

RASC Toronto Centre – www.rascto.ca
The Sky This Month – Jan 6 to Feb 2, 2021 (times in EST)
by Chris Vaughan

NEWS

Space Exploration – Public and Private

Ref. <http://spaceflightnow.com/launch-schedule/>

Launches

Mid-Jan at TBD - Virgin Orbit LauncherOne rocket via “Cosmic Girl” (Boeing 747) from Mojave Air and Space Port, California, payload 14 CubeSats to orbit for NASA field centres, U.S. educational institutions and laboratories on the ELaNa-20 rideshare mission.

Jan TBD – several Falcon 9 rockets from SLC-40, Cape Canaveral Space Force Station, Florida, payload Starlink and other small satellites.

This Month in History (a sampling)

Ref. <http://www2.jpl.nasa.gov/calendar/>, <http://www.planetary.org/multimedia/space-images/charts/whats-up-in-the-solar-system-frohn.html>,
<http://www.lunar-occultations.com/rlo/calendar.pdf>

Astro-Birthdays and Milestones

Jan 8, 1942 – Stephen Hawking born

Jan 8, 1642 – Death of Galileo Galilei, and in 1908, Birth of Doctor Who (William Hartnell)

Jan 10, 1946 – Robert Wilson, co-discoverer of cosmic microwave background born

Jan 15, 2014 – passing of John Dobson, aged 98, pioneer of astronomy outreach and developer of Dobsonian, born Sep 14, 1915 in Beijing

Jan 16, 1944 - Jill Tarter, American SETI pioneer and radio astronomer

Jan 28, 1608 - Giovanni Alfonso Borelli, Naples, mathematician/astronomer

Jan 28, 1611 - Johannes Hevelius, Danzig, astronomer, star cataloger

Astronomy and Space Exploration

Jan 9, 1839 – Scottish astronomer Thomas Henderson publishes first stellar parallax measurement

Jan 16, 1969 – Discovery of first Optical Pulsar, in the Crab Nebula, by John Cocke & Michael Disney using a 36” telescope at Kitt Peak

Jan 17, 1929 - Edwin Hubble Publishes Paper that the Universe is Expanding

Jan 19, 2006 - New Horizons Mission launch for 9 year trip to Pluto (flyby in July, 2015) and Kuiper Belt

Jan 25, 2004 – Opportunity Rover landing on Mars

Jan 27, 1967 – Apollo 1 crew, Grissom, Chaffee, and White perished in a capsule fire during training

Jan 28, 1986 – Shuttle Challenger explodes shortly after liftoff

Jan 31, 1862 – Alvin Clark discovers Sirius B (the Flea)

Feb 1, 1949 - First Light for the 200" (5.08-m) Hale telescope

Feb 1, 2003 - Space Shuttle Columbia breaks up on re-entry over Texas. All seven lives are lost.

OBSERVING

Globe at Night 2021

A citizen science program to map light pollution around the world. During the observing window, you are encouraged to make a visual measurement to determine the limiting magnitude of stars you can observe at your location. The website provides charts for assisting observations, instructions for submitting results, and an interactive map showing current and historical results. Details are at <http://www.globeatnight.org/>
Campaigns: **Orion** Jan 4-13, 2021.

Sunrise/Sunset

January 6, sunrise at 7:50 am, sunset at 4:56 pm (9h06m of daylight)
February 2, sunrise at 7:32 am, sunset at 5:30 pm (9h58m of daylight)

Astronomical Twilight

The skies are not truly dark until the Sun drops well below the horizon. Below are the times of true darkness, when the sun is more than 18° below the horizon - also known as Astronomical Twilight. Astrophotography is best done in full darkness. Details are at <https://www.timeanddate.com/sun/canada/toronto?month=10>
<http://www.timeanddate.com/astronomy/canada/toronto>

Jan 6, astronomical twilight ends at 6:39 pm EST and starts at 6:07 am EST (11h28m of imaging time)
Feb 2, astronomical twilight ends at 7:08 pm EST and starts at 5:53 am EST (10h45m of imaging time)

Moon - Orbit

Sat, Jan 9 at 11 am EST - Perigee (367,387 km)
Thu, Jan 21 at 8 am EST - Apogee (404,360 km)
Wed, Feb 3 at 2 pm EST - Perigee (370,116 km)

Moon - Phases

Wednesday, January 6 at 4:37 am EST - Third Quarter Moon (rises around midnight)
Wednesday, January 13 at 12:00 am EST - New Moon
Wednesday, January 20 at 4:01 pm EST - First Quarter Moon (sets around midnight)
Thursday, January 28 at 2:16 pm EST - Full Wolf Moon

Moon - Observing

COVID-19 is keeping us home more, so why not enjoy the Moon!

The Moon is in the evening sky for Most of this month (Jan 14-15 to Feb 2). Winter moons are higher, so we get sharper views through less atmosphere. You can view the moon in morning daylight, too from Jan 7 to 9. (Rotate a polarized filter to darken the sky).

The **Lunar Straight Wall** aka "Rupes Recta" is visible in binoculars and telescopes during evening 1-2 days after first quarter, and just before third quarter. It's a N-S aligned fault scarp that extends for 110 km across SE Mare Nubium, the dark region north of Tycho. It will be highly visible on Jan 21-22.

The **Golden Handle** is observable with eyeballs, binoculars and telescopes all night long 3-4 days before full moon. It's composed of the Jura Mountains around Sinus Iridum, west of Mare Imbrium – plus the Heraclides and Laplace promontories. Use magnification to see wrinkle ridges or "dorsae" in the Bay of Rainbows. The handle will be highly visible on Jan 23-24.

Dial-A-Moon! Request a view of the moon at any hour for any day of 2021 at <https://svs.gsfc.nasa.gov/4874>, then click on it to get a HUGE, annotated map (upright or inverted) (Great for Lunar X predictions)

The nights around full moon (Jan 26-30) accentuate lunar geology instead of topography. Look for **ray systems** around Tycho, Copernicus, Proclus, and comet-like rays at Messier in Mare Fecunditatis. Look for **terraces in Copernicus** and many nearby **craters with dark haloes** (ejected mare basalt overlying white Copernicus ejecta). Look for dark stains left by now-dormant volcanoes, three in Crater Alphonsus, and two in Crater Atlas.

Moon - Libration

Due to the moon's 5° orbital inclination and its elliptical orbit, the centre of the moon's Earth-facing hemisphere rises and falls and drifts left-and-right through the lunar month – a process known as libration. The minor rotations allow features near the lunar limb to rotate more fully into view (or disappear from view) – permitting up to 59% of the moon's surface to be observable from Earth over the course of time. Below are the times of greatest libration. Note that, viewed from the Northern Hemisphere, the moon's northern limb is on top, and the moon's eastern limb is toward the viewer's right-hand side, and vice versa.

Moon's E limb most exposed on Jan 16 (+5.4°) – waxing crescent sets at 8:48 pm (observe **Mare Smythii**, Mare Marginis, Crater Hubble)

Moon's N limb most exposed on Jan 17 (+6.7°) – in darkness

Moon's W limb most exposed on Jan 28 (–5.3°) – full moon all night, no shadows

Moon's S limb most exposed on Feb 1 (–6.6°) – waning gibbous rises at 10:15 pm (observe Craters Bailly, Uigh Beigh and Aston, Mare Orientale)

Moon – Conjunctions, Eclipses, etc.

Lunar Appulses and Conjunctions

Low in the southeastern sky on Monday, January 11, the delicate crescent of the old moon will sit a few finger widths to the right (or 4 degrees to the celestial southwest) of the bright planet Venus. The pair, which will rise at about 6:40 a.m. in your local time zone, should remain easily visible while the morning sky brightens towards sunrise, making a nice photo opportunity when composed with some interesting scenery.

Three evenings after Mercury passes close to bright Jupiter in the southwestern sky, a pretty young crescent moon will join those two planets immediately after sunset on Thursday, January 14 – setting up a lovely photo opportunity. The moon will be positioned a fist's diameter to the upper left (or 10 degrees to the celestial southeast) of Jupiter, with dimmer Mercury midway between them. You'll need an unobstructed southwestern horizon to catch Jupiter before it sets at 6 p.m. in your local time zone. Mercury will become easier to see just before it sets at 6:18 p.m., and then the moon will drop below the horizon at 6:35 p.m.

In the southwestern sky on the evening of Wednesday, January 20, the waxing, half-illuminated moon will pass Mars and Uranus, which will be reaching their minimum separation that night. After dusk the moon will be positioned a palm's width below (or 7 degrees to the celestial southwest of) bright Mars – with much dimmer Uranus sitting a thumb's width below (or 1.6 degrees south of) the reddish planet. By the time Mars sets in the west after midnight local time, the diurnal rotation of the sky will slide the moon to the planets' lower left.

Once the sky darkens on Monday evening, January 25, skywatchers can look for the large open star cluster known as Messier 35, or the Shoe-Buckle Cluster, sitting just to the upper right (or celestial west) of the bright waxing gibbous moon in Gemini. During the night the moon's orbital motion (green line) will draw the moon

farther from the cluster, and the diurnal rotation of the sky will lift the moon higher compared to the cluster. To best see Messier 35's stars, hide the bright moon beyond the left edge of your binoculars' field of view.

Moon – Conjunctions, Eclipses, etc.

Planets - Appulses and Conjunctions

From **January 9 to 12**, the planet Mercury will climb past the gas giants Jupiter and Saturn, which will be descending sunward. After sunset, look just above the southwestern horizon after sunset on Saturday, January 9 to see Mercury sitting just 1.7 degrees south of Saturn - with brighter Jupiter positioned east of them. All three objects will fit within the field of view of binoculars. Mercury will continue to move past Jupiter and Saturn on Sunday, January 10. After 24 hours, the speedy planet will be higher – forming a small triangle just above the southwestern horizon with Saturn 2 degrees to Mercury's north and Jupiter positioned 2 degrees east of them.

In the southwestern sky on the evening of **January 20**, the waxing, half-illuminated moon will pass Mars and Uranus, which will be reaching their minimum separation that night. After dusk the moon will be positioned 7 degrees to the southwest of bright Mars – with much dimmer Uranus sitting 1.6 degrees south of the reddish planet. By the time Mars sets in the west after midnight local time, the diurnal rotation of the sky will slide the moon to the planets' lower left.

Planets and Dwarf Planets

Following its December, 2020 solar conjunction, **Mercury** will return to view in the southwestern evening sky after the first week of January. This apparition will be a very good one for observers located at mid-Northern latitudes – but the planet's position north of the evening ecliptic will make Mercury difficult to see from southern latitudes. From January 9 to 12, Mercury will climb past bright Jupiter and rather faint Saturn. The best viewing times for that planet grouping will be a short period after 5:30 p.m. local time – but you'll need an unobstructed horizon to see them. On January 14 the crescent moon will be positioned a fist's diameter to the upper left (or 10 degrees to the celestial southeast) of Jupiter, with dimmer Mercury midway between them – setting up a lovely photo opportunity. On the evening of January 23 in the Americas, Mercury will reach its widest separation, 19 degrees east of the Sun, and maximum visibility, particularly between 5:30 and 6:30 p.m. local time. Viewed in a telescope during the month, Mercury's illuminated phase will wane from nearly full to a thin crescent as it moves between Earth and the sun - and its apparent disk size will swell from 5 to 9 arc-seconds. Over the same time period, Mercury will decrease in brightness.

During January, **Venus** will remain visible as a very bright, magnitude -3.9 object sitting low over the southeastern horizon before sunrise. Because Venus will be swinging sunward, that viewing window will decrease from 90 minutes on January 1 to only half an hour at month-end. On January 11, the old crescent moon will sit a few finger widths to the right (or 3-4 degrees to the celestial southwest) of Venus, making a nice photo opportunity when composed with some interesting scenery.

Mars will continue to be conveniently positioned for observing from dusk until an hour after midnight during January – but it will be far fainter and smaller than it was during October's opposition. Mars will be at its maximum elevation, more than halfway up the southern sky, right after dusk, and then it will descend as it's carried west by Earth's rotation. Because Earth will continue to increasing our distance from Mars, the red planet will diminish in brilliance by almost half this month - fading from magnitude -0.22 on January 1 to magnitude +0.44 on January 31. Telescope views of the planet will show Mars' apparent disk diameter shrinking from 10 to 8 arc-seconds. On January 5, Mars' eastward motion will carry it from Pisces to western

Aries, which it will traverse for the rest of the month. On January 20, Mars will pass only 1.6 degrees to the north of magnitude 5.76 Uranus, outshining the blue-green planet by a factor of 164! That same evening, the waxing, half-illuminated moon will be positioned 7 degrees to the southwest of the two planets.

A terrific season of **Jupiter** viewing will end in January. During the first half of the month the bright, magnitude -1.95 planet will appear above the southwestern horizon for a short time after sunset – but it will become more entrenched within the evening twilight with each passing day. One-tenth as bright Saturn will sit only 2 degrees below (or to the celestial west) of Jupiter all month long. Mercury will climb past Jupiter on January 10-12, and the young crescent moon will join those planets on January 14. Jupiter will disappear by month end – and then reach solar conjunction on January 29.

Being 11 times fainter than Jupiter, **Saturn** will be lost to view in the southwestern twilight after the opening week of January. If you can find Jupiter, binoculars might show you the ringed planet sitting less than 2 degrees to Jupiter's lower right. Saturn will reach solar conjunction on January 24, five days before Jupiter.

On January 14, magnitude 5.75 **Uranus** will complete a retrograde loop that began in mid-August. On that date it will temporarily cease its westward motion through the distant stars of southwestern Aries before resuming its regular eastward motion. During January the blue-green planet will be conveniently positioned for observing after dusk - when Uranus will be at its maximum elevation, more than halfway up the southern sky - until an hour after midnight. Telescope views of the planet will show its tiny 3.6 arc-seconds wide disk. You can use Mars to find Uranus in the same binoculars field of view from January 10 to 25. On January 20, Mars will sit only 1.6 degrees to the north of Uranus, outshining the blue-green planet by a factor of 164! That same evening, the waxing, half-illuminated moon will pass the two planets. The moon will remain close to them on January 21. Use the moonless first half of January to try seeing the magnitude 5.7 planet with unaided eyes or binoculars.

Neptune will be available for observing in the early evening sky during January. From dark sky locations the magnitude 7.9 planet can be observed in good binoculars and backyard telescopes. Look in eastern Aquarius, about 1 degree to the east of the medium-bright star Phi Aquarii, or ϕ Aqr. Both the planet and that star will appear together in the field of view of a telescope at low magnification. The best time to view the distant planet will be as soon as the sky darkens fully - when the planet will be about one-third of the way up the southwestern sky. By month-end, Neptune will be rather low in the west by the time the sky darkens enough to see it.

Dwarf planet **Ceres** (magnitude 9.3) will spend the next month travelling eastward through Aquarius in the western early evening sky - setting at about 9:30 pm now and at 8:30 pm in early February. It will pass half a degree south of the magnitude 5.2 star 94 Aquarii on Jan 11-12.

Magnitude 7 asteroid **(4) Vesta** will be observable from late evening onward all month long. It will be positioned about 4 degrees to the right (south) of the bright star Denebola in Leo. On January 23, (4) Vesta will begin a westward retrograde loop that will continue through its April 4 opposition, and into late April.

Comets

Ref <http://www.aerith.net/comet/weekly/current.html>, <http://cometchasing.skyhound.com/>, <https://in-the-sky.org/data/comets.php>, <https://www.ast.cam.ac.uk/~jds/>, <http://www.cobs.si/>

Meteor Shower(s)

Ref. <http://www.amsmeteors.org/meteor-showers/meteor-shower-calendar/>, <https://www.imo.net/files/meteor-shower/cal2018.pdf>

Quadrantids (December 28 to January 12)

Named for a now-defunct constellation called the Mural Quadrant, the annual Quadrantids meteor shower runs from December 30 to January 12. This shower's most intense period, when 50 to 100 meteors per hour can occur, lasts only about 6 hours surrounding the peak, which was predicted to occur on Sunday, January 3 at 10:00 GMT (or 5 a.m. Eastern time). At that time, the Earth was traversing the thickest part of the debris field. Quadrantids commonly produce bright fireballs owing to the shower's source, an asteroid designated 2003EH. Radiant is ~9° Northeast of Nekkar (Beta Bootis), between constellations of Draco, Her, Boo, and UMa (RA 15h 20m, Decl. +49°)

Asteroids

Ref. <http://neo.jpl.nasa.gov/ca/>, <http://www.minorplanetcenter.net/>
<https://www.youtube.com/watch?v=ONUSP23cmAE#action=share>

According to the Minor Planet Centre...

Near-Earth Objects Discovered This Year: 35 (~162/month)
Minor Planets Discovered This Year: 36 (~162/month)
Comets Discovered This Year: 0 (~3.6/month)
Observations This Year: 0.6 million

Satellites

Current GTA International Space Station (ISS) pre-dawn pass series lasts until January 10 (Most are visible between 5:20 and 6:55 am). An evening pass series runs from January 16 to February 8 (Most are visible between 6 and 7:45 pm). Some higher/brighter ones include*:

| Date | Time | Direction | Alt. | Mag. |
|-------------|--------------------|------------------|------|------|
| Mon, 18-Jan | 6:51 pm to 6:54 pm | moves SSW to SSE | 34° | -2.8 |
| Wed, 20-Jan | 6:52 pm to 6:56 pm | moves WSW to NE | 88° | -3.9 |
| Thu, 21-Jan | 6:04 pm to 6:10 pm | moves SW to ENE | 56° | -3.5 |
| Fri, 22-Jan | 6:53 pm to 6:57 pm | moves W to NNE | 41° | -2.8 |
| Sat, 23-Jan | 6:05 pm to 6:11 pm | moves WSW to NE | 59° | -3.4 |
| Mon, 25-Jan | 6:07 pm to 6:12 pm | moves W to NE | 31° | -2.4 |
| Sat, 30-Jan | 6:59 pm to 7:01 pm | moves NW to NNE | 29° | -2.6 |
| Mon, 1-Feb | 6:59 pm to 7:03 pm | moves NW to NE | 50° | -3.5 |
| Tue, 2-Feb | 6:11 pm to 6:17 pm | moves NW to E | 36° | -3.0 |

*far future predicted times may shift slightly

Occultations – Lunar and Asteroidal

Ref: <http://www.asteroidoccultation.com/> and <http://www.poyntsource.com/New/Global.htm> (additional links on the following URLs open track maps), <http://www.lunar-occultations.com/bobgraze/index.html>

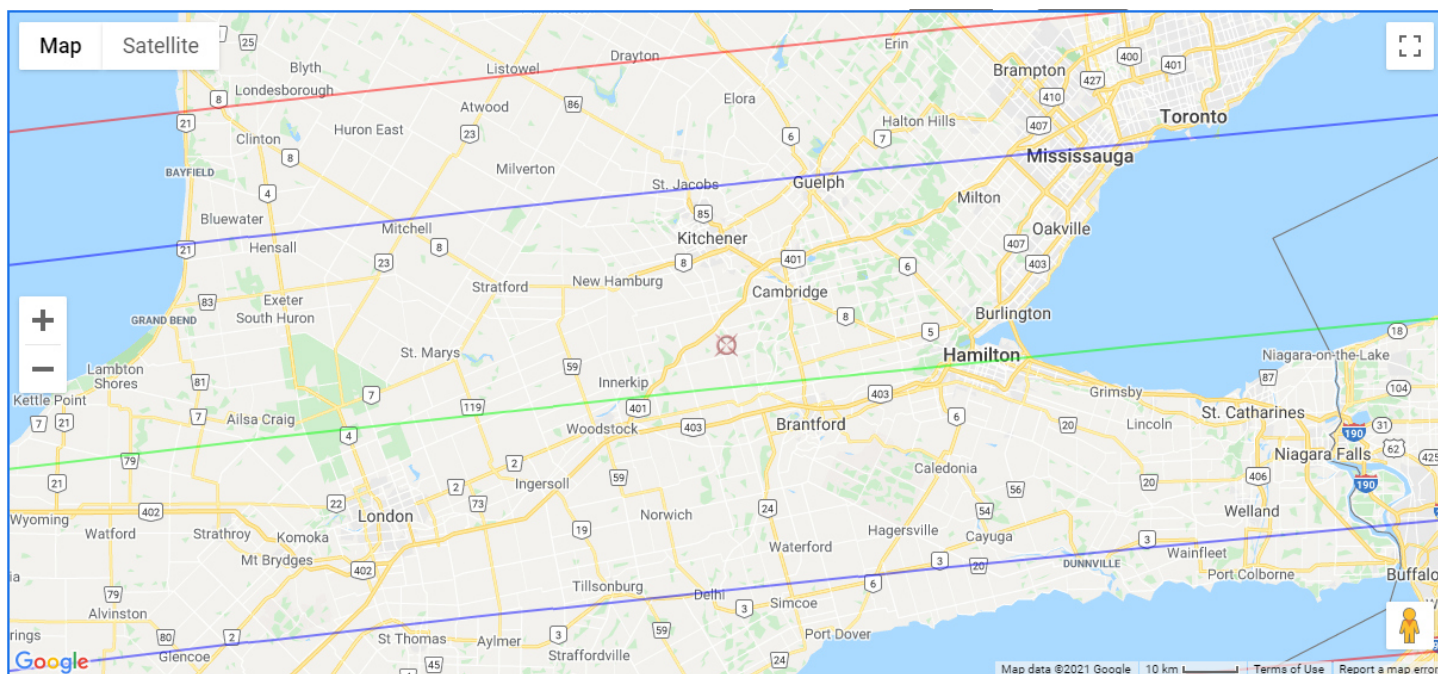
Lunar Occultations

none

Asteroidal Occultations

Rank 99 - 23 Jan 2021 at 04:28 UT (Jan 22 at 11:28 EST) asteroid (333) Badenia (mag 14.2) occults star TYC 1860-00736-1 (mag10.3), dips 3.91 mags for 12.4 secs, alt 80° in Taurus, visible from Sarnia to Hamilton , plus Mississauga, KW, Niagara

http://www.asteroidoccultation.com/2021_01/0123_333_68548.htm



Variable Stars

Algol, also designated Beta Persei, is among the most accessible variable stars for astronomy enthusiasts. This star has been known to vary in brightness since antiquity – so the ancient Greeks decided that it represented the pulsing eye of Medusa the Gorgon, whose severed head is being held aloft by Perseus (the Hero). On a regular, predictable schedule Algol's visual brightness dims noticeably for about 10 hours once every 2 days, 20 hours, and 49 minutes. This happens because a dim companion star orbiting nearly edge-on to Earth crosses in front of the much brighter main star, reducing the total light output we receive. This is known as an eclipsing binary system. You can use nearby stars to judge Algol's brightness. Algol normally shines at magnitude 2.1, similar to Almach (Gamma Andromedae) located 12 degrees to the west. Algol's minimum brightness of magnitude 3.4 is almost exactly the same as Rho Persei (or ρ Per), the star sitting two finger widths to Algol's right (or 2.25 degrees to the celestial south).

On Wednesday, January 20 at 8:53 pm EST, Algol will arrive at minimum brightness high in the western sky. Five hours later, at 1:53 am EST, Algol will have brightened to its usual magnitude and will be positioned 22 degrees above the western horizon. Alternately, one could watch Algol grow dim on Sunday, January 17 starting at 7:04 pm EST. It will reach minimum brightness at 12:04 am. The Minima of Algol are indicated on pages 99-121 of the Observers Handbook.

Mira, Latin for "wonderful" and also known as Omicron Ceti, lends its name to a class of variable stars known as pulsating variables. It is the brightest of this class of objects. Mira, which is located in the neck of Cetus, is well positioned for observing on winter evenings. The star is a very low temperature, M7-class red giant situated at a distance of 200-300 light-years from the sun. Its mean magnitude is approximately 6.6, but its pulsations lift it from magnitude 9.3 to magnitude 3.4, or brighter on occasion. The light curve typically brightens over 110 days and then drops over 220 days. It is currently at magnitude 6.2, or mid-brightness, descending from the last peak on September 22, 2020.

Double Stars

The "Winter Albireo", also designated **145 Canis Majoris and HR2764**, is an underrated, lovely coloured double star located 3.5° northeast of Wezen in Canis Major. The blue and orange stars are magnitude +5.95

and +4.80, and classed as F0 and K4III, respectively. The current separation is 26.4 arc-seconds at an angle of 52°. By the end of December, this double will rise in the east after mid-evening and remain visible all night long.

Sigma Orionis, also designated as 48 Orionis, is a +4.0 magnitude naked-eye star located 49 arc-minutes southwest of Alnitak, Orion's eastern belt star. It's also just 32 arc-minutes west of the Horsehead Nebula. In a telescope, Sigma Orionis splits into a spectacular multiple star system that resembles a narrow dart 8 arc-minutes in length. This area of the sky is well placed for observing from mid-evening onwards.

Iota Cancri is a wide binary consisting of blue (magnitude +6.58) and yellow (magnitude +4.02) stars separated by 30.5 arc-seconds. Cancer rises in the east after mid-evening.

A plug for Blake Nancarrow's suggested doubles for January, and the **RASC Double Star Observing Program** at <https://www.rasc.ca/double-stars>.

Taurus: χ (chi) Tau, Σ 528 (Struve), 59 Tauri, SAO 76573, HIP 20430

Cassiopeia: HR 9094, Σ 3053 Cas (STF), SAO 10937, HIP 207

Orion: Meissa, Lambda Ori, 39 Ori, Σ 738, SAO 112921, HIP 26207

Monoceros: HR 3174, Σ 1183 Mon, SAO 135505, HIP 39675

Perseus: θ (theta) Per, Σ 296, 13 Per, SAO 38288, HIP 12777

Auriga: θ (theta) Aur aka STT 545 SAO 58636, HIP 28380

Camelopardalis: 1 Cam aka DL Cam or (STF) Σ 550 SAO 24672, HIP 21148

Gemini: χ (chi) Gem aka ES 2628 SAO 79896, HIP 39424

Lepus: γ (gamma) Lep aka H 6 40 SAO 170759, HIP 27072

Constellations on the Meridian (Annually in mid-January)

7 pm: Fornax, NW Eridanus, Cetus, E. Pisces, Aries, Triangulum, Andromeda, W. Perseus, and Cassiopeia

9 pm: E Eridanus, W. Orion, NE. Cetus, Taurus, W. Auriga, E. Perseus, and Camelopardalis

11 pm: Columba, Canis Major, Lepus, Monoceros, E. Orion, W. Gemini, E. Taurus, Auriga, and W. Lynx, and Camelopardalis

1 am: Puppis, Pyxis, E. Monoceros, W. Hydra, Cancer, E. Gemini, Lynx, and W. Ursa Major

Just Look Up - Winter Milky Way, Orion's Belt, Hyades in Taurus, Winter Hexagon/Football Square of Pegasus



Go Beyond the Messiers! (Annually in January)

(FNGC numbers refers to the Finest NGC list on pages 318-320 of the Observers Handbook)

Rosette Nebula (NGC 2238) / cluster NGC 2244 in Monoceros 1 degree across!

Binoculars under dark sky. Try a nebula filter. (FNGC 032)



Hubble's Variable Nebula (NGC 2261) surrounding R Monocerotis is tiny, but bright and

comet shaped! Try a nebula filter. (FNGC 033)



The Parka Nebula (NGC 2392), is a magnitude 9.6 planetary nebula in Gemini.

Some blinking effect! Try an Oxygen-III filter. (FNGC 031)



Dragonfly/Owl/ET Cluster (NGC 457) in Cassiopeia (FNGC 008)



NGC 891 is a magnitude 10.8, edge-on spiral galaxy, high surface brightness,
Located 3.5 degrees east of Almach (Gamma Andromedae) (FNGC 012)

(~~06~~)

Hope to see you at DDO, Long Sault C A, Bayview Village Park, or the CAO in 2021!

Questions or comments to chris.vaughan@astrogeo.ca

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