



PAStimes

A Publication of the Phoenix Astronomical Society

Stu's Views • Stu Brackney, President PAS

The chilly winter nights have arrived in our Valley of the Sun. Members are reminded to dress warmly when attending our outdoor Star Parties.

Speaking of Star Parties, the last one held at Apache had a giant moon in the sky, which is often not preferred, as it blocks out too many other night objects, but this one was awesome! *If you took some pictures of it*, please share them with our editor@pasaz.org.

Mark your calendar for **December 5th**, as we are having a super guest speaker in the classroom at PVCC, Dr. David A. Williams, Ph.D., Research Professor, School of Earth and Space Exploration, Arizona State University. This man truly knows how to share such wonderful information about our cosmos and what ASU is doing with NASA to explore it. So be sure to register for this event at www.pasaz.org. His topic "From Galileo to Europa Clipper: Exploring an Ocean World"

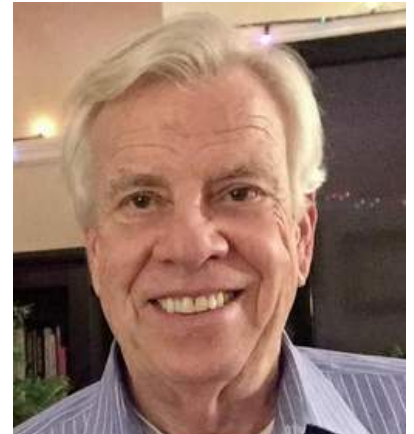
An added treat for December 5th meeting, our two PVCC Sam Insana PAS Student Scholarship winners will attend! A chance for you to share the joy of astronomy with them!

December is also the month when you, our dedicated members, renew your annual membership. No, we have not raised the prices. We have over the years modernized this process, allowing you to register using our website and PayPal, so everyone, beat the rush, get it done before you forget (smile).

From your leadership team (your Board of Directors and Managers) we send all of you greetings for a fabulous holiday season and of course CLEAR SKIES.

Finally: Keep an eye out on our public website: [PAS Event Calendar and Registration Site](#) for all our upcoming events. Tell a friend and clear skies everyone.

Clear skies everyone, the stars belong to you...Stu



Calling all stargazers and space enthusiasts! We're compiling a list of must-read books on astronomy and would love your input. Whether it's a guide to the night sky, an in-depth exploration of the cosmos, or a novel that captures the wonder of space, let us know your favorites. Share your top picks for essential astronomy books and inspire others on their journey through the stars!

SUBMIT



In This Issue

[Upcoming Events](#)

[December Lecture](#)

[November Review](#)

[Membership Renew](#)

[Outreach-StarTours](#)

[Night Sky](#)

[Spot the King of Planets](#)

[Astronomy Images](#)

[What's in the Sky This Month](#)

[Cosmic Classroom](#)

[Helpful Astronomy Websites](#)

[For Sale](#)

Upcoming Events



December 2024

5th-Monthly Lecture Series-PVCC Main Campus Dr. David Williams, Arizona State University
19th- Telescope Workshop-PVCC Main Campus
28th - Public Star Party- Apache Wash Trailhead Park

January 2025

1st -Renew Membership <https://www.pasaz.org/join-our-society>
9th-Monthly Lecture Series - TBD
23th- Telescope Workshop-PVCC Main Campus

For more information and to register for these events, go to the [PAS Event Calendar and Registration Site](#) .
It is important to register for all events. In case of an event change or cancellation, you will be notified via email.



December Lecture Series

From Galileo to Europa Clipper: Exploring an Ocean World

Speaker: Dr. David Williams, Arizona State University

Topic: From Galileo to Europa Clipper: Exploring an Ocean World

Location: PVCC Campus

ASU Professor David Williams began his professional career as a postdoc on the NASA Galileo mission, studying Jupiter's moons Io and Europa. Now a new era begins with the launch of NASA's Europa Clipper in October 2024. What will this spacecraft do? Join Dr. Williams for a review of what we know about Europa from Galileo and a look ahead at Clipper's exploration of this Ocean World.



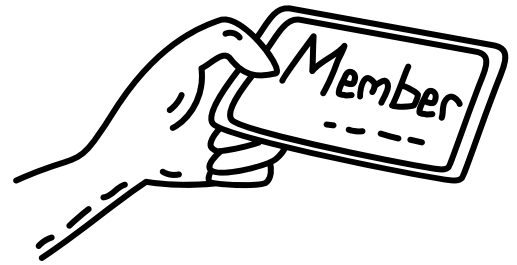
His research primarily focuses on volcanology and planetary geology, emphasizing planetary mapping, geochemical, and remote sensing studies. He has been involved in geologic mapping of various celestial bodies in the Solar System, including Jupiter's satellites, Mars, Titan, Pluto, the asteroid Vesta, and the dwarf planet Ceres. Dr. Williams has participated in several NASA missions, such as the Magellan Mission to Venus, Galileo Mission to Jupiter, and Dawn Mission to asteroid Vesta and dwarf planet Ceres. Additionally, he is a Co-Investigator on the European Space Agency's Mars Express orbiter mission and serves as the Deputy Lead for the Psyche Multispectral Imager for NASA's Psyche Mission. Dr. Williams has contributed extensively to planetary science through his research publications and leadership roles in various NASA projects



Beat the Rush...[Renew Your Membership Now](#)

Stu Brackney

Hi everyone. Great news, your Board of Directors decided not to keep up with inflation. They did not raise your annual dues! More good news is, you can easily renew your membership by going to our public website www.pasaz.org, look on the left index column for the link "Join Our Society," click on that and there ya go. Your membership runs from 1 January to 31 December or the date you sign up to the end of the year. Our new Membership Manager, Mr. Richard Pipkin will assist you with any questions you may have: Richardpipkin@pasaz.org



November Lecture Series

New development in the field of adaptive optics (AO)

Dr. Al Conrad

Steward Observatory

Large Binocular Telescope Observatory

Intro to the topic: A new development in the field of adaptive optics (AO) on ground-based telescopes enables routine monitoring of changes on Jupiter's volcanic moon Io at scales down to ~80km (achieved), or even down to ~50km (in the limit). Our observations of Io, taken with SHARK-VIS on the Large Binocular Telescope (LBT) in Arizona, demonstrate this new capability. SHARK-VIS, which saw first light at LBT on October 2nd, 2023, is one of only a few visible-light AO instruments on large telescopes.

Summary:

The speaker discusses advancements in high-resolution imaging using the Large Binocular Telescope (LBT), focusing on its capabilities for observing celestial objects, particularly in the infrared and visible wavelengths. The LBT employs adaptive optics (AO) systems to enhance angular resolution, making it possible to observe planetary bodies like asteroids and moons, and phenomena like Neptune's dark spots or Uranus's rings.

One of the key instruments, Shark-Viz, uses just one of the LBT's two 8.4-meter mirrors, but the next step is to combine the light from both mirrors (8.4 meters each) to create a 23-meter effective baseline. This combination is achieved through the LBT Interferometer (LBTI), which allows for high-resolution imaging at much higher detail. For instance, observing at 5-micron wavelengths, LBT can resolve surface features of moons like Io (one of Jupiter's moons) with a resolution of 20-30 km, far surpassing current spacecraft observations in resolution.

The potential for further resolution improvements lies in the new LBT interferometer visible extension (LIVE), which would provide three times better resolution, pushing down to 5 milliarcseconds. This could result in surface resolution on objects like Io reaching as small as 5-10 kilometers, a level comparable to spacecraft observations, but from the ground. The speaker suggests this will mark a new era in planetary imaging from Earth-based telescopes.

Additionally, the conversation touches on the innovative use of deformable mirrors in adaptive optics, allowing for real-time corrections to atmospheric distortions, significantly enhancing the image clarity. This technology involves thin, flexible mirrors with actuators that adjust to correct distortions, a major leap from earlier thick mirrors that could not be adjusted as easily.

Overall, the LBT, with its advanced instruments, promises to push the boundaries of ground-based astronomical observations, offering an unprecedented level of detail for both planetary and extragalactic science.



Gifting for Astronomers. A few tips by Stu Brackney

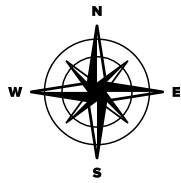
First off, I am not saying astronomers are fussy or exceedingly difficult to buy for, let's be clear about that. What I am saying is that the astronomer that you love... wants to love your gift.

For that to happen, you, my friends, need to ask them to give you a mini list of what they would prefer, because astronomy equipment and the gadgets that are attached to them can be extremely specific.

Once they give you a mini list, be sure they also tell you where they can be purchased.

With all that in hand, you are good to buy and give.

This advice is to prevent you from purchasing extremely expensive items that they do not need or cannot use. So off you go. Make one of our PAS members happy with a nice gift.



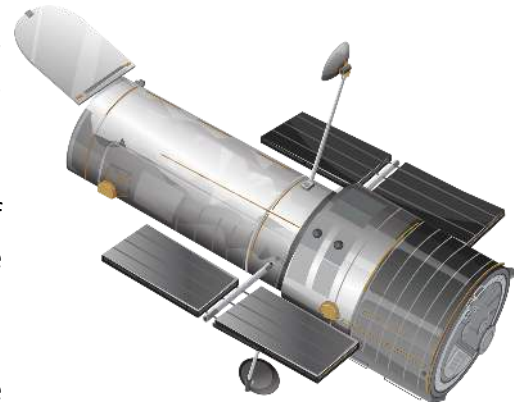
November Outreach Events

Star party at Apache Wash-Mark Johnston

The threatening clouds mostly dissipated, and we had a good turnout at the Apache Wash star party November 16th. There were 9 telescopes and about 20 participants. Jupiter, Saturn and the Moon looked spectacular, as well as some favorite double stars like Albireo, Almach, and Epsilon Lyra. Despite the almost full moon we glimpsed M57, M42, M31 and M33. The night progressively got colder and we packed up about 9:30PM.

TAKE A TOUR

Star Tours -Boy Scouts sky event - Stu Brackney

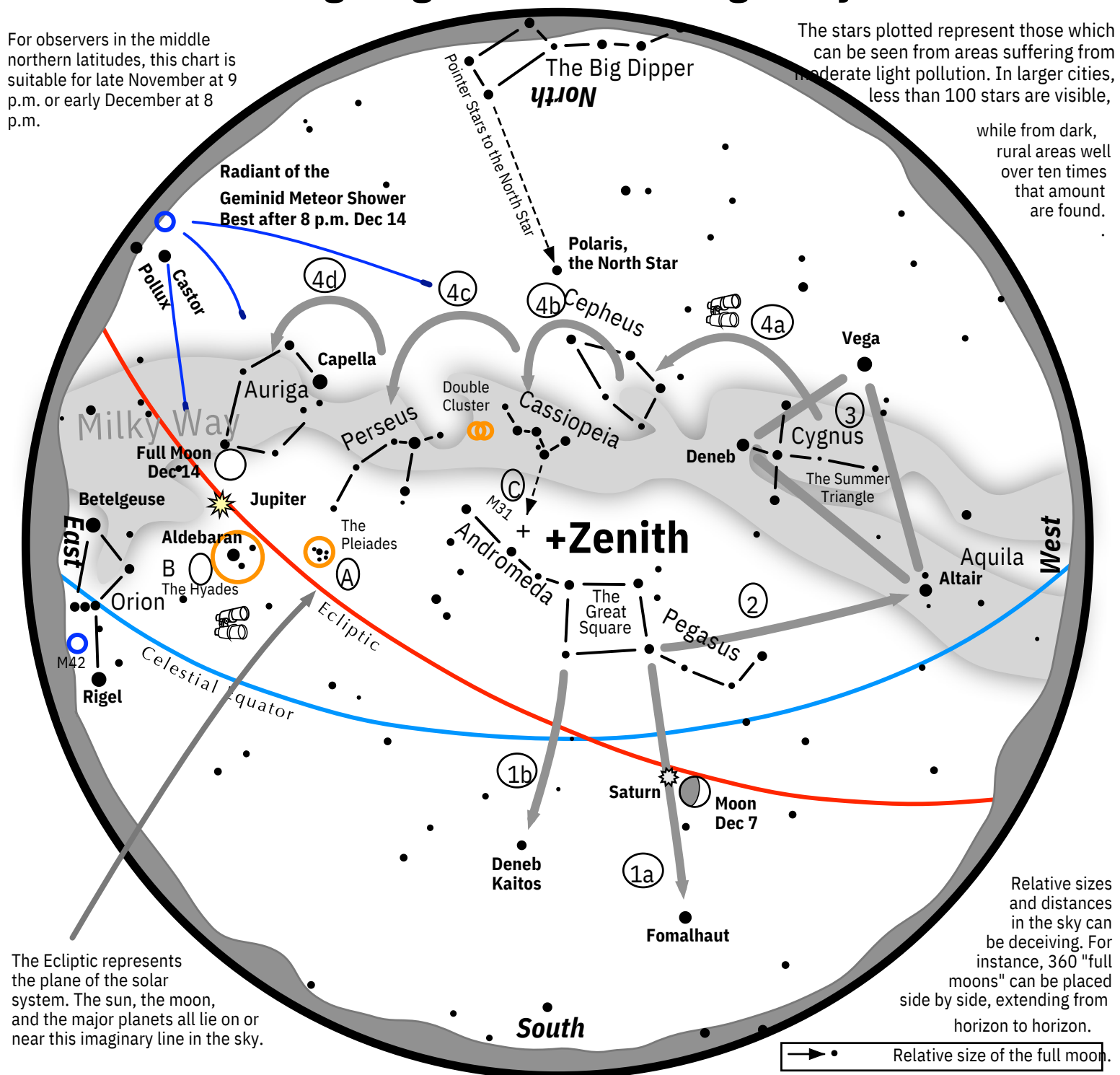


Navigating the December Night Sky

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 brightest 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.





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!

December's Night Sky Notes: Spot the King of Planets

By Dave Prosper

Updated by Kat Troche

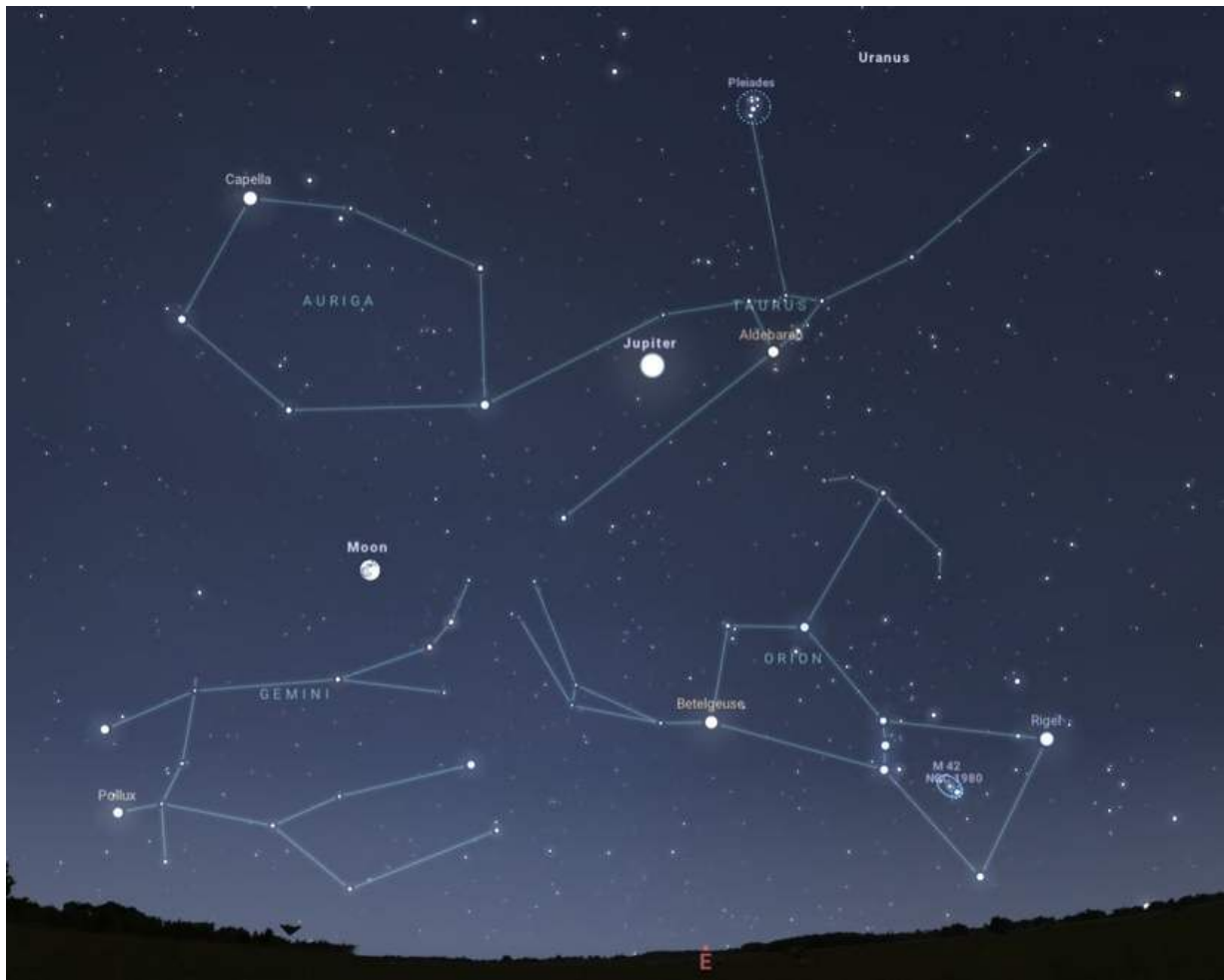
Jupiter is our solar system's undisputed king of the planets! Jupiter is bright and easy to spot from our vantage point on Earth, helped by its massive size and banded, reflective cloud tops. Jupiter even possesses moons the size of planets: Ganymede, its largest, is bigger than the planet Mercury. What's more, you can easily observe Jupiter and its moons with a modest instrument, just like Galileo did over 400 years ago.



NASA's Juno mission captured this look at the southern hemisphere of Jupiter on Feb. 17, 2020, during one of the spacecraft's close approaches to the giant planet. This high-resolution view is a composite of four images captured by the JunoCam imager and assembled by citizen scientist Kevin M. Gill. Credit: NASA, JPL-Caltech, SwRI, MSSS | Image processing by Kevin M. Gill, © CC BY

Jupiter's position as our solar system's largest planet is truly earned; you could fit 11 Earths along Jupiter's diameter, and in case you were looking to fill up Jupiter with some Earth-size marbles, you would need over 1300 Earths to fill it up – and that would still not be quite enough! However, despite its formidable size, Jupiter's true rule over the outer solar system comes from its enormous mass. If you took all of the planets in our solar system and put them together, they would still only be half as massive as Jupiter all by itself.

Jupiter's mighty mass has shaped the orbits of countless comets and asteroids. Its gravity can fling these tiny objects towards our inner solar system and also draw them into itself, as famously observed in 1994 when Comet Shoemaker-Levy 9, drawn towards Jupiter in previous orbits, smashed into the gas giant's atmosphere. Its multiple fragments slammed into Jupiter's cloud tops with such violence that the fireballs and dark impact spots were not only seen by NASA's orbiting Galileo probe but also by observers back on Earth!



Look for Jupiter near the Eye of the Bull, Aldebaran, in the Taurus constellation on the evening of December 15, 2024. Binoculars may help you spot Jupiter's moons as small bright star-like objects on either side of the planet. A small telescope will show them easily, along with Jupiter's famed cloud bands. How many can you count? Credit: Stellarium Web

Jupiter is easy to observe at night with our unaided eyes, as well-documented by the ancient astronomers who carefully recorded its slow movements from night to night. It can be one of the brightest objects in our nighttime skies, bested only by the Moon, Venus, and occasionally Mars, when the red planet is at opposition. That's impressive for a planet that, at its closest to Earth, is still over 365 million miles (587 million km) away. It's even more impressive that the giant world remains very bright to Earthbound observers at its furthest distance: 600 million miles (968 million

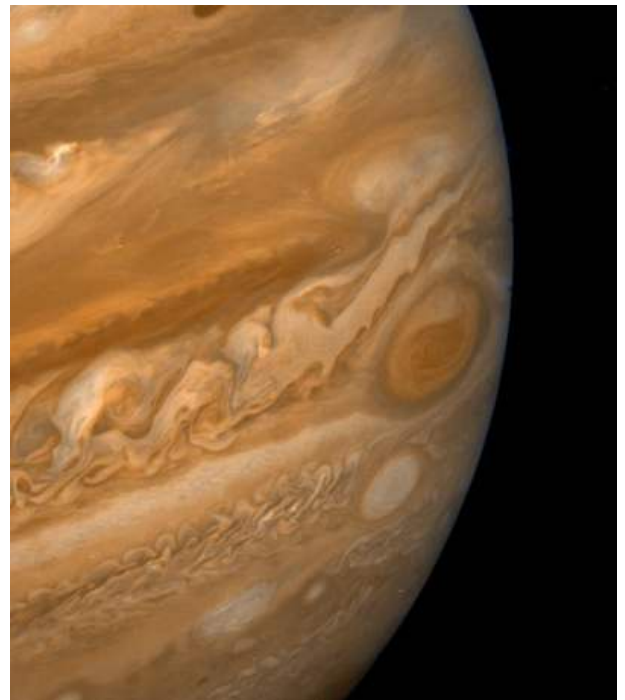
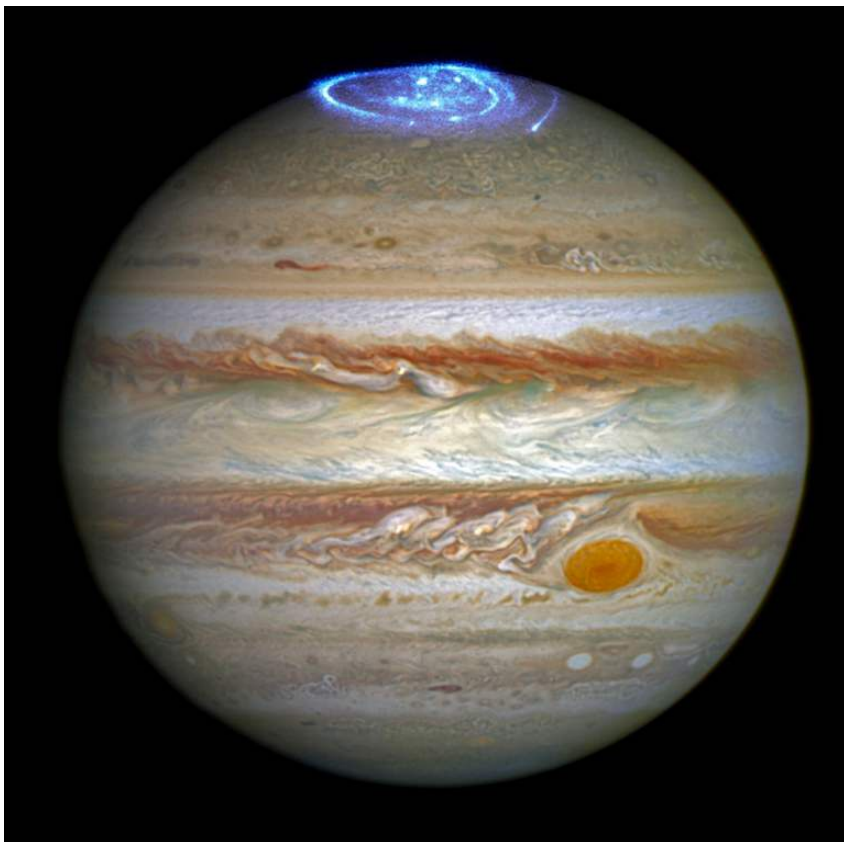


km)! While the King of Planets has a coterie of 95 known moons, only the four large moons that Galileo originally observed in 1610 – Io, Europa, Ganymede, and Calisto – can be easily observed by Earth-based observers with very modest equipment. These are called, appropriately enough, the Galilean moons. Most telescopes will show the moons as faint star-like objects neatly lined up close to bright Jupiter. Most binoculars will show at least one or two moons orbiting the planet. Small telescopes will show all four of the Galilean moons if they are all visible, but sometimes they can pass behind or in front of Jupiter or even each other. Telescopes will also show details like Jupiter's cloud bands and, if powerful enough, large storms like its famous Great Red Spot, and the shadows of the Galilean moons passing between the Sun and Jupiter. Sketching the positions of Jupiter's moons during the course of an evening – and night to night – can be a rewarding project! You can download an activity guide from the Astronomical Society of the Pacific at bit.ly/drawjupitermoons

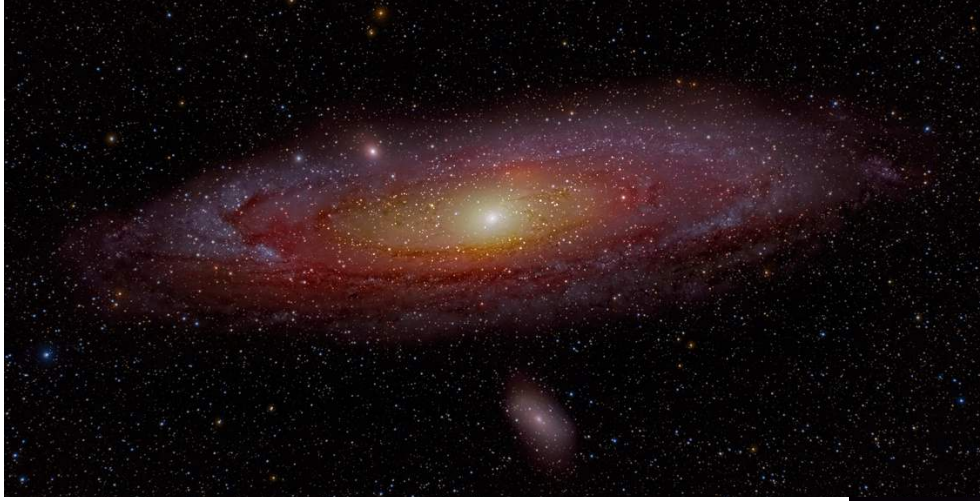
Now in its eighth year, NASA's Juno mission is one of just nine spacecraft to have visited this impressive world. Juno entered Jupiter's orbit in 2016 to begin its initial mission to study this giant world's mysterious interior. The years have proven Juno's mission a success, with data from the probe revolutionizing our understanding of this gassy world's guts. Juno's mission has since been extended to include the study of its large moons, and since 2021 the plucky probe, increasingly battered by Jupiter's powerful radiation belts, has made close flybys of the icy moons Ganymede and Europa, along with volcanic Io. What else will we potentially learn in 2030 with the Europa Clipper mission?

Find the latest discoveries from Juno and NASA's missions to Jupiter at science.nasa.gov/jupiter/

*Originally posted by Dave Prosper: February 2023
Last Updated by Kat Troche: November 2024*

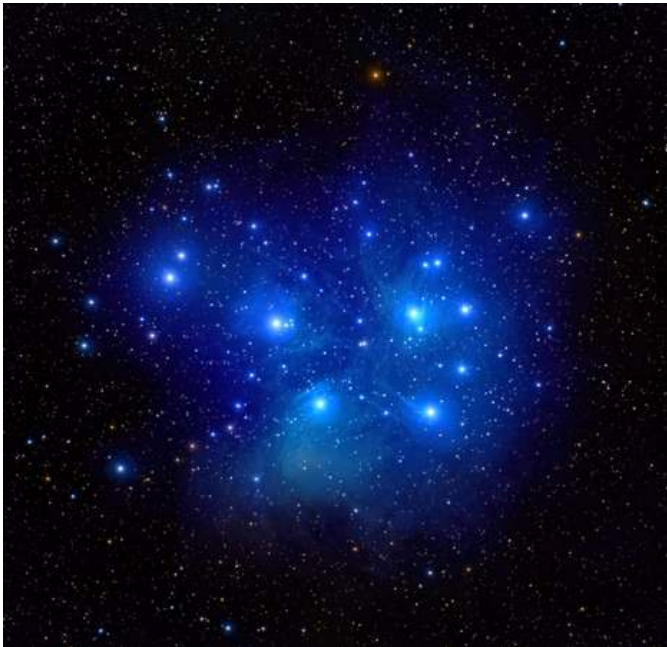


Member Astro Images



**M31-MARK
JOHNSTON**

**MOON-MARK
JOHNSTON**



**M45 -MARK
JOHNSTON**

NGC281& NGC1635 -MARK JOHNSTON



7 Telescope Targets

Each month, we feature 7 good targets for small telescopes that should be visible in the evening. For the month of December, the targets are:

1. **NGC869/884 Double Cluster** The nicest pair of side by side open clusters in the sky. Visible to the naked eye from dark sites.
2. **Eta Persei** Nice blue/yellow binary star
3. **M103** Just in time for Christmas, this open cluster looks much like a Christmas tree
4. **NGC7789 Caroline's Rose** Discovered by Caroline Herschel, a beautiful star cluster that appears like looking into a rose
5. **NGC457 Owl cluster** A star party favorite, this star cluster looks just like its namesake.
6. **NGC 891 Silver Sliver galaxy** Edge on galaxy with a conspicuous dust lane bisecting the top and bottom
7. **Gamma Aries** Yellow/red binary star

Cosmic Classroom (CC) December - Celestial Spectacles: Explore the beauty and wonder of comets, meteors, and auroras, highlighting notable events and how to observe them.



Meteors

The cause of a meteor's glow is uncertain.

A The favored theorized mechanism is that the hypersonic meteoroid grain pushes a bow front that compresses the air in front, causing the air to heat, which, in turn, heats the grain, causing it to glow.

B Another possible mechanism is friction with molecules in the upper atmosphere heating the meteoroid grain causing it to glow.

Meteoroid: while traveling in space.
Meteor: while falling through the atmosphere.
Meteorite: after striking the ground.

How to observe meteors

- lie on a blanket or comfortable reclining chair.
- observe in a dark location and extinguish all white lights.
- face the radiant for the most meteors.
- observe when no moon is present.
- tend to be best a few hours after midnight.

The zenithal hourly rate (ZHR) of a meteor shower is the number of meteors visible if the radiant were directly overhead, and if the sky conditions were perfect. The actual meteor count will be lower due to ...

- interfering moonlight,
- obscuring atmospheric haze,
- unseen meteors behind the observer,
- and sky glow from light pollution.

A meteor shower occurs when Earth passes through a stream of debris left by a passing comet, possibly from over 100 years ago. The debris consists of sand to baseball size silicate and ice grains.

Meteor showers are named for the constellation or area of the sky from which they seem to emanate.

December 13-14 – Geminid Meteor Shower: The peak occurs under a nearly full Moon, reducing visibility, but bright meteors may still be spotted the week before.

Helpful Astronomy Websites

by Mark Johnston

The following websites are great free resources to help you plan and enjoy your astronomy adventures

Astromart: astromart.com/

This is one of the top two sites for buying and selling used astronomy gear, product reviews, and forums where you can discuss any aspect of astronomy with other enthusiasts. A small fee is required.

Astrometry.net: <https://nova.astrometry.net/>

This site will take any astronomy image you send it (galaxy, starfield, nebula, etc) and then tell you what it is and where it is in the sky.

Astronomy Tools: astronomy.tools/calculators/field_of_view/

This site has a lot of capabilities but I use it primarily to figure out how a target (e.g. the Helix nebula) will look in my eyepiece or astronomy camera. You pick your scope, camera, eyepiece and target and the site does the rest.

Astrospheric: www.astrospheric.com/

Probably the best short term astronomy weather forecasting tool, providing predictions of clouds, transparency and seeing.

Clear Sky Charts: www.cleardarksky.com/

Excellent source of astronomy seeing conditions forecast. Also a great tool for finding observing sites with lower light pollution.

Cloudynights: www.cloudynights.com/

This is one of the top two sites for buying and selling used astronomy gear, product reviews, and forums where you can discuss any aspect of astronomy with other enthusiasts. Free.

Dark site finder: darksitefinder.com/map/

Great website for finding a dark observing location.

Heavens above: heavens-above.com/

Top site for predicting naked eye observations of satellites. See when the ISS is visible in your neighborhood!

Jupiter transits: shallowsky.com/jupiter/

For anyone with a small telescope, this is a great site. You can find out when the Great Red Spot and Jupiter's satellite transits are visible.

Solar Dynamic Observatory (SDO): <https://sdo.gsfc.nasa.gov/data/>

Find out how the Sun looks right now, at various wavelengths. If you own a solar telescope, this site coupled with Astrospheric is all you need to plan fabulous solar observing!

Telescopius: telescopius.com/

This site is very helpful in planning an observing evening. It will tell you when any particular target is rising and setting and when is the best time to observe it. This allows you to sequence your observing in a planned manner.

This is a first come, first served offer.
 Review the list. Decide what you want.
 Email stuartbrackney@pasaz.org what you want.
 He will set up a day/time for you to come to his location to purchase.
 Bring your check payable to Phoenix Astronomical Society or cash ... no credit cards please.



Celestron 6" F/4 Newtonian Astrograph Telescope

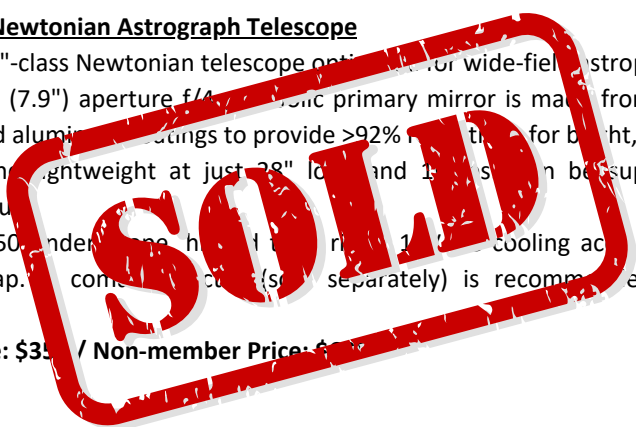
- Fast 6"-aperture reflector lets you take short exposures with bright, high-resolution results
 - Precise 2" dual-speed (10:1) linear-bearing Crayford focuser lies 7" back in the optical tube to block stray light and boost contrast
 - Orion-exclusive steel reinforcement plate under focuser eliminates flexure with heavy imaging gear attached
 - Compact 22.5" length and light 12.7 lb. assembled weight doesn't require an enormous mount
 - Includes two heavy-duty hinged tube rings, 8x50 finder scope, dovetail mounting bar, and more
- Member Price: \$250 / Non-Member Price: \$400**



Orion 8" F/4 Newtonian Astrograph Telescope

- Affordable 8"-class Newtonian telescope optimized for wide-field astrophotography
- The 200mm (7.9") aperture f/4.0 achromatic primary mirror is made from high-quality BK7 glass with enhanced aluminum coatings to provide >92% reflectivity for bright, vivid images
- Compact and lightweight at just 28" long and 15 lbs. can be supported on a mid-sized equatorial mount
- Includes 8x50 finder scope, 1.25" Sirius Plossl eyepieces, 12V cooling accelerator fan, and a quick-collimation cap. (collimation tool sold separately) is recommended for optimal flat-field performance.

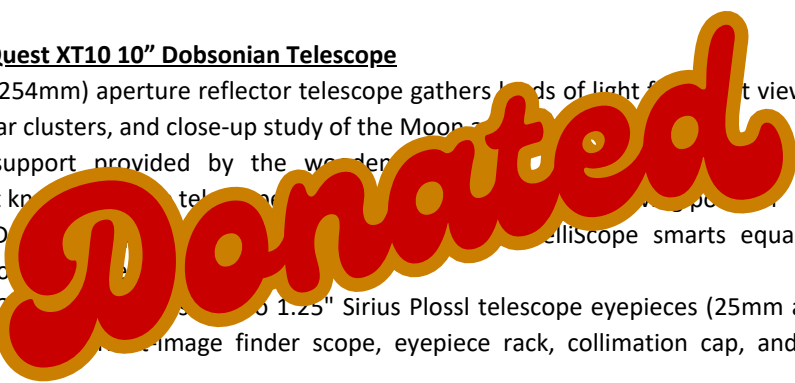
Member Price: \$350 / Non-member Price: \$450



Orion SkyQuest XT10 10" Dobsonian Telescope

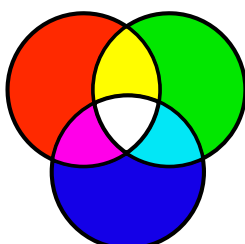
- Big 10" (254mm) aperture reflector telescope gathers loads of light for great views of nebulae, galaxies, star clusters, and close-up study of the Moon
- Stable support provided by the wonderful Orion Dobsonian design. Includes the new CorrectTension adjustment knob for easy collimation
- Simple Dobsonian design makes this telescope smart equals a reflector telescope for the price
- Includes 7mm and 1.25" Sirius Plossl telescope eyepieces (25mm and 10mm), a 9x50 right-angle image finder scope, eyepiece rack, collimation cap, and Starry Night software

Member Price: \$300 / Non-Member Price: \$500



Various Filters – 1.25"

- Red
- Yellow
- Blue
- Green
- Multiple O3 filters



Member Price: \$100 / Non-Member Price: \$200