January 2019 Astronomy Calendar by Dave Mitsky

Some information supplied and/or added by Tony Donnangelo

Times are Eastern Standard Time (-5 hrs. U.T.)

Events listed are based on a location of 40°N in the Eastern US and may not be visible in all areas.

Concerning moderate and minor meteor shower activity:
Do not have any high expectations. This general information is to account for why you might be seeing a few more than normal meteors during your observing session.

Lunar light rays may occur prior to or after the predicted time. Initial observations might have occurred after the ray's inception or continued after the observer's session. Rays may last a very short time or for many hours. Obtain further information; send reports (including non-occurrences and miss-calculations), photos, and observations of new rays to:
The Robinson Lunar Observatory: http://www.lunar-occultations.com/rlo/rlondx.htm.

1/1 Comet P/1998 VS24 (LINEAR) is at opposition at 2.783 A.U.
1/1 The Moon is 1.3° north of Venus at 5:00 p.m.
1/1 Mercury is at the descending node through the ecliptic plane at 7:00 p.m.
1/1 Mars crosses north of the celestial equator at 8:00 p.m.
1/2 Comet 356P/WISE is at closest approach to Earth at 2.518 A.U.
1/2 Comet 302P/Lemmon-PANSTARRS is at opposition at 3.789 AU)
1/2 60th Anniversary (1959) of Luna 1 launch (1st Moon flyby).
1/2 180th Anniversary (1839) of Louis Daguerre takes first photograph of the Moon.
1/2 Johann Daniel Titius' 290th birthday (1729).
1/2 Saturn is in conjunction with the Sun at 1:00 a.m.
1/3 Earth is at perihelion at 0.983 AU from the Sun.
1/3 Comet 31P/Schwassmann-Wachmann is at opposition at 2.523 A.U.
1/3 Marcus Cicero's 2125th birthday (106 BC)
1/3 The Moon is 8.4° north-northeast of first-magnitude star Antares (Alpha Scorpii) at 12:00 a.m.
1/3 The Earth is at perihelion (147,099,761 kilometers or 91,403,554 miles distant from the Sun) at 1:20 a.m.
1/3 The Moon is 3.1° north-northeast of Jupiter at 5:00 a.m.
1/3 Quadrantids meteor shower (moderate activity - 40 to 120 or more per hour) peak is predicted to occur at 9:30 p.m. Duration is from 12/28 through 1/7. The radiant is in Draco. Observing and History: http://meteorshowersonline.com/quadrantids.html
1/4 Comet 175P/Hergenrother is at opposition at 1.840 A.U.
1/4 15th Anniversary (2004) of Mars Exploration Rover A (Spirit) Mars landing.
1/4 The latest sunrise of 2019 at latitude 40° north occurs today.
1/4 The Moon is 2.8° north of Mercury at 2:00 p.m.
1/5 Comet 31P/Schwassmann-Wachmann is at closest approach to Earth at 2.521 A.U.
1/5 The Moon is 0.9° north of Saturn at 2:00 p.m.
1/5 Venus is at dichotomy (50% illuminated) at 2:00 p.m.
1/5 A partial solar eclipse visible from China, Korea, Japan, Russia, the northern Pacific Ocean, and the Aleutian Islands begins at 6:34 p.m.
1/5 New Moon (lunation 1188) occurs at 8:28 p.m.
1/5 The instant of greatest eclipse for the ongoing partial solar eclipse takes place at 8:41 p.m.
1/5 Gamma Velids meteor shower (minor activity) peaks from 5th through 8th. Duration is from 1st through 17th. Observing and History: http://meteorshowersonline.com/showers/gamma_velids.html
1/5 The partial solar eclipse ends at 10:48 p.m.
1/6 Venus is at its greatest western elongation of 47°.
1/6 233rd meeting of the American Astronomical Society (AAS) being held through the 10th in Seattle, Washington.

1/6 Venus is at greatest western elongation (46.9°) at 12:00 a.m.
1/6 99th Annual meeting of the American Meteorological Society beingheld through the 10th in Phoenix, Arizona.
1/6 Uranus is stationary in longitude at 1:00 p.m.
1/6 Uranus is stationary in right ascension, with direct motion to resume, at 7:00 p.m.
1/6 The Moon is at descending node (longitude 296.7°) at 7:08 p.m.
1/7 Comet C/2016 N6 (PANSTARRS) is at opposition at 2.414 A.U.
1/7 Comet 139P/Vaisala-Oterma is at closest approach to Earth at 2.852 A.U.
1/7 Comet C/2017 U5 (PANSTARRS) is at closest approach to Earth at 4.164 A.U.
1/7 The Moon displays minimum libration for the year (1.2°) at 10:00 a.m.
1/8 Comet C/2018 L2 (ATLAS) is at closest approach to Earth at 2.355 A.U.
1/8 The latest onset of morning twilight of 2019 at latitude 40° north occurs today.
1/8 Rho Geminids meteor shower (minor activity) peaks 8/9. Duration is 12/28 through 1/28. Observing and History: http://meteorshowersonline.com/showers/rho_geminids.html
1/8 The Moon is at apogee, subtending 29' 25" from a distance of 406,117 kilometers (252,850 miles), at 11:00 p.m.
1/9 Comet C/2018 R5 (Lemmon) is at perihelion at 3.621 A.U.
1/9 180th Anniversary (1839) of Thomas Henderson publishes first stellar parallax measurements.
1/10 Comet P/2007 T2 (Kowalski) is at closest approach to Earth at 1.568 A.U.
1/10 Comet 239P/LINEAR is at perihelion at 1.649 A.U.
1/10 Comet C/2018 A3 (ATLAS) is at closest approach to Earth at 2.606 A.U.
1/10 Comet C/2018 A3 (ATLAS) is at opposition at 2.606 A.U.
1/10 Mercury is at its southernmost declination (-24.1°) at 1:00 p.m.
1/10 The Moon is 3.0° south of Neptune at 5:00 p.m.
1/11 Comet 59P/Kearns-Kwee is at closest approach to Earth at 1.551 A.U.
1/11 Comet P/2017 S5 (ATLAS) is at closest approach to Earth at 2.550 A.U.
1/11 Comet 296P/Garradd is at opposition at 3.308 A.U.
1/11 Comet C/2016 X1 (Lemmon) is at opposition at 6.653 A.U.
1/11 Pluto is in conjunction with the Sun at 7:00 a.m.
1/11 Royal Astronomical Society (RAS) Ordinary Meeting being held in London, United Kingdom.
1/12 Comet 219P/LINEAR is at opposition at 3.247 A.U.
1/12 Comet C/2018 A3 (ATLAS) is at perihelion at 3.277 A.U.
1/12 Comet C/2017 K6 (Jacques) is at opposition at 3.760 A.U.
1/12 Mercury is at aphelion (0.4667 a.u. from the Sun) at 3:00 a.m.
1/12 Abenezra P (sunrise) lunar light ray predicted to occur at Sunset 5:02 p.m.
1/12 Abenezra C (sunrise) lunar light ray predicted to occur at 5:12:54 p.m. Sunset 5:02 p.m.
1/12 The Moon is 5.0° south-southeast of Mars at 8:00 p.m.
1/12 Hind (SE of) (sunrise) lunar light ray predicted to occur at 8:28:00 p.m.
1/13 Mercury passes 1.7° from Saturn.
1/13 Comet 139P/Vaisala-Oterma is at opposition at 2.857 A.U.
1/13 Comet C/2016 X1 (Lemmon) is at closest approach to Earth at 6.652 A.U.
1/13 Apollo asteroid 2018 XN near-Earth flyby at 0.030 A.U.
1/13 Apollo asteroid 2018 AN2 near-Earth flyby at 0.065 A.U.
1/13 Vasily Fesenkov's 130th birthday (1889).
1/13 Wilhelm Wien's 155th birthday (1864).
1/13 Mercury (magnitude -0.6) is 1.7° south of Saturn (magnitude +0.5) at 7:00 a.m.
1/13 The Lunar X (the Purbach or Werner Cross), an X-shaped illumination effect involving various rims and ridges between the craters La Caille, Blanchinus, and Purbach, is predicted to be fully formed at approximately 7:35 a.m.
1/13 January Draconids meteor shower (minor activity) peaks from 13th through 16th. Duration is from 10th through 24th. Observing and History: http://meteorshowersonline.com/showers/january_draconids.html
1/13 Saunder (sunrise) lunar light ray predicted to occur at 7:58:54 p.m.
1/14 Comet 171P/Spahr is at perihelion at 1.772 A.U.
1/14 First Quarter Moon occurs at 1:46 a.m.
1/14 The Moon is 4.8° south-southeast of Uranus at 12:00 p.m.

1/14 Fra Mauro HA (sunrise) lunar light ray predicted to occur at 8:07:09 p.m.
1/14 Parry (sunrise) lunar light ray predicted to occur at 8:10:16 p.m.
1/14 Guericke (sunrise) lunar light ray predicted to occur at 8:15:09 p.m.
1/14 Renart (sunrise) lunar light ray predicted to occur at 9:03:53 p.m.
1/14 Hesiodus (sunrise) lunar light ray predicted to occur at 11:03:02 p.m.
1/14 Bonpland (sunrise) lunar light ray predicted to occur at 11:30:08 p.m.
1/15 Comet C/2018 M1 (Catalina) is at opposition at 2.137 A.U.
1/15 Mars is at the ascending node through the ecliptic plane at 12:00 a.m.
1/15 Mercator (sunrise) lunar light ray predicted to occur at 7:34:18 p.m.
1/15 Montes Riphaeus (sunrise) lunar light ray predicted to occur at 7:51:53 p.m.
1/15 Lacus Timoris (sunrise) lunar light ray predicted to occur at 11:05:32 p.m.
1/16 50th anniversary (1969) of the discovery of the first optical pulsar by John Cocke & Michael Disney.
1/16 Comet 107P/Wilson-Harrington is at closest approach to Earth at 1.742 A.U.
1/16 Campanus (sunrise) lunar light ray predicted to occur at 12:45:37 a.m.
1/16 La Condamine (sunrise) lunar light ray predicted to occur at 1:23:50 a.m. Moonset 2:26 am.
1/16 Venus (magnitude -4.4) is 7.8° north of the first-magnitude star Antares at 6:00 p.m.
1/16 The Moon is 8.5° south-southeast of the bright open cluster M45 (the Pleiades or Subaru) in Taurus at 10:00 p.m.
1/16 Eta Craterids meteor shower (minor activity) peaks 16/17. Duration is 11th through 22nd. Observing and History: http://meteorshowersonline.com/showers/eta_carinids.html
1/16 January Booteids meteor shower (minor activity) peaks from the 16th through 18th. Duration is from 9th to 18th. Observing and History: http://meteorshowersonline.com/showers/january_bootids.html
1/17 Comet 38P/Stephan-Oterma is at opposition at 0.858 A.U.
1/17 90th anniversary (1929) of Edwin Hubble publishes paper that the universe is expanding.
1/17 Ralph Fowler's 130th birthday (1889).
1/17 The middle of the eclipse season (the Sun is at same longitude as the descending node of the Moon, 296.7°) occurs at 3:00 a.m.
1/17 Venus is at its northernmost latitude from the ecliptic plane (3.4°) at 3:00 a.m.
1/17 The Moon is 1.6° north of the first magnitude star Aldebaran (Alpha Scorpii) at 2:00 p.m.
1/17 Delta Cancrids meteor shower (minor activity) peaks. Duration is from 12/14 through 2/14. Observing and History: http://meteorshowersonline.com/showers/delta_cancrids.html
1/18 Comet 239P/LINEAR is at closest approach to Earth at 0.694 A.U.
1/18 Comet C/2017 M4 (ATLAS) is at perihelion at 3.252 A.U.
1/18 Mercury (magnitude -0.8) is 1.5° south of Pluto (magnitude +14.3) at 3:00 p.m.
1/18 Schiller C (sunrise) lunar light ray predicted to occur at 7:53:57 p.m.
1/18 Uranus is at eastern quadrature (90° from the Sun) at 8:00 p.m.
1/19 Comet P/2017 S5 (ATLAS) is at opposition at 2.559 A.U.
1/19 Comet C/2017 U5 (PANSTARRS) is at opposition at 4.186 A.U.
1/19 The Sun enters Capricornus (ecliptic longitude 299.7°) at 9:00 p.m.
1/20 Comet 247P/LINEAR is at closest approach to Earth at 0.734 A.U.
1/20 Comet 117P/Helin-Roman-Alu is at opposition at 4.074 A.U.
1/20 The Moon is 7.0° south of the first-magnitude star Pollux (Beta Geminorum) at 2:00 p.m.
1/20 The Moon is at the ascending node (longitude 116.8°) at 5:48 p.m.
1/20 Alpha Hydrids meteor shower (minor activity) peaks 20/21. Duration is 15th through 30th. Observing and History: http://meteorshowersonline.com/showers/alpha_hydrids.html
1/20 A partial lunar eclipse begins at 10:34 p.m.
1/21 Comet 59P/Kearns-Kwee is at opposition at 1.564 A.U.
1/21 Comet 91P/Russell is at opposition at 3.221 A.U.
1/21 The instant of greatest eclipse occurs at 12:12 a.m.
1/21 Super Moon.
1/21 Full Moon (known as the Ice Moon, the Moon after Yule, the Old Moon, and the Wolf Moon) occurs at 12:16 a.m.
1/21 The partial lunar eclipse ends at 1:51 a.m.

1/21 The Moon is 0.6° south of the bright open cluster M44 (the Beehive Cluster or Praesepe) in Cancer at 10:32 a.m.
1/21 The Moon is at perigee (just 14.7 hours after Full Moon), subtending 33' 26" from a distance of 357,342 kilometers (222,042 miles), at 3:00 p.m.
1/21 Eta Carinids meteor shower (minor activity) peaks 21/22. Duration is 14th through 27th. Observing and History: http://meteorshowersonline.com/showers/eta_craterids.html
1/22 Venus passes 2.4° from Jupiter.
1/22 Comet 239P/LINEAR is at opposition at 0.696 A.U.
1/22 Venus (magnitude -4.3) is 2.4° north of Jupiter (magnitude -1.8) at 11:00 a.m.
1/22 Lame (sunset) lunar light ray predicted to occur at 8:47:54 p.m.
1/22 The Moon is 2.5° N-NE of the 1st magnitude star Regulus (Alpha Leonis) at 11:00 p.m.
1/23 Comet 236P/LINEAR is at opposition at 2.711 A.U.
1/23 James Lighthill's 95th birthday (1924).
1/24 Comet 131P/Mueller is at perihelion at 2.418 A.U.
1/24 Comet 278P/McNaught is at opposition at 3.180 A.U.
1/24 Canids meteor shower (minor activity) peaks 24/25. Duration is from the 13th to the 30th. Observing and History: http://meteorshowersonline.com/showers/canids.html
1/24 Alpha Leonids meteor shower (minor activity) peaks from 24th through 31st. Duration is from 1/13 through 2/13. Observing and History: http://meteorshowersonline.com/showers/alpha_leonids.html
1/25 Comet C/2010 U3 (Boattini) is at opposition at 7.930 A.U.
1/25 Maskelyne P (sunset) lunar light ray predicted to occur at 4:37:42 a.m.
1/25 Maskelyne F (sunset) lunar light ray predicted to occur at 5:25:22 a.m.
1/26 Comet 98P/Takamizawa is at opposition at 3.943 A.U.
1/26 Catherina (sunset) lunar light ray predicted to occur at 4:21:23 a.m.
1/26 The Moon is 7.3° N-NE of the first-magnitude star Spica (Alpha Virginis), at 4:00 p.m.
1/27 Isaac Roberts' 190th birthday (1829).
1/27 Calippus (sunset) lunar light ray predicted to occur at 12:39:59 a.m. Moonrise 11:51 p.m.
1/27 Tempel (sunset) lunar light ray predicted to occur at 4:46:32 a.m.
1/27 Lilius lunar light ray predicted to occur at 5:21:59 a.m.
1/27 The Moon displays maximum libration for the year (10.1°) at 12:00 p.m.
1/27 Last Quarter Moon occurs at 4:10 p.m.
1/28 Comet C/2010 U3 (Boattini) is at closest approach to Earth at 7.929 A.U.
1/28 Comet 1P/Halley is at opposition at 33.845 A.U.
1/28 Donald Parker's 80th birthday (1939).
1/28 Lucien d'Azambuja's 135th birthday (1884).
1/28 Auguste Piccard's 135th birthday (1884).
1/28 Jean Felix Piccard's 135th birthday (1884).
1/28 Walter (sunset) lunar light ray predicted to occur at 4:58:03 a.m.
1/29 The Curtiss Cross, an X-shaped clair-obscure illumination effect located between the craters Parry and Gambart, is predicted to be fully formed at 10:54 a.m.
1/29 Mercury is at superior conjunction with the Sun (latitude -6.9°) at 10:00 p.m.
1/30 The Moon is 8.4° north-northeast of Antares at 6:00 a.m.
1/30 The Moon is 2.7° north-northeast of Jupiter at 9:00 p.m.
1/30 Capricornids-Sagitariids meteor shower (daylight activity) peaks from 1/30 to 2/3. Duration is from 1/13 to 2/28. Observing and History: http://meteorshowersonline.com/showers/capricornids_sagittariids.html
1/31 Comet 246P/NEAT is at opposition at 3.417 A.U.
1/31 Rudolf Mossbauer's 90th birthday (1929).
1/31 The Moon is 0.1° east-northeast of Venus, with an occultation occurring in western South America and Polynesia, at 1:00 p.m.

Johannes Hevelius (1611-1687), Ernst Abbe (1840-1905), George Van Biesbroeck (1880-1974), Luboš Kohoutek (1935), and Stephen Hawking (1942) were born this month.

Galileo Galilei discovered Io, Europa, and Callisto on January 7, 1610. Galileo Galilei discovered Ganymede on January 13, 1610. Nicolas-Louis de Lacaille discovered the emission nebula NGC 3372 (the Eta Carinae Nebula) on January 25, 1752. Charles Messier discovered the globular cluster M56 on January 23, 1779. Charles Messier discovered the globular cluster M80 on January 4, 1781. William Herschel discovered the spiral galaxy NGC 1084 on January 10, 1785. Pierre François André Méchain discovered Comet 2P/Encke on January 17, 1786. William Herschel discovered Titania and Oberon, two satellites of Uranus, on January 11, 1787. Giuseppe Piazzi discovered the first asteroid, 1 Ceres, on January 1, 1801. Louis Daguerre took the first photograph of the Moon on January 2, 1839. Alvan Clark discovered the white dwarf star Sirius B (the Pup) on January 31, 1862. The 36-inch Clark refractor at the Lick Observatory saw first light on January 3, 1888. Charles Perrine discovered the Jovian satellite Elara on January 2, 1905. Philibert Jacques Melotte discovered the Jovian satellite Pasiphae on January 27, 1908. Clyde Tombaugh photographed Pluto on January 23, 1930. Mike Brown, Chad Trujillo, and David Rabinowitz discovered Eris on January 5, 2005.

The Quadrantid meteor shower is predicted to peak around 9:00 p.m. EST on January 3rd. Unfortunately, the radiant, which lies at the junction of the constellations of Boötes, Hercules, and Draco, in what was once called Quadrans Muralis, will be below the horizon at that time. However, a waning crescent Moon will not compromise 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 pages 48 and 49 of the January 2019 issue of *Sky & Telescope* or browse http://earthsky.org/?p=155137 and https://amsmeteors.org/2018/12/viewing-the-2019-quadrantid-meteor-shower/ for more on the Quadrantids.

Information on Iridium flares and passes of the ISS, the Tiangong-2, the X-37B, the HST, and other satellites can be found at http://www.heavens-above.com/ and https://www.calsky.com/cs.cgi/Satellites?obs=42301117054103

The Moon is 24.5 days old, is illuminated 25.0%, subtends 30.4 arc minutes, and is located in Libra on January 1st at 0:00 UT. The Moon is at apogee (distance 63.67 Earth-radii) on January 9th and is at perigee (distance 56.03 Earth-radii) on January 21st. New Moon occurs on January 6th. A so-called supermoon, the first of three for 2019, occurs on January 21st. A supermoon is more accurately described as a perigee syzygy of the Earth-Moon-Sun system or more simply as a perigean Full Moon. A total lunar eclipse, the 27th of Saros 134, takes place throughout most of North America, South America, the eastern Pacific Ocean, the western Atlantic Ocean, extreme western Europe, and extreme western Africa on January 21st. The Moon is located in Gemini during this event. The first penumbral contact occurs at 2:36 UT and the fourth at 7:48 UT. The partial phase begins at 3:34 UT and ends at 6:51 UT. Totality starts at 7:41 UT and ends at 7:44 UT. The instant of greatest eclipse takes place at 5:12 UT. The bright open cluster M44 lies some seven degrees to the east of the Moon during the eclipse. For more on this event, browse https://eclipse.gsfc.nasa.gov/LEplot/LEplot2001/LE2019Jan21T.pdf and http://www.eclipsewise.com/lunar/LEprime/2001-2100/LE2019Jan21Tprime.html or see pages 18-21 of the January 2019 issue of *Sky & Telescope* and page 36 of the January 2019 issue of *Astronomy*. The Moon occults Venus on January 31st from western South America and Polynesia. See http://www.lunar-occultations.com/iota/planets/0131venus.htm for further information. Click on http://www.lunar-occultations.com/iota/iotandx.htm for information on other 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. 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 Sagittarius on January 1st. It enters Capricornus on January 20th. A partial solar eclipse, the 58th of Saros 102, will be visible from parts of northeastern Asia and the northern Pacific Ocean on January 6th. For more on this eclipse, see https://eclipse.gsfc.nasa.gov/SEplot/SEplot2001/SE2019Jan06P.GIF and http://www.eclipsewise.com/solar/SEprime/2001-2100/SE2019Jan06Pprime.html

Data (magnitude, apparent size, illumination, and distance from the Earth in astronomical units) for the planets and Pluto on January 1: Mercury (-0.4, 5.2", 89%, 1.30 a.u., Ophiuchus), Venus (-4.6, 26.3", 47%, 0.64 a.u., Libra), Mars (+0.5, 7.4", 87%, 1.26 a.u., Pisces), Jupiter (-1.8, 31.8", 100%, 6.19 a.u., Ophiuchus), Saturn (+0.5, 15.0", 100%, 11.04 a.u., Sagittarius), Uranus (+5.8, 3.6", 100%, 19.78 a.u. on January 16th, Pisces), Neptune (+7.9, 2.2", 100%, 30.58 a.u. on January 16th, Aquarius), Pluto (+14.3, 0.1", 100%, 34.70 a.u. on January 16th, Sagittarius).

During the evening, Mars and Neptune lie in the southwest and Uranus lies in the south. At midnight, Uranus is in the west. Mercury, Venus, Jupiter, and Saturn can be seen in the southeast in the morning.

On New Year's Day, three bright planets (Mercury, Venus, and Jupiter) and a waning crescent Moon will form a 35-degree-long span across the southeast at dawn.

Mercury brightens this month but after January 4th grows too low to be seen as it heads sunward. A waning crescent Moon passes three degrees north of the planet on that date. Mercury reaches superior conjunction on January 30th.

Venus rises more than 3.5 hours before sunrise on New Year's Day for observers at 40 degrees north. The waning crescent Moon passes within five degrees of the planet that morning. Venus reaches maximum western elongation on January 6th. Venus, Jupiter, and Antares form a rough right triangle on January 19th. On January 22nd, Venus and Jupiter lie within 2.4 degrees of each other. Antares is located just a bit more than eight degrees from the pair. The two brightest planets are separated by a bit more than four degrees on January 26th. By the end of the month, that gap increases to over nine degrees. On the morning of January 31st, the waning crescent Moon lies between Venus and Jupiter and is situated about two degrees from Venus. During January, Venus decreases in apparent diameter from 26.3 arc seconds to 19.4 arc seconds but increases in illumination from 47% to 62%.

Earth is 0.9833 a.u. distant from the Sun at perihelion on January 3rd. On that date, it's 3% (5.0 million kilometers or 3.1 million miles) closer to the Sun than at aphelion on July 6th and about 2.7% closer to the Sun than on average.

Mars fades from magnitude +0.5 to magnitude +0.9 this month and shrinks to an apparent diameter of 6.2 arc seconds. A waxing crescent Moon passes five degrees south-southeast of Mars on the night of January 12th/13th. The Red Planet sets by 11:00 p.m. local time

Jupiter's disk increases in apparent size from 31.8 arc seconds to 33.6 arc seconds as the planet brightens slightly from magnitude -1.8 to magnitude -1.9 during January. A slender waning crescent Moon lies about three degrees from Jupiter on the morning of January 3rd and about six degrees from the planet on January 30th. Data on Galilean satellite events is available online at http://www.shallowsky.com/jupiter/ and http://www.skyandtelescope.com/observing/interactive-sky-watching-tools/ and on page 51 of the January 2019 issue of *Sky & Telescope*. Click on http://www.skyandtelescope.com/observing/interactive-sky-watching-tools/ or consult page 50 of the January 2019 issue of *Sky & Telescope* to determine transit times of the central meridian by the Great Red Spot.

Saturn is in conjunction with the Sun on January 2nd and is not visible again until the second half of the month. The Ringed Planet attains an altitude of approximately seven degrees in the southeast about 45 minutes before sunrise on January 31st.

Uranus is located in extreme eastern Pisces. It's situated 1.2 degrees north of the fourth-magnitude star Omicron Piscium during the first half of the month. By January 31st, Uranus has moved to a position 1.4 degrees north-northeast of the star. Uranus is stationary on January 7th and is at eastern quadrature on January 19th. The First Quarter Moon passes five degrees south-southeast of Uranus on January 14th. The seventh planet sets after midnight.

As twilight ends in early January, Neptune lies about 30 degrees above the southwestern horizon. The eighth planet can be found halfway between the fourth-magnitude stars Lambda and Phi Aquarii. On January 1st, it is located 14 arc minutes southeast of the sixth-magnitude star 81 Aquarii. By the end of the month, Neptune lies 55 arc minutes east of that star and 46 arc minutes north of the fifth-magnitude star 83 Aquarii. The waxing crescent Moon passes three degrees south of Neptune on January 10th.

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

Additional online finder charts for Uranus and Neptune can be found at http://www.nakedeyeplanets.com/uranus.htm and http://www.nakedeyeplanets.com/neptune.htm and also at https://www.skyandtelescope.com/wp-content/uploads/WEB_UrNep18.pdf and on pages 48 and 49 of the September 2018 issue of *Sky & Telescope*.

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.

The dwarf planet Pluto is in conjunction with the Sun on January 11th.

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

Asteroid 433 Eros heads southeastward along the Perseus-Auriga border this month, eventually entering Taurus as January ends. It comes closest to the Earth on January 15th. On that date, 433 Eros will be approximately 19,000,000 miles from the Earth and will shine at ninth magnitude, the brightest it will be until 2056. 433 Eros will be moving almost one degree per day so a noticeable change in its position should be noticeable in 30 minutes time at a magnification of 100x. Asteroids brighter than magnitude +11.0 that reach opposition this month include 216 Kleopatra (magnitude +10.6) on January 10th, 704 Interamnia (magnitude +10.3) on January 15th, and 324 Bamberga (magnitude +10.4) on January 21st. See http://asteroidoccultation.com/2019_01_si.htm for information on asteroid occultation events taking place this month. Consult http://www.curtrenz.com/asteroids.html to learn more about a number of asteroids.

Comet 46P/Wirtanen glides northeastward through Lynx and Ursa Major during January. On January 10th, the brightest periodic comet of last year passes one degree south of the third magnitude star Ursae Majoris. As the comet departs the inner solar system, its brightness may drop to ninth magnitude. The recently discovered Comet C/2018 Y1 (Iwamoto) will reach perihelion in Leo in early February and may brighten to seventh or eighth magnitude. During January, it travels northwestward through northeastern Hydra and southern Virgo. Browse https://www.britastro.org/sites/default/files/2018y1.pdf for a finder chart and https://earthsky.org/astronomy-essentials/c-2018-y1-iwamoto-jan-feb-2019 for an article on the comet. Visit http://cometchasing.skyhound.com/ and http://www.aerith.net/comet/future-n.html for information on these and other comets visible this month.

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

The major meteor showers that will occur this year are discussed at https://www.skyandtelescope.com/observing/best-meteor-showers-in-2019/

Various events taking place within our solar system are discussed at http://www.bluewaterastronomy.info/styled-4/index.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/

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

Omicron^2 (40) Eridani is a fourth-magnitude triple star system consisting of three dwarf stars: a type K1V yellow-orange dwarf (A) known as Keid, a type DA4 white dwarf (B), and a type M4.5e red dwarf (C). Omicron is located about 16 light years from the Earth at 4h15m16.32s, -7°39′10.34″. Ninth-magnitude Omicron B is the most easily visible white dwarf star and can be seen with an aperture of six inches.

The famous eclipsing variable star Algol (Beta Persei) is at a minimum, decreasing in magnitude from 2.1 to 3.4, on January 3rd, 6th, 9th, 12th, 15th, 17th, 20th, 23rd, 26th, and 29th. The Demon Star is at minimum brightness for approximately two hours and is well-placed for observers in North America on the night of January 11th/12th, centered at 1:21 a.m. EST. Minima can also be observed on the night of January 14th/15th, centered at 10:10 p.m. EST, and on the evening of January 17th, centered at 6:59 p.m. EST. Consult page 50 of the January 2019 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

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

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_january-march

Telrad finder charts for the Messier Catalog and the SAC's 110 Best of the NGC are posted at http://www.astro-tom.com/messier/messier_finder_charts/messier_maps.htm 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://www.cloudynights.com/articles/cat/articles/observing-skills/free-mag-7-star-charts-r1021 and https://allans-stuff.com/triatlas/

Comet information for: January 5, 2018 (New Moon).

	Constellation	Rises	Transits	Sets
48P/Johnson	Cetus	11:54 a.m.	8:56 p.m.	10:38 p.m.
123P/West-Hartley	Leo	8:49 p.m.	4:35 a.m.	12:25 p.m.
C/2018 N2 (ASASSN)	Sculptor	2:18 p.m.	6:10 p.m.	10:01 p.m.
60P/Tsuchinshan 2	Leo	10:35 p.m.	4:32 a.m.	10:28 a.m.
78P/Gehrels 2	Aquarius	10:20 a.m.	4:08 p.m.	9:58 p.m.
46P/Wirtanen	Lynx	circumpolar	1:01 a.m.	
64P/Swift-Geherls	Aries	12:19 p.m.	8:16 p.m.	4:13 a.m.
C/2018 L2 (ATLAS)	Sagitta	5:00 a.m.	12:17 p.m.	7:34 p.m.
C/2016 N6 (PannSTARRS)	Canis Major	7:22 p.m.	12:14 a.m.	5:06 a.m.
38P/Stephen-Oterma	Lynx	4:15 p.m.	1:41 a.m.	11:11 a.m.
29/P Schwassmann-Wachmann 1	Pisces	10:07 a.m.	4:13 p.m.	10:20 p.m.
C/2015 O1 (PannSTARRS)	Ursa Major	7:29 p.m.	4:34 a.m.	1:41 p.m.
C/2016 R2 (PannSTARRS)	Boötes	11:26 p.m.	8:37 a.m.	5:49 p.m.

For location (40°16’N 76°45’W) Hummelstown, PA, USA:
January 1:

Event	Time	Altitude	Azimuth
Minimum altitude:	00:10	-72.8°	360°
Astronomical twilight begins:	05:52	-18.0°	105°
Nautical twilight begins:	06:25	-12.0°	110°
Civil twilight begins:	06:59	-6.0°	115°
Sunrise:	07:30	-0.8°	120°
Maximum altitude:	12:11	26.7°	180°
Sunset:	16:52	-0.8°	240°
Civil twilight ends:	17:22	-6.0°	245°
Nautical twilight ends:	17:56	-12.0°	250°
Astronomical twilight ends:	18:29	-18.0°	255°

February 1:

Event	Time	Altitude	Azimuth
Minimum altitude:	00:20	-66.9°	360°
Astronomical twilight begins:	05:43	-18.0°	97°
Nautical twilight begins:	06:15	-12.0°	102°
Civil twilight begins:	06:48	-6.0°	107°
Sunrise:	07:16	-0.8°	112°
Maximum altitude:	12:21	32.7°	180°
Sunset:	17:25	-0.8°	248°
Civil twilight ends:	17:54	-6.0°	253°
Nautical twilight ends:	18:27	-12.0°	258°
Astronomical twilight ends:	18:59	-18.0°	263°

For location (40°16’N 76°45’W) Hummelstown, PA, USA:
January 1:

	Mercury	Venus	Mars	Jupiter	Saturn	Uranus	Neptune	Pluto
Right ascension	$17^h\ 35^m\ 43.5^s$	$15^h\ 29^m\ 11.9^s$	$0^h\ 0^m\ 39.2^s$	$16^h\ 40^m\ 47.1^s$	$18^h\ 48^m\ 29.2^s$	$1^h\ 46^m\ 7.3^s$	$23^h\ 1^m\ 55.6^s$	$19^h\ 28^m\ 8.4^s$
Declination	-23° 16' 0"	-15° 22' 51"	-0° 14' 25"	-21° 33' 18"	-22° 29' 6"	10° 23' 18"	-7° 15' 12"	-21° 59' 53"
Range (AU)	1.303	0.639	1.266	6.189	11.043	19.540	30.368	34.681
Elongation from Sun	16.2°	46.9°	79.5°	29.0°	0.8°	107.8°	63.3°	9.8°
Brightness	-0.4	-4.4	0.5	-1.6	0.5	5.8	7.9	14.3
Equatorial Diameter	5.16"	26.12"	7.40"	31.85"	15.05"	3.61"	2.25"	0.09"
Phase Angle	37.4°	92.6°	41.7°	5.1°	0.1°	2.7°	1.7°	0.3°
Constellation	Ophiuchus	Libra	Pisces	Ophiuchus	Sagittarius	Pisces	Aquarius	Sagittarius
Meridian transit	10:59	08:52	17:24	10:04	12:11	19:08	16:24	12:51
Rises	06:24	03:46	11:25	05:23	07:34	12:33	10:50	08:12
Sets	15:34	13:58	23:23	14:45	16:49	01:46	21:58	17:30
Altitude	18.1°	34.2°	-31.2°	24.7°	9.4°	-35.7°	-25.7°	3.7°
Azimuth	145.2°	174.7°	59.6°	156.9°	130.4°	25.9°	77.0°	123.1°
% illumination	89.5	47.5	87.3	99.8	100	99.9	100	100

February 1:

	Mercury	Venus	Mars	Jupiter	Saturn	Uranus	Neptune	Pluto
Right ascension	$21^h\ 8^m\ 19.5^s$	$17^h\ 47^m\ 38.6^s$	$1^h\ 17^m\ 21.7^s$	$17^h\ 6^m\ 25.3^s$	$19^h\ 3^m\ 54.5^s$	$1^h\ 47^m\ 8.9^s$	$23^h\ 5^m\ 5.6^s$	$19^h\ 32^m\ 35.0^s$
Declination	-18° 36' 24"	-20° 51' 38"	8° 29' 40"	-22° 14' 33"	-22° 10' 13"	10° 30' 10"	-6° 54' 59"	-21° 53' 12"
Range (AU)	1.394	0.873	1.532	5.851	10.923	20.066	30.764	34.652
Elongation from Sun	2.7°	45.1°	68.9°	54.6°	27.4°	76.4°	32.5°	20.8°
Brightness	-1.3	-4.1	0.9	-1.7	0.6	5.8	8.0	14.3
Equatorial Diameter	4.83"	19.11"	6.11"	33.69"	15.21"	3.51"	2.22"	0.09"
Phase Angle	6.6°	75.7°	38.0°	8.6°	2.6°	2.8°	1.0°	0.6°
Constellation	Capricornus	Sagittarius	Pisces	Ophiuchus	Sagittarius	Pisces	Aquarius	Sagittarius
Meridian transit	12:30	09:08	16:38	08:28	10:25	17:07	14:25	10:53
Rises	07:35	04:24	10:09	03:49	05:46	10:32	08:50	06:14
Sets	17:25	13:53	23:07	13:06	15:03	23:42	20:01	15:33
Altitude	21.4°	27.8°	-2.1°	24.0°	27.3°	-6.2°	12.6°	26.5°
Azimuth	141.4°	193.1°	77.0°	203.0°	173.1°	70.6°	110.6°	165.6°
% illumination	99.7	62.2	89.4	99.4	100	99.9	100	100

The objects listed below are located between 4:00 and 6:00 hours of right ascension.

One hundred and five binary and multiple stars for January: Omega Aurigae, 5 Aurigae, Struve 644, 14 Aurigae, Struve 698, Struve 718, 26 Aurigae, Struve 764, Struve 796, Struve 811, Theta Aurigae (Auriga); Struve 485, 1 Camelopardalis, Struve 587, Beta Camelopardalis, 11 & 12 Camelopardalis, Struve 638, Struve 677, 29 Camelopardalis, Struve 780 (Camelopardalis); h3628, Struve 560, Struve 570, Struve 571, Struve 576, 55 Eridani, Struve 596, Struve 631, Struve 636, 66 Eridani, Struve 649 (Eridanus); Kappa Leporis, South 473, South 476, h3750, h3752, h3759, Beta Leporis, Alpha Leporis, h3780, Lallande 1, h3788, Gamma Leporis (Lepus); Struve 627, Struve 630, Struve 652, Phi Orionis, Otto Struve 517, Beta Orionis (Rigel), Struve 664, Tau Orionis, Burnham 189, h697, Struve 701, Eta Orionis, h2268, 31 Orionis, 33 Orionis, Delta Orionis (Mintaka), Struve 734, Struve 747, Lambda Orionis, Theta-1 Orionis (the Trapezium), Theta-2 Orionis, Iota Orionis, Struve 750, Struve 754, Sigma Orionis, Zeta Orionis (Alnitak), Struve 790, 52 Orionis, Struve 816, 59 Orionis, 60 Orionis (Orion); Struve 476, Espin 878, Struve 521, Struve 533, 56 Persei, Struve 552, 57 Persei (Perseus); Struve 479, Otto Struve 70, Struve 495, Otto Struve 72, Struve 510, 47 Tauri, Struve 517, Struve 523, Phi Tauri, Burnham 87, Xi Tauri, 62 Tauri, Kappa & 67 Tauri, Struve 548, Otto Struve 84, Struve 562, 88 Tauri, Struve 572, Tau Tauri, Struve 598, Struve 623, Struve 645, Struve 670, Struve 674, Struve 680, 111 Tauri, 114 Tauri, 118 Tauri, Struve 730, Struve 742, 133 Tauri (Taurus)

Notable carbon star for January: R Leporis

Seventy deep-sky objects for January: B26-28, B29, M36, M37, M38, NGC 1664, NGC 1778, NGC 1857, NGC 1893, NGC 1907, NGC 1931 (Auriga); IC 361, Kemble 1 (Kemble’s Cascade asterism), NGC 1501, NGC 1502, NGC 1530, NGC 1569 (Camelopardalis); NGC 1507, NGC 1518, NGC 1531, NGC 1532, NGC 1535, NGC 1537, NGC 1600, NGC 1637, NGC 1659, NGC 1700 (Eridanus); IC 418, M79, NGC 1832, NGC 1888, NGC 1964 (Lepus); B33, Cr65, Cr69, Cr70, IC 434, M42, M43, M78, NGC 1662, NGC 1973-75-77, NGC 1981, NGC 1999, NGC 2022, NGC 2023, NGC 2024, NGC 2112 (Orion); Be11, NGC 1491, NGC 1496, NGC 1499, NGC 1513, NGC 1528, NGC 1545, NGC 1548, NGC 1579, NGC 1582, NGC 1605, NGC 1624 (Perseus); DoDz3, DoDz4, M1, Mel 25, NGC 1514, NGC 1587, NGC 1647, NGC 1746, NGC 1807, NGC 1817 (Taurus)

Top ten binocular deep-sky objects for January: Kemble 1, M36, M37, M38, M42, NGC 1528, NGC 1647, NGC 1746, NGC 1981

Top ten deep-sky objects for January: M42, M43, M78, M79, NGC 1499, NGC 1501, NGC 1502, NGC 1514, NGC 1931, NGC 2024

Challenge deep-sky object for January: IC 2118 (Eridanus)