Keene Amateur Astronomers

The Newsletter for Keene Amateur Astronomers

Vol. 2025 No. 12 December 2025

# Aurora in Keene

Aurora captured over North Keene on November 11th by Gabriel Klueh with his Iphone 16 Pro.

# Contents



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# Editor's Message

You will find some wonderful images of the aurora some of our members have taken this month. I hope you enjoy them as much as I do. Please consider sending your future astronomy pictures to me to include in the newsletter for everyone to enjoy.

The active area of the Sun is rotating back to the Earth. There is a possibility that we might be treated to more auroras in the next few weeks. An excellent source to check for space weather is NOAA's Space Weather website, they also have a wonderful facebook page. I enjoyed their informative videos they posted on their facebook page NOAA NWS Space Weather Prediction Center.

This month has a number of promising viewing opportunities. Including an opportunity to see 3I ATLAS in the predawn sky. Mid-month it will be visible in the early evening skies as it passes Regulus, with its closest approach on the 19th. A telescope with a 12 inch aperture is recommended to see it.

Objects that can be viewed without a telescope are always nice on cold nights with friends and family. The Moon and Jupiter will be making a close approach on the 7th this month. If you have been hunting shooting stars without much luck this year, the Geminid Meteor shower promises to be exciting with up to 40 - 50 per hour and 120 predicted per hour under optimal dark sky conditions. The shower will begin on the 1st and peak on the 13th and 14th. For best viewing, look East after 8 PM toward the constellation Gemini. The meteors are known for being very bright and colorful. Jupiter will be appearing in Gemini during the peak of the meteor shower.

The longest night of the year will be on the Solstice, December 21st.

As part of changes to NASA, the Night Sky Network has discontinued providing new articles for distribution to clubs. I will be providing articles from the archives going forward.

December boasts some of the brightest constellations with some great viewing opportunities. This month's viewing objects are enjoyable through both binoculars and a telescope.

Great objects to view this month:

- **Messier 42 - The Orion Nebula** is a great object in the Orion constellation to view. Trapezium lies at its center. The nebula is great to view through both binoculars and a telescope.
- **The Hyades,** located in Taurus, is the closest open star cluster to the Earth at 150 light years away. Follow the three stars of Orion's Belt to the V of Taurus's head to find this star cluster.
- **Messier 45 - The Pleiades** is an open star cluster that is easily viewed with the naked eye and are a great object to view at low power with a telescope. Their famous blue glow is due to a nebula between us and the stars that make up the Pleiades.
- **Messier 35 - The Shoe-Buckle Cluster** is a relatively young open cluster in Gemini. Binoculars will show several individual stars and a telescope will further resolve it into a few hundred.

- Susan Rolke

# Monthly Business Meeting

Our next meeting and holiday celebration will take place on December 5th at Bruce Norland's home at 7 pm.

## Club Happenings

An observing event for Cheshire County 4H club members will take place weather permitting, on Friday December 12th from 7pm to 8:30pm in the Brentwood Golf Club parking lot at 365 East Surry Road. There is no rain date for this event.

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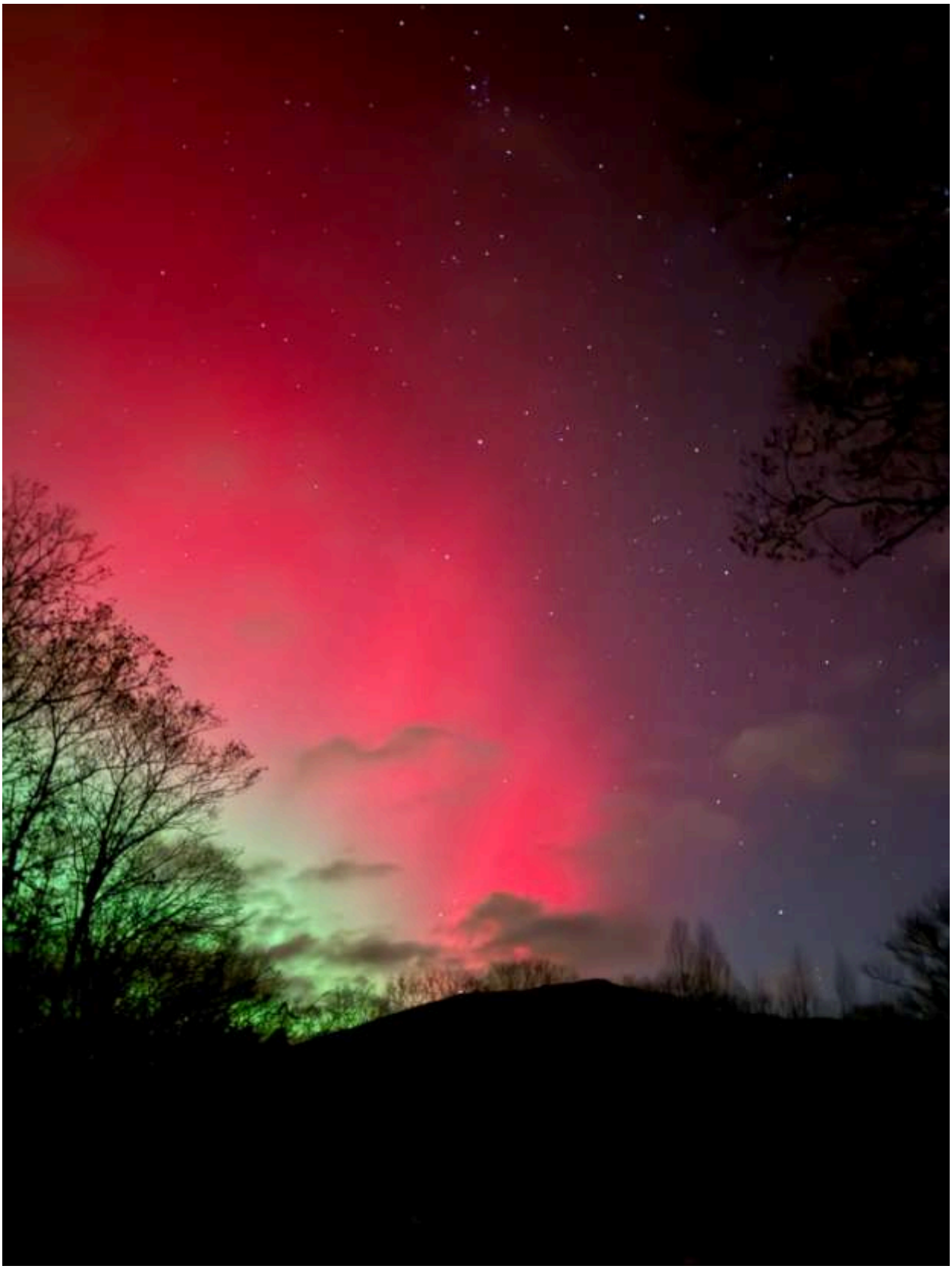
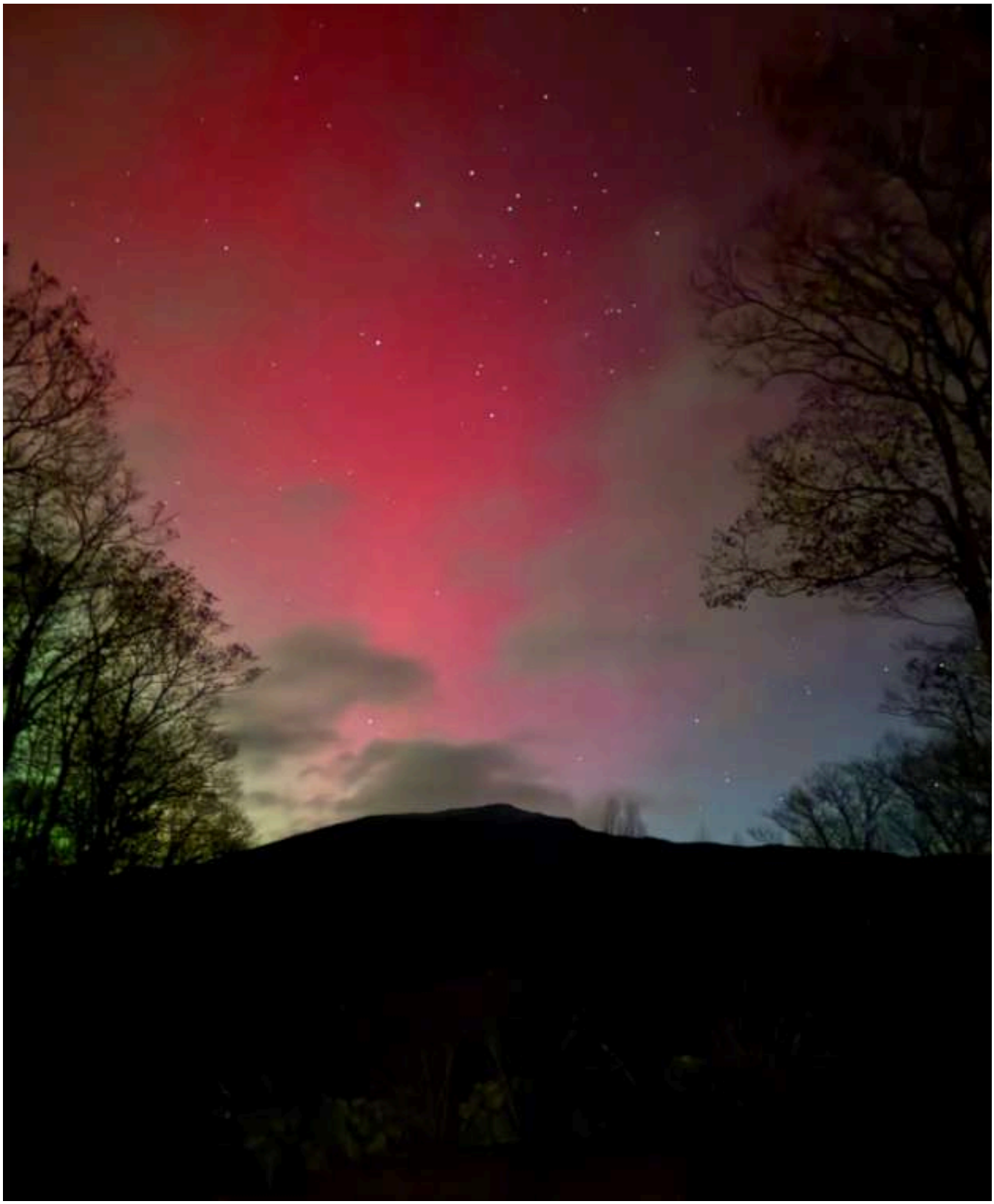
## Member Highlights

Aurora from northern Keene taken by Gabriel Klueh on an Iphone 16 Pro.

Images taken in northern Keene by Gabriel Klueh on an Iphone 16 Pro.



The aurora looking east-northeast from Marlborough, with red glow over Monadnock taken by David Targan on his Iphone.



The aurora over Monadnock taken by David Targan on an Iphone.

The constellation Perseus and the aurora taken by David Targan on an Iphone.

Aurora over Monadnock taken by David Targan on an Iphone.

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## Beyond Neptune: Ammonite's Orbit Challenges the Planet Nine Hypothesis

### By Susan Rolke

For more than a century, astronomers have wondered whether a large, unseen planet lurks in the distant reaches of our Solar System. Long before Pluto's discovery, early 20th-century researchers proposed the existence of a mysterious "Planet X" to account for oddities in the motions of Uranus. Much later, in 2016, Caltech astronomers Konstantin Batygin and Mike Brown revived this idea with the Planet Nine hypothesis. They proposed that a Neptune sized planet was orbiting 20 to 30 times farther from the Sun than Neptune itself. Their proposal explained the strange clustering and eccentric orbits of several distant Kuiper Belt objects. Something massive, they suggested, might be shepherding these icy bodies from the darkness.

*An artist's illustration of the mysterious, elusive, hypothesized Planet Nine. Image Credit: NASA*

The recent discovery of the newest Kuiper Belt object is raising questions about the possibility of whether Planet Nine exists and further constraints where it could be found if it does exist.

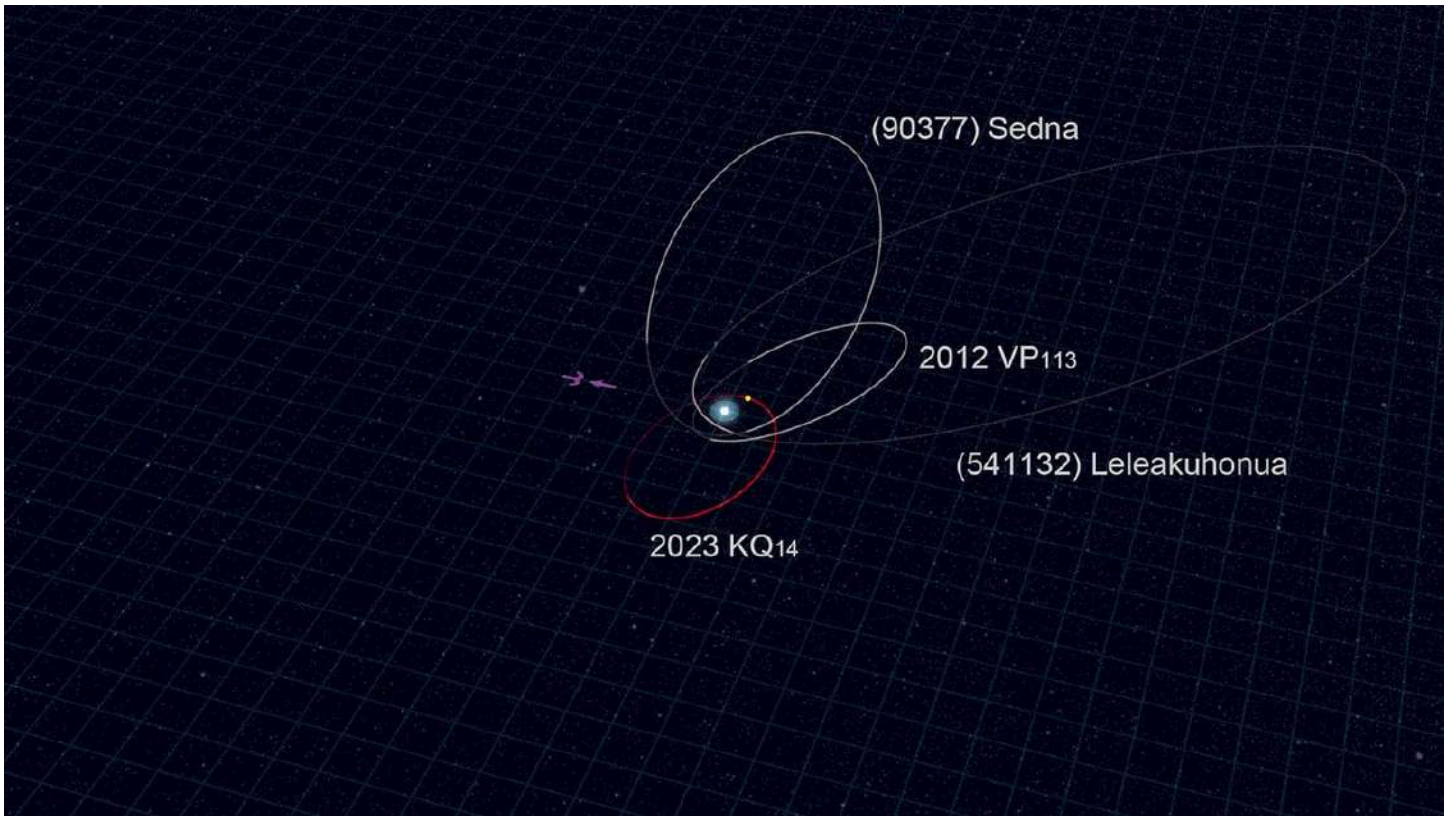
This past summer, astronomers with the Formation of the Outer Solar System: An Icy Legacy (FOSSIL) survey announced the discovery of a new distant object cataloged as 2023 KQ14, affectionately called Ammonite after the ancient spiral cephalopods. The team first discovered Ammonite using Japan's Subaru Telescope in Hawaii and determined that it is a sednoid.

Sednoids are a rare type of Trans Neptunian Objects (TNOs). Ammonite is the fourth such object discovered. Based on the amount of light it reflects, its size has been determined to be 137 to 236 miles in diameter. Sednoids orbit far beyond the gravitational influences of the planets in the inner solar system. They have extremely elongated orbits. Ammonite's closest approach to the sun is approximately 71AU, while its furthest point is about 433AU. It takes 4,000 years for it to complete one orbit around the Sun. One astronomical unit (AU) is the average distance of the Earth from the Sun. In comparison, Neptune is about 30AU away from the sun.

Using follow up observations and tracking it through 19 years of archived data, researchers were able to construct Ammonite's orbit. The FOSSIL team used extensive computer simulations to model the orbit and determined it has held a remarkably stable path for 4.5 billion years, tracing its history back to the earliest days

of the Solar System. Ammonite's orbit helps scientists model what the orbits of bodies in the outer solar system looked like shortly after our solar system formed.

While its orbit is noticeably different from the other three known sednoids, the simulations show that all four shared similar orbital characteristics about 4.2 billion years ago. Something must have dispersed them into the varied paths we see now. This finding adds complexity to the story of the early Solar System's outer reaches and raises new questions about what changed the orbits of the objects in the outer solar system.




The orbit of 2023 KQ14 (in red) compared to the orbits of the other three sednoids. Credit: NAOJ

Sednoids' peculiar orbits have often been cited as evidence for Planet Nine, yet Ammonite doesn't behave exactly as the Planet Nine hypothesis predicts. Its stability suggests no large planet has significantly perturbed its orbit. If Planet Nine does exist, Ammonite's behavior pushes it's location farther out into the Kuiper Belt than prior models predicted.

Alternatively, the formation of these extreme orbits exhibited by sednoids may be due to the gravitational interactions with a passing star, a rogue planet or a planet that was ejected from our solar system. Whatever the explanation, Ammonite narrows the location of where Planet Nine could still be hiding and underscores how little we truly know about the outermost Solar System.

This newest discovery hasn't ruled out the possibility of the existence of Planet Nine but it has changed the model and there is greater speculation on the probability of whether or not it exists.

In the coming months, the Vera C. Rubin Observatory will begin a decade long survey of the night sky searching for faint moving objects with unprecedented sensitivity. Transients, faint asteroids, long-period comets, distant dwarf planets, sednoids, and more will be captured in breathtaking detail. And if Planet Nine is out there, dim and distant though it may be, the Rubin Observatory might finally reveal it.

- Video: Orbits of Senoids

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## Night Sky Network Online Webinar

Join the NASA Night Sky Network on December 11th at 9 PM EST to hear from Dr. Robert Nemiroff and tour highlights from the Astronomy Picture of the Day archive for 2025. Dr. Robert Nemiroff is a professor of physics at Michigan Tech.

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## McDonald Observatory Livestream

Join McDonald Observatory livestream on December 17th at 9 PM EST for their Deep Sky Tour of Compact Objects.

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## Observing

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

Video: What's Up December 2025 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!

# Night Sky Notes:

# A Flame In The Sky - The Orion Nebula

## By Kat Troche

It's that time of year again: Winter! Here in the Northern Hemisphere, the clear, crisp sky offers spectacular views of various objects, the most famous of all being Orion the Hunter.


As we've previously mentioned, Orion is a great way to test your sky darkness. With the naked eye, you can easily spot this hourglass-shaped constellation. Known as an epic hunter in Greco-Roman antiqity, Orion and all its parts have many names and meanings across many cultures. In Egyptian mythology, this constellation represented the god Sah. The Babylonians referred to it as The Heavenly Shepard. In most cultures, it is Orion's Belt that has many stories: Shen in Chinese folklore, or Tayamnicankhu in Lakota storytelling. But the Maya of Mesoamerica believed that part of Orion contained The Cosmic Hearth – the fire of creation.

1,500 light years away from Earth sits the star-forming region, and crown jewel of Orion – Messier 42 (M42), the Orion Nebula. Part of the "sword" of Orion, this 24 light year wide cloud of dust and gas sits below the first star in Orion's Belt, Alnitak, and can easily be spotted with the naked eye under moderate dark skies. You can also use binoculars or a telescope to resolve more details, such as the Trapezium: four stars in the shape of a keystone (or baseball diamond). These young stars make up the core of this magnificent object.

Of course, it's not just for looking at! M42 is easily one of the most photographed nebulae around, imaged by amateur astrophotographers, professional observatories and space telescopes alike. It has long been a place of interest for the Hubble, Spitzer, and Chandra X-ray Space Telescopes, with James Webb Space Telescope now joining the list in February 2023. Earlier this year, NASA and the European Space Agency released a new photo of the Orion Nebula taken from JWST's NIRCam (Near-Infrared Camera), which allowed scientists to image this early star forming region in both short and long wavelengths.


*ESA/Webb, NASA, CSA, M. Zamani (ESA/Webb), PDRs4ALL ERS Team*

But stars aren't the only items visible here. In June 2023, JWST's NIRCam and MIRI (mid-infrared instrument) imaged a developing star system with a protoplanetary disk forming around it. That's right – a solar system happening in real time – located within the edges of a section called the Orion Bar. Scientists have named this planet-forming disk d203-506, and you can learn more about the chemistry found here. By capturing these objects in multiple wavelengths of light, astronomers now have even greater insight into what other objects might be hiding within these hazy hydrogen regions of our night sky. This technique is called Multi-spectral Imaging, made possible by numerous new space based telescopes.

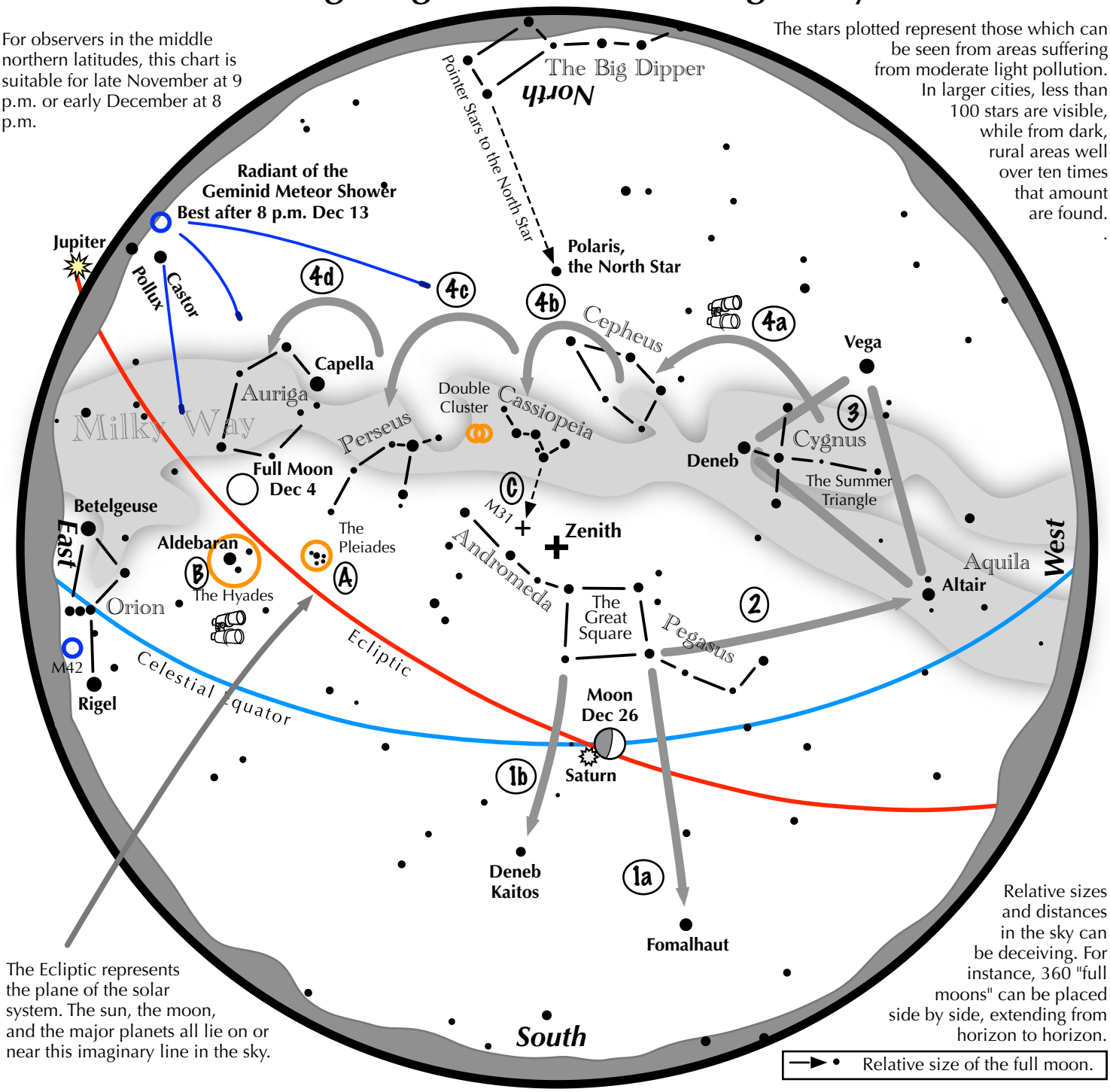
In addition to the Night Sky Network Dark Sky Wheel, a fun activity you can share with your astronomy club would be Universe Discovery Guide: Orion Nebula, Nursery of Newborn Stars. This will allow you to explain to audiences how infrared astronomy, like JWST, helps to reveal the secrets of nebulae. Or you can use public projects like the NASA-funded MicroObservatory to capture M42 and other objects.

# Navigating the December Night Sky

2025

For observers in the middle northern latitudes, this chart is suitable for late November at 9 p.m. or early December at 8 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 December night sky: Simply start with what you know or with what you can easily find.

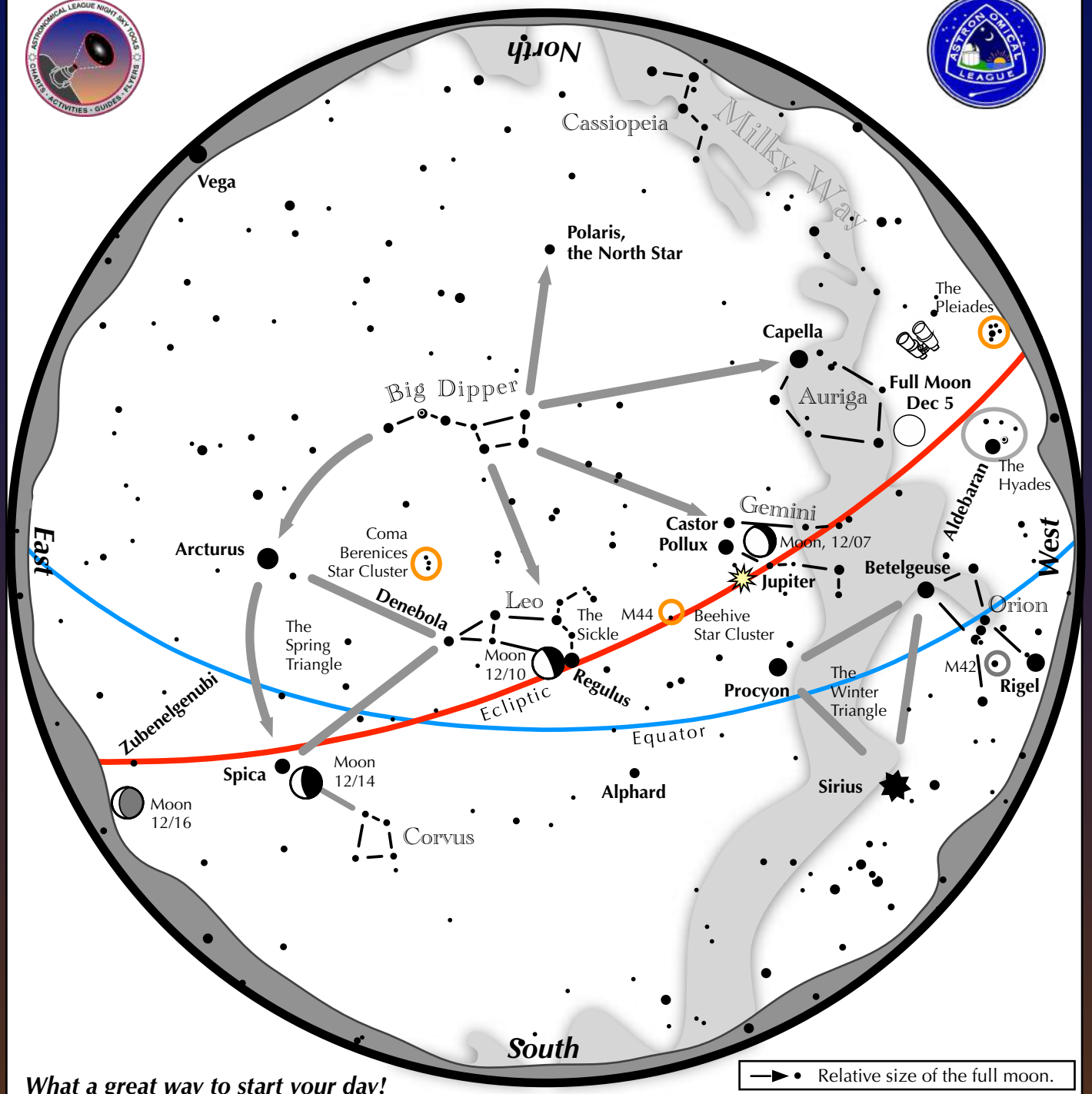
1. Face south. Almost overhead is the "Great Square" with four stars about the same brightness as those of the Big Dipper. Extend an imaginary line southward following the Square's two westernmost stars. The line strikes Fomalhaut, the brightest star in the southwest. A line extending southward from the two easternmost stars, passes Deneb Kaitos, the second bright star in the south.
2. Draw another line, this time westward following the southern edge of the Square. It strikes Altair, part of the "Summer Triangle."
3. Locate Vega and Deneb, the other two stars of the "Summer Triangle. Vega is its brightest member while Deneb sits in the middle of the Milky Way.
4. Jump along the Milky Way from Deneb to Cepheus, which resembles the outline of a house. Continue jumping to the "W" of Cassiopeia, to Perseus, and finally to Auriga with its bright star Capella.

### Binocular Highlights

**A and B:** Examine the stars of the Pleiades and Hyades, two naked eye star clusters.
**C:** The three westernmost stars of Cassiopeia's "W" point south to M31, the Andromeda Galaxy, a "fuzzy" oval.
**D:** Sweep along the Milky Way from Altair, past Deneb, through Cepheus, Cassiopeia and Perseus, then to Auriga for many intriguing star clusters and nebulous areas.

# Navigating the December Morning Sky

2025




Relative size of the full moon.

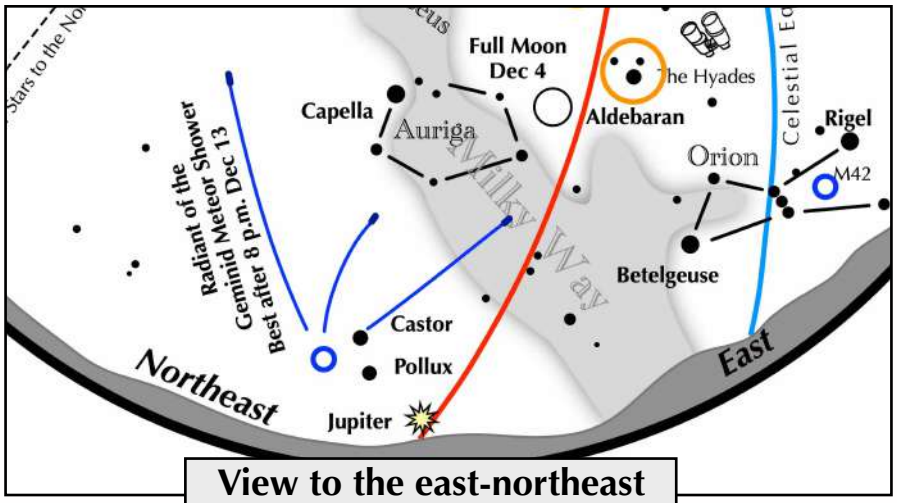
***What a great way to start your day!***

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

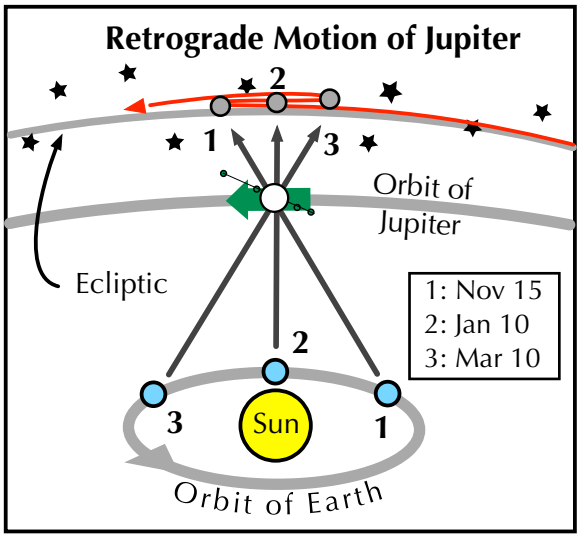
**Late sunrises in December provide opportunities for early morning skywatching.**

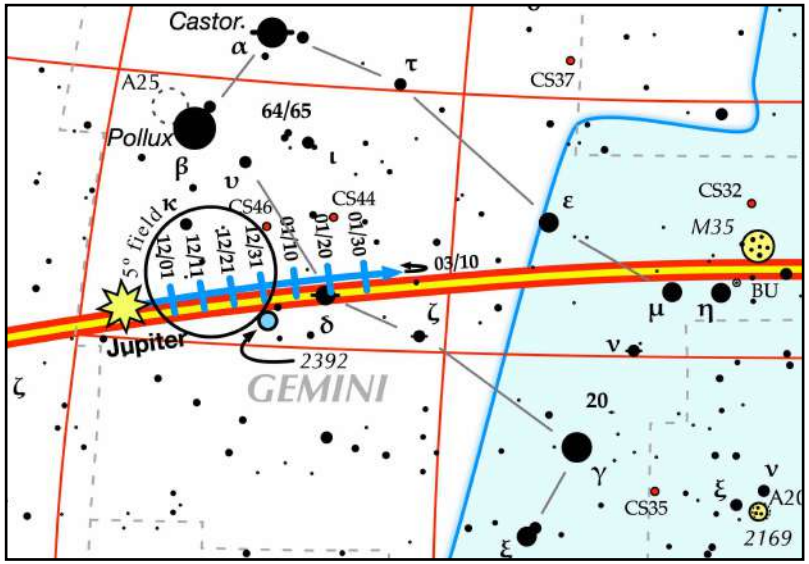
- Bright Jupiter shines high in the west.
- The near third quarter moon floats above Regulus on December 10.
- The waning crescent moon glows next to Spica on December 14.
- The thin crescent moon rises near the double star Zubenelgenubi on December 16.
- A great time for viewing the Big Dipper, Leo, and the Spring Triangle. And, in the second half of the month, it is time for galaxy viewing!

# On evenings in December (and January), try this challenge:




**View to the east-northeast in early December at 10 pm**



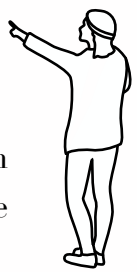




## Jupiter moves in retrograde

On evenings in December, the Giant Planet slides westward in central Gemini to the lower right of Castor and Pollux.

Observe, then plot its motion in the heavens. It continues its westward journey in January, but begins to slow in February. On about March 11, it halts and reverses direction.

The passing bright moon will hamper observations on December 4-8.



**Why do this activity?** This planetary dance can only be explained if both Earth and Jupiter orbit our sun following definable and slightly elliptical paths. Our view from Earth clearly shows this to those people who take the time to look carefully enough.