

**OBSERVING HIGHLIGHTS for June 20 to July 6, 2022, a “dark Moon” Period.  
Black Canyon Astronomical Society (BCAS), western Colorado, USA**

**SUMMARY.** From June 21 to 27, watch the last quarter Moon of June 20 wane to a thin crescent in the morning sky. The Moon is new on June 28 at 8:52 PM MDT. On evenings from June 29 to July 5, watch a crescent Moon wax to first quarter on July 6. At about 5:10 AM MDT, you can see Saturn in the south, bright Jupiter and reddish Mars high in the southeast, brilliant Venus in the east northeast, and Mercury in twilight glare near the east-northeastern horizon. In the mornings, watch the waning Moon move eastward from below Jupiter on June 21 to west of Mars on June 22, to the left of Venus on June 26, and to the left of Mercury on June 27. Try to spot earthshine on the dark part of the lunar disk, especially on mornings from June 23 to 27 and on evenings from June 29 to July 3. Using binoculars, challenge yourself to spot Ptolemy’s Star Cluster and the Butterfly Star Cluster in constellation Scorpius. Over the past several months the Sun has been very active, unleashing X-ray flares and ejecting charged particles. This solar activity can trigger auroral displays (“northern lights”) that may be visible from northern U.S. states, or even from Colorado if we get lucky. And some bright and interesting Earth satellites will pass over our region.

**WESTERN SLOPE SKIES.** Since 2011, the BCAS and KVN Community Radio have been producing Western Slope Skies (WSS), a biweekly astronomy feature. On June 24 and 29 Ranger Hannah Ashely of Black Canyon of the Gunnison National Park will present on “The Significance of the Summer Triangle.” Audio, scripts, and images from Western Slope Skies features are linked here: <https://www.kvnf.org/programs/western-slope-skies#stream/0>

**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>

**THE MOON.** The Moon reaches **last quarter** on June 20 at 9:11 PM MDT. From June 21 to 27, the crescent Moon wanes in the mornings. In the pre-dawn sky, watch the waning Moon move eastward from below Jupiter on June 21 to west of Mars on June 22, to the left of Venus on June 26, and to the left of Mercury on June 27. The **Moon is new on June 28 at 8:52 PM MDT.** On evenings from June 29 to July 5, watch the lunar crescent wax. The Moon reaches **first quarter** on July 6 at 8:14 PM MDT. Look west northwest on the evening of June 29 between 9:10 and 9:25 PM MDT and try to spot an extremely slender (only 1% illuminated!) lunar crescent in bright twilight (binoculars may help, and you will need an unobstructed west-northwestern horizon). On July 2 between 9:45 and 10:45 PM MDT, the waxing crescent Moon (now 14% illuminated) appears about 6 degrees to the right of the first magnitude star, Regulus, in constellation Leo. Try to spot earthshine on the dark part of the lunar disk, especially on mornings from June 23 to 27 and evenings from June 29 to July 3 (binoculars will enhance your view). **Please do your crescent Moon spotting before sunrise and after sunset. NEVER chance looking at the Sun directly – serious eye injury can result.** 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>

**JUNE 21: “SUMMER” SOLSTICE.** The Solstice occurs on June 21 at 3:14 AM MDT, when the Sun shines directly on the Tropic of Cancer at 23.44 degrees north latitude, as summer begins in the northern hemisphere and winter begins in the southern hemisphere. June 21 has the longest period of daylight hours for year 2022. June 20-21 is the shortest night of 2022; for the latitude of southwest Colorado there are only about 5 hours 10 minutes of true “dark time” (from the end of astronomical twilight in the evening to the beginning of astronomical twilight in the morning).

**PTOLEMY’S CLUSTER AND THE BUTTERFLY CLUSTER: AN EVENING BINOCULAR CHALLENGE.** On evenings in late June and early July the striking, central part of the Milky Way is rising in the southeast. With binoculars, it’s now possible to enjoy Ptolemy’s Cluster (aka M7) and the Butterfly Cluster (aka M6), two of the summer Milky Way’s brightest open star clusters. Can you find them? The attached/appended finder image may help. Look to the south-southeast and locate the bright stars of Scorpius (Sco), which extend from north of reddish, first-magnitude Antares, south to the “tail” of the Scorpion, which hooks to the east, terminating in three stars that form Scorpius’ “stinger.” Farther to the east, locate the “teapot” asterism in constellation Sagittarius (Sgr). Ptolemy’s Cluster (M7) is situated about one third the distance from the tip of Scorpius’ “stinger” to the “spout” of Sagittarius’ “teapot.” Ptolemy’s Star Cluster is visible to unaided eyes as a fuzzy patch of light. Without optical aid during the second century, Claudius Ptolemy was the first to chart M7, hence its popular name. Using binoculars, can you locate the Butterfly Cluster (M6) about 4 degrees north of Ptolemy’s Cluster? Both Ptolemy’s Cluster and the Butterfly Cluster will fit within the same field of view of most binoculars. Using telescopes, some people see the outline of a butterfly in M6, hence its popular name. M7 contains about 80 stars and is relatively nearby, “only” about 980 light years distant (1 light year equals 5.9 trillion miles). Fainter M6 contains about 120 stars and is about 1600 light years distant.

**SATURN RISES BEFORE MIDNIGHT.** Saturn rises in the east southeast around 11:50 PM MDT on June 20 and 10:46 PM MDT on July 6. The Ringed Planet brightens during this period from magnitude +0.60 to +0.52 as its distance to Earth decreases from 861 to 843 million miles. Saturn is the first to rise of the five bright planets that are visible during this period. With a telescope or high-magnification binoculars, it’s possible to spot Titan, Saturn’s largest moon. Telescopes of any size will show Saturn’s impressive rings. 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 IN THE MORNING.** Jupiter rises in the east at about 1:36 AM MDT on June 20 and 12:38 AM MDT on July 6. Jupiter brightens slightly during this period from magnitude -2.34 to -2.45, as its distance to Earth decreases from 464 to 441 million miles. Using binoculars or a telescope, you may be able to resolve Jupiter as a disk, which increases from 39.5 to 41.5 arc seconds wide between June 20 and July 6. You may also spot Jupiter’s four, bright “Galilean” moons with binoculars or a telescope. 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/#>

**MARS IN THE MORNING.** Mars rises in a dark eastern sky at about 2:13 AM MDT on June 20 and 1:37 AM MDT on July 6. The Red Planet brightens from magnitude +0.50 to +0.43, as its distance from Earth decreases from 126 to 118 million miles. Mars now appears slightly brighter than Saturn. Through telescopes Mars’ reddish disk appears to increase from 6.9 to 7.4 arc seconds wide during this period.

**VENUS: BRILLIANT IN MORNING TWILIGHT!** Venus rises during our long morning twilight, by about 3:55 AM MDT on June 20 and 3:58 AM MDT on July 6. During this period Venus shines brilliantly at magnitude -3.9. From July 20 through 25, look for Venus moving from about 6 degrees to the right of the Pleiades Star Cluster to about 7 degrees below that famous cluster. On the morning of July 1, Venus is about 4 degrees above and left of the reddish, first magnitude star, Aldebaran, near the Hyades Star Cluster. Through telescopes Venus' gibbous phase waxes from 83% to 87% illuminated during this period. Venus' apparent diameter diminishes from 12.4 to 11.6 arc seconds, as our Sister Planet recedes from 125 to 143 million miles. **Please do your Venus spotting before sunrise. NEVER chance looking at the Sun directly; serious eye damage can result.**

**MERCURY: A SECOND MORNING STAR!** You may be able to spot Mercury low to the east-northeastern horizon in bright morning twilight. The best times to look for Mercury may be around 4:50 AM MDT on June 20 to about 5:15 AM MDT on July 6. Find a place with an unobstructed north-northeastern horizon and look low in the sky. Binoculars may help. The Speedster Planet brightens from magnitude +0.20 to magnitude -1.27 during this period. Through telescopes on June 20, Mercury is a crescent that will appear 45% illuminated, but the Innermost Planet waxes to an 87%-illuminated, gibbous phase by July 6. Mercury's disk shrinks from 7.5 arc seconds wide on June 20 to 5.5 arc seconds wide on July 6, as its distance from Earth increases from 84 to 114 million miles. **At about 5:10 AM MDT during this period, you may see Saturn in the south, bright Jupiter and reddish Mars high in the southeast, brilliant Venus in the east-northeast, and Mercury in the twilight glare near the east-northeastern horizon. You will need an unobstructed east-northeastern horizon to spot Mercury, and binoculars may help. Please do your Mercury spotting before sunrise. NEVER chance looking at the Sun directly; serious eye damage can result.**

**THE SUN.** Solar activity has been rising, and it can be interesting to monitor the Sun as the new solar cycle "ramps up." Many M-class ("moderate") solar flares have occurred the last two weeks, and **there were X-class ("extreme") flares on March 30, April 17, 20, 30, May 3, and May 10.** There have also been coronal mass ejections ("CMEs") that have triggered auroras. The Sun currently features many sunspots and active regions. You can monitor sunspots, solar flares, 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 is very dangerous; 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 the past few months. 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/>

**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 ISS) have negative magnitudes. These predictions are for selected passes of some bright and/or interesting satellites (as summarized from Heavens-Above.com).

**June 20, 2022.** Tiangong (aka Tianhe-1, core module of Chinese Space Station launched in April 2021). **3:55 to 3:57 to 4:01 AM MDT**, WNW to NNE to E, max magnitude +1.3, appears from Earth's shadow 20 deg above WNW, maximum altitude 70 deg above NNE (Passing through Boötes, Draco, Cepheus/Cygnus, Lacerta, Andromeda, and Pisces). **Note: Tiangong's orbit may change frequently. Check for updates.**

**June 21, 2022.** Tiangong (aka Tianhe-1, core module of Chinese Space Station launched in April 2021). **4:32 to 4:35 to 4:38 AM MDT**, W to SSW to SE, max magnitude +1.3, appears from Earth's shadow 10 deg above W, maximum altitude 47 deg above SSW (Passing through Serpens, Ophiuchus, Aquila, Aquarius, and Cetus). **Note: Tiangong's orbit may change frequently. Check for updates.**

**June 21, 2022.** Hubble Space Telescope (HST). **10:25 to 10:28 PM MDT.** SW to SSW, max brightness mag. +2.4, disappears into Earth's Shadow at 19 deg above SSW at maximum altitude. (Passing through Hydra, Corvus, and Hydra, again). **Note: maximum brightness may vary, depending on orientation of the elongated HST to observer's line of sight.**

**June 22, 2022.** Hubble Space Telescope (HST). **10:13 to 10:16 PM MDT.** SW to S, max brightness mag. +2.3, disappears into Earth's Shadow at 20 deg above S at maximum altitude. (Passing through Hydra, and Corvus, and Hydra, again). **Note: maximum brightness may vary, depending on orientation of the elongated HST to observer's line of sight.**

**June 23, 2022.** Hubble Space Telescope (HST). **10:02 to 10:04 to 10:05 PM MDT.** SW to S, max brightness mag. +2.3, maximum altitude 19 deg above S, disappears into Earth's Shadow at 18 deg above S. (Passing through Hydra, and Corvus, Hydra again, Centaurus, and Lupus). **Note: maximum brightness may vary, depending on orientation of the elongated HST to observer's line of sight.**

**June 23, 2022.** Tiangong (aka Tianhe-1, core module of Chinese Space Station launched in April 2021). **10:21 to 10:24 PM MDT**, SW to SSE to SE, max magnitude +1.1, disappears into Earth's shadow 49 deg above SE, maximum altitude 52 deg above SSE (Passing through Crater, Corvus, Virgo-near Spica, Serpens, and Ophiuchus). **Note: Tiangong's orbit may change frequently. Check for updates.**

**June 24, 2022.** Hubble Space Telescope (HST). **9:50 to 9:53 to 9:54 PM MDT.** SW to S to SSE, max brightness mag. +2.4, maximum altitude 18 deg above S, disappears into Earth's Shadow at 15 deg above SSE. (Passing through Hydra, and Corvus, and Hydra again, Centaurus, and Lupus). **Note: maximum brightness may vary, depending on orientation of the elongated HST to observer's line of sight.**

**June 24, 2022.** Tiangong (aka Tianhe-1, core module of Chinese Space Station launched in April 2021). **10:58 to 11:01 PM MDT**, W to NW, max magnitude +1.4, disappears into Earth's shadow 64 deg above NW at maximum altitude (Passing through Leo, Canes Venatici, and Ursa Major-Big Dipper). **Note: Tiangong's orbit may change frequently. Check for updates.**

**June 25, 2022. X-37B (U.S. Space Force “not-so-secret” Space Plane).** 4:06 to 4:09 to 4:12 AM MDT, NW to NNE to E, maximum altitude 51 deg above NNE, max magnitude +1.2 (Passing through Boötes, Draco/Ursa Minor, Cepheus, Cassiopeia, Andromeda, Triangulum, and Aries). **X-37B’s orbit may change, or it may land. Check for updates.**

**June 25, 2022. International Space Station (ISS).** 4:37 to 4:39 to 4:42 AM MDT, SSW to SE to ENE, appears from Earth’s shadow 17 deg above SSW, max altitude 36 deg above SE, max magnitude -2.7 (Passing through Capricornus/Microscopium, Aquarius, Pisces-near Jupiter and Mars, Aries, and Taurus-near Moon and Venus). **Predictions for the ISS are subject to change due to orbital adjustments. Check for updated predictions.**

**June 25, 2022. Tiangong (aka Tianhe-1, core module of Chinese Space Station launched in April 2021).** 9:59 to 10:02 to 10:05 PM MDT, WSW to SSE to ENE, max magnitude +1.0, disappears into Earth’s shadow 9 deg above ENE, maximum altitude 87 deg above SSE (Passing through Sextans, Coma Berenices, Boötes, Hercules, Lyra-near Vega, and Cygnus). **Note: Tiangong’s orbit may change frequently. Check for updates.**

**June 26, 2022. X-37B (U.S. Space Force “not-so-secret” Space Plane).** 4:27 to 4:30 to 4:33 AM MDT, WNW to SSW to SE, maximum altitude 60 deg above SSW, max magnitude +0.2 (Passing through Corona Borealis, Hercules, Cygnus/Ophiuchus, Sagitta, Delphinus, Equuleus, Aquarius, and Cetus). **X-37B’s orbit may change, or it may land. Check for updates.**

**June 26, 2022. Tiangong (aka Tianhe-1, core module of Chinese Space Station launched in April 2021).** 10:37 to 10:40 to 10:41 PM MDT, W to N to ENE, max magnitude +1.9, disappears into Earth’s shadow 24 deg above ENE, maximum altitude 51 deg above N (Passing through Leo, Leo Minor, Ursa Major-Big Dipper, Draco, Ursa Minor, Draco again, and Cepheus/Cygnus). **Note: Tiangong’s orbit may change frequently. Check for updates.**

**June 27, 2022. International Space Station (ISS).** 4:36 to 4:38 to 4:42 AM MDT, WSW to NW to NE, appears from Earth’s shadow 20 deg above WSW, max altitude 69 deg above NW, max magnitude -3.7 (Passing through Serpens, Cygnus/Lyra, Cepheus, Cassiopeia, and Auriga). **Predictions for the ISS are subject to change due to orbital adjustments. Check for updated predictions.**

**June 27, 2022. Tiangong (aka Tianhe-1, core module of Chinese Space Station launched in April 2021).** 9:37 to 9:41 to 9:44 PM MDT, W to NNW to ENE, max magnitude +1.5, maximum altitude 64 deg above NNW (Passing through Leo, Leo Minor, Ursa Major, Draco, and Cygnus). **Note: Tiangong’s orbit may change frequently. Check for updates.**

**June 27, 2022. X-37B (U.S. Space Force “not-so-secret” Space Plane).** 10:45 to 10:48 to 10:49 PM MDT, W to NNW to NNE, maximum altitude 52 deg above NNW, max magnitude +1.0, disappears into Earth’s shadow at 41 deg above NNE (Passing through Leo, Leo Minor, Ursa Major-Big Dipper, Draco, Ursa Minor, and Cepheus). **X37B’s orbit may change, or it may land. Check for updates.**

**June 28, 2022. International Space Station (ISS).** 3:49 to 3:50 to 3:53 AM MDT, S to SE to ENE, appears from Earth’s shadow 58 deg above S, max altitude 63 deg above SE, max magnitude -3.8 (Passing through Equuleus, Pegasus, Andromeda, Triangulum, and Perseus). **Predictions for the ISS are subject to change due to orbital adjustments. Check for updated predictions.**

**June 28, 2022. X-37B (U.S. Space Force “not-so-secret” Space Plane). 9:30 to 9:33 to 9:36 PM MDT, SW to SSE to ENE, maximum altitude 56 deg above SSE, max magnitude +0.3. (Passing through Hydra, Corvus, Virgo-near Spica, Serpens, Hercules/Ophiuchus, Cygnus/Sagitta, and Vulpecula). X37B’s orbit may change, or it may land. Check for updates.**

**June 29, 2022. X-37B (U.S. Space Force “not-so-secret” Space Plane). 9:51 to 9:53 to 9:56 PM MDT, WSW to NNW to ENE, maximum altitude 53 deg above NNW, max magnitude +1.1. (Passing through Leo, Leo Minor, Ursa Major-Big Dipper, Draco, Ursa Minor, Cepheus, and Lacerta). X37B’s orbit may change, or it may land. Check for updates.**

**June 29, 2022. Tiangong (aka Tianhe-1, core module of Chinese Space Station launched in April 2021). 10:53 to 10:56, WNW to N to NNE, max magnitude +1.5, maximum altitude 56 deg above N, disappears into Earth’s shadow 55 deg above NNE (Passing through Leo, Leo Minor, Ursa Major, Draco, Ursa Minor, and Draco again). Note: Tiangong’s orbit may change frequently. Check for updates.**

**June 30, 2022. International Space Station (ISS). 3:48 to 3:49 to 3:53 AM MDT, WNW to NW to NE, appears from Earth’s shadow 36 deg above WNW, max altitude 43 deg above NW, max magnitude -2.9 (Passing through Hercules, Draco, Ursa Minor-near Polaris, Camelopardalis, and Auriga). Predictions for the ISS are subject to change due to orbital adjustments. Check for updated predictions.**

**July 1, 2022. Tiangong (aka Tianhe-1, core module of Chinese Space Station launched in April 2021). 10:31 to 10:34 to 10:35 PM MDT, WNW to NNE to E, max magnitude +1.1, maximum altitude 77 deg above NNE, disappears into Earth’s shadow 55 deg above E (Passing through Leo, Leo Minor, Ursa Major-Big Dipper, Draco/Hercules, and Lyra-near Vega). Note: Tiangong’s orbit may change frequently. Check for updates.**

**July 3, 2022. International Space Station (ISS). 3:00 to 3:03 AM MDT, NNW to NNE, appears from Earth’s shadow at max altitude 29 deg above NNW, max magnitude -2.0 (Passing through Draco, Camelopardalis, and Auriga). Predictions for the ISS are subject to change due to orbital adjustments. Check for updated predictions.**

**July 3, 2022. Tiangong (aka Tianhe-1, core module of Chinese Space Station launched in April 2021). 10:09 to 10:12 to 10:13 PM MDT, WNW to SSW to SE, max magnitude +1.0, maximum altitude 68 deg above SSW, disappears into Earth’s shadow 38 deg above SE (Passing through Leo, Coma Berenices, Boötes, Serpens, and Ophiuchus). Note: Tiangong’s orbit may change frequently. Check for updates**

**July 5, 2022. Tiangong (aka Tianhe-1, core module of Chinese Space Station launched in April 2021). 9:47 to 9:50 to 9:51 PM MDT, W to SSW to SSE, max magnitude +1.8, maximum altitude 39 deg above SSW, disappears into Earth’s shadow 21 deg above SSE (Passing through Leo-near Regulus, Virgo-near Moon, Libra, Scorpius, and Ophiuchus). Note: Tiangong’s orbit may change frequently. Check for updates**

**July 6, 2022. X-37B (U.S. Space Force “not-so-secret” Space Plane). 10:39 to 10:42, NW to NNE, disappears into Earth’s shadow at maximum altitude of 47 deg above NNE, max magnitude +1.0. (Passing through Ursa Major, Ursa Minor, and Draco/Cepheus). X37B’s orbit may change, or it may land. Check for updates.**

Satellite orbits can change. **These predictions for satellite passes may be inaccurate by up to several minutes, especially after June 24.** 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!**

An image for finding star clusters M7 and M6 in constellation Scorpius (Sco).

