Snake River Skies

The Newsletter of the Magic Valley Astronomical Society

February 2021

Membership Meeting
See President's Message for February

Centennial Observatory
Due to the need to maintain social distance during the Covid-19 pandemic, access to the observatory dome is one small group at a time.

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

President's Message for February

Colleagues,

To say that this last year has been challenging is both an understatement and a redundancy. However, there appear to be glimmers of hope, but we ask that you hang in there and come along.

A great sign is that Chris Anderson over at the Herrett Center feels comfortable enough to work with the City of Rocks and the Hagerman Fossil Beds National Monument in getting the star parties back up and running. Hagerman's summer visit will be set for June 5th, while City of Rocks is set for July 2 and 3.

While working with City of Rocks, Chris reported something great – the staff there is working to get its own Deep Sky certification. They have purchased some meters, and are looking forward to working with us. Chris Anderson also had another moment last month: An occultation observation he took part in appears to have uncovered evidence of a previously unknown double star. More later on that.

Another challenge we have faced is trying to get going despite cold weather. It is a challenge to get out in lower temperatures, and the clouds get in the way more often. I really appreciate your patience as we try to find time to test outgoing live. It seems the last couple of times we have tried to do that, the clouds have got in the way. We'll keep trying.
Fortunately, others have had some luck: Tim Frazier is playing with a new EVScope. For more on the eVScope, check out the March issue of *Astronomy*.

In the meantime, would you share with us what you're doing to keep astronomically busy? I have been catching up on podcasts and online classes put on by the Planetary Society and hope to apply what I've learned to beyond just getting a T-shirt.

Don't forget that if you were one of the many who watched the Great Conjunction last month and either have sketches, images, or some sort of record of activity, head over to the Astronomical League to get your pin. It's quite easy to do.

As for this month's meeting, we have reviewed what's been done at the Faulkner Planetarium to handle COVID-19 guidelines, and feel comfortable in renewing the annual planetarium visit. For the Feb. 13th meeting, you will want to show up about 10 minutes early. Don't forget your mask, but do attend for a great time. The 7 p.m. show is "Birth of Planet Earth," and promises to be a great time.

In the meantime, if you do get out, share with us your images.

Until then,
Clear Views,
Rob Mayer

February 2021 Calendar

Sun	Mon	Tue	Wed	Thu	Fri	Sat
	1	2	3	4 Last Quarter Moon  Visible: 53% ↓ Age: 21.88 Days	5 BSU 1st Friday Astronomy	6
7	8	9 **Telescope Tuesday Observatory 7:00-9:00pm** 	10	11 New Moon  Visible 0% Age: 29.25 Days	12	13 MVAS General Meeting see president's msg. for details Centennial Observatory Public Star Party 7:00 – 9:00p
14	15	16	17	18 Mars Perseverance Landing 	19 First Quarter Moon  Visible 47% ↑ Age: 7.13 Days	20
21	22	23 **Telescope Tuesday Observatory 7:30-9:00pm** 	24	25	26	27 Snow Moon 1:19 am  Visible 100% Age: 14.93 Days
28						

Inside this issue!

Calendar of Events

Friday, February 5 Boise State Physics First Friday Astronomy
"How to Talk Science so Journalists Will Listen" by Lisa Grossman, Science News (www.sciencenews.org) Online Lecture begins 7:30 pm (MT)
http://www.astrojack.com/ffa-science-journalists

If you missed this presentation, you can view it and other previous lectures online at http://www.astrojack.com:

Scheduled for Mar 5, 2021: Psyche: Journey to a Metallic World by Prof Lindy Elkins-Tanton, School of Earth & Space Exploration, Arizona State Univ.

February 9th Centennial Observatory - Telescope Tuesday 7:00 – 9:00pm

Special Note: I am including this lecture information for the Boise Astronomical Society (BAS) meeting for those in the Magic Valley who may be interested in attending. A Zoom meeting link will be sent out later via e-mail. Editor.

Friday, Feb 12 BAS General Meeting guest speaker – Prof Paul Hickson

Join us for our General Meeting and hear our guest speaker, Prof Paul Hickson, Department of Physics and Astronomy, University of British Columbia-Vancouver. In 1982, he published a list of 100 compact galaxy groups that is so well known that the Jan 31st Star Date podcast "Hickson Compact Groups" describes how to find groups 16 and 92 in our current night sky! He's also part of research groups working on a Liquid Mirror telescope for the lunar surface and the Thirty Meter Telescope. This will be an amazing evening! Please be sure to attend.

Thursday, Feb 18 BSU Dept. of Physics presents a Virtual Planetarium show

This evening's program will be hosted by the Department of Physics and will start at 7:30 pm. Participation is FREE but you must register to attend. Navigate to http://boi.st/thirdthursday to sign up, and you may leave a question for the moderator. You will be contacted the week before the event and provided with the Zoom link.

Thursday, Feb 18 NASA's Mars Perseverance Landing

The Mars Perseverance Lander, which launched less than a year ago on July 30th, is expected to land on the red planet today. This month's NASA Night Sky Notes is all about Perseverance. This NASA website covers the mission. If you're reading this ***before*** February 18th, be sure to scroll through the various 'banners' of information at the top of the webpage. One of them is "Where is Perseverance?" and includes mileage counters.

February 23rd Centennial Observatory - Telescope Tuesday

Friday, Feb 27 Full Snow Moon

"As the snowiest month in the United States, February's full moon is commonly known as the Full Snow Moon in Native American cultures. These ancient tribes named this month after the way trees cracked in the cold, or how people had to sit shoulder to shoulder around the fire for warmth. Even the Celts called it the Moon of Ice. As expected of the coldest month in the year, the Full Snow Moon is also known by more sinister names, such as the Bone Moon." Read the complete story of the Snow Moon here.

Our Sun, the Moon and the Solar System Planets

The zodiacal light should be visible in the west after evening twilight from a dark location during the first two weeks of February. Click on https://www.atoptics.co.uk/highsky/zod1.htm for more on the zodiacal light.

The major meteor showers occurring this year are discussed at https://skyandtelescope.org/observing/best-meteor-showers-in-2021/

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/

The Moon is 18.6 days old, is illuminated 89.4%, subtends 32.0', and is located in the constellation of Virgo at 0:00 UT on February 1st. The Moon attains its greatest northern declination (+25.1 degrees) for the month on February 23rd and its greatest southern declination (-24.9 degrees) on February 9th. Longitudinal libration is at a maximum of +4.6 degrees on February 12th and at a minimum of -6.3 degrees on February 24th. Latitudinal libration is at a maximum of +6.6 degrees on February 14th and a minimum of -6.6 degrees on December 1st and -6.5 degrees on February 28th. Favorable librations for the following lunar features occur on the indicated dates: Crater Hausen on February 1st, Crater Le Gentil on February 2nd, Crater Cabeus on February 3rd, and Crater Hayn on February 15th. New Moon occurs on February 11th. The Moon is at perigee (a distance of 58.03 Earth-radii) on February 3rd and is at apogee (a distance of 63.41 Earth-radii) on February 18th. The Curtiss Cross occurs on February 5th and the Lunar X on February 19th. The Moon will occult the fourth-magnitude star Omega Ophiuchi on the morning of February 6th, the bright open cluster M35 on the morning of February 22nd, and the fourth-magnitude star Kappa Geminorum on the evening of February 23rd, as described on page 50 of the February issue of Sky & Telescope. Browse http://www.lunar-occultations.com/iota/iotandx.htm for additional 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. See https://svs.gsfc.nasa.gov/4768 for a lunar phase and libration calculator and for the Lunar Reconnaissance Orbiter Camera (LROC) Quickmap. Click on https://www.calendar-12.com/moon_calendar/2021/february 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 the constellation of Capricornus on February 1st. It enters Aquarius on February 16th.

Brightness, apparent size, illumination, distance from the Earth in astronomical units, and location data for the planets and Pluto on February 1: Mercury (magnitude +1.1, 8.8", 18% illuminated, 0.76 a.u., Capricornus), Venus (magnitude -3.9, 10.1", 98% illuminated, 1.65 a.u., Sagittarius), Mars (magnitude +0.4, 7.9", 89% illuminated, 1.19 a.u., Aries), Jupiter (magnitude -2.0, 32.5", 100% illuminated, 6.07 a.u., Capricornus), Saturn (magnitude +0.6, 15.2", 100% illuminated, 10.96 a.u., Capricornus), Uranus (magnitude +5.8, 3.5", 100% illuminated, 20.07 a.u. on February 15th, Aries), Neptune (magnitude +8.0, 2.2", 100% illuminated, 30.83 a.u. on February 15th, Aquarius), and Pluto (magnitude +14.4, 0.1", 100% illuminated, 35.07 a.u. on February 15th, Sagittarius).

Mars and Uranus can be seen in the southwest and Neptune in the west in the evening sky. Mars is in the west at midnight. In the morning sky, Mercury, Venus, Jupiter and Saturn lie in the east.

During February, four planets converge in the east at morning twilight. Venus, Jupiter, and Saturn lie within a circle with a diameter of 5.4 degrees on February 6th. On February 10th, the Moon, Venus, and Saturn lie within a circle with a diameter of 5.2 degrees and the Moon, Venus, and Jupiter lie within a circle with a diameter of 3.6 degrees. Mercury, Venus, and Jupiter lie within a circle with a diameter of 4.6 degrees on February 13th.

Mercury is inferior conjunction on February 8th. It also attains its greatest heliocentric latitude north on that day. Mercury returns to the morning sky in the second half of February. It's positioned three degrees west of Jupiter on the morning of February 28th. Saturn lies 5.5 degrees to the west of Mercury on that date. This will be the best morning apparition of the speediest planet for southern hemisphere observers this year.

Venus changes little in apparent size or brightness this month. Venus passes 0.4 degrees south of Saturn on February 6th and 0.4 degrees south of Jupiter on February 11th.

Mars is at eastern quadrature on February 1st. As the distance between the Earth and Mars increases, observing surface features becomes very hard. Syrtis Major, the most prominent albedo feature, may be visible with difficulty until local midnight during the first five days of the month. The vernal equinox occurs in the Martian northern hemisphere on February 7th. Mars enters Taurus on February 23rd. The Red Planet passes approximately three degrees southwest of the bright open cluster M45 on February 28th. On the same date, Mars is almost 1.5 astronomical units from the Earth and subtends only 6.4 arc seconds, while shining at just magnitude +0.9.

Jupiter emerges into morning twilight as a naked-eye object around February 19th. Jupiter (magnitude -2.0) forms an isosceles triangle with Mercury (magnitude +0.3) and Saturn (magnitude +0.7) low in the east-southeast 30 minutes before sunrise on February 25th.

The Ringed Planet reenters the dawn sky around the middle of the month. When Venus passes 0.4 degrees south of Saturn on February 6th, the two planets are just 11 degrees from the Sun. On the morning of February 20th,

Saturn and Mercury are separated by 4.4 degrees as the two planets rise. Jupiter forms a triangle with those two planets and is 7.7 degrees east of Saturn when it rises some 22 minutes later.

Uranus is located about 10.5 degrees south of the second-magnitude star Hamal (Alpha Arietis). Uranus and Mars are separated by approximately 6.5 degrees as February begins. A waxing crescent Moon passes three degrees south of Uranus on February 17th. Visit http://www.nakedeyeplanets.com/uranus.htm for a finder chart.

Neptune lies about two degrees northeast of the fourth-magnitude star Phi Aquarii on February 1st. A slender waxing crescent Moon passes four degrees south of Neptune on February 13th. The eighth planet disappears from view by the middle of the month. Browse http://www.nakedeyeplanets.com/neptune.htm for a finder chart.

Finder charts for Uranus and Neptune are also available online.

See http://www.curtrenz.com/uranep.html for additional information on the two outer planets.

Click on http://www.skyandtelescope.com/observing/interactive-sky-watching-tools/ for JavaScript utilities that will illustrate the positions of the five brightest satellites of Uranus and the position of Triton, Neptune's brightest satellite.

A summary on the planets for February can be found at https://skynews.ca/february-2021-planets-at-a-glance/

The graphic at https://www.timeanddate.com/astronomy/planets/distance displays the apparent and comparative sizes of the planets, along with their magnitudes and distances, for a given date and time.

The dwarf planet **Pluto** is not visible this month.

A guide to planetary observing for the year by the British magazine The Sky at Night is posted at https://www.skyatnightmagazine.com/advice/skills/astronomy-guide-viewing-planets-night-sky/

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

Milky Way, and Zodiacal light, right. Looks to me like the zodiacal light is brighter.
Photo taken in March 2017 by Yuri Beletsky Nightscapes

Asteroids

Asteroids 18 Melpomene and 60 Echo travel northwestward through southern Cancer this month on roughly parallel trajectories. Asteroid 10 Echo passes just south of the open cluster M67 from February 5th through February 8th. Asteroid 18 Melpomene lies about one degree north of M67 during that period. Asteroids brighter than magnitude +11.0 that reach opposition this month include 60 Echo (magnitude +10.3) on February 1st, 18 Melpomene (magnitude +9.4) on February 2nd, and 29 Amphitrite (magnitude +9.2) on February 21st. Finder charts for 18 Melpomene and 29 Amphitrite be found on page 49 of the February 2021 issue of Sky & Telescope. Consult http://asteroidoccultation.com/2021_02_si.htm for information on asteroid occultation events taking place this month. Visit http://www.curtrenz.com/asteroids.html to learn more about a number of asteroids.

Comets

Comet C/2021 A2 (NEOWISE) travels northwestward from Puppis to Auriga during February. The faint periodic comet 88P/Howell heads northeastward through Aquarius and Pisces. It enters Cetus at the end of February. Two other faint periodic comets, 17P/Holmes and 141P/Machholz 2, lie nearby in the vicinity of the Circlet of Pisces and Cetus respectively. Visit http://cometchasing.skyhound.com/ and http://www.aerith.net/comet/future-n.html and https://cobs.si/ for information on these and other comets visible this month.

Meteor Showers

The Quadrantid meteor shower is predicted to peak around 9:30 a.m. EST (14:30 UT) on January 3rd. The radiant lies at the junction of the constellations of Boötes, Hercules, and Draco, in what was once called Quadrans Muralis, and is highest just prior to dawn. Unfortunately, a waning gibbous Moon will compromise the peak of this year's Quadrantids. The Quadrantid shower can sometimes reach zenithal hourly rates of more than 100 meteors per hour for a relatively short period of time. The near-Earth asteroid 2003 EH1, which may be an extinct comet, is believed to be the source of these meteors. See https://earthsky.org/?p=155137 and https://amsmeteors.o...hower-calendar/ for more on the Quadrantids. The major meteor showers occurring this year are discussed at https://www.skyandte...howers-in-2021/

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

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/

A monthly podcast on various astronomical topics is available at https://www.skyandtelescope.com/observing/astronomy-podcasts/

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

Earth & Miscellaneous

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

All times, unless otherwise noted, are UT (subtract seven hours and, when appropriate, one calendar day for MST)

2/1 Mars is at eastern quadrature (90 degrees from the Sun) at 10:00
2/2 Asteroid 18 Melpomene (magnitude +9.4) is at opposition in Cancer at 7:00
2/3 The astronomical cross-quarter day (i.e., a day half way between a solstice and an equinox) known as Imbolc, Candlemas, or Groundhog Day occurs today; the Moon is 6.2 degrees north-northeast of the first-magnitude star Spica (Alpha Virginis) at 6:00; the Moon is at perigee, subtending 32' 17" from a distance of 370,116 kilometers (229,980 miles), at 19:03
2/4 Last Quarter Moon occurs at 17:37
2/5 The Curtiss Cross, an X-shaped clair-obscure illumination effect located between the craters Parry and Gambart, is predicted to be visible at 21:42
2/6 Venus (magnitude -3.9) is 0.4 degrees southeast of Saturn (magnitude +0.7) at 8:00; Venus, Jupiter, and Saturn lie within a circle with a diameter of 5.4 degrees at 9:00; the Moon is 5.3 degrees north-northeast of the first-magnitude star Antares (Alpha Scorpii) at 12:00
2/7 The Moon is at the descending node (longitude 258.2 degrees) at 1:00; the Martian northern hemisphere vernal equinox occurs at 11:00
2/8 Mercury is at its northernmost latitude from the ecliptic plane (7.0 degrees) at 7:00; Mercury is at inferior conjunction with the Sun (0.652 astronomical units from Earth, latitude 7.0 degrees) at 14:00
2/9 Asteroid 2 Pallas is in conjunction with the Sun at 20:00
2/10 The Moon is 3.0 degrees south of Saturn at 11:00; the Moon, Venus, and Saturn lie within a circle with a diameter of 5.2 degrees at 16:00; the Moon is 3.0 degrees south of Venus at 20:00; the Moon, Venus, and Jupiter lie within a circle with a diameter of 3.6 degrees at 23:00
2/11 The Moon is 3.6 degrees southeast of Jupiter at 0:00; the equation of time, the difference between mean solar time (as indicated by clocks) and apparent solar time (as indicated by sundials), is at a minimum of -14.23 minutes at 3:00; the Moon is 8.0 degrees southeast of Mercury at 8:00; Venus is 0.4 degrees south of Jupiter at 12:00; New Moon (lunation 1214) occurs at 19:06
2/13 Mercury (magnitude +2.7) is 4.6 degrees north-northwest of Venus (magnitude -3.9) at 10:00; Mercury, Venus, and Jupiter lie within a circle with a diameter of 4.6 degrees at 11:00; the Moon is 4.0 degrees south of Neptune at 17:00; Mercury is 4.0 degrees north of Jupiter at 19:00
2/15 Mercury (magnitude +2.0) is 3.9 degrees north-northwest of Jupiter (magnitude -2.0) at 14:00
2/16 The Sun enters Aquarius (longitude 327.9 degrees on the ecliptic) at 9:00
2/17 The Moon is 2.8 degrees southeast of Uranus at 19:00
2/18 The Moon is at apogee, subtending 29' 32" from a distance of 404,467 kilometers (251,324 miles), at 10:22; the Sun's longitude is 330 degrees at 11:00
2/19 The Lunar X (the Purbach or Werner Cross), an X-shaped clair-obscure illumination effect involving various rims and ridges between the craters La Caille, Blanchinus, and Purbach, is predicted to be fully formed at 8:30; the Moon is 5.5 degrees southeast of the bright open cluster M45 (the Pleiades or Subaru) in Taurus at 18:00; First Quarter Moon occurs at 18:47
2/20 Venus is at aphelion (0.7282 astronomical units from the Sun) at 8:00; the Moon is 4.9 degrees north of Aldebaran at 12:00; Mercury is stationary, with prograde or direct (eastward) motion to commence, at 13:00
2/22 The Moon is 0.4 degrees north of the bright open cluster M35 in Gemini at 8:00; asteroid 29 Amphitrite (magnitude +9.2) is at opposition in Leo at 16:00
2/23 Mercury is 4.1 degrees northeast of Saturn at 8:00; the Moon is 7.3 degrees south of the first-magnitude star Castor (Alpha Geminorum) at 21:00
2/24 The Moon is 3.7 degrees south of the first-magnitude star Pollux (Beta Geminorum) at 2:00
2/25 The Moon is 2.6 degrees north-northeast of the bright open cluster M44 (the Beehive Cluster or Praesepe) in Cancer at 3:00
2/26 The Moon is 4.3 degrees north-northeast of the first-magnitude star Regulus (Alpha Leonis) at 18:00
2/27 The Full Moon (known as the Hunger, Snow, or Storm Moon) occurs at 8:17

Deep Sky

The famous eclipsing variable star Algol (Beta Persei) is at a minimum, decreasing in magnitude from 2.1 to 3.4, on February 1st, 4th, 7th, 10th, 12th, 15th, 18th, 21st, 24th, and 27th. Consult page 50 of the February 2021 issue of Sky & Telescope for the times of the minima. For more on Algol, see http://stars.astro.illinois.edu/sow/Algol.html and http://www.solstation.com/stars2/algol3.htm

The Mira-type variable star R Virginis reaches it maxima of approximately sixth magnitude on February 24th. Information on observing some of the more prominent Messier galaxies is available at http://www.cloudynights.com/topic/358295-how-to-locate-some-of-the-major-messier-galaxies-and-helpful-advice-for-novice-amateur-astronomers/

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_February-march

Telrad finder charts for the Messier Catalog and the SAC's 110 Best of the NGC are posted at http://avila.star-shine.ch/astro/messiercharts/messierTelrad.htm and http://www.custerobservatory.org/docs/messier2.pdf?fbclid=IwAR3CYsJNUlvQ9wll06NN7UHUGJw79RN223CrYVIqTi-tTIFdwMhiJElo8dY and http://sao64.free.fr/observations/catalogues/cataloguesac.pdf

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

Free sky atlases can be downloaded at http://www.deepskywatch.com/files/deepsky-atlas/Deep-Sky-Hunter-atlas-full.pdf and https://allans-stuff.com/triatlas/

Forty binary and multiple stars for February: 41 Aurigae, Struve 872, Otto Struve 147, Struve 929, 56 Aurigae (Auriga); Nu-1 Canis Majoris, 17 Canis Majoris, Pi Canis Majoris, Mu Canis Majoris, h3945, Tau Canis Majoris (Canis Major); Struve 1095, Struve 1103, Struve 1149, 14 Canis Minoris (Canis Minor); 20 Geminorum, 38 Geminorum, Alpha Geminorum (Castor), 15 Geminorum, Lambda Geminorum, Delta Geminorum, Struve 1108, Kappa Geminorum (Gemini); 5 Lyncis, 12 Lyncis, 19 Lyncis, Struve 968, Struve 1025 (Lynx); Epsilon Monocerotis, Beta Monocerotis, 15 (S) Monocerotis (Monoceros); Struve 855 (Orion); Struve 1104, k Puppis, 5 Puppis (Puppis)

Notable carbon star for February: BL Orionis (Orion)

Fifty deep-sky objects for February: NGC 2146, NGC 2403 (Camelopardalis); M41, NGC 2345, NGC 2359, NGC 2360, NGC 2362, NGC 2367, NGC 2383 (Canis Major); M35, NGC 2129, NGC 2158, NGC 2266, NGC 2355, NGC 2371-72, NGC 2392, NGC 2420 (Gemini); NGC 2419 (Lynx); M50, NGC 2232, NGC 2237, NGC 2238, NGC 2244, NGC 2245, NGC 2251, NGC 2261, NGC 2264, NGC 2286, NGC 2301, NGC 2311, NGC 2324, NGC 2335, NGC 2345, NGC 2346, NGC 2353 (Monoceros); NGC 2169, NGC 2174, NGC 2194 (Orion); M46, M47, M93, Mel 71, NGC 2421, NGC 2423, NGC 2438, NGC 2439, NGC 2440, NGC 2467, NGC 2506, NGC 2509 (Puppis)

Top ten binocular deep-sky objects for February: M35, M41, M46, M47, M50, M93, NGC 2244, NGC 2264, NGC 2301, NGC 2360

Top ten deep-sky objects for February: M35, M41, M46, M47, M50, M93, NGC 2261, NGC 2362, NGC 2392, NGC 2403

Challenge deep-sky object for February: IC 443 (Gemini)

The objects listed above are located between 6:00 and 8:00 hours of right ascension.

2021 Ushers in 2020

Brian Jackson -- Boise State University, Dept. of Physics
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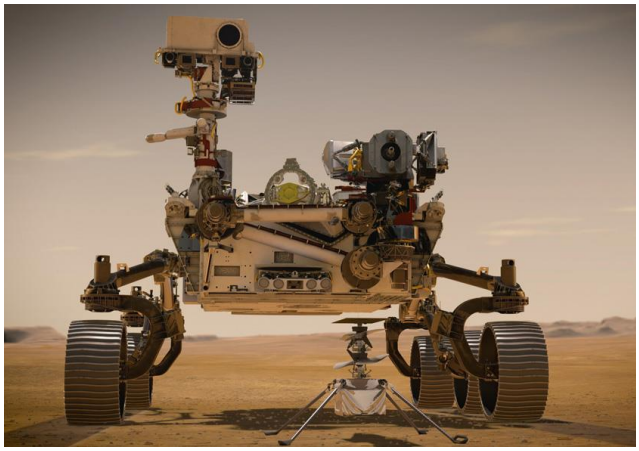


Artist's concept of Perseverance and Ingenuity credit: NASA/JPL-

On February 18, NASA will give the world a belated Valentine - the Mars 2020 rover, nicknamed "Perseverance", will land on the northwestern rim of Jezero Crater, an ancient lakebed. Perseverance will search for signs of Martian life, whether still living or long extinct. It will employ a suite of instruments to probe the remains of a vast river delta. But this rover has more than an exciting geological toolkit up its sleeve -- Perseverance carries an automated helicopter named "Ingenuity", which will allow scientists to fly on another planet for the first time ever.

A Delta is the Desert's Memory of a River

Dump a bucket of water on the present-day surface of Mars, and you'll get a short-lived puff of vapor and ice. That's because the atmospheric pressure is too low for water to remain liquid on the surface. However, 3.0 billion years ago water flowed frequently, and sometimes catastrophically, across the surface of Mars, as evidenced by many geological features including large river deltas. As on Earth today, these Martian deltas were laid down in places where rivers met a large body of water and deposited their sediment loads. These deltas, therefore, record the story of Mars' ancient hydrosphere and may possibly harbor signs of Martian life, past or present. Mars 2020's landing site, Jezero Crater, was once a large lake fed by a river that flowed for perhaps 10 million years. Long ago (nobody knows exactly when or why), Mars dried up and Jezero Lake emptied out, the 1-kilometer high delta remained.

The MOXIE of Mars 2020

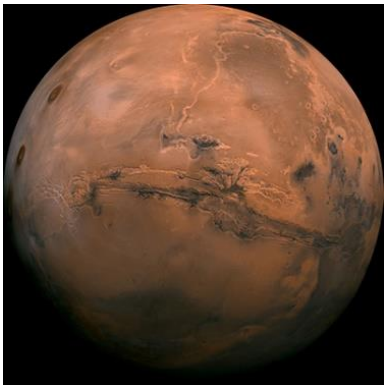
When the Mars 2020 Perseverance rover lands on February 18, it brings a whole sci-fi novel of instruments. Among them, the SuperCam, an 18-Watt laser that will fry rocks from more than 7 meters away and chemically characterize the mineral vapor that forms (it even includes a microphone that will let scientists listen to the 'pop' sound). Like other rovers, Perseverance also has a long arm it can use to investigate rocks up close, this time using the SHERLOC (Scanning Habitable Environments with Raman & Luminescence for Organics & Chemicals) instrument, which is essentially a digital magnifying glass to see fine detail in the Martian rocks. SHERLOC will be guided toward its targets by a wide-angle camera, WATSON (Wide Angle Topographic Sensor for Operations and eNgineering). In addition, Perseverance carries an experiment called MOXIE (Mars Oxygen In-Situ Resource Utilization Experiment) to test how easily the Martian air can be coaxed (or in this case, catalyzed) into forming molecular oxygen, a technology key to future human exploration.

The Ingenuity of Icarus

But perhaps the most exciting experiment on Perseverance is the Ingenuity drone. Ingenuity is a two-rotor (two blades each), autonomous helicopter with a 1.2-meter wingspan and a mass of about 2 kg, not much bigger than a guinea pig. These dimensions are required to achieve lift on a planet with an atmosphere 1% of Earth's. With maximum lateral flight, Ingenuity may only fly about 300 meters at a time, and it is only scheduled to fly about five times during the mission. However, its importance lies not in its flight capabilities but rather in its capability to fly at all. Ingenuity will help NASA understand how to operate a flying drone on another planet, potentially opening a new chapter in planetary exploration. Currently, NASA's rovers are severely limited in their abilities to traverse rough terrain, and weeks or months of testing and planning accompanies every approach to a steep outcrop or craggy ledge. If a mission could instead fly up to an outcrop without worrying about its footing, vast swaths of terrain would be open to exploration. Ingenuity is also an important rehearsal for NASA's more ambitious Dragonfly mission, a nuclear-powered octocopter that will explore the hazy skies of Saturn's moon Titan in the 2030s.

NASA TV will host a live broadcast starting at 10:30 am MST on February 18 to report on Mars 2020's landing -- https://mars.nasa.gov/mars2020/timeline/landing/watch-online/. Fingers crossed for a safe but exciting touchdown.

MARS – THE ROBOT PLANET *by Loretta J Cannon*



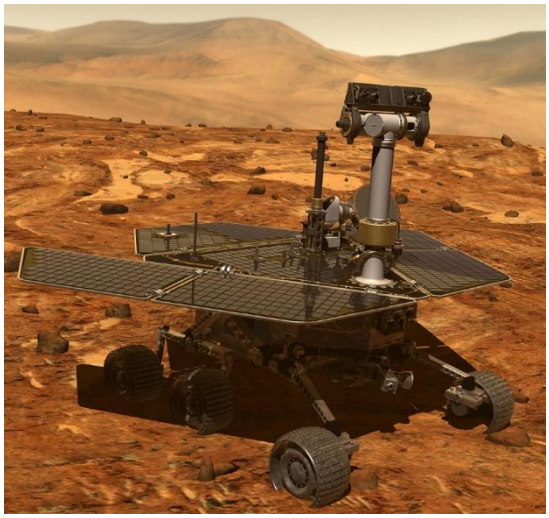
We began our look at the exploration of Mars, as the only planet in our system inhabited solely by robots, back in October 2020. The table below summarizes what we've learned so far, what we'll learn about today, and what we'll learn next month. Interestingly, the first launch of a Mars probe was not in 1964, but rather in October 1960 when the Soviets launched both Marsnik 1 and Marsnik 2, though neither probe was able to achieve Earth orbit and either burned up or fell back to Earth. Including these attempts, humankind has been attempting (and mostly succeeding) to explore Mars for the last 60 years.

Mars as seen by Viking 1 orbiter (Image credit: NASA/JPL-Caltech)

Mission Name	Mission Type	Launch Date	Arrival Date	End Date	Of note
Mariner 3 " 4	flybys	Fall 1964	--- July 1965	--- Dec 1967	Failed to reach Mars First photos of another world from space
Mariner 6 " 7	flybys	Feb 1969 Mar 1969	31 July 1969 8 Aug 1969	~July 1971 ~July 1971	After successful flyby, entered heliocentric orbit. Mariner 7 ended successfully as Mariner 6 did
Mariner 8 " 9	flyby orbiter	9 May 1971 30 May 1971	--- 14 Nov 1971	--- 27 Oct 1972	Launch Failure First spacecraft to orbit Mars
Viking 1 " 2	orbiters + landers	20 Aug 1975 9 Sept 1975	19 June 1976 7 Aug 1976	11 Nov 1982 12 Apr 1980	Believed to have found life, but not confirmed Between both orbiters, mapped 97% of surface
M. Observer	orbiter	25 Sept 1992	---	22 Aug 1993	Lost Contact enroute to Mars
M. Global Surveyor	orbiter	7 Nov 1996	12 Sept 1997	21 Nov 2006	1st 3D profiles of North Pole; more images than any previous mission; Mars Surveyor Program #1
M. Pathfinder and Sojourner	lander rover	4 Dec 1996	4 July 1997	27 Sept 1997	First (and very successful) lander + rover; first bouncy castle landing
M. Climate Orbiter	orbiter	11 Dec 1998	23 Sept 1999	---	Mars Surveyor Program #2; Lost contact after it began its orbital insertion maneuver at Mars
M. Polar Lander and Deep Space 2	lander	3 Jan 1999	3 Dec 1999	---	Mars Surveyor Program #3; Lost contact as it entered Mars' orbit; no evidence of crashed craft
M. Odyssey	orbiter	7 Apr 2001	24 Oct 2001	→	Holds record for longest continuously active orbiter around a non-Earth world
(MER) Spirit and Opportunity	rovers	10 June 2003 8 July 2003	4 Jan 2004 25 Jan 2004	25 May 2011 13 Feb 2019	But for the Martian dust, these might still be operating, having achieved many goals & firsts
M. Reconnaissance	orbiter	12 Aug 2005	11 Sept 2006	→	Mission Elapsed Time (as of Feb 4, 2021) 15 yrs 5 mos 23 days 14 hrs
Phoenix	lander	4 Aug 2007	25 May 2008	2 Nov 2008	
Curiosity (Mars Science Lab)	rover	26 Nov 2011	6 Aug 2012	→	
Maven	orbiter	18 Nov 2013	21 Sept 2014	→	
Insight	lander	5 May 2018	26 Nov 2018	→	
MarCO - WALL E - EVE	CubeSat	5 May 2018	26 Nov 2018	29 Dec 2018 4 Jan 2019	Successful technology demo - comm relay for Insight mission landing status
Perseverance and Ingenuity	rover helicopter	30 July 2020	*18 Feb 2021*		see CURRENTS IN SPACE for article by Prof Brian Jackson, Physics Dept, BSU

Of the 21 spacecraft listed, 16 were successful, 5 are still ongoing, and 1 should arrive at Mars this month. Only 4 failed. This is impressive. It is worth noting that these are only the NASA (U.S.) Mars missions. Other countries have sent spacecraft. Between 1960 and 1988, the Soviets launched 18 spacecraft to Mars, only 4½ succeeded. France has had 2 failed missions. Japan sent a successful orbiter in 1998. The European Space Agency (ESA) has had 2 successful orbiter-with-lander missions. India sent a successful orbiter in 2013. China's first orbiter failed in 2011; their 2020 orbiter-with-lander succeeded. The United Arab Emirates launched a successful orbiter in 2020. All of which increases the total number of robot inhabitants on and around Mars.

SPIRIT and OPPORTUNITY ROVERS

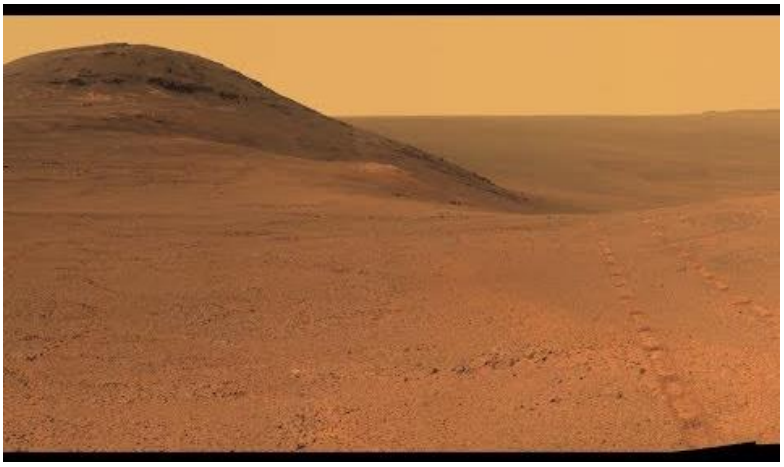


Launched in 2003 and arriving in 2004, these twin workhorses achieved so much. Mission goals for *Spirit* and *Opportunity* (Mars Exploration Rovers) included studying areas where climate and geographic evidence might indicate water (and life) may have once existed. Both rovers far exceeded their planned life expectancies of 90 days.

ROVER	MISSION	ROVER	DISTANCE
Spirit	7 yrs, 11 mos	6 yrs, 2 mos	4.8 miles
Opportunity	14 yrs, 11 mos	undetermined	28.0 miles

No bigger than golf carts, these rovers each weigh an impressive 405 lbs and each have five instruments on a robotic arm including a Mossbauer Spectrometer (MB), an Alpha Particle X-ray Spectrometer (APXS), Microscopic Imager (MI), Rock Abrasion Tool (RAT), and magnets. The panoramic mast assembly houses two cameras and a mini thermal emission spectrometer. These instrument packages would prove successful analyzing various rocks and soils on Mars.

The two rovers were sent to opposite sides of the red planet, to areas where (based on previous robotic studies) there may have been liquid water previously. *Spirit*'s lander package hit the planet at a velocity of almost 46 feet per second, bounced 28 times (remember the description of *Pathfinder*'s airbag landing), and came to rest inside the Gusev crater, a mere eight miles from the target landing site. *Opportunity*'s lander bounced 26 times and came to rest in Meridiani Planum's Eagle crater, only nine miles from the target site. Both final resting sites were renamed to honor lives lost in Space Shuttle accidents, respectively, Columbia Memorial Station and Challenger Memorial Station.



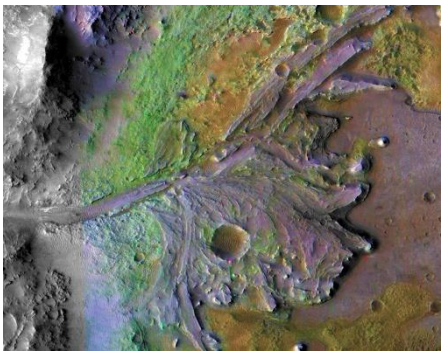
Over the course of their years' long exploratory efforts, many discoveries were made, some by accident. In 2005, *Spirit*'s cameras captured movies of dust devils, the best evidence then of Martian wind effects. In early 2007, one of *Spirit*'s front wheels stopped turning and scraped off enough top soil to reveal an area of almost pure silica, strong evidence for a wet ancient Mars with possible steam vents or hot springs. The movie at right covers *Opportunity*'s trip and some accomplishments (credit: NASA-JPL). During its time on Mars, *Opportunity* broke records: longest continuous operation on the surface of Mars; farthest distance travelled by any vehicle on another celestial body; driving at steepest tilt on slope of 32 degrees.

Though both rovers periodically had their solar cells cleared of dust by strong Martian winds (increasing rover power), it was dust that disabled them both in the end. *Spirit* became mired in soft soil in May 2009; by Jan 2010 it was designated a stationary science platform, and in March, they lost contact. When the mission was 'called' in May 2011, the cause was attributed to excessive cold overwhelming its internal heaters. In 2018, an historic planet-wide dust storm finally took out *Opportunity*, obscuring its solar panels. The last signal came through on June 10th.

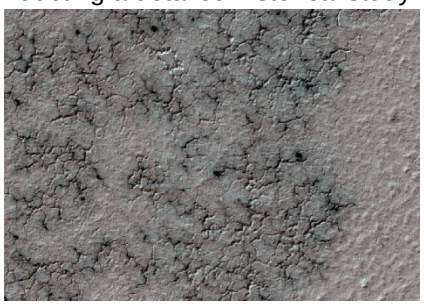
MARS RECONNAISSANCE ORBITER (MRO)

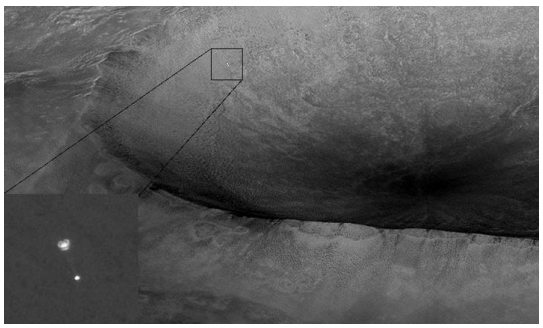
This intrepid orbiter left Earth in Aug 2005 and achieved its operational, polar orbit in September 2006. Though originally planned for only a 24-month mission, the MRO is still operational today alongside the *Odyssey* orbiter. Whereas *Odyssey* carries only three instruments, the MRO has ten, including "the most powerful telescopic camera ever flown to another planet" (according to a NASA Fact sheet). The High-Resolution Imaging Science Experiment (HiRISE) camera can resolve an object as small as 3-feet across and has produced some of the most amazing images of Mars, including weather features, potential future landing sites, and also keeping

an eye on the other robot inhabitants of the planet. Above is a swirling dust devil (credit: NASA/JPL-Caltech/UoAZ). The image at Right is the Jezero Crater as seen in Nov 2018, where Mars 2020 *Perseverance* will land on Feb 18th (credit: NASA/JPL-Caltech/MSSS/JHU-APL). At Left, the rover *Opportunity* was spotted traversing the Perseverance Valley in Sept 2018 (credit: NASA/ JPL-Caltech/UoAZ). Scientists produced a fascinating animation of HiRISE watching the Curiosity rover trek across a clay unit. When you watch, the rover is first seen near the top center of the image and ends up at the bottom center, and you can see rover tracks.



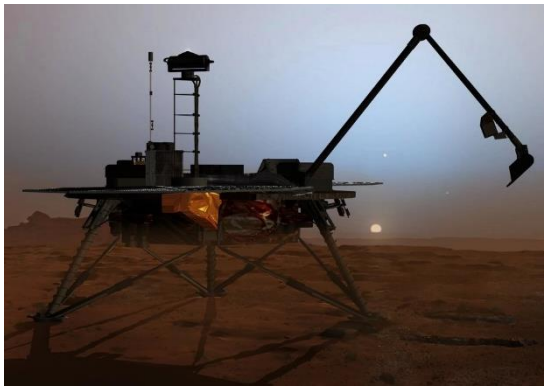
Previous Mars missions have identified multiple locations where flowing water existed in the planet's past. With that in mind, in addition to a comprehensive study of Martian weather, the MRO has been conducting a detailed historical study of water across the planet. Among the MRO instruments that are performing these studies are: CRISM (Compact Reconnaissance Imaging Spectrometer for Mars), which has been identifying water-related surface minerals, and SHARAD (Shallow Subsurface Radar), which can penetrate up to 1/3 mile below the surface looking at rock, ice, and melted water. The CTX (Context Camera) was used in 2016 for a crowd-sourced experiment in which 10,000 individuals viewed images of Mars' south pole to identify targets for HiRISE; all of which led to a more thorough understanding of seasonal carbon dioxide ice and the 'spider' feature seen on sheets of CO_2 ice (see image at Right, credit: NASA/JPL-Caltech/UoAZ).





PHOENIX LANDER

Launched in Aug 2007, this small and short-lived lander, the first in NASA's Mars Scout Program, landed in May 2008 farther north on Mars than any other lander, at Vastitas Borealis in the Martian arctic. What was interesting, as *Phoenix* approached Mars, the three spacecraft currently orbiting the planet (*Odyssey*, MRO, and *Mars Express*[1]) had their trajectories adjusted so they could observe, and MRO's HiRISE not only scouted the landing area but also took the image at Left (note the inset) of *Phoenix* hanging from its parachute (credit: NASA/ JPL-Caltech/UoAZ). This was the first successful stationary soft-landing since *Viking 2* in 1976.



Can you guess what the mission goals were? That's right – search for signs of life and study Mars' climate and geology with an eye towards future human exploration. And though *Phoenix* only operated on the surface for a little over five months, it performed some remarkable science experiments. NASA announced experimental evidence for water on Mars in July (collaborating data from MRO). In August, perchlorates were identified, not definitive proof for life, but the controversial experiments from the *Viking* landers were re-examined. I reported on the *Viking* experiments last October and how, quite recently, a pharmacology professor wanted to see the data, but NASA had to first digitize the information from original microfilm. A new scoop of soil was analyzed in September, and preliminary results indicated perchlorate again plus salts, sodium, magnesium, chloride, and potassium.

By October, *Phoenix* automatically went into 'safe' mode (instruments turn off to conserve energy) due to bad weather and reduced sunlight – winter had come. The lander continued to communicate with Earth daily until November 2nd, then nothing. NASA concluded that CO_2 ice had more than likely built up on and damaged the solar panels, that the ice may have been up to 7 inches thick. By May 2010, images from MRO showed the solar panels had been severely damaged by weather.

This sage will conclude in March, and we will review the landing and early days of *Perseverance* and *Ingenuity* !!

[1] *Mars Express* is a joint ESA-NASA orbiter that launched June 2003.

This article is distributed by NASA Night Sky Network

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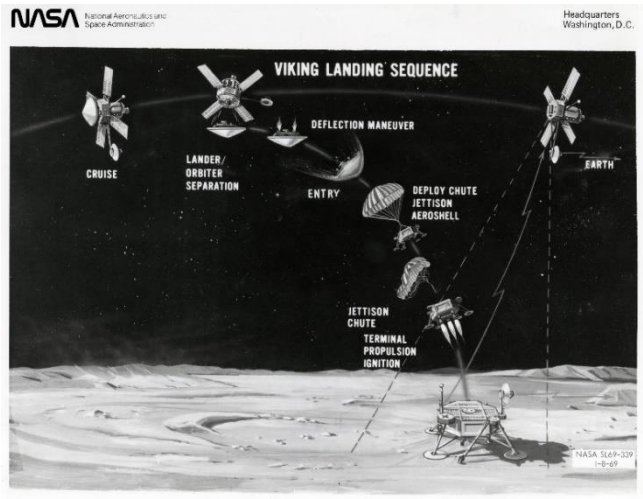
Landing on Mars: A Tricky Feat!

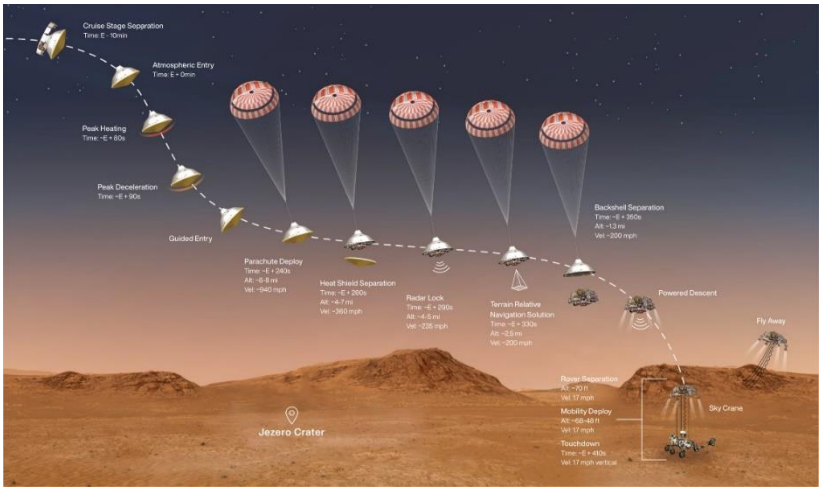
David Prosper

The Perseverance rover and Ingenuity helicopter will land in Mars's Jezero crater on February 18, 2021, NASA's latest mission to explore the red planet. Landing on Mars is an incredibly difficult feat that has challenged engineers for decades: while missions like Curiosity have succeeded, its surface is littered with the wreckage of many failures as well. Why is landing on Mars so difficult?

Mars presents a unique problem to potential landers as it possesses a relatively large mass and a thin, but not insubstantial, atmosphere. The atmosphere is thick enough that spacecraft are stuffed inside a streamlined aeroshell sporting a protective heat shield to prevent burning up upon entry - but that same atmosphere is not thick enough to rely on parachutes alone for a safe landing, since they can't catch sufficient air to slow down quickly enough. This is even worse for larger explorers like Perseverance, weighing in at 2,260 lbs (1,025 kg). Fortunately, engineers have crafted some ingenious landing methods over the decades to allow their spacecraft to survive what is called Entry, Descent, and Landing (EDL).



The Viking landers touched down on Mars in 1976 using heat shields, parachutes, and retrorockets. Despite using large parachutes, the large Viking landers fired retrorockets at the end to land at a safe speed. This complex combination has been followed by almost every mission since, but subsequent missions have innovated in the landing segment. The 1997 Mars Pathfinder mission added airbags in conjunction with parachutes and retrorockets to safely bounce its way to a landing on the Martian surface. Then three sturdy "petals" ensured the lander was pushed into an upright position after landing on an ancient floodplain. The Opportunity and Spirit missions used a very similar method to place their rovers on the Martian surface in 2004. Phoenix (2008) and Insight (2018) actually utilized Viking-style landings. The large and heavy Curiosity rover required extra power at the end to safely land the car-sized rover, and so the daring "Sky Crane" deployment system was successfully used in 2012. After an initial descent using a massive heat shield and parachute, powerful retrorockets finished slowing down the spacecraft to about 2 miles per hour. The Sky Crane then safely lowered the rover down to the Martian surface using a strong cable. Its job done, the Sky Crane then flew off and crash-landed a safe distance away. Having proved the efficacy of the Sky Crane system, NASA will use this same method to attempt a safe landing for Perseverance this month!



Despite the wide gap between these missions in terms of technology, they both performed their landing maneuvers automatically, since our planets are too far apart to allow Earth-based engineers to control them in real time! You can watch coverage of the Mars Perseverance landing starting at 11:00 AM PST (2:00 PM EST) on February 18 at nasa.gov/nasalive. Touchdown is expected around 12:55 PM PST (3:55 PM EST). NASA has great resources about the Perseverance Rover and accompanying Ingenuity helicopter on mars.nasa.gov/mars2020. And of course, find out how we plan to land on many different worlds at nasa.gov.

Above and Upper Right: Illustrations of the Entry, Descent, and Landing (EDL) sequences for Viking in 1976, and Perseverance in 2021. (NASA/JPL/Caltech)

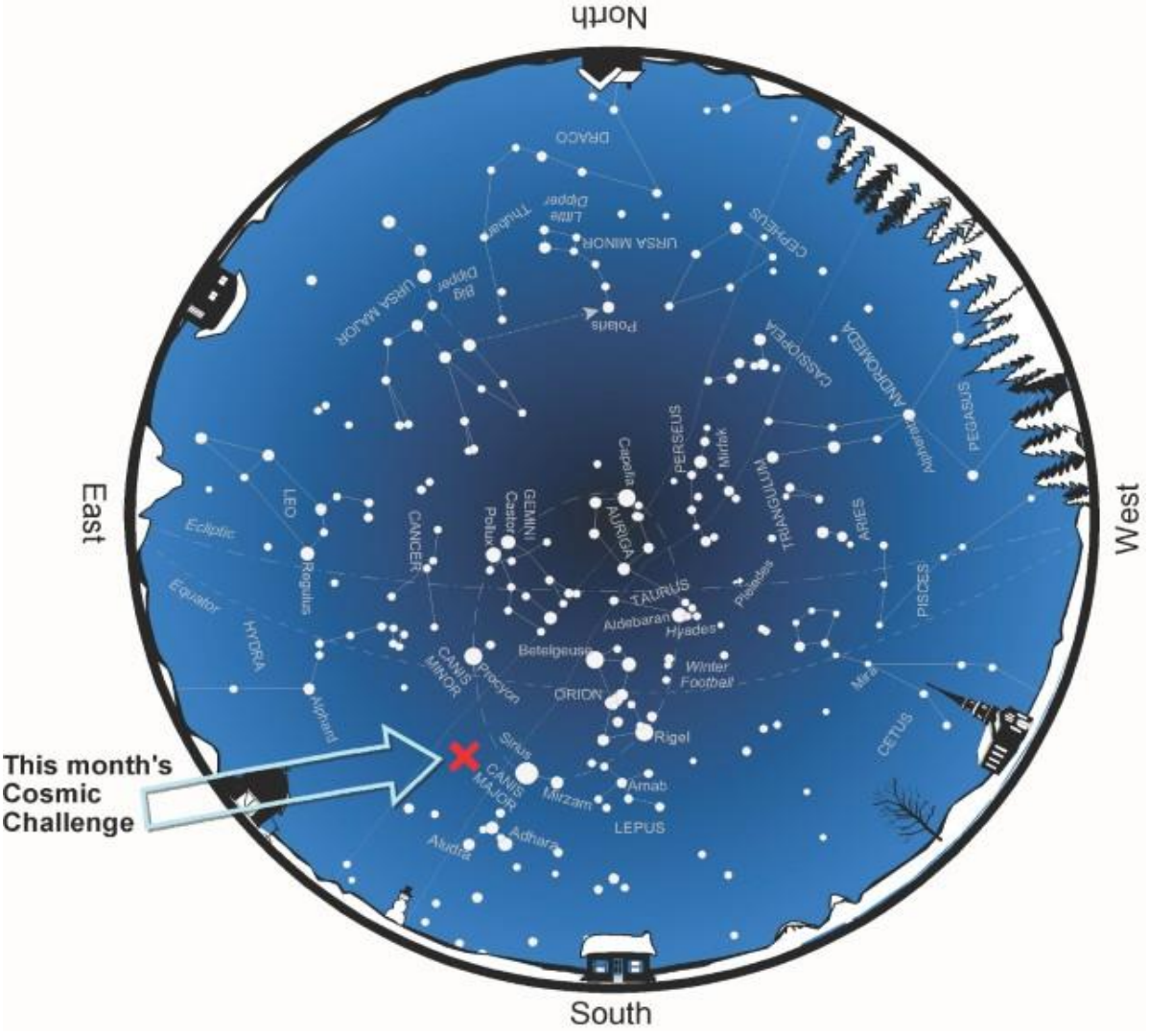
NGC 2438

	Medium scopes: 6-inch (15cm) to 9.25-inch (23cm)

Target	Type	RA	DEC	Constellation	Mag	Size
NGC 2438	Planetary nebula	07h 41.8m	-14° 44.1'	Puppis	10.8	64"

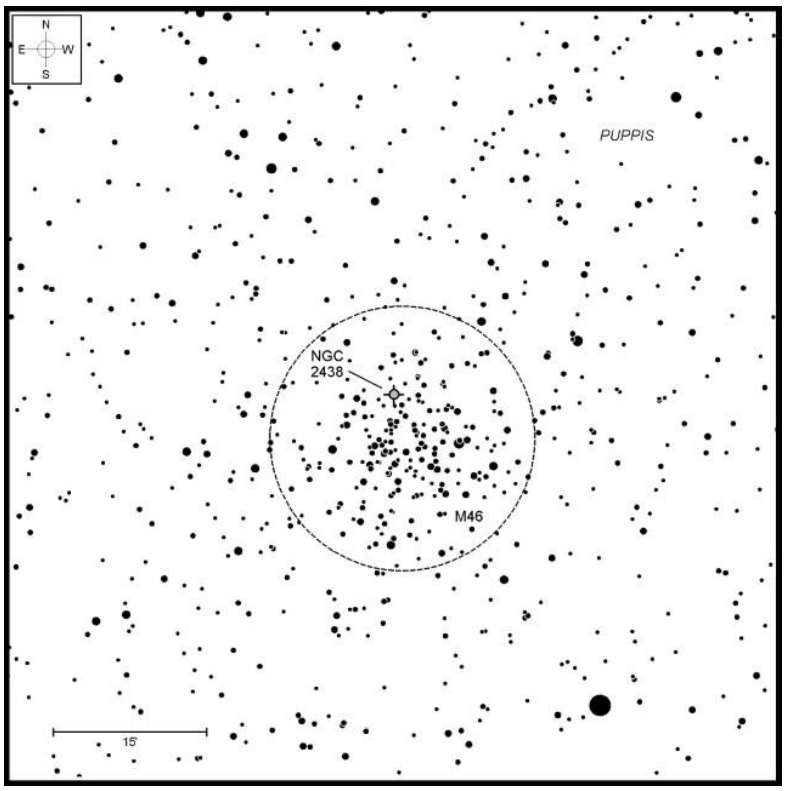
M46 in Puppis is one of my favorite open clusters and a striking sight through just about any telescope. More than 500 stars are crammed into an area just a Moon's diameter across, creating one of the most jam-packed throngs in the winter sky.

M46 was discovered by Charles Messier on February 19, 1771, only three days after he had published the first edition of his catalog covering M's 1 through 45. Of his new catch, Messier wrote "A cluster of very small stars, between the head of the Great Dog and the two hind feet of the Unicorn; one cannot see these stars but with a good refractor." But when William Herschel gazed upon M46 through his 18.7-inch reflector on March 19, 1786, he saw something else, something Messier apparently had missed or overlooked, floating among the cluster stars north of the group's center. He probably thought to himself, "That's not a star at all. That's a tiny disk of light." Herschel included his find as H-IV-39, the 39th planetary nebula in his catalog, but today, we know it best as NGC 2438.



February evening star map, adapted from Star Watch by Phil Harrington

While NGC 2438 may look like it belongs to M46, in reality it is much closer to Earth. The most recent study of the distance to NGC 2438 came last year. In a paper entitled Searching for central stars of planetary nebulae in Gaia DR2 [Astronomy & Astrophysics. 616], authors N. Chornay and N. A. Walton examined the Gaia spacecraft's Data Release 2. Gaia is the European Space Agency's astrometric spacecraft designed to accurately measure positions, distances and motions of stars with unparalleled accuracy. Their study pegged the distance to NGC 2438 at 1,376 light years.



In a 2013 study, The Open Cluster NGC 2437 (Messier 46) [Publications of the Astronomical Society of the Pacific, Volume 125, Number 924], author T.J. Davidge placed M46 at 4,660 light years from Earth.

Earlier studies that led to same conclusion of different distances compared the spectra of the planetary with those of stars in M46. These showed that both M46 and NGC 2438 were moving away from the solar system, but at two different speeds. Were the planetary and cluster physically associated, they would be moving through space at the same speed.

At Left: Finder chart adapted from Cosmic Challenge: The Ultimate Observing List for Amateurs by Phil Harrington.

M46 and NGC 2438 are easiest to find by dropping 5° due south from 4th-magnitude Alpha (α) Monocerotis, the brightest star in Monoceros. Trying to find *that star* is its own challenge, especially with less-than-perfect sky conditions. Fortunately, a line extended from Sirius [Alpha (α) Canis Majoris] through Gamma (γ) Canis Majoris for 11° to the east points right at Alpha Mon. Use your binoculars or finderscope to trace the line, and then shift southward to find M46 within a slender stellar triangle.

Incidentally, you will also find another open cluster, M47, at the triangle's western tip, just 1½° west of M46. Both clusters make a spectacular couple in binoculars and rich-field telescopes. Again, however, they are nowhere near each other in space. M47 is 1,624 light years away.

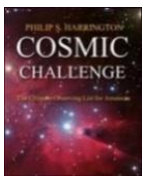
Credit and Copyright: Adam Block/Mount Lemmon SkyCenter/University of Arizona, CC BY-SA 3.0 US, via Wikimedia Commons

As striking as that low-power view is, NGC 2438 will take at least 150x to tell it apart from just another cluster star. Focus your attention on the stars in the northern part of the cluster, keeping an eye out for a tiny, softly glowing disk of greenish light. That will be the 11th-magnitude planetary. Through my 8-inch (20cm) reflector at 203x and with an oxygen-III filter in place, the nebula's ring shape is clearly evident and appears very slightly oval. Removing the filter and using averted vision adds a 13th-magnitude star within the ring, just slightly offset to the northwest of center. Don't be fooled into thinking that you are seeing the nebula's forbearer, however. NGC 2438's actual central star barely cracks 18th magnitude. The dim sun we are seeing is most likely a distant member of M46. Another of M46's stars, an 11th-magnitude point, appears to just brush the nebula's southeastern edge.

NGC 2438 appears to float among stars of M46 in this rendering of the view through the author's 8-inch (20cm) reflector at 203x.

Good luck! And be sure to post your results in this column's online discussion forum (Phil Harrington's February cosmic challenge forum).

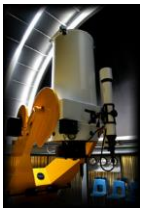
Until next month, remember that half of the fun is the thrill of the chase. Game on!



About the Author: Phil Harrington writes the monthly *Binocular Universe* column in Astronomy magazine and is the author of 9 books on astronomy, including Cosmic Challenge: The Ultimate Observing List for Amateurs.
Visit www.philharrington.net to learn more.

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!

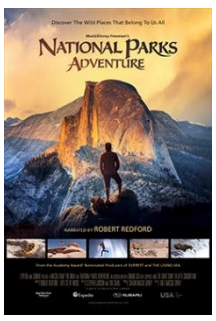


Centennial Observatory Upcoming Events

Event	Place	Date	Time	Admission
Telescope Tuesday	Centennial Observatory	Tuesday, February 9th, 2021	7:00 to 9:00 PM	$1.50 or free with Faulkner Planetarium admission
Monthly Free Star Party	Centennial Observatory	Saturday, February 13th, 2021	7:00 to 9:00 PM	FREE
Telescope Tuesday	Centennial Observatory	Tuesday, February 23rd, 2021	7:30 to 9:00 PM	$1.50 or free with Faulkner Planetarium admission

Due to the need to maintain social distance during the Covid-19 pandemic, access to the observatory dome is one small group at a time. Contact the Herrett Center 208-732-6655 for more info.

Faulkner Planetarium



Now Showing!

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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.

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.