

# Sky Guide 2024

BY MARTIN RATCLIFFE AND RICHARD TALCOTT

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A stunning total solar eclipse graces the skies above parts of the U.S., Canada, and Mexico on April 8. ALAN DYER

*Martin Ratcliffe is a planetarium professional with Evans & Sutherland and enjoys observing from Salt Lake City. Richard Talcott is a contributing editor of Astronomy.*

A supplement to *Astronomy* magazine

S	M	T	W	T	F	S
	1	2	☾	4	5	6
7	8	9	10	☉	12	13
14	15	16	☾	18	19	20
21	22	23	24	☉	26	27
28	29	30	31			

- 4 Quadrantid meteor shower peaks
- 6 Venus passes 6° north of Antares, 3 A.M. EST
- 8 The Moon passes 6° south of Venus, 3 P.M. EST
- 9 The Moon passes 7° south of Mercury, 2 P.M. EST
- 10 The Moon passes 4° south of Mars, 4 A.M. EST
- 12 Mercury is at greatest western elongation (24°), 10 A.M. EST
- 14 The Moon passes 2° south of Saturn, 5 A.M. EST
- 15 The Moon passes 0.9° south of Neptune, 3 P.M. EST
- 18 The Moon passes 3° north of Jupiter, 4 P.M. EST
- 19 The Moon passes 3° north of Uranus, 3 P.M. EST
- 20 Pluto is in conjunction with the Sun, 9 A.M. EST
- 27 Mercury passes 0.2° north of Mars, 11 A.M. EST

# The Demon Star prowls the night

**A**lgol is the easiest variable star to observe. Every 2.87 days, it dims to less than one-third its normal brightness and noticeably changes the look of its host constellation, Perseus. Algal passes nearly overhead on January evenings and remains visible almost all night.

It appears medieval astronomers knew Algal varies. Its Arabic name translates to “Demon,” suggesting these early skywatchers observed the star’s unusual behavior. It wasn’t until 1783 that British astronomer John Goodricke figured out that Algal’s brightness changes because two stars periodically eclipse each other.

We now know the nature of the Algal binary system. It



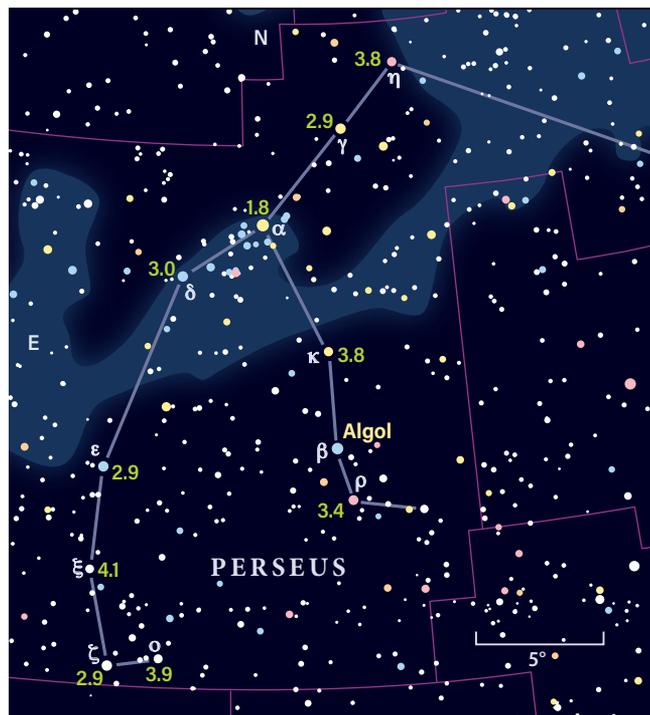
The eclipsing binary star Algal in Perseus normally shines at magnitude 2.1, but it dims to magnitude 3.4 every 2.87 days. BILL AND SALLY FLETCHER

consists of a hot blue main sequence star with 3.7 times the Sun’s mass and an orange subgiant star of 0.8 solar mass. Because the secondary star has evolved off the main sequence, it is physically larger than the primary. It fills its Roche lobe, a

teardrop-shaped region around the star within which orbiting material is gravitationally bound, so material flows from it onto the primary star.

Our line of sight to Algal closely aligns with the two stars’ orbital plane. A main eclipse occurs when the orange subgiant passes in front of its brighter companion, resulting in a magnitude drop from 2.1 to 3.4 and then a return to 2.1 over a period of 10 hours. Half an orbit later, the primary eclipses the secondary, though the 0.1-magnitude drop is hardly noticeable.

It’s easy to estimate Algal’s brightness by comparing it to that of nearby stars. Conveniently, the brightest star in Perseus, Alpha (α) Persei, shines at magnitude 1.8 and appears slightly brighter than Algal normally does. And just 2° south of Algal lies magnitude 3.4 Rho (ρ) Per. When the Demon Star is in the depths of an eclipse, it matches Rho’s brilliance. These two comparison stars make it a snap to quickly check if an eclipse is underway.



Use the Demon Star’s neighbors to estimate the brightness of this variable star. ALL ILLUSTRATIONS: ASTRONOMY: ROEN KELLY

# Winter's flurry of active comets

Feb 2024

S	M	T	W	T	F	S
				1	☾	3
4	5	6	7	8	☉	10
11	12	13	14	15	☾	17
18	19	20	21	22	23	☉
25	26	27	28	29		

Several comets could make this winter a season to remember. Scientists expect three to come within range of binoculars. The best, Comet C/2021 S3 (PANSTARRS), could reach 6th magnitude in February.

On Feb. 1, you can see PANSTARRS rising with the bright star Antares in the southeast around 4 A.M. local time. Ninety minutes later, Antares stands 15° high in a dark sky with the comet 2° to the east. Unfortunately, a bright Moon in Virgo interferes with the view.

The comet moves to the northeast at about 1° per day. It soon crosses into Ophiuchus, where a waning crescent Moon passes south of the comet Feb. 5. You can use 2nd-magnitude Eta (η) Ophiuchi as a guide during this period. On the 10th, PANSTARRS lies 5° south of this star. The comet comes closest to the Sun on Feb. 14 when it stands 4° southeast of Eta.

Comet C/2021 S3 should maintain this brightness through February and into early March as it crosses Serpens Cauda and then back into Ophiuchus. It passes 2° west of magnitude 3.5 Xi (ξ) Serpentis on Feb. 17.

Two other comets could command your attention this winter. Comet 62P/Tsuchinshan reaches 7th magnitude in January and February while 144P/Kushida peaks at 8th magnitude during the same two months.

Comet Tsuchinshan comes within 50 million miles of Earth at its closest in late January. On the 29th, it passes midway between two of the brighter galaxies in the Virgo Cluster, M87 and M49.

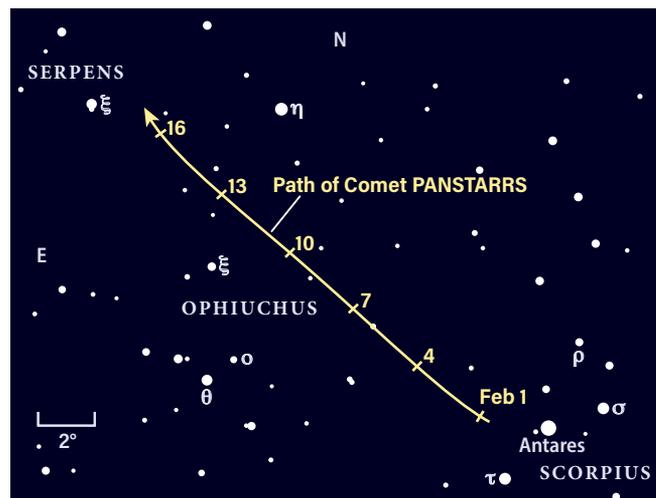
Its slow motion in February keeps it within 0.5° of the 11th-magnitude spiral galaxy NGC 4596 from the 7th to the 27th. On the 23rd, it comes close enough to appear against the outer spiral arms of the

4'-wide galaxy. It returns to a point midway between M87 and M49 on March 9, though it will have faded to 9th magnitude by then.

Comet 144P/Kushida makes its closest approach to the Sun in late January. On Jan. 4, it lies some 6° south of Uranus. It crosses the Hyades Cluster in Taurus in early February and passes within 0.1° of 1st-magnitude Aldebaran on the 10th.



The wispy tail of Comet C/2021 S3 (PANSTARRS) glows dimly against a background of faint stars in this image from May 13, 2023. PEPE CHAMBO



Comet C/2021 S3 (PANSTARRS) could reach 6th magnitude and show up nicely through binoculars as it cuts through Scorpius and Ophiuchus in early February.

- 7 The Moon passes 5° south of Venus, 2 P.M. EST 👁️ 🏠

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- 8 The Moon passes 4° south of Mars, 2 A.M. EST 👁️ 🏠

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- 10 The Moon passes 1.8° south of Saturn, 8 P.M. EST 👁️ 🏠

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- 12 The Moon passes 0.7° south of Neptune, 2 A.M. EST 🏠 🔭

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- 15 The Moon passes 3° north of Jupiter, 3 A.M. EST 👁️ 🏠

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- The Moon passes 3° north of Uranus, 9 P.M. EST 🏠

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- 22 Venus passes 0.6° north of Mars, 11 A.M. EST 👁️ 🏠 🔭

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- 28 Mercury is in superior conjunction, 4 A.M. EST

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- Saturn is in conjunction with the Sun, 4 P.M. EST

## Moon Phases

- ☾ First Quarter
- ☉ Full Moon
- ☾ Last Quarter
- ☉ New Moon

- 👁️ Events that can be viewed with **the naked eye**
- 🏠 Events that can be viewed with **binoculars**
- 🔭 Events that can be viewed with a **telescope**

S	M	T	W	T	F	S
					1	2
☉	4	5	6	7	8	9
☽	11	12	13	14	15	16
☿	18	19	20	21	22	23
♃	24	●	26	27	28	29
♄						30
♅						31

- 3 Asteroid Juno is at opposition, 1 P.M. EST 

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- 7 The Moon passes 4° south of Mars, midnight EST  

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- 8 The Moon passes 3° south of Venus, noon EST  

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- 13 The Moon passes 4° north of Jupiter, 9 P.M. EDT  

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- 14 The Moon passes 3° north of Uranus, 8 A.M. EDT 

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- 17 Neptune is in conjunction with the Sun, 7 A.M. EDT

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- 19 Equinox (northern spring/southern autumn begins), 11 P.M. EDT 

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- 21 Venus passes 0.3° north of Saturn, 10 P.M. EDT  

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- 24 Mercury is at greatest eastern elongation (19°), 7 P.M. EDT  

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- 25 Penumbral lunar eclipse, 3 A.M. EDT  

# Mercury glows brightly at dusk

**T**he solar system's innermost planet puts on a fine show these March evenings. Mercury's tight orbit around the Sun always keeps it close to our star's glare. The elusive world typically appears only for a few weeks on either side of its greatest elongations from the Sun.

March brings an advantage for Northern Hemisphere viewers, however. The ecliptic — the Sun's apparent path across our sky that the planets follow closely — makes a steep angle to the western horizon after sunset. This places Mercury higher in the evening sky than during other seasons. The best time to look comes around greatest eastern elongation March 24.

Your first realistic opportunity to see Mercury this month occurs on the 11th. Start your search a half-hour after sunset. Find brilliant Jupiter high in the west and then locate the slender crescent Moon much



Mercury glows brightly to the left of a Sun pillar above the Church of Santa Maria in Castello in the Italian village of Tarquinia in May 2021. MARCO MENIERO

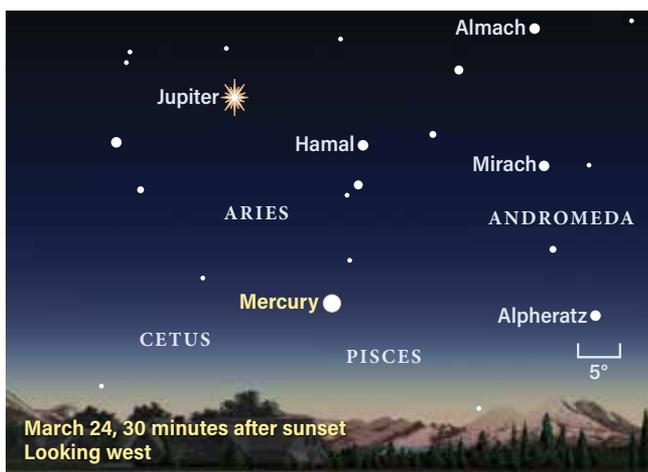
lower in the sky. Extend an imaginary line between these two objects toward the western horizon, and you should see Mercury standing 5° high. It shines at magnitude -1.3 and should be easy to pick out of the twilight glow.

The planet becomes easier to see as it climbs higher with each passing day. It appears 9° high 30 minutes after sundown on the 17th, though it has faded slightly to magnitude -0.9.

A telescope reveals the planet's disk, which spans 6" and appears 70 percent lit.

Mercury's peak arrives at greatest elongation on the 24th. It then lies 19° east of the Sun and stands 12° above the western horizon a half-hour after sunset. Although the planet has dimmed to magnitude -0.1, its greater altitude makes it easier to see. A telescope shows an 8"-diameter disk and crescent phase. Although Mercury maintains a decent altitude through the end of March, it fades by a full magnitude and becomes difficult to see.

The innermost planet circles the Sun once every 88 days, so it makes several other appearances during the year. The best of the bunch comes in the first week of September when the inner world climbs highest above the eastern horizon before dawn. It appears nearly as good on mornings in early January and late December. If you want to see it again at dusk, your best chance comes in the latter half of July.



The innermost planet appears at its best in the evening sky around the time of its greatest eastern elongation March 24.

# Great American Eclipse, part 2

# 2024 April

S	M	T	W	T	F	S
	☾	2	3	4	5	6
7	☉	9	10	11	12	13
14	☾	16	17	18	19	20
21	22	●	24	25	26	27
28	29	30				

**A**pril 8 brings the second total eclipse of the Sun in seven years to North America. Alas, this is the last total eclipse for our continent until 2044, so be sure to take advantage of its proximity.

Tens of millions of people live in the path of totality and will have front-row seats for this event. But millions more will travel into the path, clogging roadways, hotels, motels, and campsites, so plan to arrive at your destination at least a day ahead of time.

Tempted to avoid the hassle and settle for a partial eclipse?

Take the advice of eclipse expert Fred Espenak, who recently noted that seeing a 95 percent eclipse is like missing the last number in the lottery — it may be exciting, but it's no match for hitting the jackpot.

Most of an eclipse's drama comes in the final five minutes before totality. The Sun's intensity drops dramatically, colors become more saturated, and shadows sharpen. In the last seconds before totality, a final sliver of sunlight passes through a deep lunar valley to deliver a majestic diamond ring. The Sun's corona then blossoms into view as the sky turns a deep blue except near

the horizon, where the colors of twilight rule.

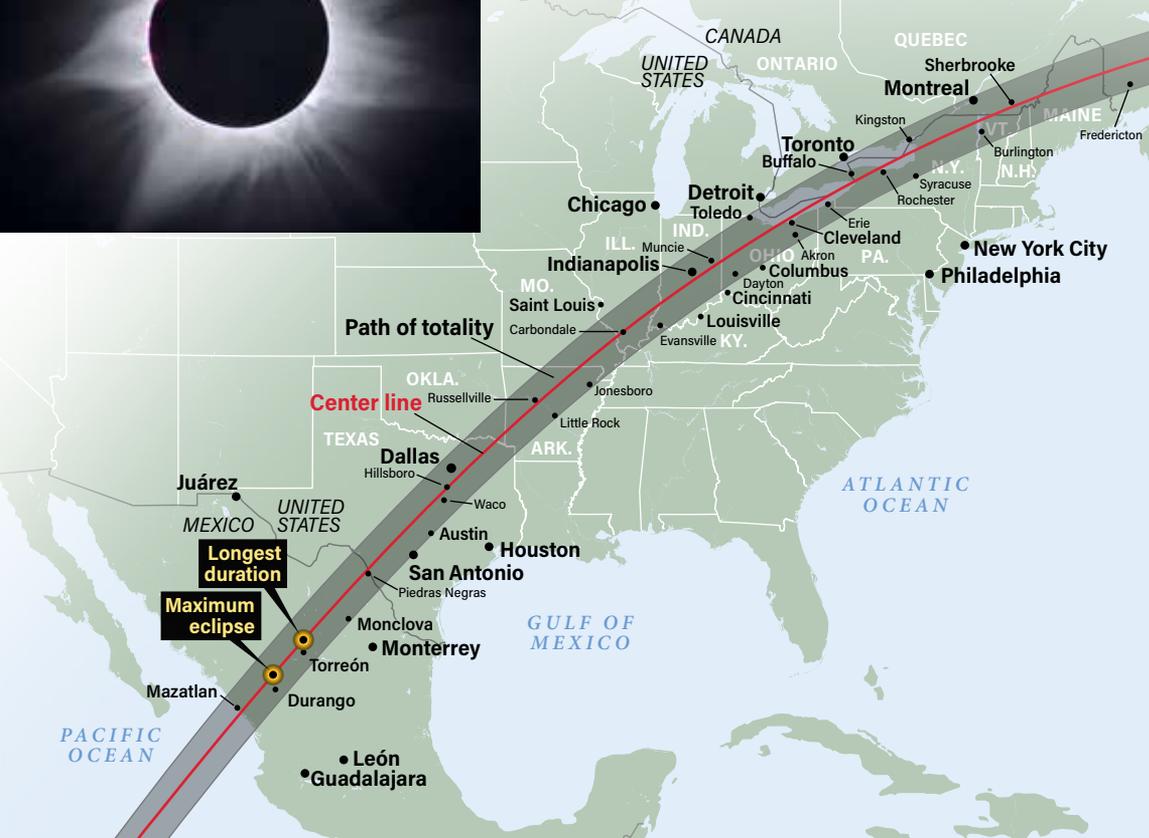
This scene plays out wherever clear skies grace the path of totality. This track makes landfall on the Pacific Coast at Mazatlán, Mexico. From there, it heads to the north-east, crossing into the U.S. in Texas and then making its way to New England and the Canadian Maritimes. More than four minutes of totality await observers on the center line from Mexico to Ohio, while the rest experience more than three minutes.

*Astronomy's* April issue will detail all you need to know about this spectacular event.



**LEFT: Several reddish prominences arced into the Sun's gauzy corona during the April 20, 2023, total solar eclipse. FABRIZIO MELANDRI**

**BELOW: April 8, 2024, brings the second total solar eclipse in seven years to the U.S. Observers on the center line can see up to 4 minutes 25 seconds of totality.**



- 5 The Moon passes 2° south of Mars, midnight EDT

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- 6 The Moon passes 1.2° south of Saturn, 5 A.M. EDT

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- 7 The Moon passes 0.4° south of Neptune, 4 A.M. EDT

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- The Moon passes 0.4° north of Venus, 1 P.M. EDT

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- 8 Total solar eclipse, 2 P.M. EDT

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- 10 The Moon passes 4° north of Jupiter, 5 P.M. EDT

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- The Moon passes 4° north of Uranus, 8 P.M. EDT

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- Mars passes 0.5° north of Saturn, 11 P.M. EDT

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- 11 Mercury is in inferior conjunction, 7 P.M. EDT

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- 18 Mercury passes 2° north of Venus, 7 P.M. EDT

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- 20 Jupiter passes 0.5° south of Uranus, 4 A.M. EDT

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- 22 Lyrid meteor shower peaks

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- 28 Mars passes 0.04° south of Neptune, midnight EDT

S	M	T	W	T	F	S
		☾	2	3	4	
5	6	☉	8	9	10	11
12	13	14	☾	16	17	18
19	20	21	22	☉	24	25
26	27	28	29	☾	31	

3 The Moon passes 0.8° south of Saturn, 7 P.M. EDT   

4 The Moon passes 0.3° south of Neptune, 3 P.M. EDT  

The Moon passes 0.2° north of Mars, 10 P.M. EDT   

5 Eta Aquariid meteor shower peaks 

6 The Moon passes 4° north of Mercury, 4 A.M. EDT  

9 Mercury is at greatest western elongation (26°), 6 P.M. EDT   

13 Uranus is in conjunction with the Sun, 5 A.M. EDT

18 Jupiter is in conjunction with the Sun, 3 P.M. EDT

19 Asteroid Pallas is at opposition, 11 A.M. EDT  

31 The Moon passes 0.4° south of Saturn, 4 A.M. EDT   

The Moon passes 0.02° south of Neptune, 11 P.M. EDT  

# Antares vanishes behind the Moon



The photographer captured 1st-magnitude Antares just as it was about to disappear behind the crescent Moon's dark limb October 21, 2009. TUNÇ TEZEL

The Moon cuts a path across our sky every month. It frequently passes in front of, or

occults, faint stars, but only four 1st-magnitude stars potentially lie in its path. These luminaries — Aldebaran, Antares, Regulus, and Spica — typically go through periods where they experience monthly occultations followed by years-long lulls as the Moon's orbit slowly shifts.

This year finds both Antares and Spica in the Moon's sights. But the former takes center stage this month. The luminary of Scorpius the Scorpion shines brightly enough to show up well through binoculars and telescopes against Luna's bright limb even when the Moon is Full, as it will be when it passes in front of Antares on May 23.

Antares provides a more intriguing target than the other 1st-magnitude stars because it is a red supergiant. Its tremendous girth means Antares fades out behind the Moon's limb and then returns to view quickly,

rather than instantaneously the way the other stars do.

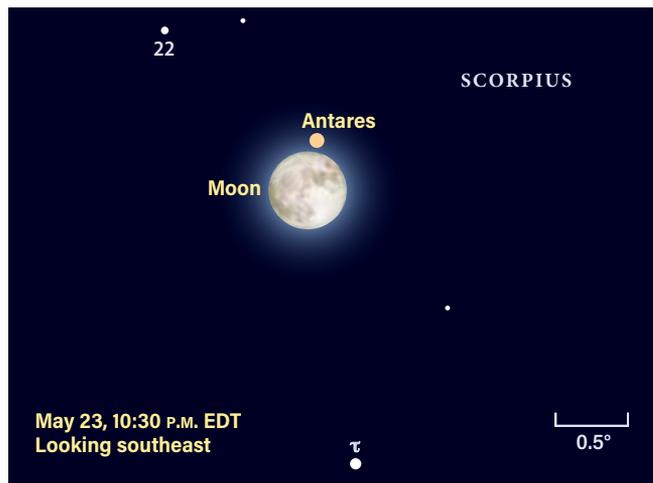
This month's occultation shows up best from the southeastern U.S. Observers east of a line from Pensacola, Florida, through Richmond, Virginia, see Antares disappear soon after the Full Moon rises. For those farther west, Antares already lies behind the Moon as the pair rises, and only the star's reappearance can be seen. For locations west of a

line that runs from near Milwaukee to the San Antonio area, the occultation ends before the Moon rises.

Observers near Philadelphia and Toronto and points in between should look for a stunning grazing occultation, when Antares skips behind mountains along the Moon's northern limb and flashes in and out of view. The rest of North America experiences the Moon rising next to Antares.

Watching the Moon occult Antares through a telescope or binoculars is a visual spectacle. The vibrant orange color of the star contrasts beautifully with the Moon's brightly lit limb. Begin observing at least 20 minutes before the event and watch the two approach. Does the star blink out instantly, or does it fade away?

For occultation aficionados, note that a Last Quarter Moon occults Antares before dawn March 3 over a similar geographical area.



Residents in the southeastern U.S. can watch the Full Moon occult ruddy Antares on May 23. This view depicts the scene from Miami just after the star reappears.

# Solar max augurs a grand show

2024  
June

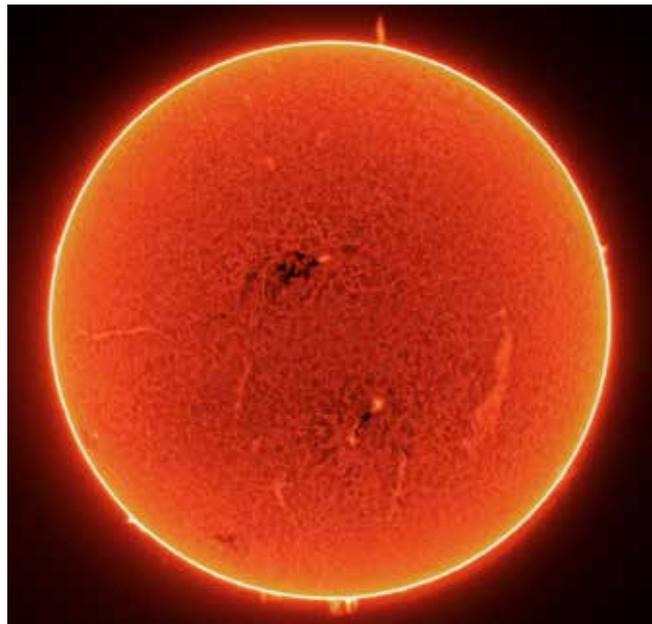
S	M	T	W	T	F	S
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9	10	11	12	13	☾	15
16	17	18	19	20	●	22
23	24	25	26	27	☽	29
30						

**T**his year could see solar activity peak. Astronomers initially thought solar maximum would arrive in mid-2025, but some now expect it could come up to a year earlier. The peak also could be stronger than earlier predictions called for; after all, 2023 saw the number of sunspots running 50 percent higher than expected. With June offering the maximum amount of sunlight, there's no better time to start observing our star.

But first, you must exercise extreme caution when viewing the Sun. Even a brief look through binoculars or a telescope can permanently blind you. Consider using a 4-inch or smaller telescope to project the Sun's image onto a white card. Align your instrument's shadow with the Sun until you see the solar disk on the card. You'll find it helpful to mount a larger card on the top end of the scope to cast a shadow.

To directly observe the Sun, place a specialized solar filter built specifically for this purpose over the front end of your scope. A 60mm refractor provides exquisite views of sunspots (darker regions that give off less light because they are cooler), faculae (bright regions that show up best near the solar limb), and delicate granulation (convection cells covering the Sun's visible surface, or photosphere). Don't be surprised to see sunspots change appearance in just a few hours.

To see the Sun's upper atmosphere, or chromosphere,



**The Sun's activity has been increasing rapidly these past few years. Several sunspots, filaments, and prominences adorn this Hydrogen-alpha view from July 11, 2022.** ROB LYONS



**A bright and colorful auroral display amazed observers in Alaska's Chena River State Recreational Area March 25, 2023.** JOHN CHUMACK

use a Hydrogen-alpha filter that blocks all sunlight except in a narrow band around 656.3 nanometers. With this setup, you can view filaments (dark threads of cooler material), plages (bright patches around sunspots), and prominences (fiery tongues of gas arcing above the solar limb).

High levels of solar activity also rain charged particles down on Earth's magnetic field, triggering beautiful auroral displays. To see these, plan a trip to northern latitudes during the cooler months of the year when darkness holds for several hours each night.

- 2 The Moon passes 2° north of Mars, 8 P.M. EDT  

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- 4 Mercury passes 0.1° south of Jupiter, 6 A.M. EDT   

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- Venus is in superior conjunction, noon EDT

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- The Moon passes 4° north of Uranus, 9 P.M. EDT 

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- 5 The Moon passes 5° north of Jupiter, 10 A.M. EDT  

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- 14 Mercury is in superior conjunction, 1 P.M. EDT

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- 20 Solstice (northern summer/southern winter begins), 5 P.M. EDT 

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- 27 The Moon passes 0.08° north of Saturn, 11 A.M. EDT   

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- 28 The Moon passes 0.3° north of Neptune, 5 A.M. EDT  

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- 29 Mercury passes 5° south of Pollux, 6 A.M. EDT  

S	M	T	W	T	F	S
	1	2	3	4	○	6
7	8	9	10	11	12	☾
14	15	16	17	18	19	20
●	22	23	24	25	26	☽
28	29	30	31			

- 1 The Moon passes 4° north of Mars, 2 P.M. EDT 

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- 2 The Moon passes 4° north of Uranus, 6 A.M. EDT 

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- 3 The Moon passes 5° north of Jupiter, 4 A.M. EDT 

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- 5 Dwarf planet Ceres is at opposition, 8 P.M. EDT 

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- 7 The Moon passes 3° north of Mercury, 3 P.M. EDT 

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- 13 Jupiter passes 5° north of Aldebaran, 3 A.M. EDT 

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- 15 Mars passes 0.6° south of Uranus, 5 A.M. EDT 

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- 22 Mercury is at greatest eastern elongation (27°), 3 A.M. EDT 

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- 23 Pluto is at opposition, 2 A.M. EDT 

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- 24 The Moon passes 0.4° north of Saturn, 5 P.M. EDT 

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- 25 The Moon passes 0.6° north of Neptune, 11 A.M. EDT 

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- 27 Mercury passes 3° south of Regulus, 8 A.M. EDT 

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- 29 The Moon passes 4° north of Uranus, 2 P.M. EDT 

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- 30 The Moon passes 5° north of Mars, 7 A.M. EDT 

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- The Moon passes 5° north of Jupiter, 8 P.M. EDT 

# A dwarf planet meets the Archer



**L**ook up in the sky: Is it a planet? Is it an asteroid? No, it's a dwarf planet. Ceres has the distinction of being the only object to be called all three at one time or another. While our changing understanding of the cosmos alters categories, nothing changes the fact that Ceres was the first object discovered in what became known as the asteroid belt. And July offers the best chance all year to spot this intriguing object.

The asteroid belt occupies the region between the orbits of Mars and Jupiter. It's littered with debris from the solar system's earliest days. Indeed, the entire early solar system was full of such objects. During and after this formative period, the major planets scattered most of these bodies into the far reaches of the solar system. The asteroid belt holds the remaining objects, which

**NASA's Dawn spacecraft captured the dwarf planet Ceres from its low-altitude mapping orbit in 2016. The bright crater Occator lies dead center.** NASA/JPL-CALTECH/UCLA/MPS/DLR/IDA

number in the hundreds of thousands.

None of this was known the night of Jan. 1, 1801, when Italian astronomer Guiseppe Piazzi opened up Palermo Observatory and discovered a new object moving among the stars. He announced the discovery of a new planet and called it Ceres.

As astronomers discovered more objects in this region, Ceres lost its planetary status

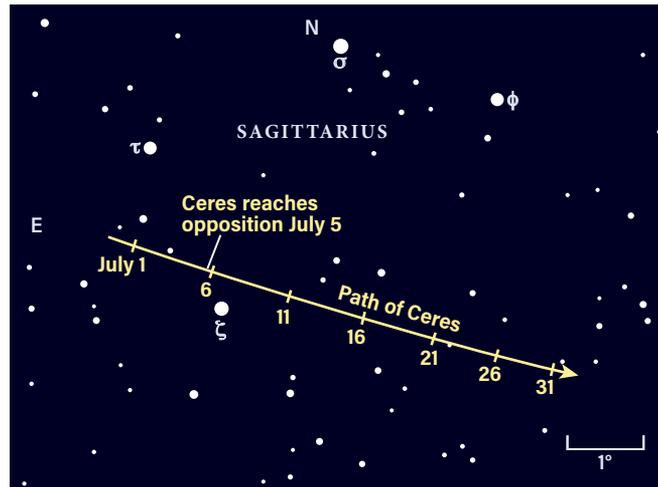
and settled on being the largest asteroid. It became a dwarf planet in 2006 when astronomers once again modified definitions. The Dawn spacecraft orbited it from 2015 to 2018, revealing a stunning world of craters and cryovolcanoes.

You can track this intriguing dwarf planet with binoculars this month. Your target area is eastern Sagittarius. Identify the Teapot asterism and then home in on magnitude 2.6 Zeta (ζ) Sagittarii, the star that joins the Teapot's handle to its base.

Ceres spends all of July within the same binocular field as Zeta. But the best time to look for the 8th-magnitude dwarf planet comes in the month's first 10 days, when it appears closest to the bright star. On the evening of the 1st, Ceres lies 1.5° northeast of Zeta and 1.4° south-southeast of magnitude 3.3 Tau (τ) Sgr.

The dwarf planet reaches opposition and peak visibility July 5. It then rises at sunset, climbs highest in the south near 1 A.M. local daylight time, and sets at sunrise. That night it stands 0.7° north-northeast of Zeta. Two nights later, it slides 0.4° north of the star.

Ceres continues to move westward from night to night. On the 14th, it stands 1.5° due west of Zeta and 0.6° north of the 8th-magnitude globular star cluster M54. The dwarf planet lies midway between the globular and a trio of 6th- and 7th-magnitude stars that night.



**Ceres appears brightest in July when it cuts through the Teapot asterism in Sagittarius the Archer.**

# Shooting stars for August mornings

2024  
Aug

S	M	T	W	T	F	S
				1	2	3
○	5	6	7	8	9	10
11	☾	13	14	15	16	17
18	●	20	21	22	23	24
25	☽	27	28	29	30	31

**M**ost people consider the Perseids to be the year's finest meteor shower. Not only does it offer a high rate of meteors, but it also occurs on warm summer nights. It stands out even more this year because its peak coincides with a First Quarter Moon on the night of Aug. 11/12. Luna sets by midnight local daylight time on the 11th, leaving the hours after midnight free from its interference.

The streaks of light we see in the sky arise when Earth plows through debris left behind by Comet 109P/Swift-Tuttle. This comet orbits the Sun once every 130 years. Heat from our star liberates fine particles from the comet's icy nucleus, and this material now spreads along the entire orbit. Friction with molecules in our atmosphere heats the particles to incandescence.

The shower gets its name from the constellation Perseus the Hero, where the meteors appear to radiate. This is strictly a perspective effect, however — the particles travel on parallel paths through space.

Perseus reaches a reasonable altitude by 11 P.M. local daylight time and climbs higher with each passing hour. The shower can produce up to 100 meteors per hour, its so-called zenithal hourly rate. This assumes the radiant lies overhead with near perfect conditions and a completely dark sky. The number of meteors you'll see drops when the radiant lies



Sicily's Mount Etna erupted during the 2023 Perseid shower, providing a striking foreground for three bright meteors. GIANNI TUMINO

## Meteor showers in 2024

Name	Peak date	Moon's phase	Prospects
Quadrantids	Jan. 4	Last Quarter Moon	Fair
Lyrids	April 22	Full Moon	Poor
Eta Aquariids	May 5	Waning crescent	Excellent
Perseids	Aug. 12	First Quarter Moon	Excellent
Orionids	Oct. 21	Waning gibbous	Poor
Leonids	Nov. 17	Full Moon	Poor
Geminids	Dec. 13	Full Moon	Poor

lower and light pollution affects your view. Most people count themselves lucky if they see 60 meteors per hour, or an average of one each minute. You'll still get a decent show the day before and after the peak, so don't despair if clouds interfere that night.

The best views come when you look at least 45° from the radiant and at least 30° above the horizon. The constellation Cygnus and its neighbors are a favorite region to watch because the fiery meteors add to the Milky Way's spectacle. Settle into a comfortable

position on a lounge chair or on your deck and start counting. Be sure to notice Mars and Jupiter within 1° of each other in central Taurus.

Although the Perseids are great this year, the other major meteor showers don't fair as well. Only the Eta Aquariids in May peak with the Moon out of the way. A Full or nearly Full Moon hinders viewing of April's Lyrids, October's Orionids, November's Leonids, and December's Geminids. And January's Last Quarter Moon does no favors for the Quadrantid shower.

- 4 Venus passes 1.1° north of Regulus, 6 P.M. EDT

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- 5 Mars passes 5° north of Aldebaran, 3 P.M. EDT

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- The Moon passes 1.7° north of Venus, 6 P.M. EDT

---

- The Moon passes 7° north of Mercury, 8 P.M. EDT

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- 6 Mercury passes 6° south of Venus, 11 A.M. EDT

---

- 11 Mercury passes 6° south of Regulus, 6 P.M. EDT

---

- 12 Perseid meteor shower peaks

---

- 14 Mars passes 0.3° north of Jupiter, 1 P.M. EDT

---

- 18 Mercury is in inferior conjunction, 10 P.M. EDT

---

- 20 Asteroid Vesta is in conjunction with the Sun, 5 A.M. EDT

---

- The Moon passes 0.5° north of Saturn, 11 P.M. EDT

---

- 21 The Moon passes 0.7° north of Neptune, 6 P.M. EDT

---

- 25 The Moon passes 4° north of Uranus, 8 P.M. EDT

---

- 27 The Moon passes 6° north of Jupiter, 9 A.M. EDT

---

- The Moon passes 5° north of Mars, 8 P.M. EDT

S	M	T	W	T	F	S
1	○	3	4	5	6	7
8	9	10	☾	12	13	14
15	16	●	18	19	20	21
22	23	☾	25	26	27	28
29	30					

- 1 The Moon passes 5° north of Mercury, 5 A.M. EDT 

---

- 4 Mercury is at greatest western elongation (18°), 11 P.M. EDT 

---

- 5 The Moon passes 1.2° south of Venus, 6 A.M. EDT 

---

- 8 Saturn is at opposition, 1 A.M. EDT 

---

- 9 Mercury passes 0.5° north of Regulus, 3 A.M. EDT 

---

- 17 The Moon passes 0.3° north of Saturn, 6 A.M. EDT 

---

- Venus passes 3° north of Spica, 9 A.M. EDT 

---

- Partial lunar eclipse, 11 P.M. EDT 

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- 18 The Moon passes 0.7° north of Neptune, 4 A.M. EDT 

---

- 20 Neptune is at opposition, 8 P.M. EDT 

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- 22 The Moon passes 5° north of Uranus, 3 A.M. EDT 

---

- Equinox (northern autumn/southern spring begins), 9 A.M. EDT 

---

- 23 The Moon passes 6° north of Jupiter, 7 P.M. EDT 

---

- 25 The Moon passes 5° north of Mars, 8 A.M. EDT 

---

- 30 Mercury is in superior conjunction, 5 P.M. EDT 

# Saturn starts to lose its rings

**T**he final weeks of summer find Saturn at its best. The ringed world reaches opposition the night of Sept. 7/8. As the name implies, opposition means the planet lies opposite the Sun in our sky, so it rises at sundown and remains visible all night. Opposition also brings a planet closest to Earth, so it shines at its brightest. This year, Saturn peaks at magnitude 0.5.

You can find the distant world among the faint background stars of eastern Aquarius. Use magnitude 4.2 Phi (φ) Aquarii as your guide. Saturn lies about 2° southwest of the star at opposition. On Aug. 26, the planet passes 1.2° due south of Phi. Of course, Saturn shines 30 times brighter than the star, so the solar system world makes a better guide to the distant sun than vice versa.

If you've paid close attention the past several years, you might notice that Saturn



The Cassini spacecraft orbited Saturn for 13 years and snapped more than 450,000 images. Here it caught the planet's rings nearly edge-on. NASA/JPL/SSI

appears a bit dimmer than at previous oppositions. It's not your imagination. The planet's rings have been closing for a while now and will turn edge-on to our line of sight in March 2025 for the first time since 2009. The narrower rings reflect less light in our direction. At opposition, the ring system tips 3.7° to our line of sight.

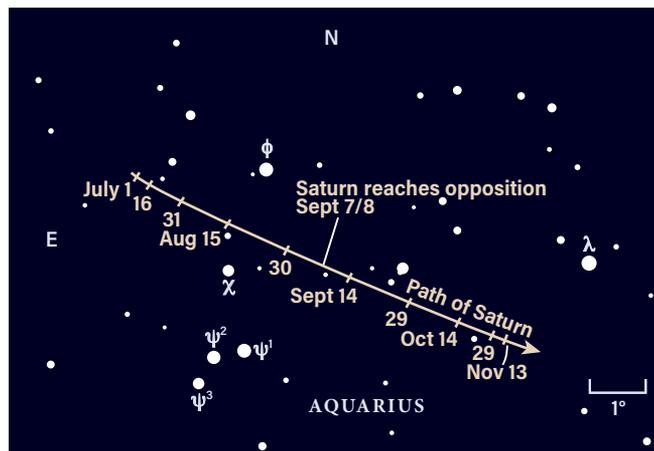
For a couple of days around opposition, the rings brighten noticeably relative to the planet's disk. This so-called Seeliger effect arises because

the ring particles cast their shadows directly away from our view. At all other times, the shadows fall on neighboring particles and darken them.

Use your telescope to explore Saturn. The rings' narrow tilt delivers better than normal views of the planet's globe this year. Notice that the disk appears noticeably flattened. At opposition, the equator spans 19.2" while the polar diameter measures only 17.3". The planet has a banded atmosphere similar to but far more subtle than Jupiter's.

The narrowing rings mean that some of Saturn's bigger moons — which lie in the same plane as the rings — now regularly transit and pass behind the planet's disk. Tethys, Dione, and Rhea all experience these events. Massive Titan orbits farther out and won't join in the fun until next year.

You'll also want to mark your calendar for Sept. 17. That morning, observers in the western third of North America can watch a nearly Full Moon occult Saturn.



The ringed planet spends 2024 among the background stars of Aquarius the Water-bearer, peaking at magnitude 0.5 in early September.

# A comet for the naked eye?

Oct 2024

S	M	T	W	T	F	S
		1	○	3	4	5
6	7	8	9	☾	11	12
13	14	15	16	●	18	19
20	21	22	23	☽	25	26
27	28	29	30	31		

**A**lthough it's still too early to know with any confidence, Comet C/2023 A3 (Tsuchinshan-ATLAS) could reach naked-eye visibility this month. Astronomers at China's Purple Mountain Observatory discovered the comet in January 2023, and researchers with South Africa's Asteroid and Terrestrial-impact Last Alert System (ATLAS) independently found it a month later.

Although it then lay more than a billion miles from the Sun, it glowed at 18th magnitude — quite bright for such a small and distant object.

As a new visitor from the Oort Cloud, this fresh comet could put on a nice show when it peaks in October. Predicting the brightness of a new comet a year in advance is fraught with uncertainty, however. Early estimates suggest it might reach magnitude -1 — potentially making it the comet of the decade — or max out at 3rd magnitude (a nice binocular comet barely visible to the naked eye).

A good test for this fresh comet comes in May as it crosses Virgo. If it has brightened to 9th or 10th magnitude by then, prospects for October look promising.

We'll get an early morning teaser when the comet makes its closest approach to the Sun on Sept. 27. It then lies 36 million miles from our star and appears low in the east during morning twilight. (Better views come to those

who live farther south.) Optimistic estimates place it around 1st magnitude then.

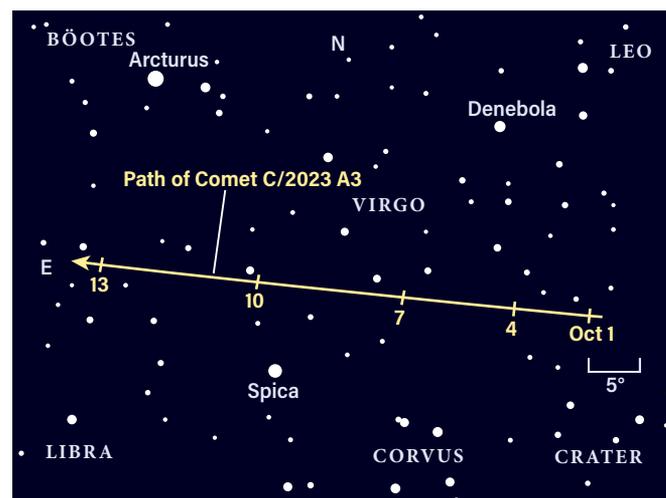
As it swings around the Sun, it reappears in evening twilight in early October. It climbs higher with each passing day as it moves rapidly eastward against the backdrop of Virgo the Maiden. Look for it Oct. 9 and 10 as it passes less than 10° north of 1st-magnitude Spica. It comes closest to Earth on the 12th at a distance of 44 million miles.

Although it fades after this, its increasing altitude carries it into a darker sky.

If the comet develops a significant dust tail, we could see a brightness jump around Oct. 9. The geometry of the Sun, Earth, and comet on that date causes sunlight to forward scatter through the dusty debris and enhance its intensity. Also keep an eye out for a sunward-pointing tail around Oct. 14 when Earth crosses the comet's orbital plane.



Comet C/2023 A3 (Tsuchinshan-ATLAS) glowed around 17th magnitude when it posed against the backdrop of eastern Virgo in May 2023. GIANLUCA MASI



Comet C/2023 A3 could reach naked-eye visibility when it peaks in early October among the background stars of Virgo the Maiden.

- 2 Annular solar eclipse, 3 P.M. EDT
- 5 The Moon passes 3° south of Venus, 4 P.M. EDT
- 14 The Moon passes 0.1° north of Saturn, 2 P.M. EDT
- 15 The Moon passes 0.6° north of Neptune, 2 P.M. EDT
- 16 Asteroid Juno is in conjunction with the Sun, 11 A.M. EDT
- 19 The Moon passes 4° north of Uranus, noon EDT
- 21 Mars passes 6° south of Pollux, 2 A.M. EDT
- Orionid meteor shower peaks
- The Moon passes 6° north of Jupiter, 4 A.M. EDT
- 23 The Moon passes 4° north of Mars, 4 P.M. EDT
- 25 Venus passes 3° north of Antares, 3 P.M. EDT

S	M	T	W	T	F	S
					○	2
3	4	5	6	7	8	☾
10	11	12	13	14	●	16
17	18	19	20	21	☾	23
24	25	26	27	28	29	30

- 3 The Moon passes 2° south of Mercury, 3 A.M. EST  
- 4 The Moon passes 3° south of Venus, 7 P.M. EST  
- 9 Mercury passes 2° north of Antares, 11 P.M. EST  
- 10 The Moon passes 0.09° north of Saturn, 9 P.M. EST   
- 11 The Moon passes 0.6° north of Neptune, 9 P.M. EST  
- 15 The Moon passes 4° north of Uranus, 8 P.M. EST 
- 16 Mercury is at greatest eastern elongation (23°), 3 A.M. EST   
- Uranus is at opposition, 10 P.M. EST   
- 17 Leonid meteor shower peaks 
- The Moon passes 6° north of Jupiter, 10 A.M. EST  
- 20 The Moon passes 2° north of Mars, 4 P.M. EST  

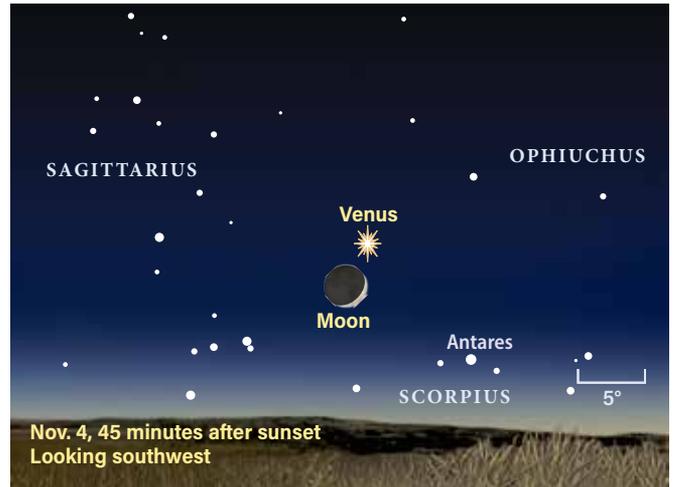
# Venus plies the evening sky

**F**ew sights grab the attention of casual skywatchers better than a close conjunction between a crescent Moon and a bright planet. A perfect example arrives the evening of Nov. 4 when a three-day-old Moon slides 3° south of brilliant Venus. The pair becomes obvious low in the southwest starting about a half-hour after sunset and grows more prominent as twilight deepens. Look for earthshine — sunlight reflecting off our planet to the Moon and back to us — casting an ashen glow on Luna's otherwise dark part.

This conjunction is just one highlight in Venus' evening apparition during the latter half of 2024. After passing behind the Sun in early June, the planet emerges at dusk in late July. It shows up despite the bright twilight because it shines at magnitude  $-3.9$ , brighter than any other point of light in the sky.

Track Venus as it heads eastward across Leo, enters Virgo in late August and then Libra in late September. The inner world zips through northern Scorpius for a week starting in mid-October, by which point it has brightened to magnitude  $-4.0$ . It finds itself against the backdrop of Ophiuchus at its Nov. 4 lunar conjunction.

Venus crosses into Sagittarius on the 8th, setting up a series of encounters with some of the Archer's stunning deep-sky objects. Grab your binoculars Nov. 12 for a view



Don't miss the spectacular conjunction between Venus and a waxing crescent Moon the evening of Nov. 4.



Venus shines brilliantly above the Beehive star cluster (M44) from a picture-perfect site in Egypt's Black Desert on June 19, 2023. OSAMA FATHI

of the planet passing 1° south of the magnificent Lagoon Nebula (M8). The star cluster embedded in the nebula, NGC 6530, should be easy to see, but the Lagoon will be tougher because of its low altitude.

The dazzling planet next sets its sights on magnitude 2.8 Lambda ( $\lambda$ ) Sagittarii, the star marking the top of the Archer's Teapot asterism. Venus lies 0.5° from this star Nov. 16.

The inner world now sets 2.5 hours after the Sun and stands 12° above the southwestern horizon an hour after sunset. Two nights later, binoculars reveal the spectacular globular star cluster M22 1.6° north of Venus. The planet continues its trek through eastern Sagittarius for the rest of November before entering Capricornus during December's first week. It remains among the Sea Goat's stars the rest of the year, brightening to magnitude  $-4.4$  by year's end.

Viewing Venus through a telescope over the final months of 2024 reveals a steady transformation in its size and phase. When the planet first appears at dusk in late July, it shows a nearly full disk measuring 10" across. At its Nov. 4 conjunction with the Moon, its disk spans 15" and looks three-quarters lit. And by New Year's Eve, its diameter has swollen to 22" while the Sun illuminates 56 percent of its Earth-facing hemisphere.

# A gas giant looms large

2024  
Dec

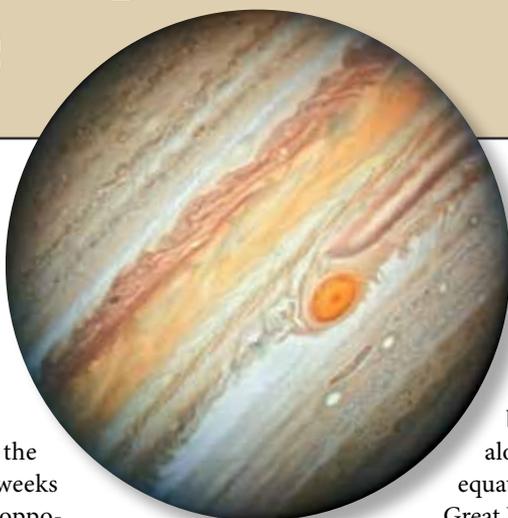
S	M	T	W	T	F	S
○	2	3	4	5	6	7
☾	9	10	11	12	13	14
●	16	17	18	19	20	21
☽	23	24	25	26	27	28
29	○	31				

**J**upiter blazes a wonderful path across Taurus throughout the second half of 2024, but most observers will concentrate their attention on the planet in the days and weeks surrounding its Dec. 7 opposition. At its peak that night, Jupiter blazes at magnitude  $-2.8$ , second only to Venus among the night sky's stars and planets.

Jupiter's apparition begins in the morning sky in late June. Early risers should catch the magnitude  $-2.0$  world July 3 when it appears just north of the Hyades star cluster and some  $10^\circ$  east-southeast of the even more impressive Pleiades Cluster (M45). A slender crescent Moon completes the gorgeous scene.

Jupiter moves eastward relative to Taurus' stars, though at a leisurely pace thanks to its distant orbit. Mars lies closer to the Sun and thus travels faster, making a beeline for its sister world. The two come together in a stunning conjunction Aug. 14 when only  $19'$ , two-thirds the Full Moon's width, separate them. They won't be any closer until 2033.

The giant planet continues eastward until reaching its stationary point  $4^\circ$  shy of 3rd-magnitude Zeta ( $\zeta$ ) Tauri in early October. It then begins its retrograde (westward) loop and heads back toward the Hyades for its Dec. 7 opposition. Jupiter remains visible



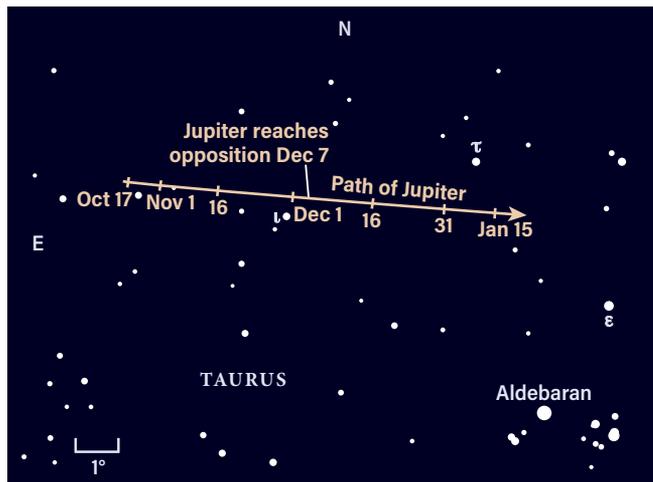
**The Hubble Space Telescope took this portrait of Jupiter's cloud tops and dynamic Great Red Spot on June 27, 2019.** NASA/ESA/A. SIMON (GSFC)/M.H. WONG (UC, BERKELEY)

all night at opposition and reaches a peak altitude of about  $70^\circ$  at local midnight. This is as high as it has been for Northern Hemisphere observers since 2014.

Jupiter's high altitude translates into steady views through a telescope because the planet's light traverses less of Earth's turbulent atmosphere. If you view it at opposition, you'll see that its equator spans  $48.2''$ ,  $3.1''$  more than its polar diameter.

The giant planet looks magnificent through any telescope. Its rich cloud belts provide an ever-changing appearance, with turbulence most common along the edges of the two equatorial belts and in the Great Red Spot's wake.

Jupiter rotates in less than 10 hours. Combine this with its all-night visibility at opposition and December's extended hours of darkness, and you can observe more than one complete rotation of the planet in a single night — just be sure to dress warmly. It's a perfect time to view Jupiter's colorful cloud tops, the Great Red Spot, and its numerous large white ovals. You can also follow the changing aspects of the four Galilean moons — Io, Europa, Ganymede, and Callisto — and their occasional transits, shadow transits, eclipses, and occultations.



**Jupiter dazzles at magnitude  $-2.8$  in early December when it reaches opposition and peak visibility against the backdrop of Taurus the Bull.**

- 4 The Moon passes  $2^\circ$  south of Venus, 6 P.M. EST

---

- 5 Mercury is in inferior conjunction, 9 P.M. EST

---

- 7 Jupiter is at opposition, 4 P.M. EST

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- 8 The Moon passes  $0.3^\circ$  north of Saturn, 4 A.M. EST

---

- 9 The Moon passes  $0.8^\circ$  north of Neptune, 4 A.M. EST

---

- 10 Mercury passes  $7^\circ$  north of Antares, 6 A.M. EST

---

- 13 The Moon passes  $4^\circ$  north of Uranus, 5 A.M. EST

---

- Geminid meteor shower peaks

---

- 14 The Moon passes  $5^\circ$  north of Jupiter, 3 P.M. EST

---

- 18 The Moon passes  $0.9^\circ$  north of Mars, 4 A.M. EST

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- 21 Solstice (northern winter/southern summer begins), 4 A.M. EST

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- Mercury passes  $7^\circ$  north of Antares, 7 P.M. EST

---

- 24 Mercury is at greatest western elongation ( $22^\circ$ ), 10 P.M. EST

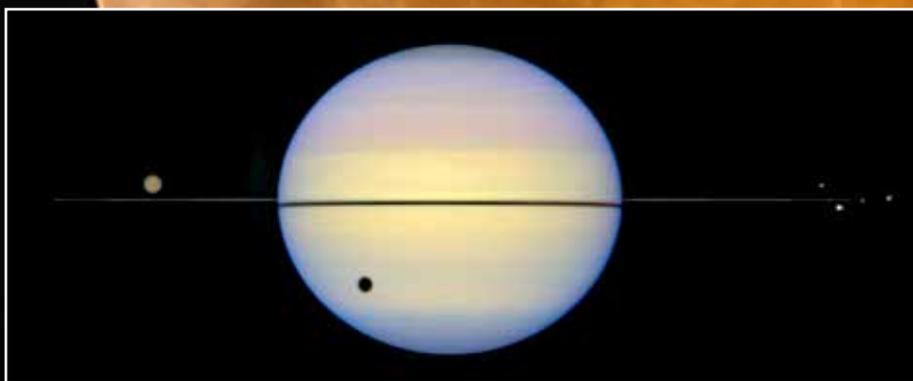
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- 28 The Moon passes  $6^\circ$  south of Mercury, 11 P.M. EST

The first total lunar eclipse since 2022 will occur the night of March 13/14, 2025. ALAN DYER

# 2025 Preview

## LOOKING AHEAD TO NEXT YEAR ...



### UNLIKE 2023 AND 2024,

2025 fails to deliver a central solar eclipse to North America. Fortunately, we get the next best thing: a total lunar eclipse visible across the continent. The event will occur the night of March 13/14 and provide 66 minutes of totality for those under clear skies. A second, slightly longer total lunar eclipse arrives Sept. 7, but that one can be seen only from the Eastern Hemisphere.

The two solar eclipses in 2025 are partial events. The best one for North America appears in the sky March 29 when residents of the northeastern U.S. and eastern Canada will witness the eclipse at sunrise. The Sept. 21 eclipse can be seen from southeastern Australia and New Zealand.

Planet observers will see more action in 2025 than they did this year. Venus will

**LEFT INSET: Saturn will turn its rings edge-on to earthbound observers in March 2025 for the first time in 16 years.** NASA/ESA/ERICH KARKOSCHKA (LPL)

**RIGHT INSET: Mars will return to glory at opposition in January 2025, when it will shine as brightly as Sirius.** ESA/MPS FOR OSIRIS TEAM

dominate the evening sky during January and February, peaking at greatest eastern elongation Jan. 9. After a brief interlude when it becomes lost in the Sun's glare, the brilliant planet will return to view before dawn in April. It will reach greatest western elongation May 31, then remain a morning fixture into autumn.

Both Mars and Saturn will put on great shows in 2025. The Red Planet comes to opposition and peak visibility Jan. 15, when it shines at magnitude  $-1.4$  and shows a

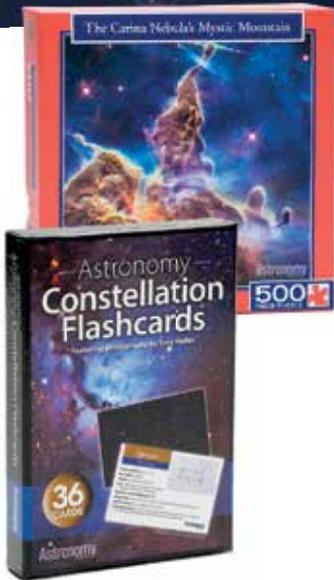
disk that spans  $15''$ . Meanwhile, the ringed planet won't be — its rings turn edge-on to our line of sight in late March and will remain out of sight until early May, when the Sun illuminates them once again.

Although Jupiter will look great both early and late in 2025, it does not experience an opposition. Still, you can look forward to a stunning conjunction between Jupiter and Venus on Aug. 12 when the two will pass within  $1^\circ$  of each other.

Meteor observing will make a good comeback in 2025. Although the Perseids peak during a waning gibbous Moon, the other two strongest showers — the Quadrantids and the Geminids — will reach maximums under crescent Moons. And both the Orionids and Leonids will peak near New Moon.

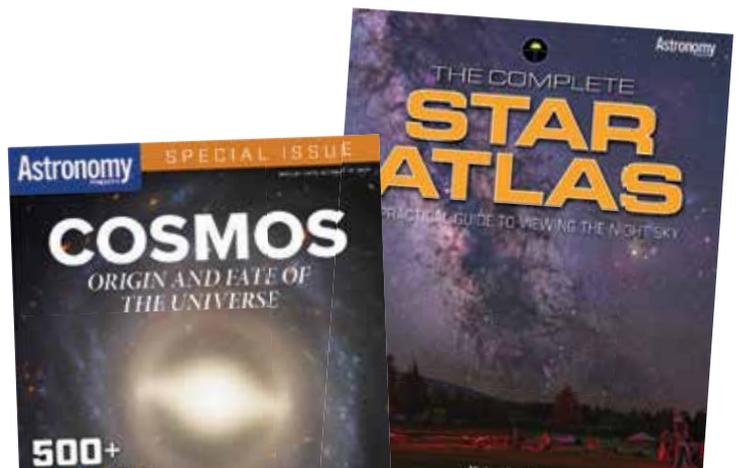
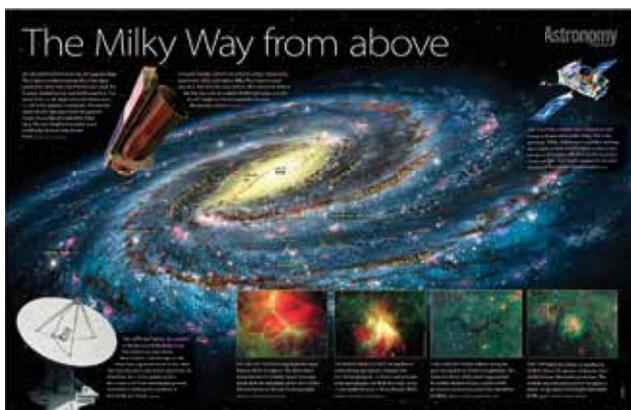
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