude -2.2, 37.0", 99% illuminated, 5.33 a.u., Sagittarius), Saturn (magnitude +0.6, 16.3", 100% illuminated, 10.17 a.u., Sagittarius), Uranus (magnitude +5.7, 3.7", 100% illuminated, 18.83 a.u. on November 16th, Aries), Neptune (magnitude +7.9, 2.3", 100% illuminated, 29.51 a.u. on November 16th, Aquarius), and Pluto (magnitude +14.3, 0.1", 100% illuminated, 34.42 a.u. on November 16th, Sagittarius).

During the evening, Mars and Uranus are in the east, Jupiter and Saturn in the south, and Neptune in the southeast. Mars and Uranus lie in the southwest and Neptune in the west at midnight. Mercury and Venus are located in the east and Uranus in the west the morning sky.

A very thin crescent Moon, Mercury, Venus, and Spica form a trapezoid in the east-southeast on the morning of November 13th.

Mercury is visible in the eastern morning sky for the entire month. Northern hemisphere observers are favored. It brightens from magnitude +1.6 to magnitude -0.7 during November. The speediest planet increases in illumination from 14%, when it will appear as a tiny crescent, to 95%, while shrinking in apparent size from 9.0 to 5.0 arc seconds. Mercury shines at magnitude -0.6 when it attains greatest western elongation on November 10th and is at its greatest heliocentric latitude north on November 12th. The waning crescent Moon passes two degrees north of Mercury on November 13th. Mercury will rise almost an hour before the Sun as November ends.

Venus does not change much in brightness or angular size during November. The brightest planet lies just 20 arc minutes from the fourth-magnitude star Zaniah (Eta Virginis) on November 1st. The waxing crescent Moon passes three degrees north of Venus on November 15th.

As the Earth pulls away from **Mars**, it fades from magnitude -2.1 to magnitude -1.1, decreases in angular size from 20.1 to 14.8 arc seconds, and changes in phase from 98% to 92% illumination. Mars continues to retrograde until it reaches its second stationary point on November 15th. The waxing gibbous Moon passes five degrees south of the Red Planet on November 25th. The next time that Mars will achieve an apparent diameter greater than 20.0 arc seconds will be in 2033. Articles on Mars appear on pages 44 to 47 of the October issue of Astronomy and pages 48 to 50 of the October 2020 issue of Sky & Telescope. See https://curtrenz.com/mars.html for more on the 2020-2021 Martian perihelic apparition. Click on https://skyandtelescope.org/observing/interactive-sky-watching-tools/mars-which-side-is-visible/ in order to determine what Martian surface features are visible.

Jupiter dims from magnitude -2.2 to magnitude -2.0 and shrinks in angular size from 37.0 to 34.5 arc seconds over the course of November. The gap between Jupiter and Saturn decreases from 5.1 degrees to 2.3 degrees this month as the two gas giants head for a historic conjunction next month. Jupiter and Saturn are at heliocentric conjunction on November 2nd. The waxing crescent Moon passes two degrees south of Jupiter on November 19th. Information on Great Red Spot transit times and Galilean satellite events is available on pages 50 and 51 of the November 2020 issue of Sky & Telescope and online at http://www.skyandtelescope.com/observing/interactive-sky-watching-tools/ and https://www.projectpluto.com/jevent.htm

At midmonth, **Saturn's** globe subtends 16 arc seconds and its rings are inclined by 22 degrees. The waxing crescent Moon passes three degrees south of Saturn on November 19th. Eighth-magnitude Titan is due north of Saturn on November 3rd and November 20th and due south of the planet on November 11th and November 27th. Iapetus shines at magnitude +10.2 when it reaches greatest western elongation eight arc minutes due west of Saturn on November 4th. The peculiar satellite dims to almost eleventh magnitude on November 25th when it is at superior conjunction. For information on the positions of Saturn's major satellites, browse http://www.skyandtelescope.com/observing/interactive-sky-watching-tools

On November 1st, **Uranus** is located three degrees southeast of the variable carbon star TX Piscium (19 Piscium). The ice giant is just one day past opposition on that date and is visible for the entire night. The gap decreases to 2.5 degrees by the end of the month. As Phil Harrington describes in the article appearing at https://www.cloudynights.com/articles/cat/column/phil-harrington-s/cosmic-challenge-spotting-uranus-r3263, Uranus can be seen without optical aid from a dark site. The waxing gibbous Moon passes three degrees south of Neptune on November 27th. Visit http://www.nakedeyeplanets.com/uranus.htm for a finder chart.

Neptune is positioned less than one degrees from the fourth-magnitude star Phi Aquarii in eastern Aquarius for the entire month. By November 29th, Neptune has moved to its stationary point just 44 arc minutes east-northeast of the star. The waxing gibbous Moon passes five degrees south of Neptune on November 23rd. Browse http://www.nakedeyeplanets.com/neptune.htm for a finder chart.

Finder charts for Uranus and Neptune are also available at https://skyandtelescope.org/wp-content/uploads/UranusNeptune2020_BW_WebFinder.pdf and an article on observing the ice giants is posted at https://skyandtelescope.org/observing/ice-giants-neptune-and-uranus/

The faint dwarf planet **Pluto** lies just 41 arc minutes south of Jupiter in northeastern Sagittarius on November 12th. Finder charts for Pluto can be found at pages 48 and 49 of the July 2020 issue of Sky & Telescope and on page 243 of the RASC Observer's Handbook 2020.

For more on the planets and how to locate them, see http://www.nakedeyeplanets.com

Free star charts for the month can be downloaded at http://www.skymaps.com/downloads.html and https://www.telescope.com/content.jsp?pageName=Monthly-Star-Chart and http://whatsouttonight.com/

Information on passes of the ISS, the USAF's X-37B, the HST, Starlink, and other satellites can be found at Heavens Above.

A wealth of current information on solar system celestial bodies is posted at http://nineplanets.org/ and http://www.curtrenz.com/astronomy.html

Information on the celestial events transpiring each week can be found at http://astronomy.com/skythisweek and http://www.skyandtelescope.com/observing/sky-at-a-glance/

Trivia: In observance of the Día de los Muertos on November 1, which famous female astronomer was featured in the Faulkner Planetarium's Halloween show during the song: Werewolves of London by Warren Zevon? Answer buried in the Newsletter.

Asteroids

The dwarf planet/asteroid 1 Ceres shines at ninth magnitude as it travels north-eastward through southern Aquarius this month. It passes about a degree south of the large planetary nebula NGC 7293 (the Helix Nebula) on November 19th and lies within a degree of NGC 7293 from November 18th through November 24th. Asteroid 8 Flora (magnitude +8.1) lies approximately one degree west of Gamma Ceti (magnitude +3.5) when it reaches opposition on November 1st and glides westward through Cetus for the remainder of the month. Asteroid 51 Nemausa (magnitude +10.8) is at opposition in Taurus on November 25th. For information on this year's bright asteroids and upcoming asteroid occultation events respectively, consult https://curtrenz.com/asteroids.html and http://asteroidoccultation.com/

Comets

Comet 88P/Howell shines at ninth magnitude as it heads eastward through Sagittarius during November. It passes just south of the second-magnitude star Nunki (Sigma Sagittarii) on November 1st and north of the globular cluster M54 on November 1st and November 2nd. The periodic comet is located south of Jupiter on November 14th, south of Saturn on November 18th, and south of the globular cluster M75 on November 20th and November 21st. For additional information on comets visible this month, browse http://cometchasing.skyhound.com/ and http://www.aerith.net/comet/future-n.html

A list of the closest approaches of comets to the Earth is posted at http://www.cometography.com/nearcomet.html

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Meteor Showers

The peaks of the Southern and Northern Taurid meteor showers take place on November 6th and November 12th respectively but will be severely compromised by bright moonlight. These streams form part of the complex associated with Comet 2P/Encke. The Leonid meteor shower occurs on the night of November 17th/18th. Leonid meteors are debris from the periodic comet 55P/Tempel-Tuttle, which last reached perihelion in 1998. Due to their high speed (71 kilometers or 44 miles per second), the fastest of any meteor shower, the Leonids produce more fireballs than most showers. Browse https://earthsky.org/?p=53077 for information on the 2020 Leonids. An article on the Northern and Southern Taurids and the Leonids can be found on page 50 of the November 2020 issue of Sky & Telescope. The minor Alpha Monocerotid and November Orionid meteor showers occur on November 21st and November 28th respectively. See https://www.skyandtelescope.com/observing/best-meteor-showers-in-2020/ for information on 2020's better meteor showers.

Earth & Miscellaneous

Information on passes of the ISS, the USAF's X-37B, the HST, Starlink, and other satellites can be found at http://www.heavens-above.com/

A wealth of current information on solar system celestial bodies is posted at http://nineplanets.org/ and http://www.curtrenz.com/astronomy.html

Information on the celestial events transpiring each week can be found at https://stardate.org/nightsky and http://astronomy.com/skythisweek and http://www.skyandtelescope.com/observing/sky-at-a-glance/

Free star maps for November can be downloaded at http://www.skymaps.com/downloads.html and https://www.telescope.com/content.jsp?pageName=Monthly-Star-Chart

Data on current supernovae can be found at http://www.rochesterastronomy.org/snimages/

Finder charts for the Messier objects and other deep-sky objects are posted at https://freestarcharts.com/messier and https://freestarcharts.com/ngc-ic and https://www.cambridge.org/turnleft/seasonal_skies_october-december

Telrad finder charts for the Messier Catalog and the SAC's 110 Best of the NGC are posted at http://www.custerobservatory.org/docs/messier2.pdf and http://sao64.free.fr/observations/catalogues/cataloguesac.pdf respectively.

Information pertaining to observing some of the more prominent Messier galaxies can be found at http://www.cloudynights.com/topic/358295-how-to-locate-some-of-the-major-messier-galaxies-and-helpful-advice-for-novice-amateur-astronomers/

Author Phil Harrington offers an excellent freeware planetarium program for binocular observers known as TUBA (Touring the Universe through Binoculars Atlas), which also includes information on purchasing binoculars, at http://www.philharrington.net/tuba.htm

Stellarium and Cartes du Ciel are useful freeware planetarium programs that are available at http://stellarium.org/ and https://www.ap-i.net/skychart/en/start

Deep-sky object list generators can be found at http://www.virtualcolony.com/sac/ and http://tonightssky.com/MainPage.php and https://telescopius.com/

Freeware sky atlases of varying "depth" can be downloaded at http://www.deepskywatch.com/deep-sky-hunter-atlas.html and http://www.olle-eriksson.com/night-sky-maps/ and https://allans-stuff.com/takis-8-5-magnitude-star-atlas/

Deep Sky

Copernicus observes a lunar eclipse on November 5, 1500. Wolfgang Schuler independently discovers Tycho's Supernova on November 6, 1572. Cornelius Gemma independently discovers Tycho's Supernova on November 9, 1572. Tycho Brahe observes Tycho's Supernova on November 11, 1572. SN 1604 (Kepler's Supernova) becomes visible to the unaided eye on October 9, 1604. Nicolas-Claude Fabri de Peiresc makes the first telescopic observations of M42 (the Orion Nebula) on November 26, 1610. Jan de Munck discovers Comet C/1743 X1 (the Great Comet of 1744) on November 29, 1743. Captain James Cook observes a transit of Mercury from New Zealand on November 9, 1769. William Herschel (Carolyn[1]) discovers the ring galaxy NGC 922 on November 17, 1784. E.E. Barnard discovers the emission nebula NGC 281 (the Pacman Nebula) on November 16, 1881. The first photograph of a meteor was taken on November 26, 1885. The minor planet/comet 2060 Chiron or 95P/Chiron was discovered by Charles Kowal on November 1, 1977.

Two stars with exo-planetary systems, Upsilon Andromedae (magnitude +4.1) and 51 Andromedae (magnitude +5.5), can be seen this month without optical aid.

The famous eclipsing variable star Algol (Beta Persei) is at a minimum, decreasing in brightness from magnitude +2.1 to magnitude +3.4, on November 1st, 4th, 7th, 10th, 13th, 16th, 18th, 21st, 24th, 27th, and 30th. Consult http://www.skyandtelescope.com/observing/interactive-sky-watching-tools/ and page 50 of the November 2020 issue of Sky & Telescope for the times of the eclipses. Algol is at minimum brightness for observers in North America for about two hours centered at 12:11 a.m. EST on November 13th and at 9:00 p.m. EST on November 15th. The chance of seeing Algol at least one magnitude fainter than normal on a random night is about 1 in 30. For more on Algol, see http://stars.astro.illinois.edu/sow/Algol.html and http://www.solstation.com/stars2/algol3.htm

Seventy binary and multiple stars for November: Otto Struve 514, Alpha Andromedae (Alpheratz), Struve 3, h1947, Struve 19, Struve 24, 26 Andromedae, Struve 40, Pi Andromedae, Delta Andromedae, Struve 47, Eta Andromedae, Struve 79, Beta Andromedae (Mirach), Struve 108, Struve 179, South 404 (Andromeda); 1 Arietis, Struve 178, Gamma Arietis, Lambda Arietis (Mesarthim) (Aries); Struve 3053, Struve 3057, Struve 16, Struve 30, Otto Struve 16, Alpha Cassiopeiae (Schedar), Struve 59, Eta Cassiopeiae, Burnham 1, Struve 70, Otto Struve 23, h1088, Struve 163, Struve 170, Struve 182 (Cassiopeia); 34 Piscium, Struve 8, 35 Piscium, Struve 15, 38 Piscium, 42 Piscium, 49 Piscium, 51 Piscium, 55 Piscium, 65 Piscium, Psi Piscium, Otto Struve 22, Struve 98, Otto Struve 26, Phi Piscium, Zeta Piscium, h636, Otto Struve 30, Struve 122, Struve 132, Otto Struve 31, 100 Piscium, Struve 145, 107 Piscium, h644 (Pisces); h5440, Kappa-1 Sculptoris, h1949, h3442, h3379, Tau Sculptoris, Epsilon Sculptoris (Sculptor); Struve 143, Struve 183 (Triangulum)

Notable carbon star for November: Z Piscium

Seventy deep-sky objects for November: M31, M32, M110, NGC 252, NGC 404, NGC 752 (Andromeda); NGC 680, NGC 691, NGC 697, NGC 772 (Aries); Cr 463, IC 1747, K14, M103, NGC 129, NGC 133, NGC 146, NGC 185, NGC 225, NGC 281, NGC 278, NGC 381, NGC 436, NGC 457, NGC 559, NGC 637, NGC 654, NGC 659, NGC 663, Tr 1 (Cassiopeia); NGC 40, NGC 188 (Cepheus); NGC 151, NGC 175, NGC 178, NGC 210, NGC 227, NGC 245, NGC 246, NGC 247, NGC 274, NGC 337, NGC 578, NGC 584, NGC 596, NGC 615, NGC 636, NGC 681, NGC 720, NGC 779 (Cetus); NGC 7814 (Pegasus); M76, St 4 (Perseus); M74, NGC 128, NGC 194, NGC 488, NGC 524 (Pisces); NGC 24, NGC 55, NGC 134, NGC 150, NGC 253, NGC 254, NGC 288, NGC 289, NGC 439, NGC 613 (Sculptor); M33, NGC 672 (Triangulum)

Top ten binocular deep-sky objects for November: M31, M33, M103, NGC 225, NGC 288, NGC 253, NGC 457, NGC 654, NGC 663, NGC 752

Top ten deep-sky objects for November: M31, M32, M33, M76, M103, M110, NGC 40, NGC 253, NGC 457, NGC 752

Challenge deep-sky object for November: IC 59 (Cassiopeia)

The objects listed above are located between 0:00 and 2:00 hours of right ascension.

A Leonid meteor. The meteor shower peaks on the morning of November 17 each year.
Image credit: Navicore / Wikipedia Commons.

"MARS IS THE ONLY KNOWN PLANET INHABITED SOLELY BY ROBOTS"

by Loretta J Cannon

An intriguing statement, though it isn't clear who coined the phrase. While looking for the 'source' of this statement, I found an article from 2014 by Mika McKinnon, in which she delightfully explores the 'robot planet' idea, because her brother asked her to 'fact-check' the quote. Were Isaac Asimov (1920-1992) alive today, I think he might just like knowing that Mars is a Robot planet. Our focus here though is on '*How* did Mars become a robot planet?'.

THE MARINER PROBES

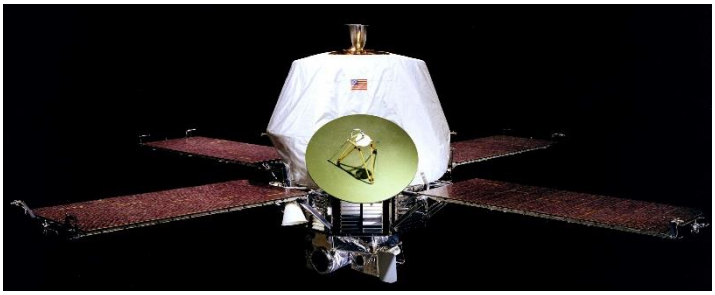
The first series of Earth probes that made it to Mars were the Mariners. The primary NASA mission objectives "were to study the surface and atmosphere of Mars during close flybys to establish the basis for future investigations, particularly those relevant to the search for extraterrestrial life, and to demonstrate and develop technologies required for future Mars missions and other long-duration missions far from the Sun."
RIGHT: *Mariner 4*, [credit: NASA]

About the time I was celebrating my 1st birthday in 1962, NASA approved two probes for the Mariner Mars 1964 project. Launched within weeks of each other in 1964, *Mariner 3* never reached Mars orbit while *Mariner 4* successfully reached our neighbor planet in July 1965, taking the first photos of another world from space. The surface pressure was quite low across a cratered, lifeless-looking landscape of red dust and rocks, with no evidence of an ancient civilization. NASA maintained contact with *Mariner 4* until Dec 1967. This little probe opened the door for us to a 'world' of new information.

The next pair of spacecraft, *Mariners 6* and *7*, were launched in Feb and March 1969. Their mission involved looking for signs of life and gathering data to improve the design of future Mars missions. They confirmed the heavily-cratered surface appearance seen in 1965. New images and scans of the south polar region indicated the ice was composed of both water and carbon dioxide, with that molecule making up 98% of the thin atmosphere. The low surface pressure was further defined as equivalent to being almost 20 miles above Earth. Surface temperatures ranged from -99°F to -193°F at the south polar cap. A close-up investigation of the Hellas Planitia impact crater – among the largest known impact craters in the solar system – in the southern hemisphere showed no smaller craters within it. NASA maintained contact with both spacecraft until 1971. I located an amazing 'movie' of Mars compiled from a series of images taken by *Mariner 7* as it approached the planet.

LEFT: reconstructed color image using *Mariner 7* approach data.
[Credit: NASA/JPL/Ted Stryk]

In May 1971, *Mariners 8* and *9* were launched with a mission goal of achieving a stable Martian orbit to gather atmospheric and surface data. Due to a malfunctioning launch vehicle, *Mariner 8* fell back to Earth, while *Mariner 9* went on to successfully enter Mars orbit in Nov 1971, becoming the first man-made object to orbit another world. Over the next three months, the little spacecraft (shown RIGHT [credit: NASA]) mapped almost 85% of Mars' surface, including the extinct volcano Olympus Mons, one of twenty identified. The great Valles Marineris (Mariner Valley) was also described, a series of canyons some 120 miles wide and more than 2,500 miles long, with depths up to 4 miles. The deepest canyon on Earth, Hells Canyon in



Idaho, is only 1½ miles deep. Altogether, this little probe sent back 7,329 photos, including 80 images of the moons Phobos and Deimos. Contact with *Mariner 9* was lost in Oct 1972. The derelict craft continues to orbit Mars today and is expected to enter atmosphere and burn up in 2022.

VIKING – THE FIRST LANDERS
RIGHT: Model of *Viking* Lander
[Credit: NASA/JPL-Caltech/Univ of Arizona]

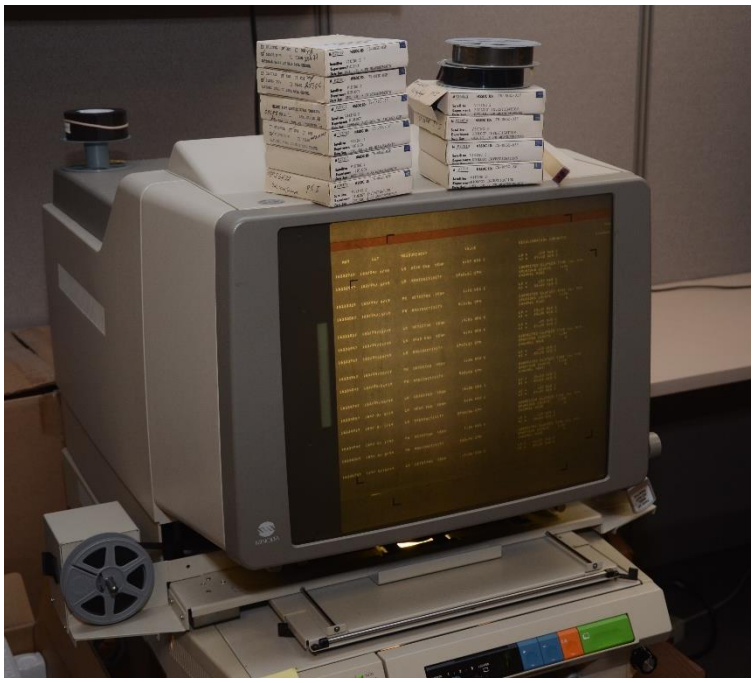
By 1975, NASA had built and launched *Vikings 1* and *2*, spacecraft designed with both an 'orbiter' and a 'lander'. I remember these spacecraft, watching the launches in the Fall of my 8th grade year. *Viking 1*'s lander touched down in July 1976 (while America was still celebrating our Bicentennial) just 17 miles short of its secondary landing site on the western slopes of Chryse Planitia (Golden Plain). The primary landing site was dismissed based on photos indicating a rough surface. *Viking 2* was also redirected to a secondary landing site due to rough surface conditions, setting down in Sept 1976 at Utopia Planitia close to the northern ice cap, where mission planners hoped to find signs of life. It's worth noting that the large impact basin Utopia is the largest such feature known in the Solar System, with a diameter of 2,050 miles. These two landers became the first robots on the surface of Mars.

The *Viking* landers acquired 4,500 images around their landing sites and completed numerous experiments, while the orbiters acquired 52,663 images, mapping 97% of the surface of Mars. According to NASA "the two landers conducted three biology experiments designed to look for possible signs of life. These experiments discovered unexpected and enigmatic chemical activity in the Martian soil but provided no clear evidence for the presence of living micro-organisms in soil near the landing sites. … Mars is self-sterilizing. … [T]he combination of solar ultraviolet radiation that saturates the surface, the extreme dryness of the soil and the oxidizing nature of the soil chemistry prevent the formation of living organisms in the Martian soil."

"This color picture of Mars was taken July 21--the day following Viking I's successful landing on the planet. … Orange-red surface materials cover most of the surface, apparently forming a thin veneer over darker bedrock exposed in patches … . The reddish surface materials may be limonite (hydrated ferric oxide). Such weathering products form on Earth in the presence of water and an oxidizing atmosphere. The sky has a reddish cast, probably due to scattering and reflection from reddish sediment suspended in the lower atmosphere." [credit: NASA/JPL]

The original mission profile called for a mission length of 90 days after landing, around Nov 1976. Yet both orbiters and landers functioned well beyond this limit. First an Extended Mission and then the Continuation Mission gathered data until July 1979. Lander 2's last transmission was received in April 1980. Lander 1 sent daily and weekly weather reports until its last transmission arrived in Nov 1982. Orbiter 1 ceased operating in July 1978, while Orbiter 2 survived four years, completing 1,489 orbits, until it too ceased operations in Aug 1980.

Interestingly, the results of the biology experiments created controversy from the moment the negative result was reported. Early in this century, a request came in to the NASA Space Science Data Coordinated Archive at Goddard Space Flight Center in Maryland, a pharmacology professor wanted access to data from the *Viking* biology experiments. The Archive had the data but they were reluctant to lend it out – it was still on microfilm. They decided to digitize the microfilm to ensure the data survived. (It is almost mind-boggling that it took almost 40 years before they decided to digitize such valuable and irreplaceable data!)



For those of you too young to remember, microfilm data storage is a process wherein a standard page is filmed as a single frame onto a very small reel of film, which is then read a single page at a time in a huge-by-today's-standards machine that looks somewhat like a computer monitor circa 1990. One moves the film through the reader using sliders, dials or buttons while another dial or button adjusts the focus. I have used one of these machines and, since I am *not* prone to motion-sickness, I was able to move the 'film' rather quickly through the reader while scanning for a specific document; I was reading old newspapers looking for a specific date. The image at LEFT shows actual boxes of *Viking* data sitting atop a microfilm reader; if you click on the photo and zoom in, you can read the labels on the boxes!

LEFT: Reader with microfilm rolls [credit: David Williams, planetary curation scientist for the NASA Space Science Data Coordinated Archive at Goddard Space Flight Center]

With the requested *Viking* biology experiment data, now in a safe digitized format, the pharmacology professor re-examined the original analysis and concluded there was one 'good' positive result – life may exist on Mars. The experiment with the controversial results was Labeled Release (LR) [I'd heard a NASA scientist in the documentary *The Farthest Voyager in Space* admit they weren't good at coming up with good names. But I like literal.] For LR, a scooped-up soil sample is saturated with a specific nutrient cocktail, then the air above the sample (it's been enclosed in a test chamber) is analyzed for the presence of either methane or carbon dioxide, which would indicate that 'something' had metabolized the given nutrients. Since the other two experiments didn't find organic molecules, the original conclusion was that the LR test had been 'affected' by some component of the Martian soil. The 40 year-old controversy helped NASA scientists design the experiments for the next generation of landers – rovers.

NEXT UP – MORE ORBITERS

While the new landers – rovers – were on the design board, the next 'robots' sent to Mars were advanced orbiters. The *Mars Observer* orbiter was designed to orbit the planet for a year, using instrument designs based on *Viking* data, instruments to study geology, climate and atmosphere to increase our understanding of planetary evolution. The spacecraft successfully launched in Sept 1992. Over the next eleven months, while traveling to Mars, the spacecraft sent telemetry home to Earth. No other spacecraft sent to Mars had sent telemetry enroute. Then on Aug 22, 1993, two days before orbital insertion at Mars, all contact with *Observer* stopped. Contact has never been re-established, nor has a clear explanation for the spacecraft failure been determined.

On the bright side, in addition to the data gathered enroute, the instrument technology designed for *Observer* was applied to later Mars orbiters.

We will learn about these and other orbital missions – Global Surveyor (launched 1996), Climate Orbiter (1998), Odyssey (2001), Reconnaissance Orbiter (2005), MAVEN (2013-14) – and the next generation of landers – Spirit & Opportunity (launched 2003), Phoenix (2007-08), Curiosity (2011-12), Insight (2018).

NASA Night Sky Notes

This article is distributed by NASA Night Sky Network

The Night Sky Network program supports astronomy clubs across the USA dedicated to astronomy outreach. Visit nightsky.jpl.nasa.gov to find local clubs, events, and more!

The International Space Station: 20 Continuously Crewed Years of Operation

David Prosper

Did you know that humans have been living in the International Space Station, uninterrupted, for twenty years? Ever since the first crew members docked with the International Space Station (ISS) in November 2000, more than 240 people have visited this outpost, representing 19 countries working together. They have been busy building, upgrading, and maintaining the space station - while simultaneously engaging in cutting-edge scientific research.

The first modules that would later make up the ISS were launched into orbit in 1998: the Russian Zarya launched via a Proton-K rocket, and the US-built Unity module launched about a week and a half later by the Space Shuttle Endeavour. Subsequent missions added vital elements and modules to the Space Station before it was ready to be inhabited. And at last, on November 2, 2000, Expedition-1 brought the first three permanent crew members to the station in a Russian Soyuz capsule: NASA astronaut William M. Shepherd and Russian cosmonauts Sergei Krikalev and Yuri Gidzenk. Since then, an entire generation has been born into a world where humans continually live and work in space! The pressurized space inside this modern engineering marvel is roughly equal to the volume of a Boeing 747, and is sometimes briefly shared by up to 13 individuals, though the average number of crew members is 6. The unique microgravity environment of the ISS means that long-term studies can be performed on the space station that can't be performed anywhere on Earth in many fields including space medicine, fluid dynamics, biology, meteorology and environmental monitoring, particle physics, and astrophysics. Of course, one of the biggest and longest experiments on board is research into the effects of microgravity on the human body itself, absolutely vital knowledge for future crewed exploration into deep space.

Stargazers have also enjoyed the presence of the ISS as it graces our skies with bright passes overhead. This space station is the largest object humans have yet put into orbit at 357 feet long, almost the length of an American football field (if end zones are included). The large solar arrays – 240 feet wide - reflect quite a bit of sunlight, at times making the ISS brighter than Venus to observers on the ground! Its morning and evening passes can be a treat for stargazers and can even be observed from brightly-lit cities. People all over the world can spot the ISS, and with an orbit only 90 minutes long, sometimes you can spot the station multiple times a night. You can find the next ISS pass near you and receive alerts at sites like NASA's Spot the Station website (spotthestation.nasa.gov) and stargazing and satellite tracking apps.

Hundreds of astronauts from all over the world have crewed the International Space Station over the last two decades, and their work has inspired countless people to look up and ponder humanity's presence and future in space. You can find out more about the International Space Station and how living and working on board this amazing outpost has helped prepare us to return to the Moon - and beyond! - at nasa.gov.

A complete view of the ISS as of October 4, 2018, taken from the Soyuz capsule of the departing crew of Expedition 56 from their Soyuz capsule. This structure was built by materials launched into orbit by 37 United States Space Shuttle missions and 5 Russian Proton and Soyuz rockets, and assembled and maintained by 230 spacewalks, with more to come! Credit: NASA / Roscosmos More info: bit.ly/issbasics

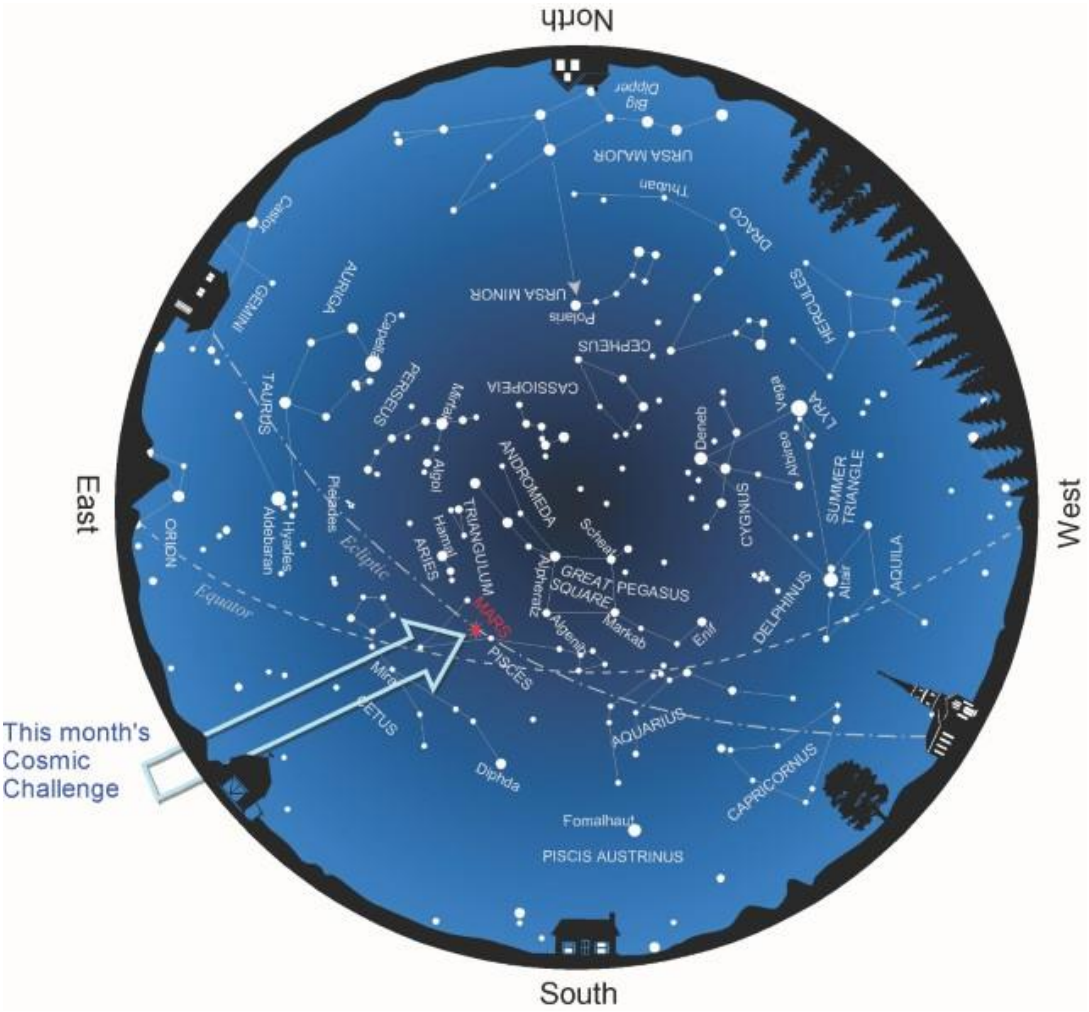
Phil Harrington's Cosmic Challenge November 2020

The Eye of Mars

This month's suggested aperture range:
Small Aperture Scopes 3 to 6 inch (76.2mm to 152.4mm)

With Mars just having passed opposition on October 13, I thought it might be fun to challenge you to see a specific surface feature on the Red Planet before it slips too far away.

First, most readers probably realize that some Martian oppositions are better than others. An *aphelic* opposition occurs at or near Martian aphelion, when the Red Planet comes no closer than 50 to 61 million miles (81 to 98 million km) to Earth. During these comparatively poor viewing periods, Mars, which measures 4,219 miles (6,794 km) in diameter, will measure no more than 14" across. In more favorable years, when Mars reaches opposition at or near perihelion, the planet will be less than 35 million miles (56 million km) from Earth and will appear about 25" diameter. These are called *perihelic* oppositions. This year's Martian opposition was perihelic, as was the previous opposition in 2018. Both afforded observers some prime Mars-watching. The next perihelic oppositions won't be until June 27, 2033, and September 15, 2035. In between now and then, the oppositions in 2022, 2025, 2027, 2029 and 2031 will be aphelic.



Above: Autumn star map showing the location of this month's Cosmic Challenge.
Credit: Map adapted from **Star Watch** by Phil Harrington

1: Trivia answer (buried in the newsletter) is the "Little Old Lady" mutilated last night.

No other planet in our solar system appears so enticing, yet proves so frustrating, through backyard telescopes as does the Red Planet, Mars. On one hand, the planet's thin carbon dioxide atmosphere affords us a nearly cloud-free, round-the-clock view of its sun-drenched surface. On the other hand, however, the planet's small size coupled with its distance away conspire together to shrink the planet's disk to no more than 25" across at its best. Usually, Mars appears far smaller than that. As a result, whatever surface details are visible through our telescopes prove small, vague, and tenuous, at best.

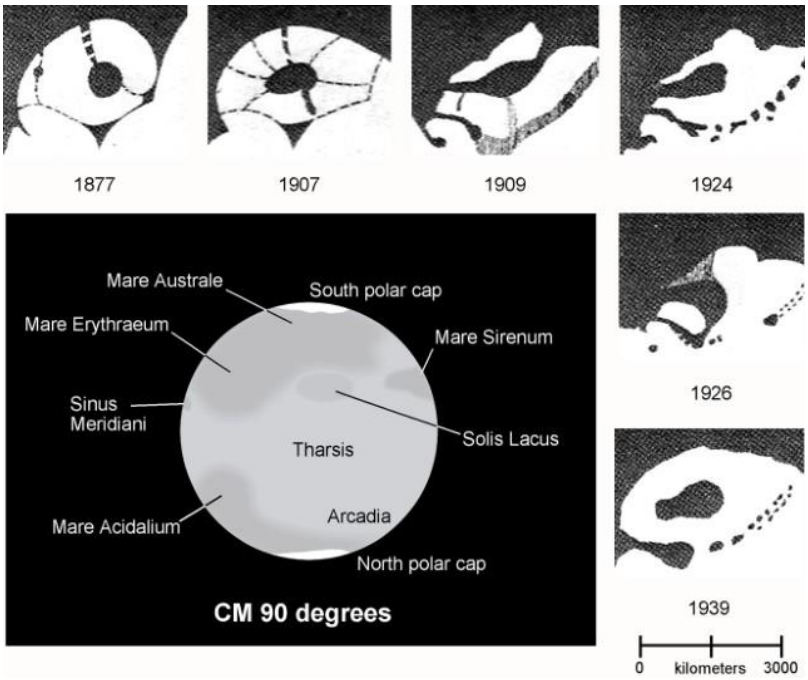
This contradictory set of conditions undoubtedly led to some of the controversial surface features that early Mars observers claimed to see. Without a doubt, the best-known case of Martian illusions has to be the widespread misconception that the planet is covered in a web of thread-thin canals. Many references attribute the "discovery" of Martian canals to the Italian astronomer Giovanni Schiaparelli. Viewing Mars in 1877, Schiaparelli saw what he interpreted as dark, thin lines stretching across the lighter areas of the planet's surface and connecting the darker regions. He described these vague markings as "canali," which in Italian, means channels or grooves. Once his observations, published in 1878, reached the ears of English-speaking astronomers, canali was mistranslated to mean "canals," which of course, are artificial waterways constructed by intelligent beings. Suddenly, the hunt for the Martians was on!

Actually, Schiaparelli was not the first person to see "canali." At least half a dozen observers recorded linear features on Mars as far back as 1840. In 1867, Richard A. Proctor published a map of Mars based largely on observations and drawings by William Dawes (of "Dawes Limit" fame). Proctor presumed that the darker parts of the planet were seas and the reddish tracts continents, and proceeded to name several features after English astronomers, such as Dawes Ocean, Herschel Continent, and Terby Sea.

Schiaparelli's 1878 report also included a map of Mars, showing far more detail than Proctor's, which contained several fanciful errors. To correct these errors, Schiaparelli decided to abandon any names previously assigned and instead create his own references based on biblical and mythological entities. Terby Sea, for instance, became Solis Lacus. For the most part, the names we still use when discussing features on Mars are those assigned by Schiaparelli. That is, minus the canals, of course.

While we may chuckle today at the thought of canals crisscrossing the planet, many of the surface features that perplexed generations of astronomers continue to intrigue observers today. Even with robotic spacecraft scurrying about the surface of the Red Planet or in orbit high above, Mars still beckons backyard planet watchers. There are many striking features across the Martian surface, from the fork-shaped Sinus Meridiani (or what Proctor had christened Dawes's Forked Bay) to the dark wedge of Syrtis Major (formerly Kaiser Sea).

Since it was first detected in the 19th century, the region Solis Lacus, located at Martian longitude 85° west and Martian latitude 26° south, has puzzled observers. Nicknamed the Eye of Mars, or Oculus, for its cyclopic appearance, this feature has been observed to undergo dramatic changes in size and appearance. Normally, Solis Lacus appears as a dark, elliptical feature measuring some 500 miles east-to-west by 300 miles north-to-south, surrounded by a brighter region known as Thaumasia. Together, they resemble a human eye, almost as if Mars is looking back at us.

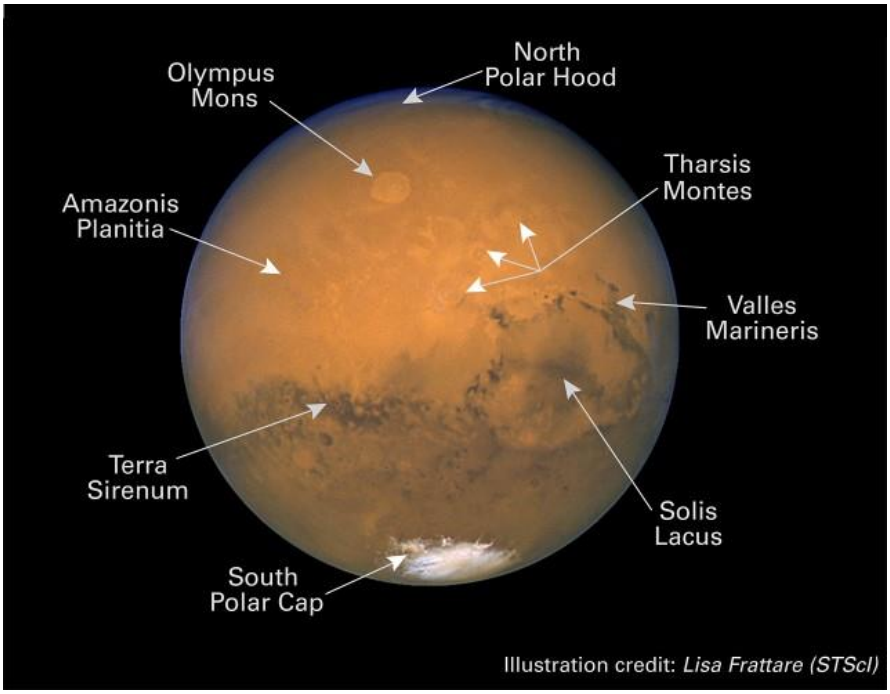


Above: The many variations of the Eye of Mars

Since Schiaparelli first drew a detailed view of Solis Lacus in 1877, observers have watched it go through a variety of changes, as the figure above demonstrates. Schiaparelli's original drawing recorded a dark, segmented viaduct across Thaumasia, connecting the "eye" to Mare Erythraeum to the south. Within 30 years, others recorded not one, but several thin straits radiating outward from Solis Lacus, bridging the gap between it and the mare, as if the Eye was bloodshot. As the early 20th century wore on, Solis Lacus continued to morph from oval to circular, blending in part into Mare Erythraeum before separating again. By the 1971 opposition of Mars, it had shrunken in size and faded in darkness, only to experience resurgence two years later. As the 21st century opened, the Eye was dark again, although not as large as it had appeared in the past.

The cause of these variations is likely due to dust storms that rage across the Red Planet. The powdery Martian soil can be picked up by high winds and swept across plains and down into basins. As this material is blown about, darker, subsurface regions are alternately exposed and covered up, accounting for what was once interpreted as growth of seasonal vegetation.

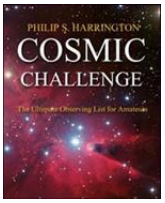
In general, dedicated planet watchers prefer refractors and long-focus reflectors because they usually produce the highest image contrast. Short-focus Newtonians and most catadioptric telescopes yield lower image contrast owing to their large central obstructions. And since magnifications over 200x are usually needed to see fine details, be sure to use a high-quality eyepiece. Popular super-wide-field eyepieces are wonderful for panoramic views of star fields and broad nebulae, but they are often surpassed by simpler conventional eyepieces, such as orthoscopics and Plössls, for planetary observing. Finally, many observers report great success using color filters to enhance various features on Mars. For Solis Lacus, try an orange (Wratten #21) or red (#23A or #25) filter to increase the contrast of the dark eye against the surrounding bright region. I am sure that many readers have their own opinions on this, so I welcome you to post them in this column's discussion forum below.



Above: Mars as seen by the Hubble Space Telescope in 2003.
Credit: NASA/ESA and Lisa Frattare (STScI)

Have a favorite challenge object of your own? I'd love to hear about it, as well as how you did with this month's test. Contact me through my web site or post to this month's discussion forum.

Until next month, remember that half of the fun is the thrill of the chase. Game on!



About the Author: Phil Harrington writes the monthly *Binocular Universe* column in Astronomy magazine and is the author of 9 books on astronomy. Visit his web site at www.philharrington.net to learn more.

A revised, second printing of Cosmic Challenge: The Ultimate Observing List for Amateurs is now available with updated data tables and charts for finding various solar system objects, such as Pluto and Vesta, as well as improved renditions of the many eyepiece sketches that accompany each of the 187 challenges encompassing more than 500 individual objects. The book is available from Amazon.com.

Observatory and Planetarium

The Herrett Center has re-opened, with COVID-19 safety protocols for your protection. Check out our reopening video message and we hope to see you soon!

Centennial Observatory Upcoming Events

Event	Place	Date	Time	Admission
Telescope Tuesday	Centennial Observatory	Tuesday, November 10th, 2020	6:15 to 9:00 PM	$1.50 or free with Faulkner Planetarium admission
Monthly Free Star Party	Centennial Observatory	Saturday, November 14th, 2020	6:00 to 9:00 PM	FREE
Telescope Tuesday	Centennial Observatory	Tuesday, November 24th, 2020	6:00 to 9:00 PM	$1.50 or free with Faulkner Planetarium admission

Due to limited space for social distancing within the confined space of the observatory dome, the observatory is currently closed until further notice.

Faulkner Planetarium
Now Showing!

Visit the Herrett Center Video Vault

About the Magic Valley Astronomical Society

Magic Valley Astronomical Society
550 Sparks St.
Twin Falls, ID

The Magic Valley Astronomical Society (MVAS) was founded in 1976. The Society is a non-profit [501(c) 3] educational and scientific organization dedicated to bringing together people with an interest in astronomy.

In partnership with the Centennial Observatory, Herrett Center, College of Southern Idaho - Twin Falls; we hold regularly scheduled monthly meetings and observation sessions, at which we share information on current astronomical events, tools and techniques for observation, astrophotography, astronomical computer software, and other topics concerning general astronomy. Members enthusiastically share their telescopes and knowledge of the night sky with all who are interested. In addition to our monthly public star parties we hold members only star parties at various locations throughout the Magic Valley.

MVAS promotes the education of astronomy and the exploration of the night sky along with safe solar observing through our public outreach programs. We provide two types of outreach; public star parties and events open to anyone interested in astronomy, and outreach programs for individual groups and organizations (e.g. schools, churches, scout troops, company events, etc.), setting up at your location. All of our outreach programs are provided by MVAS volunteers at no cost. However, MVAS will gladly accept donations. Donations enable us to continue and improve our public outreach programs.

Membership is not just about personal benefits. Your membership dues support the work that the Magic Valley Astronomical Society does in the community to promote the enjoyment and science of astronomy.
Speakers, public star parties, classes and support for astronomy in schoolrooms, and outreach programs just to name a few of the programs that your membership dues support.

Annual Membership dues will be:
$20.00 for individuals, families, and $10.00 for students.
Contact Treasurer Jim Tubbs for dues information via e-mail: jtubbs015@msn.com

Donations to our club are always welcome and are even tax deductible. Please contact a board member for details.

Membership Benefits:
Lending Telescopes: The society currently has three telescopes for loan and would gladly accept others please contact President Robert Mayer, for more information on these and other benefits.

Telescopes are an individual thing and not practical for public use. However, everyone should have the experience of a good look at the moon for at least 5 minutes in their life time. It is a dimension and feeling that is unexplainable. Pictures or TV can't give this feeling, awareness, or experience of true dimension. A person will not forget seeing our closest neighbor, the moon. Norman Herrett in a letter to Dr. J. L. Taylor, president of the College of Southern Idaho, Twin Falls, ID, USA.