

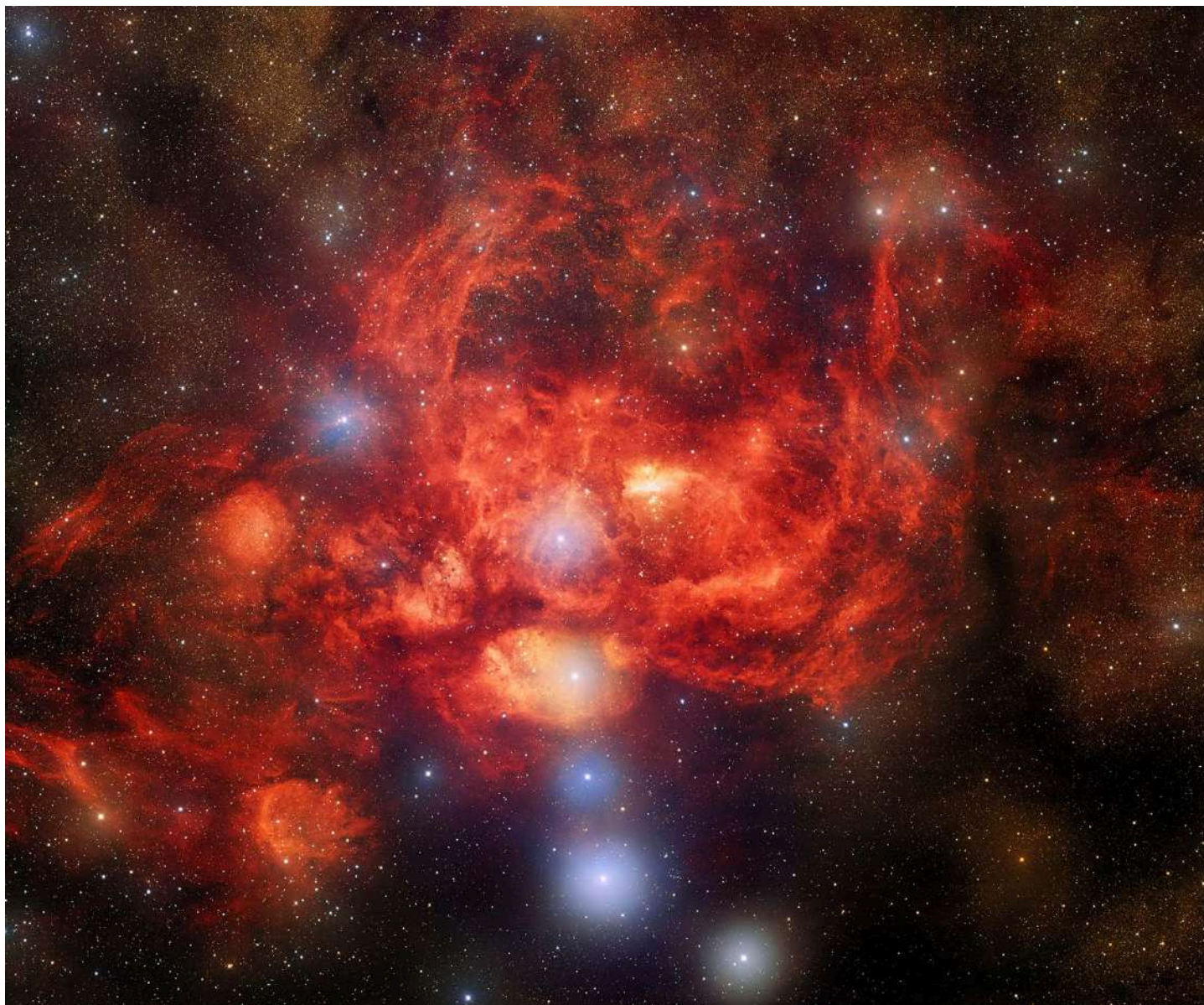


The Newsletter for Keene Amateur Astronomers

Vol. 2026 No. 10

October 2026

The Lobster Nebula



This image, taken by astronomers using the US Department of Energy-fabricated [Dark Energy Camera](#) on the [Víctor M. Blanco 4-meter Telescope](#) at [Cerro Tololo Inter-American Observatory](#), a Program of NSF's NOIRLab, captures the star-forming nebula NGC 6357, which is located 8000 light-years away in the direction of the constellation Scorpius. This image reveals bright, young stars surrounded by billowing clouds of dust and gas inside NGC 6357, which is also known as the Lobster Nebula. **Credit:** CTIO/NOIRLab/DOE/NSF/AURA T.A. Rector (University of Alaska Anchorage/NSF's NOIRLab), J. Miller (Gemini Observatory/NSF's NOIRLab), M. Zamani & D. de Martin (NSF's NOIRLab)

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Editor's Message

October is a great month for doing some backyard astronomy. Sunset is earlier and the cooler weather makes for better conditions for observing. This month there are several great viewing opportunities. Be sure to check the star maps at the end of the newsletter. Saturn is in opposition on the 4th and is visible most of the night throughout the month. The Moon will occult Jupiter on the 6th in the wee hours of the morning. Occultation starts roughly at 4 am. Be sure to check your favorite astronomy software before setting your alarm so you don't miss it if you plan to get up to see it. It will be exciting to watch through a pair of binoculars or a widefield lens on a telescope which will allow you to see Jupiter and its moons pass behind the Moon. An hour and a half later, Jupiter and its moons will re-emerge on the other side.

There are two meteor showers this month. Both showers average 15 - 20 meteors an hour, but the Draconids that peak on the 8th might offer better viewing due to the Moon being close to New. These meteors will appear to radiate from between the constellations Hercules and Draco near the star Vega. Later on October 21st into the 22nd, the Orionids Meteor Shower will peak. However, the almost Full Moon will wash out some of the fainter meteors. The best chance to catch these meteors might be after 2:30 am on the 22nd after the Moon sets. Meteors can appear anywhere in the sky but most seem to radiate from the constellation Orion.

Saturn will pair up with a nearly Full Moon a few days later on the 23rd and 24th. The Moon will pass close to the Pleiades on the 27th and 28th.

Great objects to view this month:

- **Messier 44 - The Beehive Cluster** open star cluster located in Cancer. It will appear with Mars this month making it a great target to view with binoculars. The best view will be on the 11th when Mars appears to be at the center of the cluster.

- **NGC 869 and NGC 884 - The Double Cluster** a pair of young open star clusters in the constellation Perseus. They can be viewed together through a pair of binoculars or a telescope.
- **NGC 281 - The Pacman Nebula** a bright emission nebula in Cassiopeia. A good target to view with either binoculars or a telescope.

I hope you are able to find time to step outside this month and enjoy the beauty and wonder of the night sky.

- Susan Rolke

Monthly Business Meeting

The business meeting will be held at Keene State College in the Young Student Center on October 23rd at 7 pm.

Club Happenings

An observing session will take place for the Moore Free Library in Newfane, VT Friday October 16th at 7 pm with a rain date of Sunday the 18th. Observing will take place at the top of Cemetery Hill Rd, in Newfane.

A work session at the observatory has been scheduled for October 24th from 9 am till noon.

Astronomy Conventions, Retreats, and More

[Appalachian Mountain Club](#) is celebrating its 150th year and offering two opportunities to see the dark, the first in October and the second in December.

[New England Fall Astronomy Festival](#) at UNH in Durham NH. This year's festival will be held October 16th and 17th. Admission is Free.

Earth in Motion: The Milankovitch Cycles

By Susan Rolke

At our last business meeting, there was a lively discussion about the Milankovitch cycles. We decided that the topic would make a good newsletter article, so let's take a closer look at these astronomical cycles and the slow motions of our planet. Earth's tilt, orbit, and orientation in space are constantly changing, although these occur on timescales far longer than a human lifetime. These subtle movements affect our view of the sky, the timing of the seasons, and over much longer periods, they can also influence Earth's climate.

In the 1920s, Serbian mathematician and astronomer Milutin Milankovitch studied how the motion of Earth through space changes over extremely long periods of time. He identified three important cycles involving Earth's orbit, the tilt of its axis, and the orientation of that axis. Together, these cycles describe subtle but continuous changes in the way Earth moves in relation to the Sun. Milankovitch was particularly interested in how these astronomical changes affect the distribution of sunlight across our planet and how, over immense spans of time, they can influence Earth's climate.

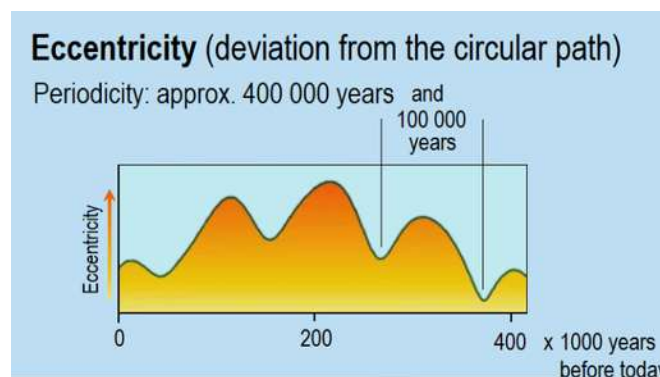
The three cycles operate on timescales ranging from tens of thousands to hundreds of thousands of years. They change the amount and distribution of solar energy reaching different parts of Earth, particularly at the mid-latitudes. Over long periods, these variations can influence the growth and retreat of continental ice sheets. More broadly, the Milankovitch cycles give us a glimpse of Earth in motion, showing how even seemingly fixed aspects of our planet are slowly changing over astronomical timescales.

The three changes in Earth's motion that Milankovitch identified have become known as the Milankovitch cycles:

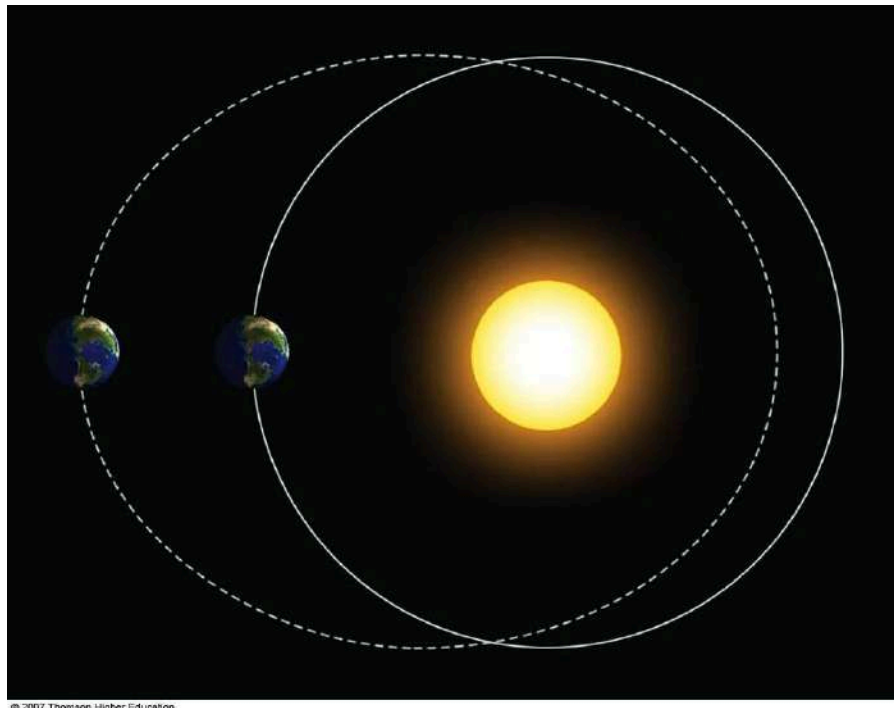
1. Eccentricity: changes in the shape of Earth's orbit around the Sun.
2. Obliquity: changes in the angle of Earth's axis relative to the plane of its orbit.
3. Precession: changes in the direction in which Earth's axis points as the planet rotates.

Earth's orbit around the Sun is approximately elliptical, although at times it is very close to a circle. The shape of the orbit gradually changes from an almost perfect circle to slightly more elliptical and back again. Much of this variation is caused by the gravitational influence of the other planets, primarily Jupiter and Saturn.

It is often stated that the Earth's eccentricity follows a roughly 100,000-year cycle. While this is a useful approximation, the actual pattern is considerably more complicated. Several cycles contribute to these changes, including periods of approximately 95,000 and 125,000 years, which are part of a much longer cycle of about 413,000 years. When these cycles interact, they produce the roughly 100,000-year pattern commonly associated with changes in Earth's eccentricity.



Credit: Sciencia58, Wikipedia Commons



Not to Scale. Credit: Thomson Higher Education

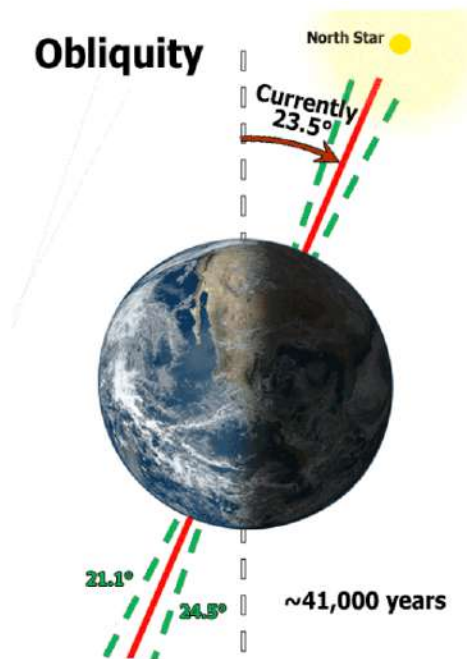
The shape of Earth's orbit affects climate in several ways. Kepler's laws tell us that Earth, or any planet in our solar system, travels fastest when it is closest to the Sun, a point called perihelion, and slowest when it is farthest away, at aphelion. This difference in orbital speed affects the length of our seasons.

Earth reaches perihelion around January 3. As a result, winters in the Northern Hemisphere are roughly 4.5 days shorter than summer because the Earth is moving faster when it is closer to the Sun. Spring is also about three days longer than autumn. The Southern Hemisphere experiences the opposite pattern, with its winter being longer and its summer shorter. As Earth's orbit becomes more circular, the difference in orbital speed between perihelion and aphelion becomes smaller, and the lengths of the seasons gradually become more even.

Eccentricity also affects the amount of solar radiation Earth receives. The difference in distance between Earth's closest approach to the Sun in January and its farthest point in July is approximately 5.1 million kilometers, or about 3.2 million miles. That may sound like a tremendous difference, but it represents only about a 3.4 percent change in Earth's distance from the Sun.

However, this relatively small change in distance is enough to affect the amount of solar radiation Earth receives. The intensity of sunlight decreases with the square of the distance, so even a modest change in Earth's distance from the Sun produces a somewhat larger change in the amount of solar radiation reaching our planet. Earth receives about 6.8 percent more solar radiation in January than in July.

As Earth travels around the Sun, its axis of rotation is tilted relative to the plane of its orbit. This tilt is known as obliquity, and it is what causes the seasons.



Over the past million years, Earth's axial tilt has varied between about 22.1 and 24.5 degrees. The greater the tilt, the more extreme the seasons become. The hemisphere experiencing summer receives more direct sunlight as its hemisphere is tilted toward the Sun. This has the result of the hemisphere experiencing winter receiving less sunlight.

The effects of changing obliquity are not the same everywhere on Earth. Higher latitudes experience a much greater change in seasonal sunlight than areas closer to the equator. In general, greater axial tilt favors periods of deglaciation, when glaciers and large ice sheets melt and retreat.

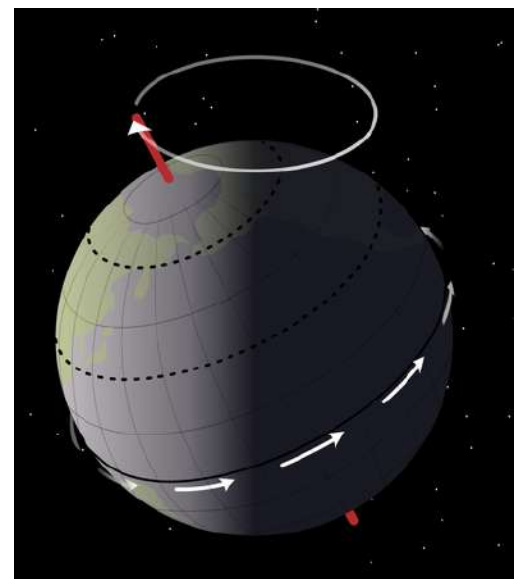
Earth's axis is currently tilted about 23.4 degrees, roughly halfway between its two extremes. The angle is slowly decreasing as part of a cycle that takes about 41,000 years to complete. Earth reached its maximum tilt roughly 10,000 years ago and will reach its minimum tilt in about another 10,000 years.

As obliquity decreases, the seasons gradually become less extreme. Winters become warmer, while summers become cooler, particularly at higher latitudes. Cooler summers are especially important because less winter snow and ice melts during the summer months. Over thousands of years, this allows snow and ice to accumulate and eventually build into large ice sheets.

The growing ice sheets reinforce the cooling process. Ice and snow reflect a significant amount of incoming sunlight back into space rather than absorbing it. As the amount of ice cover increases, more solar energy is reflected away from Earth, promoting further cooling and allowing the ice sheets to grow even larger.

The last of the three Milankovitch cycles is precession, the gradual change in the direction Earth's rotational axis points in space. As Earth spins, its axis slowly wobbles like a spinning top. Rather than pointing in a fixed direction, the axis traces a circular path in the sky over time. This motion, known as axial precession, is caused primarily by the gravitational pull of the Sun and Moon on Earth's equatorial bulge. One complete cycle takes about 26,000 years.

Although axial precession does not change the total amount of sunlight Earth receives, it changes when the seasons occur in relation to Earth's position in its orbit. Currently, the Northern Hemisphere's winter occurs near perihelion, the point where Earth is closest to the Sun. This means that Southern Hemisphere summers occur when Earth is closest to the Sun, making the seasons

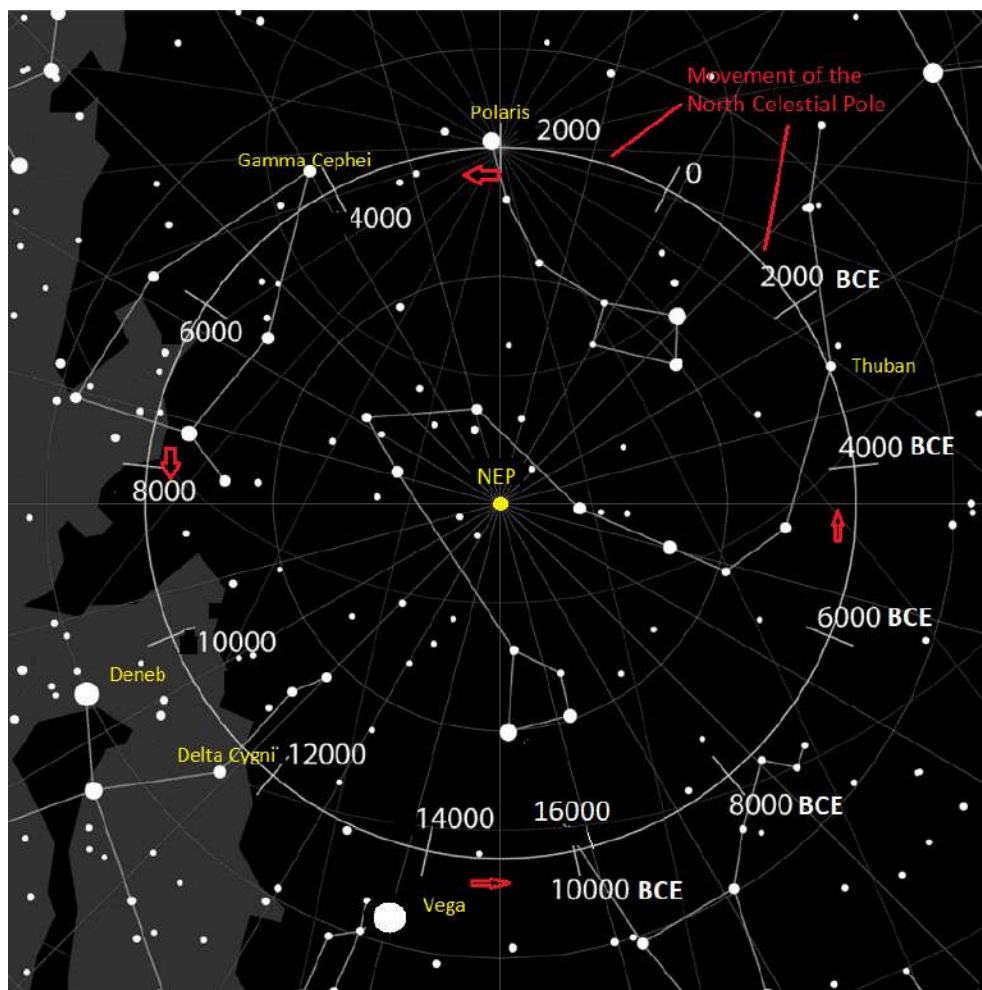
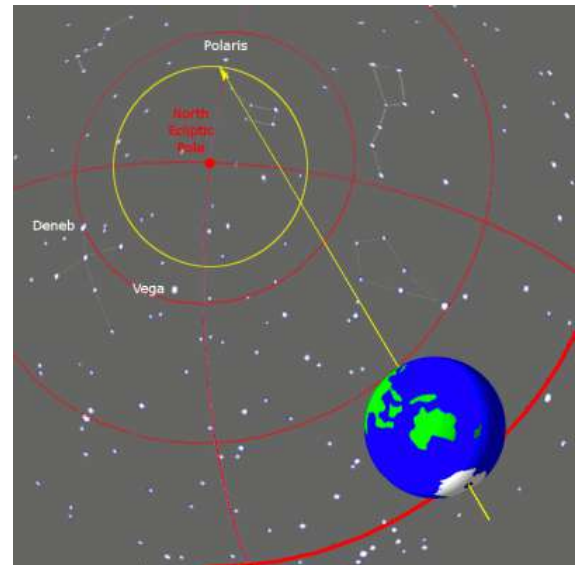


Credit: NASA

somewhat more intense than that experienced in the Northern Hemisphere. In about 13,000 years, precession will reverse this arrangement. Northern Hemisphere summer will occur near perihelion, resulting in greater seasonal contrasts, while the Southern Hemisphere will experience more moderate seasons.

Axial precession has an interesting astronomical outcome. Our pole stars change over time. Although this change is hardly noticeable in one's lifetime. As Earth's axis slowly traces its circle through the sky, the star nearest the celestial pole changes. Polaris is our current North Star, but it will not always hold that position. About 12,000 years from now, the bright star Vega will be close to the north celestial pole.

Figure on right: The position of the North Celestial Star changes against the fixed background of the stars as the Earth precesses.
Source of image: Tfr000 on Wikipedia



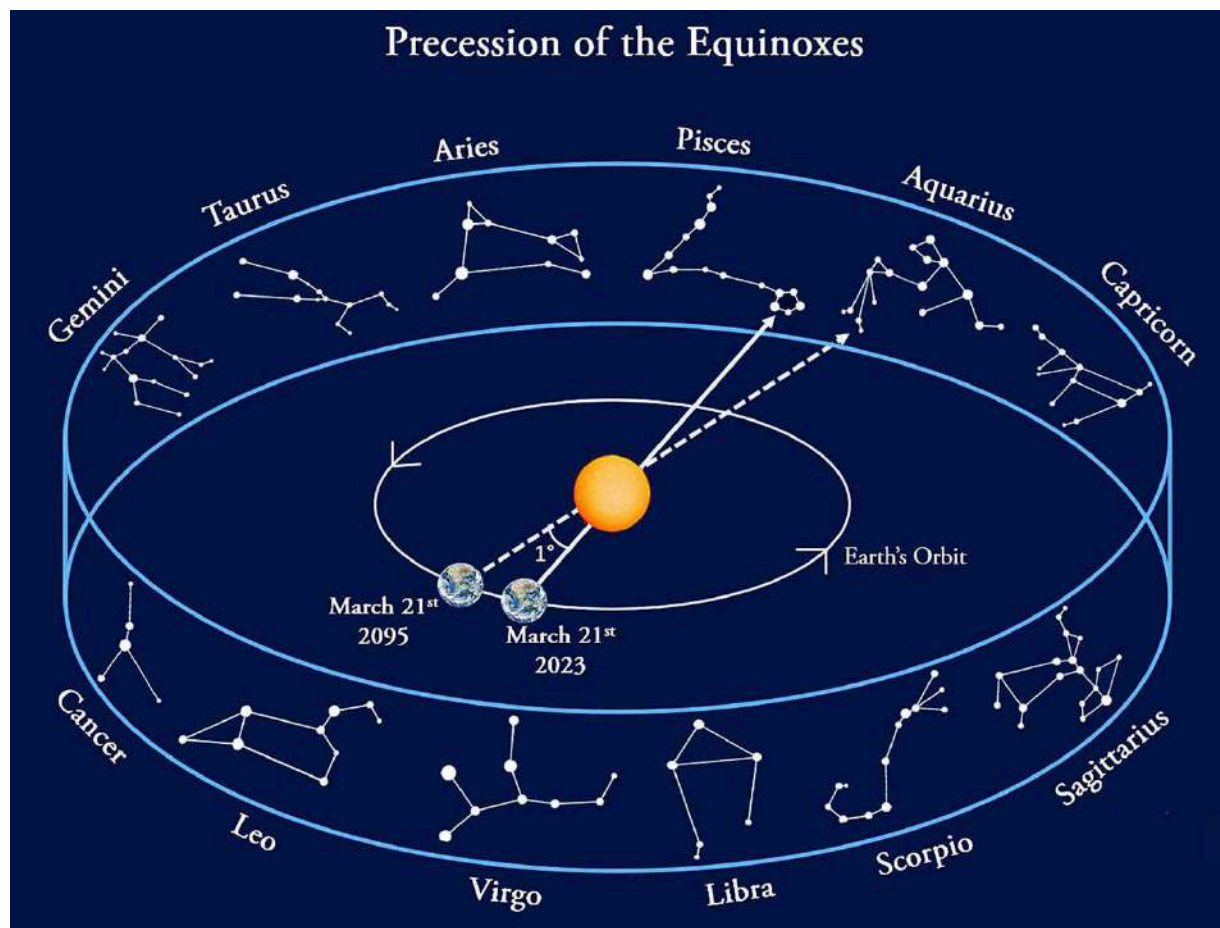
Credit: Explaining science.com

Precession does more than change our pole star. It also means that your zodiac sign is probably wrong. Don't worry. That's okay. We're astronomers.

Our calendar is based on the seasons. A tropical year is the time it takes for Earth to complete one cycle of the seasons, measured from one spring equinox to the next, for example. Because the tropical year is tied to the seasons, the Northern Hemisphere's summer solstice will always occur in June, regardless of where Earth happens to be in relation to the background stars.

A sidereal year, on the other hand, is the time it takes Earth to complete one orbit around the Sun and return to the same position relative to the stars. It is about 20 minutes longer than the tropical year. The difference is caused by precession. While Earth completes its orbit, the planet's rotational axis has slowly changed direction, causing the position of the equinoxes to shift slightly against the background stars.

That shift is tiny from one year to the next, but it adds up over centuries. The equinoxes slowly drift backward through the zodiac constellations at a rate of about one degree every 72 years. After roughly 26,000 years, they will have completed a full circle.



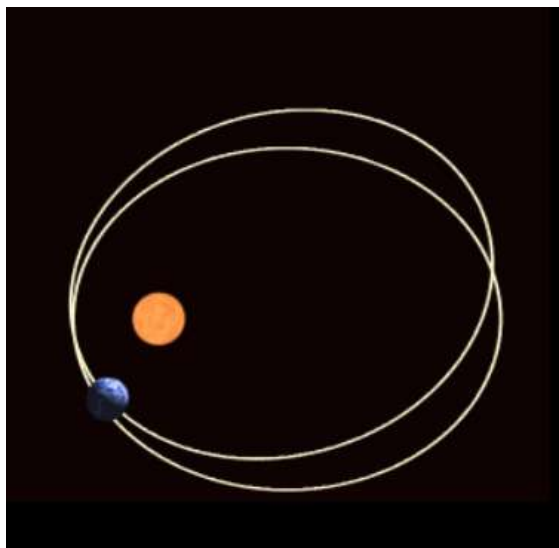
On March 21st, 2023, the Sun appeared close to the border of the Pisces and Aquarius constellations. After 72 years, on March 21st 2095, the Earth would have slipped backwards along its orbit by 1°, and the Sun will be closer to Aquarius. Note, diagram is not to scale and changes are exaggerated for explanation. Credit: Bibhu Dev Misra.

So what does this mean for your zodiac sign? If you look at the constellation where the Sun actually appears during the month of your birth, it probably won't be the constellation associated with your astrological sign. When the traditional zodiac was established, the positions of the Sun and the equinoxes relative to the background stars were different from where they are today. Precession has gradually shifted those positions.

The ancient Greek astronomer Hipparchus is generally credited with recognizing and measuring this motion in the second century B.C. It became known as the precession of the equinoxes because the equinoxes slowly move westward along the ecliptic relative to the distant stars. Over the course of a complete precession cycle, the position of the Sun at the equinoxes moves through all of the zodiac constellations.

Today, the March or vernal equinox occurs in the constellation Pisces and is slowly moving toward Aquarius. Some of you may remember the song "Aquarius" from the musical *Hair*, which proclaimed the coming of the "Age of Aquarius." Astronomically speaking, however, the transition into Aquarius is still a long way off. Depending on how the boundaries of the constellations are defined, the Sun will not enter Aquarius at the vernal equinox for several centuries.

There is one more type of precession worth mentioning, apsidal precession. The orientation of the Earth's elliptical orbit slowly changes over time. In other words, the location of perihelion and aphelion gradually shifts relative to the background of the solar system. This motion is driven primarily by gravitational interactions with other planets, particularly Jupiter and Saturn, and has a cycle of roughly 112,000 years.



Credit: WillowW, Wikipedia

When axial and apsidal precession are considered together, their combined effect on the timing of the seasons relative to Earth's orbit produces a precession cycle of about 23,000 years on average. Together, these motions help explain why the relationship between Earth's seasons, its position in its orbit, and the background stars is constantly changing. Over thousands of years, our pole star changes, the seasons shift relative to perihelion and aphelion, and even the constellation marking the spring equinox changes.

For us, these changes are far too slow to notice from year to year. But over the vast timescales of astronomy, Earth is constantly moving through a changing cosmic landscape.

The Milankovitch cycles are a reminder that Earth is not traveling through space on a fixed and unchanging path. Over tens of thousands of years, the tilt of our planet, the shape of its orbit, and the direction its axis points all slowly change. These movements alter our view of the sky, shift the position of the seasons within Earth's orbit, and even change which stars mark our celestial poles. The cycles are important to understanding Earth's long-term climate history, but they operate on timescales far too long to explain the rapid climate changes we are experiencing today. From an astronomical perspective, however, they offer a fascinating glimpse of Earth as a dynamic planet moving through a constantly changing solar system.

Resources to Investigate Further:

- Video - [We'll have a new "North Star" in just 1,000 years/Precession of the Equinoxes](#) (long but good explanations with visuals)
- Video - [Precession of the Earth and the Signs of the Zodiac](#)
- Video - [Orbital Precession \(apsidal\)](#)
- Video - [Obliquity, Eccentricity, and Precession](#) (a good quick visual)
- Video - [Star Talk: The Link Between Milankovitch Cycles and Climate Change](#)

Night Sky Network Online Webinar

Join the NASA Night Sky Network on Tuesday, October 20, at 8:00 pm for a presentation with NASA scientist Rebekah Hounsell about NASA's next flagship space telescope, the Nancy Grace Roman Space Telescope. [Night Sky Network](#).

McDonald Observatory

Join the [McDonald Observatory](#) and astronomer Lindsay House at 8:30 pm on October 28th to learn about dark matter and dark energy. Learn about dark energy, the research being done by the Hobby-Eberly Telescope and enjoy live views from one of McDonald's 16 inch telescopes.

Observing

To find skywatching tips for this month, click on the following link to learn more.

Video: [What's Up October 2026 Sky Watching Tips from NASA](#)

You can find past pdfs of the Astronomical League charts [here](#). Turn to the end of the Newsletter to see what is up this month.

NASA Night Sky Notes



This article is distributed by NASA's Night Sky Network (NSN).

The NSN program supports astronomy clubs across the USA dedicated to astronomy outreach. Visit nightsky.jpl.nasa.gov to find local clubs, events, and more!

October's Night Sky Notes: Spooky Stargazing

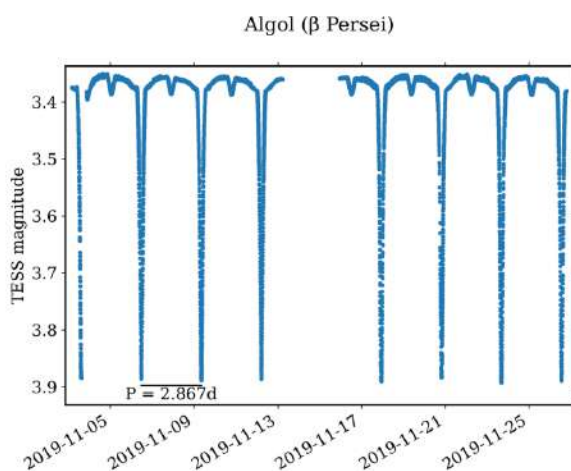
By Kat Troche



Perseus holding the head of Medusa. Credit: Stellarium

The Ghoul

Located within the constellation Perseus lies a star called Algol, also known as 'Demon Star' or 'The Ghoul'. You can spot this star during the autumn months, along with Cassiopeia and Andromeda in the northeastern sky, beginning after 9 PM. In Greek mythology, this star represents the 'blinking eye' of the gorgon Medusa. But how can a star blink?



Light curve of the eclipsing binary star Algol recorded by NASA's Transiting Exoplanet Survey Satellite (TESS), stored on NASA's [Mikulski Archive for Space Telescopes](#) (MAST). Credit: NASA/Wikipedia Commons

Algol is a triple-star system, with two of the three stars orbiting one another. This [eclipsing binary](#) causes the system to go from a bright +2.1 magnitude to a slightly dimmer +3.4 magnitude about every three days. Using data from NASA's [Transiting Exoplanet Survey Satellite](#) (TESS) mission, this light curve shows the regular dimming, or Medusa's 'blinking eye'!

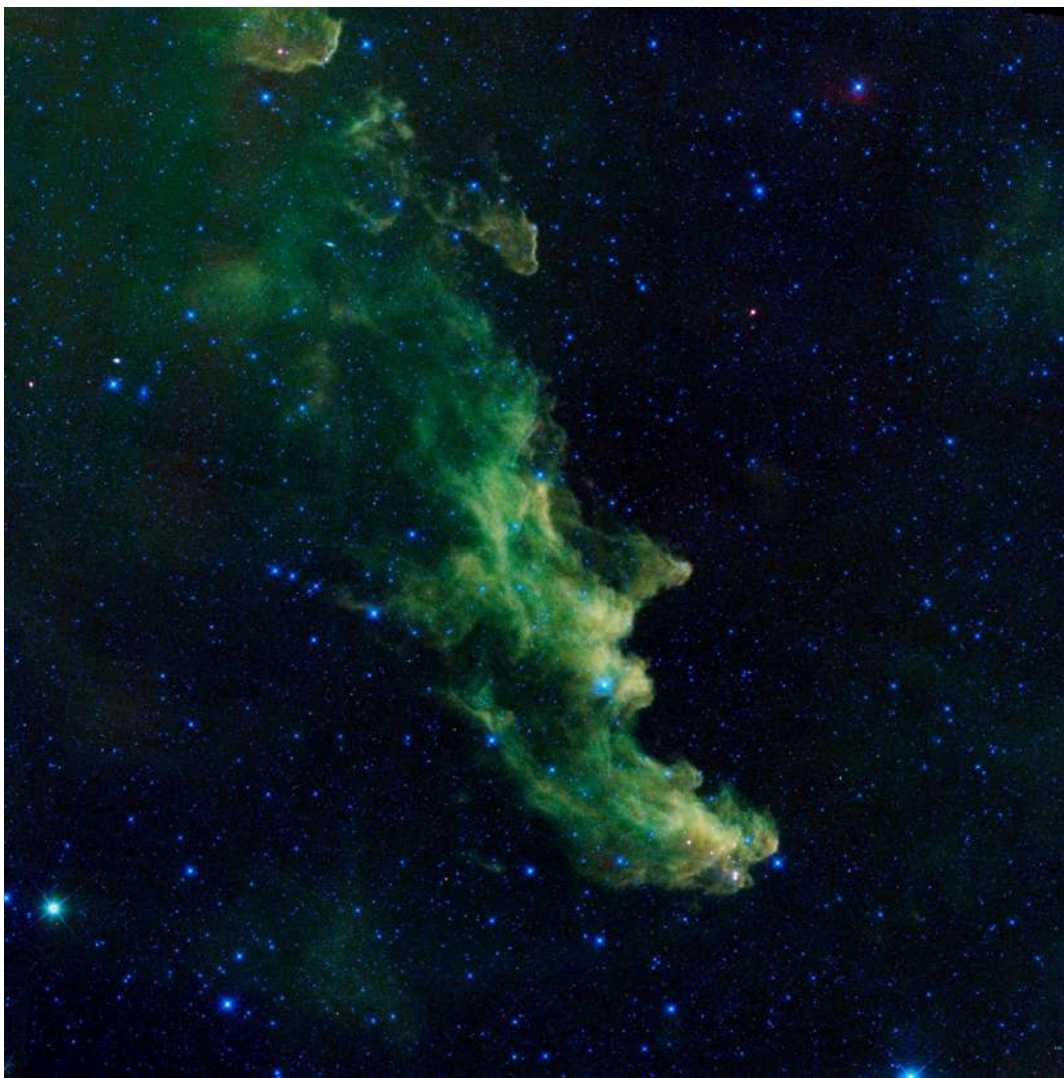


Using the constellations Cassiopeia and Andromeda, locate Perseus. You can find Algol (circled above) by using the star Almach as a guide. Credit: Stellarium

There is no shortage of resources on how to calculate the dimming – or minima – of Algol, from interactive charts to data plots. Find the one that works best for you. Because it has a similar magnitude of brightness, you can compare Algol's brightness to the nearby star Almach (Gamma Andromedae) in Andromeda using a small telescope or binoculars.

Witch Head Nebula

Between the Eridanus and Orion constellations lies a spooky silhouette, illuminated by the star Rigel. IC 2118, or the [Witch Head Nebula](#), is a reflection nebula about 900 light-years away from Earth. Because reflection nebulae rely on nearby starlight to appear visible, they can be difficult to see with the naked eye, especially if they are as far away as this one. While the Witch Head Nebula can't be seen with the naked eye, telescopes with very large apertures and low magnification make it easier to catch under dark skies. Astrophotographers, with or without smart telescopes, can image this haunting outline within a few hours, depending on equipment and sky quality. And what is a witch without [their broom](#)! You can find the Witch's Broom in the Western Veil Nebula, located in the constellation Cygnus.



An infrared portrait of the Witch Head nebula from NASA's Wide-field Infrared Survey Explorer, or WISE, shows billowy clouds where new stars are brewing. Credit: NASA/JPL-Caltech

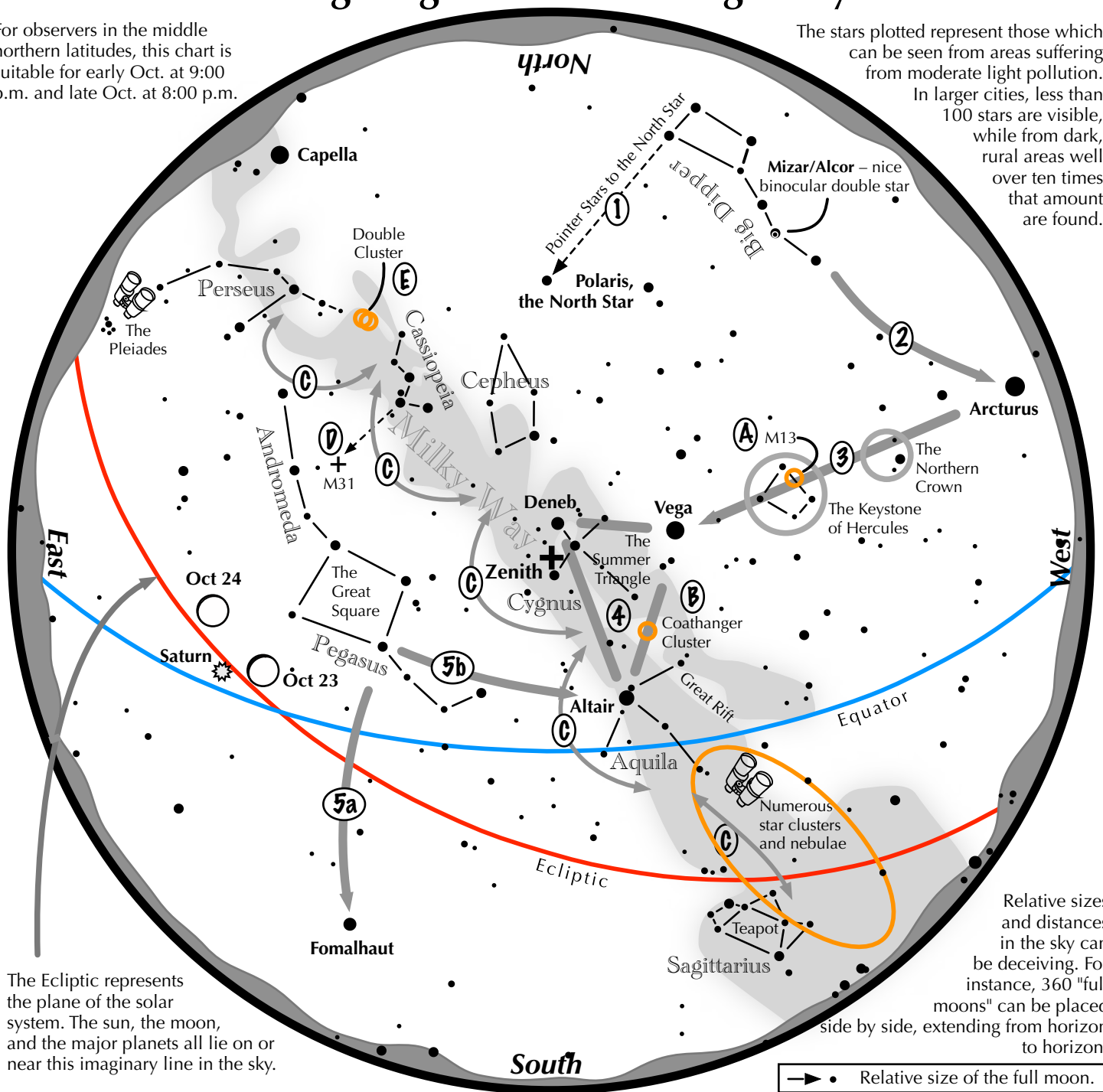
Want more tips for getting into the season? Read our article on how you can make some spooky sidewalk astronomy fun for your community with [Trick or Treat: Sidewalk Astronomy!](#)

Navigating the October Night Sky

2026

For observers in the middle northern latitudes, this chart is suitable for early Oct. at 9:00 p.m. and late Oct. at 8:00 p.m.

The stars plotted represent those which can be seen from areas suffering from moderate light pollution. In larger cities, less than 100 stars are visible, while from dark, rural areas well over ten times that amount are found.



The Ecliptic represents the plane of the solar system. The sun, the moon, and the major planets all lie on or near this imaginary line in the sky.

Relative sizes and distances in the sky can be deceiving. For instance, 360 "full moons" can be placed side by side, extending from horizon to horizon.

→ • Relative size of the full moon.

Navigating the October night sky: Simply start with what you know or with what you can easily find.

- 1 Extend a line north from the two stars at the tip of the Big Dipper's bowl. It passes by Polaris, the North Star.
- 2 Follow the arc of the Dipper's handle. It intersects Arcturus, the brightest star in the early October evening sky.
- 3 To the northeast of Arcturus shines another star of the same brightness, Vega. Draw a line from Arcturus to Vega. It first meets "The Northern Crown," then the "Keystone of Hercules." A dark sky is needed to see these two dim stellar configurations.
- 4 Nearly overhead lie the summer triangle stars of Vega, Altair, and Deneb.
- 5 High in the east are the four moderately bright stars of the Great Square. Its two southern stars point west to Altair. Its two western stars point south to Fomalhaut.

Binocular Highlights

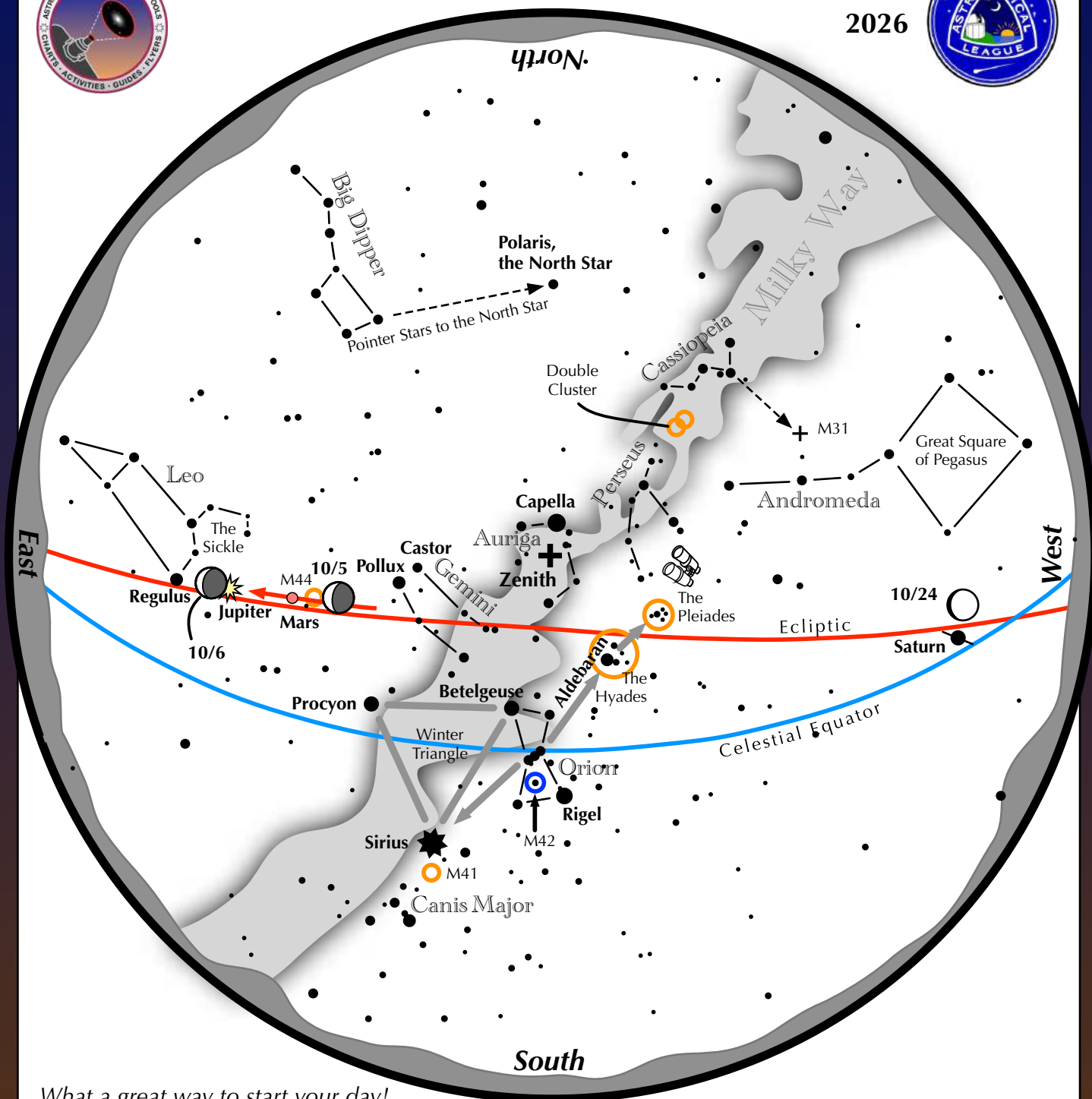
A: On the western side of the Keystone glows the Great Hercules Cluster, a ball of 500,000 stars. **B:** 40% of the way between Altair and Vega, twinkles the "Coathanger," a group of stars outlining a coathanger. **C:** Sweep along the Milky Way for an astounding number of fuzzy star clusters and nebulae amid many faint glows and dark bays, including the Great Rift. **D:** The three westernmost stars of Cassiopeia's "W" point south to M31, the Andromeda Galaxy, a "fuzzy" oval. **E:** Between the "W" of Cassiopeia and Perseus lies the Double Cluster.





Navigating the mid October Morning Sky

2026



What a great way to start your day!

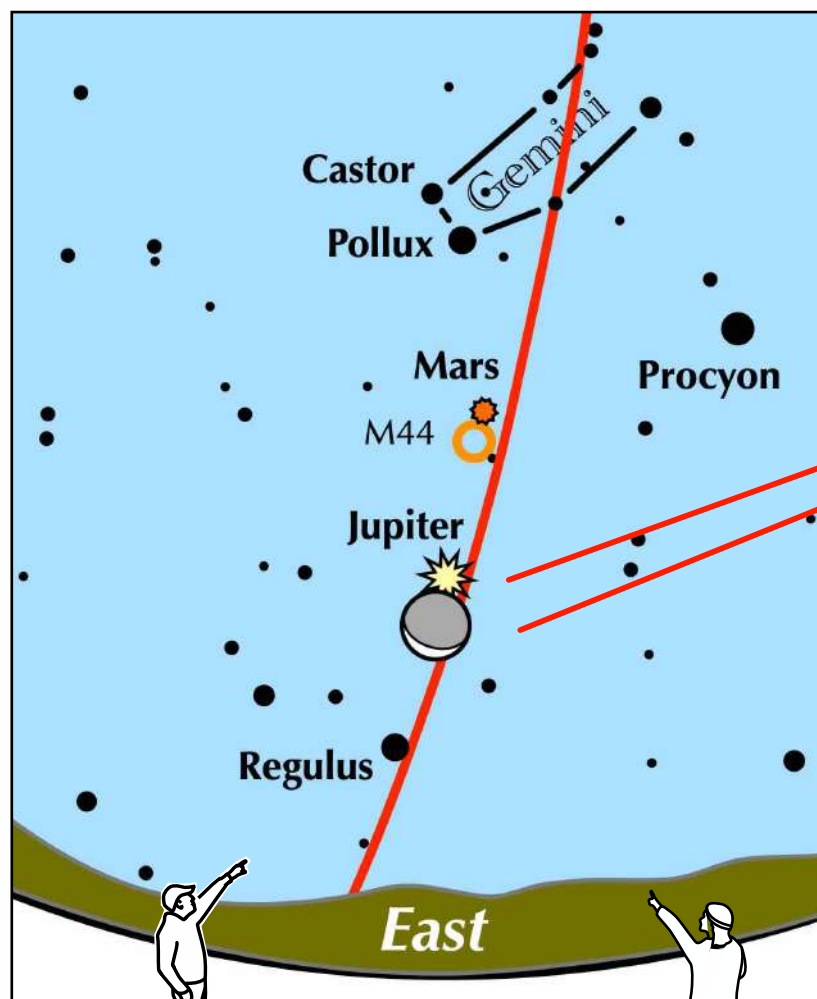
For observers in the middle northern latitudes, this chart is suitable for mid October at 5:00 a.m.

Late sunrises in October provide opportunities for early morning skywatching.

- Bright Jupiter shines high in the east.
- Crescent moon lies just west of Mars on October 5.
- The crescent moon glows next to and occults bright Jupiter on October 6.
- The near full moon glows in the west next to Saturn on October 24.
- During the first half of October, gaze high in the south and overhead to see these many celestial features: the Pleiades, the Hyades with Aldebaran, Orion, Capella and Auriga, the Winter Triangle with Sirius and Procyon, Gemini, and, in the east, Jupiter.

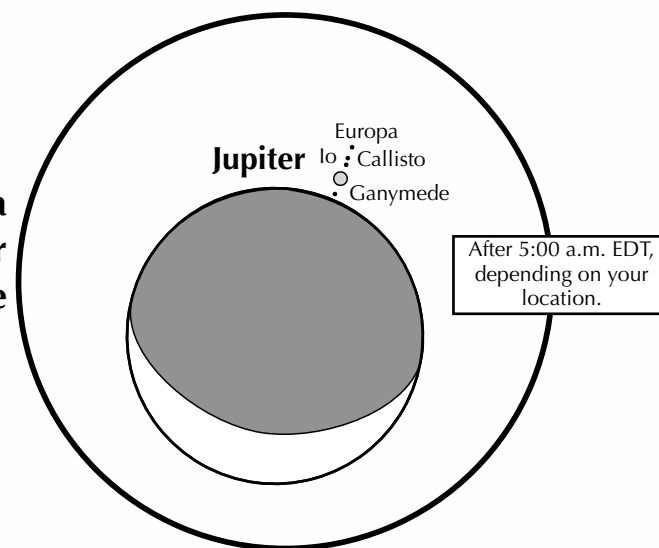
Astronomical League www.astroleague.org; duplication is allowed and encouraged for all free distribution.

In the early morning of October 6, try this challenge:



**View low in the east
on October 6
2 hours before sunrise**

**View through a
very low power
telescope**



**Moon occults Jupiter for the eastern US.
For the rest of us, it lies very close to Jupiter**

On the morning of October 6, the moon appears very close to Jupiter.

For those in the eastern half of the US, the planet and its Galilean satellites fully emerge from occultation after 5:00 a.m. The exact time depends on observing location.

Those in the western US see Jupiter immediately next to the dark edge of the crescent moon.

About 5:35 a.m. EDT, Ganymede's shadow begins transiting the planet. It lasts until 9:15 a.m. EDT. Its exit can be seen by west coast telescope users.

And Mars can be found approaching the Beehive star cluster.