

OBSERVING HIGHLIGHTS for September 17 to October 2, 2022, a “dark Moon” Period.
Black Canyon Astronomical Society (BCAS), western Colorado, USA

SUMMARY. Summer is ending! The good news is that our nighttime hours are expanding, while temperatures likely remain comfortable. And on September 22, 23 and 24 Black Canyon of the Gunnison N. P. is holding their annual AstoFest with help from the BCAS and astronomy volunteers. Both Saturn and Jupiter are prominent in the evening sky, and Jupiter appears almost as bright as it ever gets. On clear, late September evenings, find a place away from artificial lights to enjoy the star clouds of the Milky Way, which arc across our sky from Sagittarius in the southwest, through Cygnus at zenith, to Cassiopeia and Perseus in the northeast. On mornings from September 18 to 24, watch the last quarter Moon of September 17, wane to a thin crescent. The Moon is new on September 25. On evenings from September 26 to October 1, watch a crescent Moon wax to first quarter on October 2. Enjoy seeing earthshine on the dark part of the lunar disk, especially on mornings from September 20 to 24 and evenings from September 27 to 29 (binoculars will help). Mars now rises before midnight. Watch the Red Planet brighten rapidly as Earth’s (December) close approach to Mars draws nearer. Venus is descending into glaring morning twilight and getting difficult to spot. Over the past several months the Sun has been active, unleashing X-ray flares and ejecting charged particles. This solar activity can trigger auroral displays (“northern lights”) that may be visible on the AuroraMax website, from northern U.S. states, or even from Colorado if we get lucky. And there are visible passes of the bright International and Tiangong Space Stations.

WESTERN SLOPE SKIES. Since 2011, the BCAS and KVNF Community Radio have been producing Western Slope Skies (WSS), a biweekly astronomy feature. On September 16 and 21, Park Ranger Hannah Ashley will tell us how to enjoy Black Canyon National Park’s AstroFest, which will be held on September 22, 23, and 24. Then on September 30 and October 5 Aaron Watson, Chair of the Colorado Chapter of the International Dark Sky Association, will present on “Dark Skies in Colorado.” Audio, scripts, and images from Western Slope Skies features are linked here:

<https://www.kvnf.org/programs/western-slope-skies#stream/0>

BCAS PUBLIC OBSERVING EVENTS. On the evening of September 16, the BCAS will be represented at Top of the Pines, a new International Dark Sky Park in Ouray County. Then come join us at the September 22-24 AstroFest of Black Canyon of the Gunnison National Park. AstroFest, a cooperative celebration of astronomy, is brought to you by the National Park Service, astronomy volunteers, and the Black Canyon Astronomical Society. AstoFest events are being held both at the National Park and in Montrose. You can find a detailed schedule of AstroFest events here:

<https://www.nps.gov/blca/learn/news/black-canyon-astronomy-festival-september-22-through-24-2022.htm>

Hope you can join us!

Note: The apparent brightness of sky objects is measured in “magnitude” units. Many bright stars are magnitude +1, while the faintest stars easily visible to the unaided eye under dark skies are magnitude +6. Some of the brightest stars are 0 magnitude (e.g., Vega, Arcturus), while the brightest sky objects have negative magnitudes (e.g., Jupiter at -2 to -3 magnitude, Venus at -4 to -5 magnitude, the full Moon at -12 to -13 magnitude, and the Sun at -26.7 magnitude). Angular distances on the sky are usually cited in degrees of arc. Helpful ways to estimate 1, 5, 10, 15, and 25 degrees of arc can be found here: <https://www.timeanddate.com/astronomy/measuring-the-sky-by-hand.html>

SEPTEMBER 22 – EQUINOX! In the northern hemisphere, fall begins on September 22 at 7:04 PM MDT, when the Sun shines directly on Earth's equator. As aspen leaves turn gold on the Western Slope, our nighttime hours are expanding by minutes each day. Early fall temperatures are often mild, so this is a great time to enjoy the wonders of the night sky. As evening twilight ends, the stars and constellations of summer are still high in the sky, and the fall constellations are rising in the east. Enjoy breathtaking views of the Milky Way, which stretches from the southwestern horizon, across the zenith to the northeast. And it's still fairly dark at 5:30 AM MDT, so early risers we can enjoy Orion and other winter constellations before dawn.

THE MOON. The Moon reaches **last quarter on September 17** at 3:52 PM MDT. From September 18 to 24, the crescent Moon wanes in the mornings. In the wee hours of September 17, the last quarter Moon is about 5 degrees northeast of Mars. On September 24 at 6:35 AM MDT with the Sun only 6 degrees below the horizon, look for a slender (2%-illuminated) crescent Moon about 8 degrees above Venus, which you may be able to spot barely above the eastern horizon. **The Moon is new on September 25** at 3:54 PM MDT. On evenings from September 26 to October 1, watch the lunar crescent wax. On the evening of September 30 at about 8 PM MDT, look southwest and you will see the 28%-illuminated, crescent Moon about 2 degrees above and left from the red supergiant star, Antares. The Moon reaches **first quarter on October 2** at 6:14 PM MDT. Enjoy seeing earthshine on the dark part of the Moon's disk, especially on mornings from September 20 to 24 and evenings from September 27 to 29 (binoculars will enhance your view). You can find a stunning visualization of lunar phases for all of year 2022 here:

<https://apod.nasa.gov/apod/ap220201.html>

<https://svs.gsfc.nasa.gov/4955>

Please do your crescent Moon spotting before sunrise and after sunset. NEVER chance looking at the Sun directly; serious eye damage can result.

ENJOY THE MILKY WAY! During this dark Moon period find a spot away from artificial lights and take in the star clouds of the Milky Way, our home galaxy. At around 9:30 PM MDT we can see the star clouds of the bright central Milky Way in constellation Sagittarius above the southwestern horizon. Follow this glowing band of stars upward through constellations Scutum and Aquila to constellation Cygnus at zenith. Notice that the Milky Way gets dimmer in the northeast, through constellations Cassiopeia and Perseus. When we look to the northeast, we are looking away from our Galaxy's crowded center towards its less crowded outer regions. This is a wonderful time of year to observe the "Great Rift", a dark zone that appears to divide the Milky Way from Sagittarius in the southwest through Cygnus at zenith. The "Great Rift" is a concentration of dusty, molecular clouds that absorb and block light from more distant stars in our Galaxy. Such dust lanes are common in the disks of most spiral galaxies, including our Milky Way.

SATURN IN THE EVENING. Saturn is well above the southeastern horizon as evening twilight ends. The Ringed Planet remains visible for much of the night, setting in the southwest at about 4:03 AM MDT on September 17 and 3:03 AM MDT on October 2. Be sure to view Saturn and its impressive rings through a telescope during the next several months, perhaps with BCAS members and NPS rangers at the Black Canyon N. P. AstroFest. On the evening of September 22, we will be observing Saturn from the Montrose Botanic Gardens, and on September 23 we will have telescopes pointed at Saturn from near the South Rim Campground of Black Canyon N. P. Saturn's rings will be getting harder to see in the next few years, because they will appear less inclined from Earth's perspective (we will be viewing them "edge-on" in year 2025). Now past its August 14 opposition from the Sun, Saturn has faded slightly to magnitude +0.5, as its distance from Earth increases from 839 million miles on September 17 to 854

million miles on October 2. Telescopes of any size will show Saturn's impressive rings. Saturn's disk now appears about 18 arc seconds wide, and its rings span 42 arc seconds. With a telescope or high-magnification binoculars, it's possible to spot Titan, Saturn's largest moon. Telescopes with apertures larger than about 6 inches may reveal several other moons of the Ringed Planet. You can follow the changing positions of Saturn's moons by referring to various planetarium apps and/or this site: <https://skyandtelescope.org/observing/interactive-sky-watching-tools/saturns-moons-javascript-utility/>

JUPITER AT ITS BEST – ALL NIGHT LONG. Bright Jupiter is opposite the Sun in the sky ("at opposition") on September 26, and that's about when Earth is nearest the Giant Planet. This month's close approach of 367 million miles is the closest Jupiter-Earth encounter since October 8, 1963. Earth passes nearest Jupiter every 13 months or so. But because the orbits of Jupiter and Earth about the Sun are slightly elliptical, distances between Jupiter and Earth at close approaches vary. Jupiter is now visible all night long, in the eastern sky during early evening, high in the south near midnight, and in the west before dawn. The Giant Planet shines brightly at magnitude -2.94. That's about as bright as Jupiter ever appears (at least as seen from Earth during recent epochs). Using binoculars or a telescope, you can resolve Jupiter's disk, which is now nearly 50 arc seconds wide. Jupiter is a very interesting sight in a telescope. You can easily see the dark belts and lighter colored zones in the Giant Planet's atmosphere. Sometimes, you may also see the Great Red Spot, a giant storm in Jupiter's southern hemisphere. Come to Black Canyon N. P. AstroFest to get views of Jupiter through telescopes from the Montrose Botanic Gardens on September 22 and/or from the South Rim of Black Canyon N. P. on September 23. In addition to the belts and zones, you can also spot Jupiter's four, bright "Galilean" moons with binoculars or telescopes. You can identify these moons by their changing positions near Jupiter, night-by-night, by using various astronomy apps, or the following link:

<https://skyandtelescope.org/observing/jupiters-moons-javascript-utility/#>

If you have a telescope, try viewing shadow transits (Jovian solar eclipses!) of Jupiter's moons on the nights listed below. Ganymede casts the largest shadow of Jupiter's moons, and its shadow is the easiest to spot crossing Jupiter. And there are two Ganymede shadow transits during this period! Europa's smaller shadow is more challenging to see. Io's shadow is larger than Europa's but smaller than Callisto's shadow.

September 20, 2022, 6:10 PM to 9:02 PM MDT, Ganymede's shadow crosses Jupiter (Locally, the Sun sets at 7:13 PM MDT, and Jupiter rises at 7:28 PM MDT).

September 22, 2022, 1:26 AM to 3:40 AM MDT, Io's shadow crosses Jupiter.

September 23, 2022, 7:56 to 10:10 PM MDT, Io's shadow crosses Jupiter (the Great Red Spot may also be visible). Note: [Try to observe this transit through telescopes at Black Canyon N. P. South Rim during AstroFest!](#)

September 27-28, 2022, 10:12 PM to 1:02 AM MDT, Ganymede's shadow crosses Jupiter (The Great Red Spot may also be visible).

September 29, 2022, 3:22 AM to 5:36 AM MDT, Io's shadow crosses Jupiter. (The Great Red Spot may also be visible).

September 30-October 1, 2022, 9:50 PM to 12:06 AM MDT, Io's shadow crosses Jupiter.

October 1, 2022, 4:46 PM to 7:26 PM MDT, Europa's shadow crosses Jupiter (Locally, Jupiter rises at 6:41 PM MDT and the Sun sets at 6:56 PM MDT).

MARS RISES BEFORE MIDNIGHT. Mars rises in the east northeast at about 11:07 PM MDT on September 17 and 10:28 PM MDT on October 2. The Red Planet brightens rapidly from magnitude -0.35 to -0.64 during this period, as its distance from Earth decreases from 80 to 72 million miles. Mars now appears much brighter than all the stars in Colorado's night sky, excepting Sirius (although the planets Jupiter and Venus appear brighter than Mars). On the morning of September 17, Mars is about 5 degrees to the right (south) of the last quarter Moon, and the Moon, Mars, and the red giant star, Aldebaran form a nearly straight line, about 11 degree long. Through telescopes Mars' reddish disk increases from 10.9 to 12.1 arc seconds wide during this period. Mars' disk now appears large enough for resolving some surface features with telescopes. You can find an interactive chart of Mars' surface features that are visible from Earth at any time and date at this link...

https://skyandtelescope.org/wp-content/plugins/observing-tools/mars_profiler/mars.html

Mars' surface features may get progressively easier to spot through the fall, as Earth draws nearer the Red Planet (in 2022, Mars and Earth will be closest in early December).

VENUS DESCENDS INTO BRIGHT MORNING TWILIGHT. On September 17, Venus rises 9 degrees north of due east at 6:09 AM MDT, when the Sun is only 10 degrees below the horizon. Venus still shines brilliantly at magnitude -3.9, but our Sister Planet gets progressively harder to spot as it rises later and is overwhelmed by glaring morning twilight. Through telescopes, Venus appears at nearly full phase. Its gibbous disk is more than 99% illuminated, as "Earth's Twin" moves toward the far side of the Sun from our perspective (Venus' solar conjunction will occur on October 22). During this period Venus' apparent diameter diminishes from 9.9 to 9.8 arc seconds, as it recedes from 157 to 159 million miles. **Please do your Venus spotting before sunrise. NEVER chance looking at the Sun directly; serious eye damage can result.**

THE SUN. Solar activity has been increasing this year, and it can be interesting to monitor the Sun as the new solar cycle "ramps up." M-class ("moderate") solar flares have been occurring frequently, and there were several X-class ("extreme") flares earlier in the year. There also have been coronal mass ejections ("CMEs") of charged particles that have triggered auroras recently. As of September 16, there are several sunspot groups and active regions in the Sun's southern hemisphere, so keep an eye out for more flares and CMEs. You can monitor sunspots, solar flares, CMEs, and other solar activity safely and in "real time" at the following sites:

<https://sdo.gsfc.nasa.gov/data/>

<https://stereo.gsfc.nasa.gov/beacon/>

<http://halpha.nso.edu/>

<https://www.swpc.noaa.gov/>

<https://sohowww.nascom.nasa.gov/data/realtime-images.html>

<http://www.sidc.be/silso/ssngraphics>

Do not look at the Sun directly without safe, specialized solar filters. Looking at the Sun can be very dangerous unless you take adequate precautions. Severe eye damage and even blindness can result.

AURORAS (aka "polar lights" or "northern lights"). Although it can be challenging to spot auroras from Colorado's mid-northern latitudes, "northern lights" have been seen from our region in 2022. Solar magnetic storms, when directed toward Earth, can cause auroras. With current, high solar activity, chances for auroras are good. You can get predictions for auroras, their intensity, and geographic extent from NOAA's Space Weather Prediction Center:

<https://www.swpc.noaa.gov/>

Starting in late September, you may also view auroras online in “real time” via the Canadian Space Agency’s “AuroraMax” all-sky camera at Yellowknife: <https://www.asc-csa.gc.ca/eng/astronomy/northern-lights/auroramax-observatory.asp>

EARTH SATELLITE HIGHLIGHTS. The following predictions are for western Colorado, specifically Montrose, in Mountain Daylight Time (MDT). Numerous Earth satellites are visible every clear night. Note that brighter satellites have smaller magnitude numbers, and the brightest (e.g., the International and Tiangong Space Stations) have negative magnitudes. These predictions are for selected passes of some bright and/or interesting satellites (as summarized from Heavens-Above.com).

September 16, 2022. International Space Station (ISS). 9:06 to 9:09 to 9:11 PM MDT, W to NNW to N, max altitude 25 deg above NNW, max magnitude -1.7, disappears into Earth’s shadow 20 deg above N (Passing through Boötes, Canes Venatici, Ursa Major-Big Dipper, Draco, and Camelopardalis). **Predictions for the ISS are subject to change due to orbital adjustments. Check for updated predictions.**

September 17, 2022. Tiangong (Chinese Space Station launched in April 2021). 5:47 to 5:48 to 5:51 AM MDT, SSW to SSE to E, max magnitude -1.1, appears from Earth’s shadow 20 deg above SSW, maximum altitude of 37 deg above SSE (Passing through Eridanus, Orion, Monoceros, Canis Minor, Hydra, and Leo-near Regulus). **Note: Tiangong’s orbit may change frequently. Check for updates.**

September 17, 2022. International Space Station (ISS). 8:17 to 8:21 to 8:24 PM MDT, WSW to NNW to NE, max altitude 39 deg above NNW, max magnitude -2.4 (Passing through Boötes, Ursa Major, Draco, Camelopardalis, and Perseus). **Predictions for the ISS are subject to change due to orbital adjustments. Check for updated predictions.**

September 18, 2022. Tiangong (Chinese Space Station launched in April 2021). 6:21 to 6:24 to 6:27 AM MDT, WSW to NNW to ENE, max magnitude -2.2, appears from Earth’s shadow 10 deg above WSW, maximum altitude of 82 deg above NNW (Passing through Pisces-near Jupiter, Aries, Perseus, Auriga-near Capella, Lynx, Leo Minor, and Leo). **Note: Tiangong’s orbit may change frequently. Check for updates.**

September 18, 2022. International Space Station (ISS). 9:08 to 9:10 to 9:11 PM MDT, NW to NNW to N, max altitude 14 deg above NNW, max magnitude -0.9, disappears into Earth’s shadow 12 deg above N (Passing through Canes Venatici, Ursa Major-Big Dipper, and Camelopardalis). **Predictions for the ISS are subject to change due to orbital adjustments. Check for updated predictions.**

September 19, 2022. Tiangong (Chinese Space Station launched in April 2021). 5:23 to 5:26 AM MDT, S to SSE to ENE, max magnitude -2.1, appears from Earth’s shadow 61 deg above S, maximum altitude of 62 deg above SSE (Passing through Taurus, Gemini, Cancer, and Leo). **Note: Tiangong’s orbit may change frequently. Check for updates.**

September 19, 2022. International Space Station (ISS). 8:18 to 8:21 to 8:23 PM MDT, WNW to NNW to NNE, max altitude 19 deg above NNW, max magnitude -1.3 (Passing through Coma Berenices, Canes Venatici, Ursa Major-Big Dipper, Camelopardalis, and Perseus). **Predictions for the ISS are subject to change due to orbital adjustments. Check for updated predictions.**

September 20, 2022. Tiangong (Chinese Space Station launched in April 2021). 5:57 to 5:59 to 6:02 AM MDT, W to NNW to ENE, max magnitude -1.9, appears from Earth's shadow 23 deg above W, maximum altitude of 60 deg above NNW (Passing through Pegasus, Andromeda, Cassiopeia, Camelopardalis, Ursa Major, Leo Minor, and Leo). Note: Tiangong's orbit may change frequently. Check for updates.

September 22, 2022. Tiangong (Chinese Space Station launched in April 2021). 5:33 to 5:33 to 5:36 AM MDT, NW to N to ENE, max magnitude -1.7, appears from Earth's shadow 43 deg above NW, maximum altitude of 49 deg above N (Passing through Cassiopeia, Camelopardalis, Ursa Major, Leo Minor, and Leo). Note: Tiangong's orbit may change frequently. Check for updates.

September 23, 2022. Tiangong (Chinese Space Station launched in April 2021). 6:06 to 6:09 to 6:12 AM MDT, WNW to N to E, max magnitude -1.5, appears from Earth's shadow 15 deg above WNW, maximum altitude of 47 deg above N (Passing through Pegasus, Lacerta, Cassiopeia, Camelopardalis, Ursa Major, Leo Minor, and Leo). Note: Tiangong's orbit may change frequently. Check for updates.

September 24, 2022. X-37B (U.S. Space Force "not-so-secret" Space Plane). 5:52 to 5:53 to 8:55 AM MDT, WSW to S to ENE, appears from Earth's shadow at 35 deg above WSW, max altitude 89 deg above S, max magnitude +0.2 (Passing through Pisces, Perseus, Auriga, Lynx, and Leo Minor). X37B's orbit may change, or it may land. Check for updates

September 25, 2022. Tiangong (Chinese Space Station launched in April 2021). 5:42 to 5:43 to 5:46 AM MDT, NW to N to E, max magnitude -1.7, appears from Earth's shadow 34 deg above NW, maximum altitude of 55 deg above N (Passing through Cassiopeia, Camelopardalis, Ursa Major, Leo Minor, and Leo-near Regulus). Note: Tiangong's orbit may change frequently. Check for updates.

September 25, 2022. Tiangong (Chinese Space Station launched in April 2021). 5:42 to 5:43 to 5:46 AM MDT, NW to N to E, max magnitude -1.7, appears from Earth's shadow 34 deg above NW, maximum altitude of 55 deg above N (Passing through Cassiopeia, Camelopardalis, Ursa Major, Leo Minor, and Leo-near Regulus). Note: Tiangong's orbit may change frequently. Check for updates.

September 26, 2022. Tiangong (Chinese Space Station launched in April 2021). 6:16 to 6:19 to 6:22 AM MDT, WNW to SSW to ESE, max magnitude -2.2, appears from Earth's shadow 14 deg above WNW, maximum altitude of 73 deg above SSW (Passing through Pegasus, Triangulum, Perseus/Aries, Taurus-near Mars, Gemini, Canis Minor-near Procyon, and Hydra). Note: Tiangong's orbit may change frequently. Check for updates.

September 28, 2022. Tiangong (Chinese Space Station launched in April 2021). 5:52 to 5:53 to 5:56 AM MDT, WSW to SSW to SE, max magnitude -1.7, appears from Earth's shadow 36 deg above WSW, maximum altitude of 44 deg above SSW (Passing through Pisces, Cetus, Eridanus, Orion-near Rigel, Lepus, and Canis Major-near Sirius). Note: Tiangong's orbit may change frequently. Check for updates.

September 29, 2022. International Space Station (ISS). 8:18 to 8:21 PM MDT, NNW to NNE, disappears into Earth's shadow at max altitude 18 deg above NNE, max magnitude -1.9 (Passing through Ursa Major and Camelopardalis). Predictions for the ISS are subject to change due to orbital adjustments. Check for updated predictions.

October 1, 2022. International Space Station (ISS). 8:17 to 8:20 to 8:21 PM MDT, NW to NNE to NE, disappears into Earth's shadow at max altitude 36 deg above NE, max magnitude -3.0 (Passing through Ursa Major-Big Dipper, Draco, Camelopardalis, and Cassiopeia). Predictions for the ISS are subject to change due to orbital adjustments. Check for updated predictions.

October 2, 2022. International Space Station (ISS). 7:29 to 7:32 to 7:34 PM MDT, NNW to NNE to E, max altitude 24 deg above NNE, disappears into Earth's shadow at 12 deg above E, max magnitude -2.3 (Passing through Ursa Major, Camelopardalis, Cassiopeia/Perseus, and Andromeda). Predictions for the ISS are subject to change due to orbital adjustments. Check for updated predictions.

Satellite orbits can change. **These predictions for satellite passes may be inaccurate by up to several minutes, especially after September 22.** For more accurate predictions of these and other satellites, check Heavens-Above.com or other satellite prediction sites for updates on the nights you wish to observe. Check out the "Live Sky View" feature at Heavens-Above.com. "Live Sky View" shows positions of visible satellites, their changing brightness (magnitude), and their motion in "real time." Be sure to set application(s) for your location and time zone.

HAPPY OBSERVING!