The Bays Mountain Astronomy Club Newsletter

November 2023

Kingsport, TN

Table of Contents

Cosmic Reflections

William Troxel - BMAC Chair

reetings fellow BMACers!

Adam here again. Last month's meeting was a lot of fun! Those who attended enjoyed Robin's presentation about famed astronomer, Vera Rubin. I am biased, but Robin provided, as usual, a great presentation. We also had Michael Hopkins share some very cool projects he's been doing for his enjoyment of astronomy as part of Show & Tell.

There is no November meeting. The next meeting will be December 1.

It is looking like it may be a while for William to return, so Greg Penner has agreed to be interim chair for the club. We thank him for stepping up to help out.

Michael Hopkins demonstrating his 3D printed solar filter holders, Sun shade and Sun finder. Image by Robin Byrne.

BMAC Notes

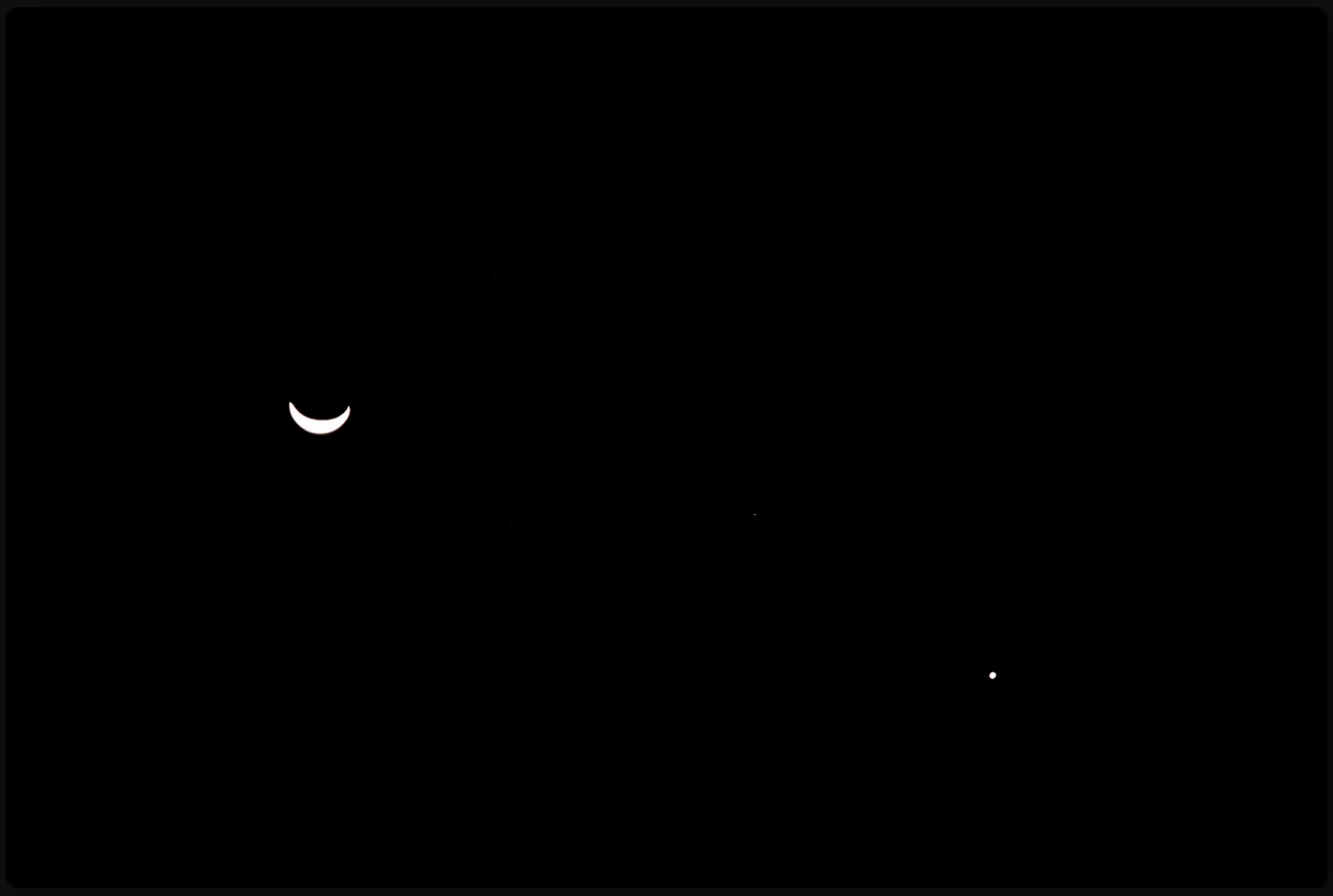
BMAC Photos

Michael Hopkins sent in:

My dog woke me up the early morning of Oct 10th at 5:45 for a trip outside. I was prepared the night before with hopes of a clear sky to see the crescent Moon, Regulus and Venus all together. Early preparations [a week prior] to take night photos using my Cannon Rebel camera with manual settings using a telephoto lens of the bright full Moon paid off.

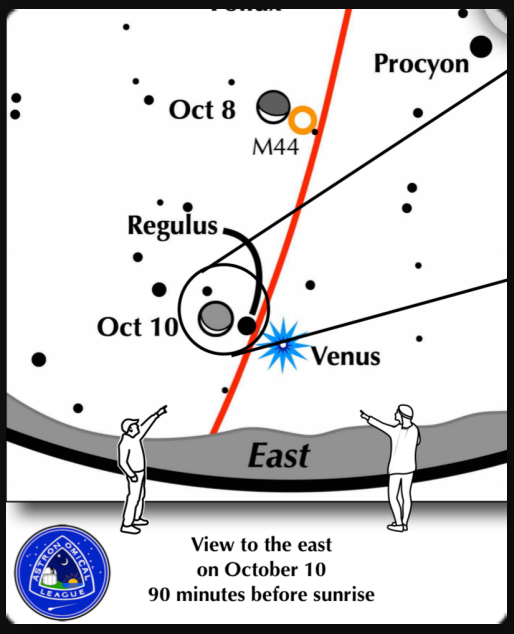
So with those setting's, I was able to capture the three points of light on Oct 10th.

Just minutes into getting the photo I wanted, low briskly moving clouds rolled in. I was lucky my dog woke me up!



The Moon, Regulus and Venus (l-r). Image by Michael Hopkins

The Moon about a week before.



What it looked like.

dam Thanz sent in:

Robin and I jokingly said to each other the morning of Oct. 13, 2023, the day before the annular eclipse, that it would great to see the crescent Moon. Well, it became a reality! I went out on the back deck and noticed how clear the sky was. Walking to the far end of the deck, I was able to see in a low dip in our mountain range horizon, the super-thin crescent Moon! In binoculars, about 5 minutes before this image, I could see a ring of light all around the Moon, not just the bottom as seen in this image. The image was taken at 7:11a EDT in East Tennessee. The Moon was 28.4 days old (1.1 days to new) with 1.4% illumination. Notice that the crescent is not solid, but has gaps from crater rims causing shadows.

Thin, crescent Moon on Oct. 13, 2023. Image by Adam Thanz

Robin Byrne sent in some photos from one of the public viewing opportunities for the annular eclipse on October 14, 2023. These were at ETSU. The following six images are from Robin.


SUBWAY
GIANT MAGELLAN TELESCOPE
BRAVO
PRESSO


SUNSPOTTER
MAP OF THE UNITED STATES
PATH OF TOTALITY 2017
ANNULAR PATH OF TOTALITY 2023
PATH OF TOTALITY 2024
MOON
EARTH
PATH OF TOTALITY
PARTIAL
TOTALITY
PARTIAL
SUN
EXTERNAL TANGENT LINES
The Radio Sun

“Night Skies of Aboriginal Australia”

7p – November 10, 2023 – One Presentation Only!

ays Mountain Planetarium is excited to host Paul Curnow for this single, special, live evening presentation. Paul is an astronomy lecturer at the Adelaide Planetarium in South Australia and an expert on the Australian Aboriginal night sky. Tickets must be purchased in advance for this limited engagement.

For all the details and how to purchase tickets, click **here**.

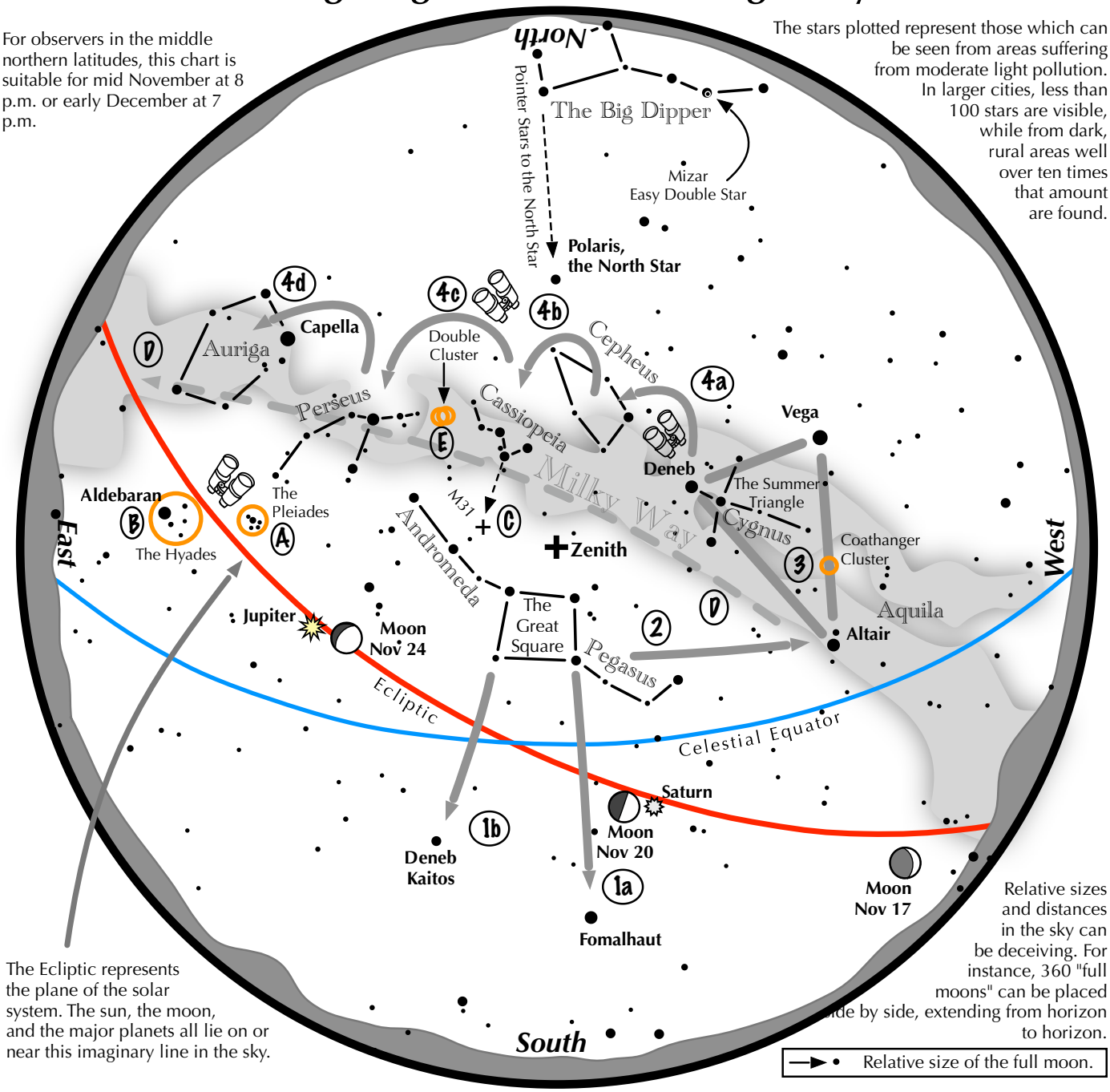
Sky News from the Astronomical League

The Astronomical League has a plethora of educational content to help you learn and enjoy the night sky more. The following inserts are just a tiny bit of what they provide.

Navigating the November Night Sky

For observers in the middle northern latitudes, this chart is suitable for mid November at 8 p.m. or early December at 7 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 November night sky: Simply start with what you know or with what you can easily find.

1. Face south. Almost overhead lies the "Great Square" with four stars about the same brightness as those of the Big Dipper. Extend a line southward following the Square's two westernmost stars. The line strikes Fomalhaut, the brightest star in the south. A line extending southward from the two easternmost stars, passes Deneb Kaitos, the second brighest star in the south.
2. Draw a line westward following the southern edge of the Square until 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, then to Perseus, and finally to Auriga with its bright star Capella.

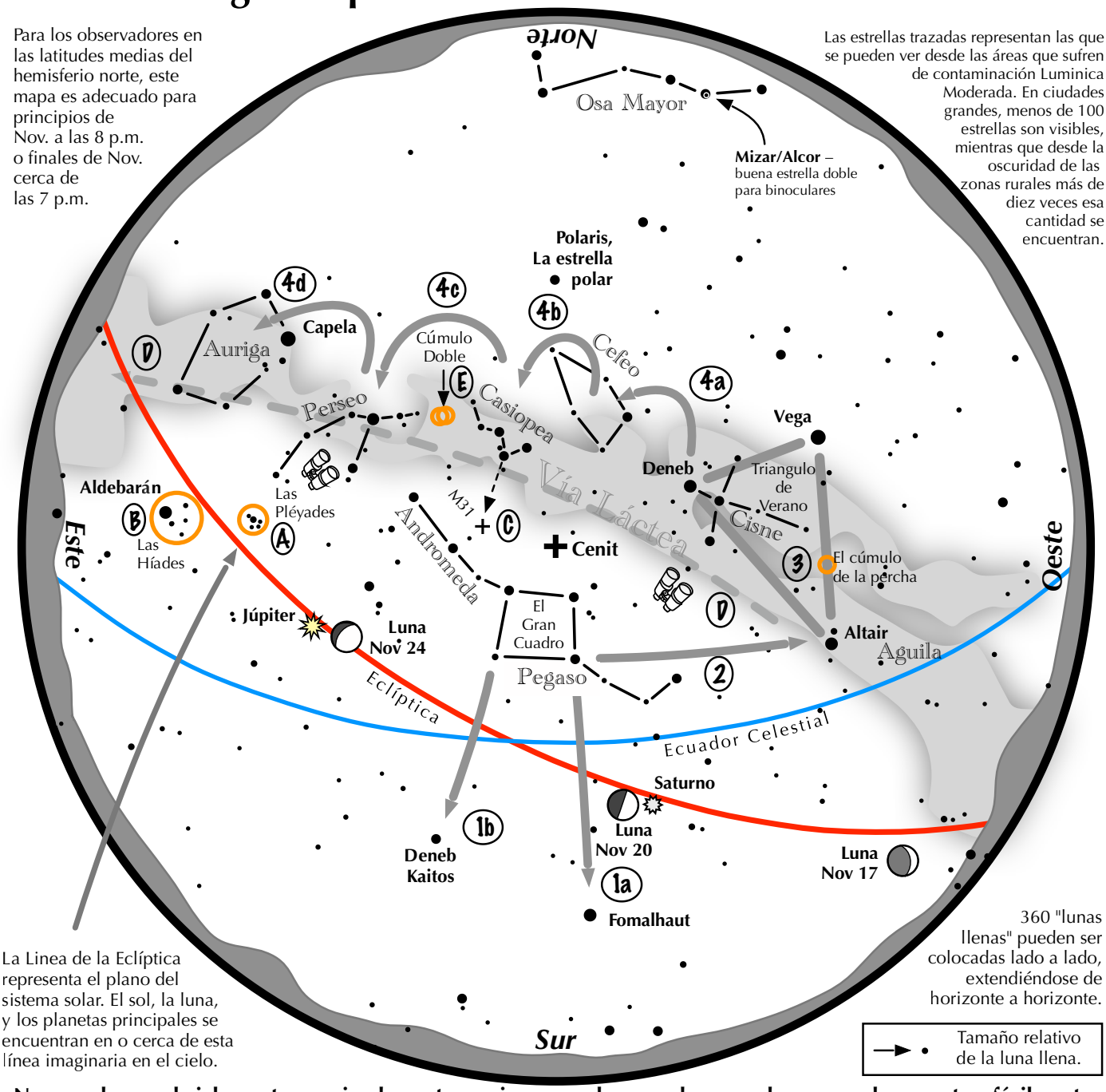
Binocular Highlights

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. **E.** The Double Cluster.

Navegando por el cielo nocturno de Noviembre

Para los observadores en las latitudes medias del hemisferio norte, este mapa es adecuado para principios de Nov. a las 8 p.m. o finales de Nov. cerca de las 7 p.m.

Las estrellas trazadas representan las que se pueden ver desde las áreas que sufren de contaminación Luminica Moderada. En ciudades grandes, menos de 100 estrellas son visibles, mientras que desde la oscuridad de las zonas rurales más de diez veces esa cantidad se encuentran.



La Linea de la Eclíptica representa el plano del sistema solar. El sol, la luna, y los planetas principales se encuentran en o cerca de esta línea imaginaria en el cielo.

360 "lunas llenas" pueden ser colocadas lado a lado, extendiéndose de horizonte a horizonte.

Tamaño relativo de la luna llena.

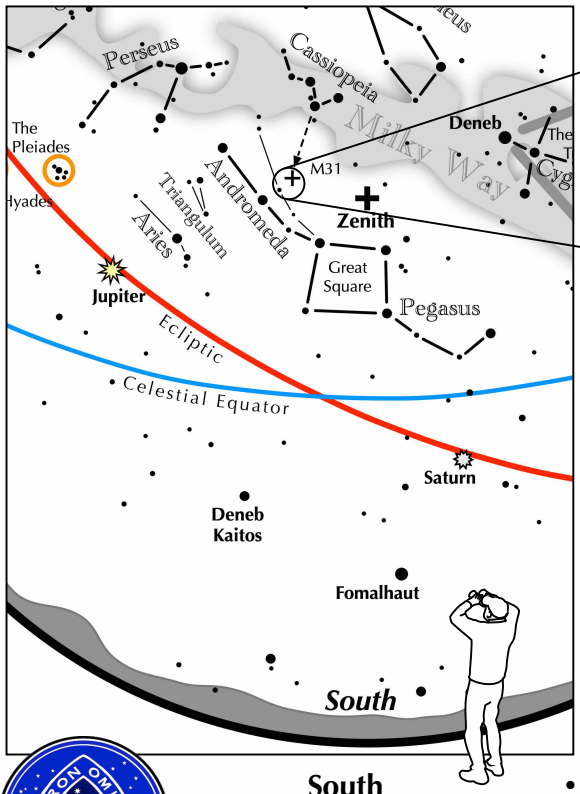
Navegando por el cielo nocturno: simplemente comience con lo que sabe o con lo que puede encontrar fácilmente.

1. Hacia el sur. Casi arriba está el "Gran Cuadro" con cuatro estrellas con el mismo brillo que las de la Osa Mayor. Extiende una línea imaginaria hacia el sur siguiendo las dos estrellas más occidentales del Gran Cuadro. La línea lleva a Fomalhaut, la estrella más brillante del sur. Una línea que se extiende hacia el sur desde las dos estrellas más orientales, lleva a Deneb Kaitos, la segunda estrella más brillante del sur.
2. Dibuja otra línea, esta vez hacia el oeste siguiendo el borde sur del Gran Cuadro. Lleva a la estrella Altair.
3. Ubique a Vega y Deneb, las otras dos estrellas del "Triángulo de verano." Vega es su miembro más brillante, mientras que Deneb se localiza en el medio de la Vía Láctea.
4. Salta a lo largo de la Vía Láctea desde Deneb hasta Cefeo, que se asemeja al contorno de una casa. Continúa saltando a la "W" de Casiopea, a Perseo y finalmente a Auriga con su brillante estrella Capela.

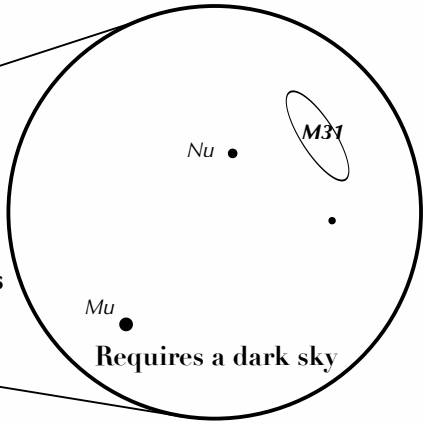
Destacan con Binoculares. A y B: examina las estrellas de las Pléyades y las Híades, dos cúmulos de estrellas a simple vista. **C:** Las tres estrellas más occidentales de la "W" de Casiopea apuntan hacia el sur hasta M31, la Galaxia de Andrómeda, un óvalo "borroso." **D:** Barrer a lo largo de la Vía Láctea desde Altair, pasar Deneb, a través de Cefeo, Casiopea y Perseo, y luego a Auriga por muchos intrigantes cúmulos de estrellas y áreas nebulosas. **E.** Cúmulo Doble de Perseo.

Traducción al español por Dr. Salvador Aguirre

If you can observe only one celestial event this month, consider this one:



South
90 minutes after sunset



View through 10x50 binoculars

Requires a dark sky

Have you seen M31, the Andromeda Galaxy?

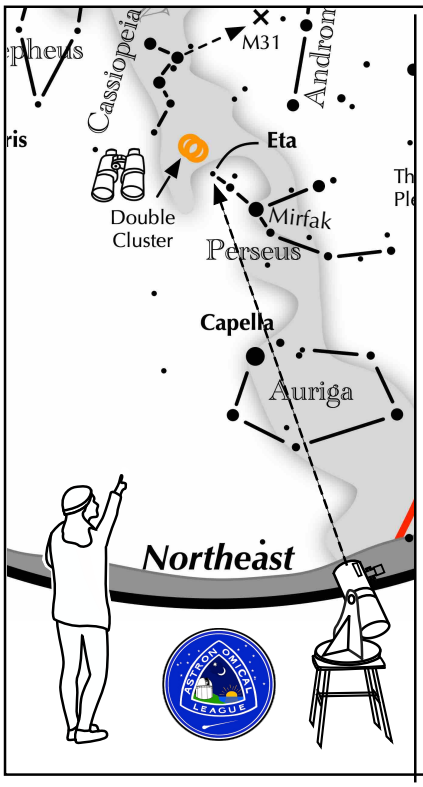
Look high in the south 90 minutes after sunset in November.

- Find the Great Square nearly at the zenith.
- Identify the line of four stars beginning at the northeast corner of the Great Square and extending northeast.
- Identify a second but dimmer line extending more northeasterly than the first line. These two lines represent Andromeda.
- Identify the third star on each line.
- A line passing through those two stars and extending northwest for the same length lands on M31.

or ...

- Draw an arrow pointing southward through the three westernmost stars of Cassiopeia's "W."
- Extend that line for the same length as Cassiopeia is wide.
- It ends on M31.

ASTRONOMICAL LEAGUE Double Star Activity



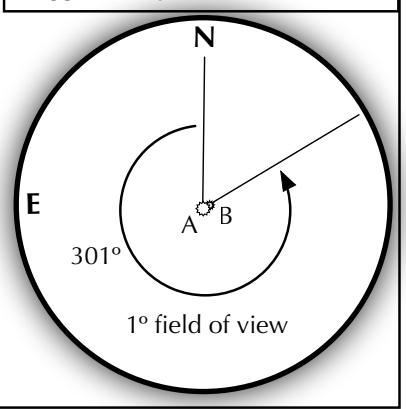
Other Suns: Eta Persei

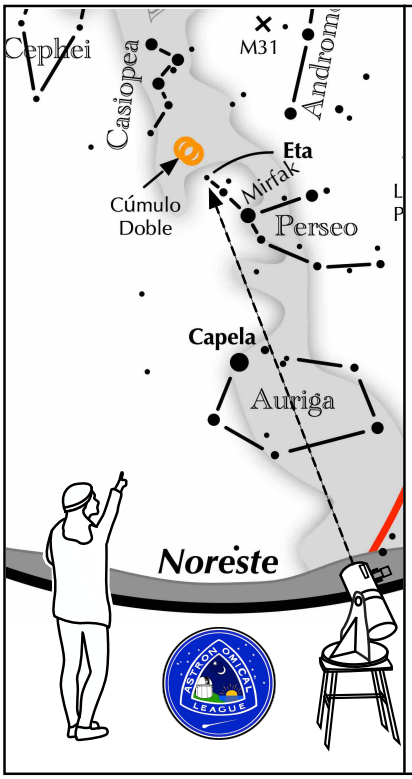
How to find Eta Persei on a November evening

Face northeast. Between bright Capella and the "W" of Cassiopeia, is the constellation Perseus. Eta Persei is not quite mid way between Mirfak, the brightest star in Perseus, and the eastern edge of the "W." It lies close to the Double Cluster.

Suggested magnification: 40x
Suggested aperture: >3 inches

Eta Persei
A-B separation: 28 sec
A magnitude: 3.8
B magnitude: 8.5
Position Angle: 301°
A & B colors:
yellow, blue





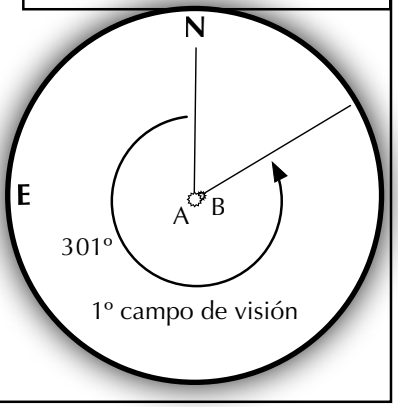
Otros Soles: Eta Persei

Cómo encontrar a Eta Persei en una tarde de noviembre

Mira al noreste. Entre la brillante Capella y la "W" de Casiopea, se encuentra la constelación de Perseo. Eta Persei no está a mitad de camino entre Mirfak, la estrella más brillante de Perseo, y el borde oriental de la "W". Se encuentra cerca del Cúmulo Doble.

Ampliación sugerida: >40x,
Apertura sugerida: >75 mm

Eta Persei
A-B separación: 28 sec
A magnitud: 3.8
B magnitud: 8.5
PA: 301°
A & B color:
amarilla, azul



2025 Astronomical League Convention Planning

The Astronomical League is a federation of astronomy clubs throughout the USA. The annual national convention of the Astronomical League, ASTROCON 2025, will be held June 25-28, 2025, under the spectacularly dark skies of Bryce Canyon National Park in southern Utah. The venue will be Ruby's Inn and Convention Center a few miles from the park entrance. A special area a few miles east of the convention center will be available for evening viewing plus astrophotography/digital imaging workshops.

The convention will include:

- Daytime workshops/presentations and evening follow-up sessions dealing with how to enhance your own personal viewing and/or astrophotography/digital imaging skills
- Social events providing opportunities to network with fellow amateurs from around the country
- Exhibitors showcasing their products and services
- Daytime solar and evening viewing opportunities
- Observing and imaging contests

Volunteers are needed to coordinate workshops for ASTROCON 2025

The convention's goal is to teach how to enhance one's personal viewing experiences through workshops and evening viewing plus opportunities to learn photography/digital imaging skills. As we are in the planning stages, we seek volunteers to help organize and present workshops.

A few ideas for workshops include:

- Setting up your own personal observing program (Including Astronomical League Observing Programs to consider)
- Observing tips including clothing, how best to use your own eyes, equipment ideas
- Using star charts (digital and paper)
- Creation of observing lists for difference types of objects
- Understanding eyepiece selection
- Using filters for visual and photographic work
- Sketching workshop
- Observing log workshop - starting and keeping your own journal
- Astrophotography/Digital Imaging workshops (novice and advanced)

Please feel free to contact us if you wish to volunteer to help with workshops, exhibitor displays or any other aspect of the convention.

Vacation in one of the most beautiful areas of the country with other national parks within a day's drive.

Registering for the convention and reserving a room is anticipated to start July 2024. Check the Astronomical League website at that time for more information.

Sincerely,

- Astrocon 2025 Planning Committee:
- Lowell Lyon, Event Coordinator, (801) 699-7283
- David Moulton, Curtis MacDonald (Utah Valley Astronomy Club)
- Aleta Cox, Marlene Egger, Jamie Bradley, Tony Sarra, Krista Lemoine, Ivo Stutznegger, Linda Lyon (Salt Lake Astronomical Society)
- Bob Cavanaugh, Convention Webmaster

RASC 2024 Observer's Handbooks (USA) and Calendars available on League Sales Web Store

The RASC 2024 Observer's Handbooks (USA version) and Calendars are available for PRE-ORDER on the League Sales web store **here**.

League Sales sells these items each fall at a fantastic price with our members in mind.

Stock will arrive in typically in November and typically ship in December in time for Christmas.

We suggest ordering early to ensure availability, as stock will be limited once the order comes in. If we have your order early, then we will order enough product for you.

If your club wants to place a group order, you will find versions of the RASC Calendar for 6+ units and for the RASC Handbook for 10+ units, both on the League Sales web store. Those will

save you a bit on the per unit cost, but also will get free shipping on the order.

Mitch Glaze, Astronomical League Office Manager

Stellar Observations

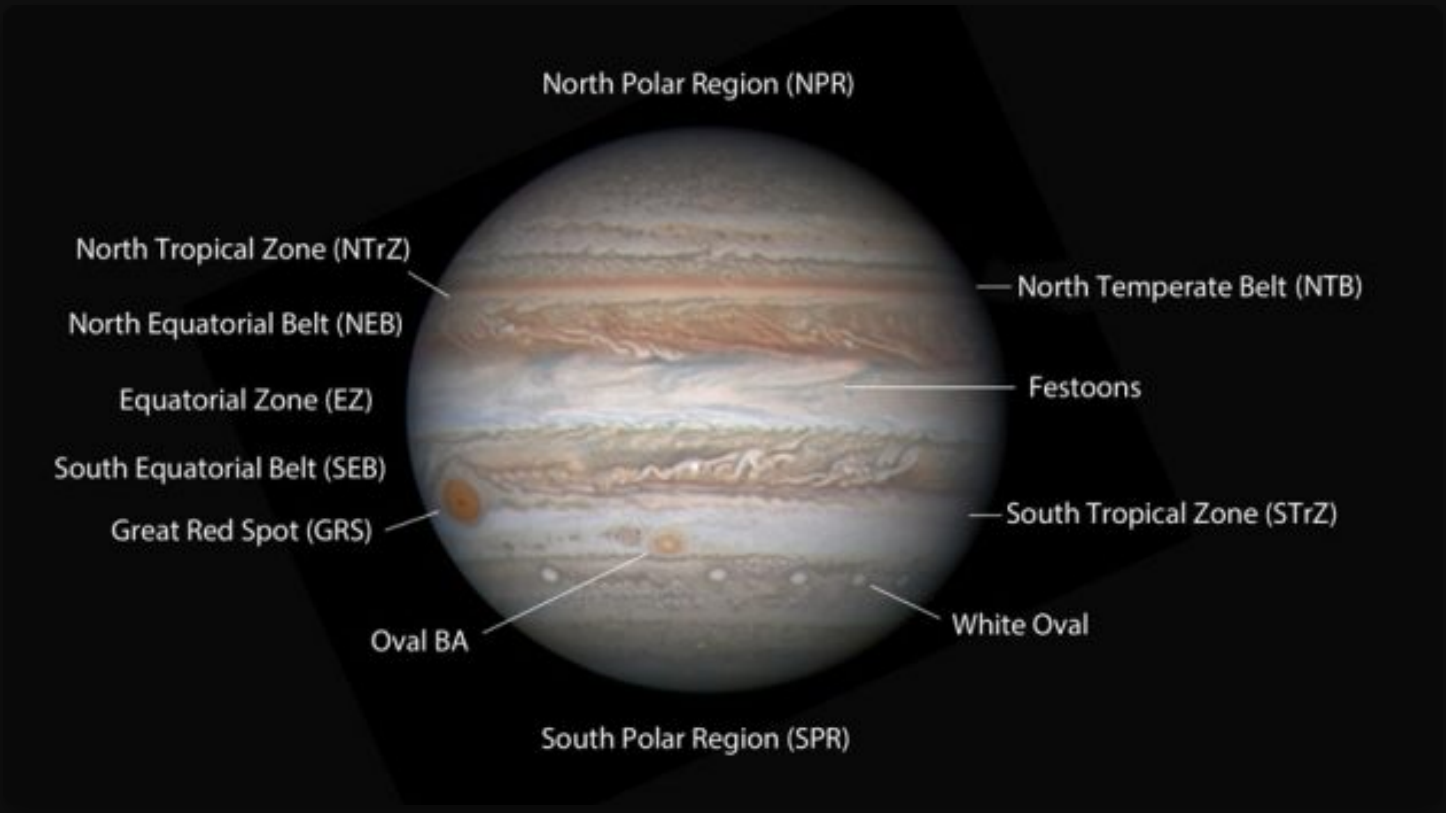
Greg Penner

King of the Planets

Jupiter will be taking center stage in November's night sky as it reaches opposition on November 3rd. Rising at sunset and crossing the meridian at midnight, Jupiter will be well-placed for viewing all night long. Virtually any type of instrument can be used to make productive observations of Jupiter and its four largest moons; Io, Europa, Ganymede and Callisto. Binoculars can show that Jupiter is a disk (measuring 49.5" across) and can see [all four] of the brightest moons. A small telescope (3-4 inch diameter) reveals the cloud bands and possibly other features such as the Great Red Spot (GRS). Much depends on the quality of the telescope and the seeing conditions. I viewed Jupiter with my 3 1/2" high quality refractor in mid-October on a night of average seeing conditions and had a nice view of the equatorial belts and a glimpse of the GRS. Larger aperture telescopes from 6" - 12" will show more detail such as "festoons," which are curved cloud formations protruding from the equatorial belts. Another unique Jovian feature is that it rotates rapidly, taking about 10

hours for a complete revolution. Over a few hours of observing, surface features will come and go. This year Jupiter will carve a path higher in the sky compared to previous years, making it easier to observe for those of us with tall hills and trees around us.

Jupiter in the November sky - Stellarium



Jupiter surface features - from Sky & Telescope article by Bob King, photo by Damian Peach

The dark bands known as the north and south equatorial belts are the most prominent features visible on Jupiter, even through small telescopes as mentioned above. The lighter bands between the belts are called zones. Jupiter's rapid rotation, high winds, and rise and fall of gases are what cause the variety of belts and zones that make up the planet's visible surface. This constantly churning atmosphere leads to the creation of cyclonic storms such as the GRS, which has been

observed on the planet's surface for centuries. The GRS does periodically go through changes visible in telescopes, sometimes appearing darker or lighter. Jet streams of opposite direction on the edges of the belts and zones cause turbulence, which in turn creates the fascinating features called garlands and festoons. These features are some of the most rewarding to glimpse through a telescope, usually requiring nights of steady seeing. Larger aperture telescopes will also bring out more of the intricate details of these features.

One of my favorite Jovian observing projects is to watch the various "phenomena" of Jupiter's moons. Every day there are interesting interactions between Jupiter's disk or shadow and the four largest moons. The types of interaction are:

- Occultation - when a moon disappears behind Jupiter's disk
- Eclipse - when a moon is eclipsed by Jupiter's shadow
- Transit - when a moon transits across the visible side of Jupiter's disk
- Shadow Transit - when a moon casts its shadow onto Jupiter

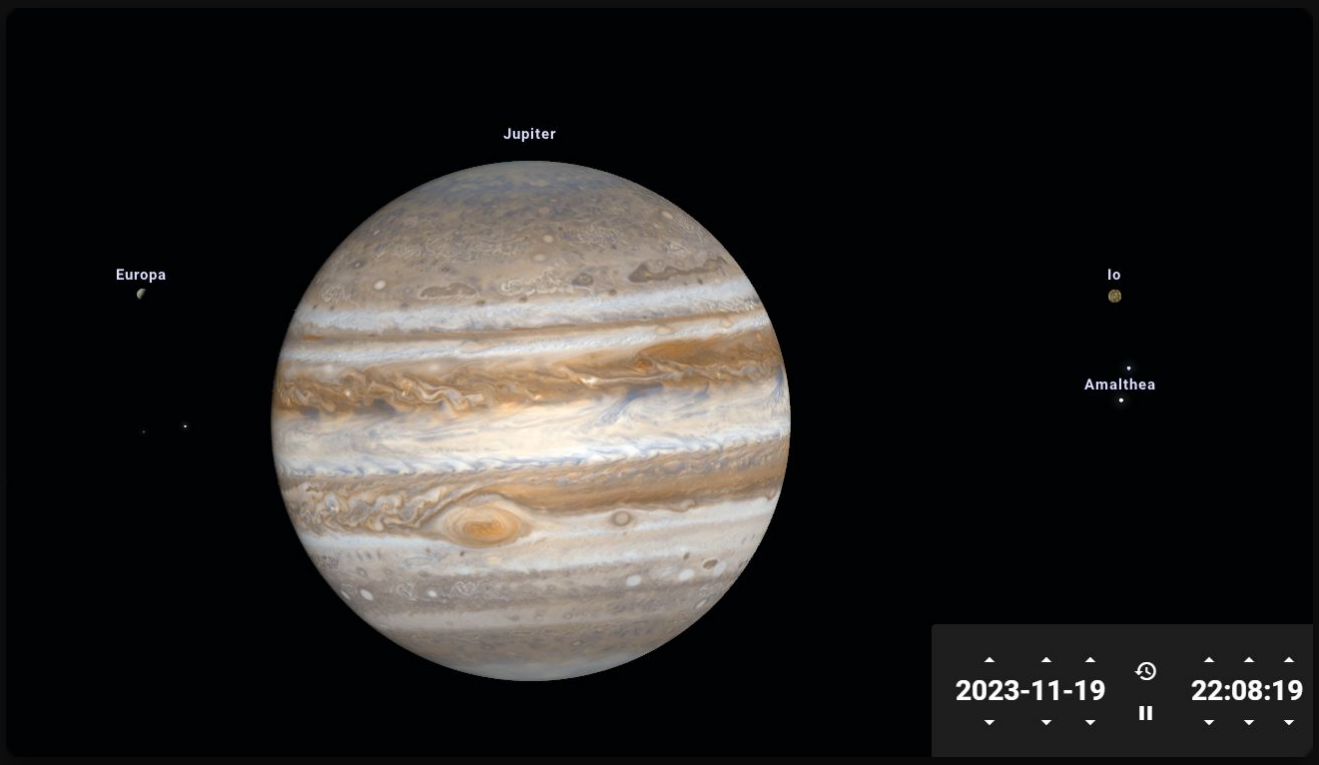
Sky & Telescope magazine has a very useful chart that appears in each issue (during months when Jupiter is visible) that lists dates/times for all of these phenomena. Also, in the same section of the magazine is a listing of times that the Great Red Spot crosses the planet's central meridian. With these two resources you can plan a fun night of observing a variety of Jovian phenomena. An image of the "Phenomena of Jupiter's Moons" chart is included in this article to illustrate how I use it to plan some observing sessions. I've circled some times on the chart for phenomena that I want to observe that coincide with times that the GRS will also be visible, so I will get a bigger payoff for my observing session.

Phenomena of Jupiter's Moons, November 2023

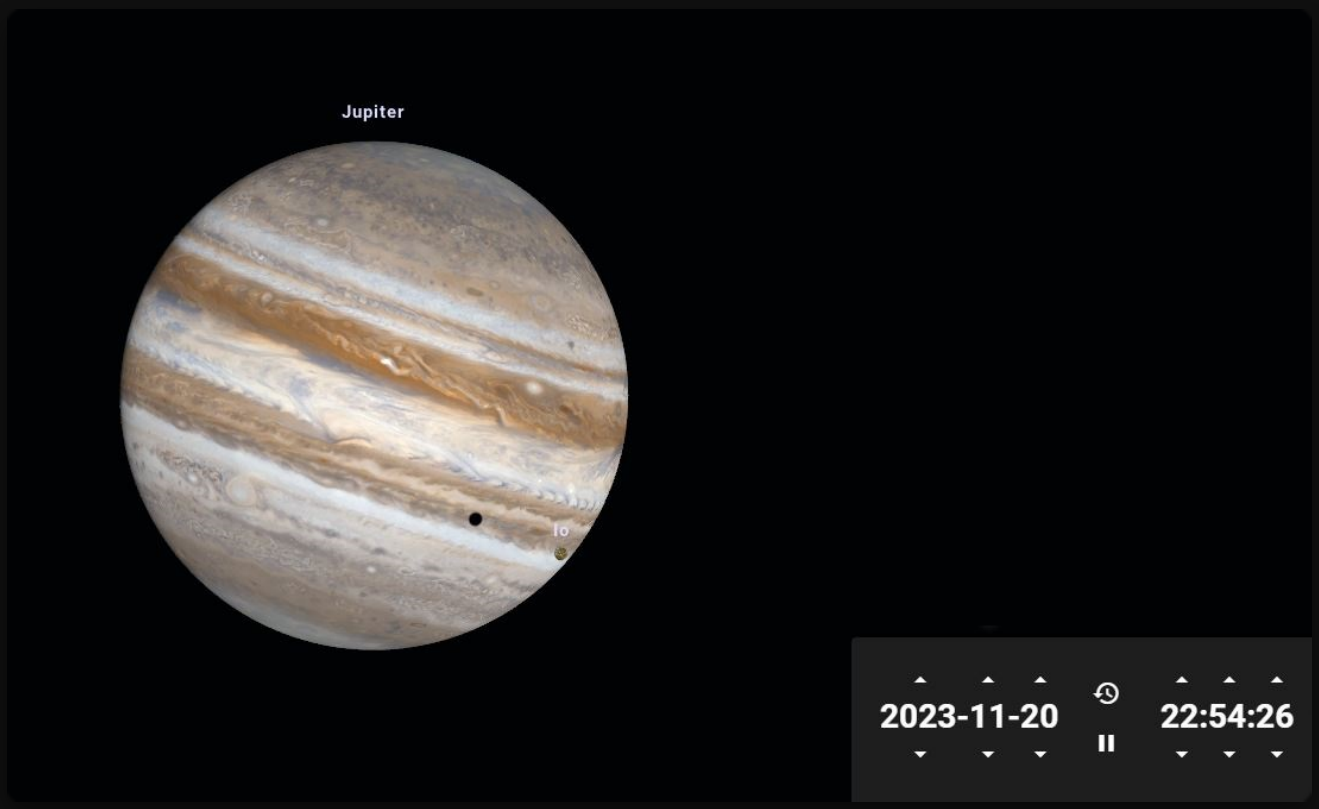
Nov. 1	14:59	I.Sh.I
	15:03	I.Tr.I
	17:10	I.Sh.E
	17:11	I.Tr.E
Nov. 2	6:12	II.Ec.D
	8:33	II.Ec.R
	12:19	I.Ec.D
	14:29	I.Oc.R
Nov. 3	9:28	I.Sh.I
	9:29	I.Tr.I
	11:37	I.Tr.E
	11:38	I.Sh.E
	13:59	III.Sh.I
	14:18	III.Tr.I
	15:18	III.Tr.E
	15:42	III.Sh.E
Nov. 4	1:15	II.Sh.I
	1:15	II.Tr.I
	3:28	II.Tr.E
	3:34	II.Sh.E
	6:47	I.Oc.D
	8:58	I.Ec.R
Nov. 5	3:54	I.Tr.I
	3:57	I.Sh.I
	6:03	I.Tr.E
	6:07	I.Sh.E
	19:26	II.Oc.D
	21:52	II.Ec.R
Nov. 6	1:12	I.Oc.D
	3:26	I.Ec.R
	22:20	I.Tr.I
	22:26	I.Sh.I
Nov. 7	0:29	I.Tr.E
	0:36	I.Sh.E
	3:44	III.Oc.D
	5:36	III.Ec.R
	14:22	II.Tr.I
	14:33	II.Sh.I
	16:35	II.Tr.E
	16:52	II.Sh.E
	19:38	I.Oc.D
	21:55	I.Ec.R
Nov. 8	16:46	I.Tr.I
	16:54	I.Sh.I
	18:55	I.Tr.E
	19:05	I.Sh.E
Nov. 9	8:33	II.Oc.D
	11:11	II.Ec.R
	14:04	I.Oc.D
	16:24	I.Ec.R
Nov. 10	11:12	I.Tr.I
	11:23	I.Sh.I
	13:21	I.Tr.E
	13:34	I.Sh.E
	17:31	III.Tr.I
	18:02	III.Sh.I
	18:37	III.Tr.E
	19:44	III.Sh.E
Nov. 11	3:28	II.Tr.I
	3:51	II.Sh.I
	5:42	II.Tr.E
	6:10	II.Sh.E
	8:30	I.Oc.D
	10:52	I.Ec.R
Nov. 12	5:38	I.Tr.I
	5:52	I.Sh.I
	7:47	I.Tr.E
	8:02	I.Sh.E
	21:41	II.Oc.D
Nov. 13	0:30	II.Ec.R
	2:56	I.Oc.D
	5:21	I.Ec.R
Nov. 14	0:04	I.Tr.I
	0:21	I.Sh.I
	2:13	I.Tr.E
	2:31	I.Sh.E
	6:56	III.Oc.D
	9:36	III.Ec.R
	16:35	II.Tr.I
	17:08	II.Sh.I
	18:49	II.Tr.E
	19:28	II.Sh.E
	21:22	I.Oc.D
	23:50	I.Ec.R
Nov. 15	18:30	I.Tr.I
	18:50	I.Sh.I
	20:39	I.Tr.E
	21:00	I.Sh.E
Nov. 16	10:48	II.Oc.D
	13:49	II.Ec.R
	15:48	I.Oc.D
	18:18	I.Ec.R
Nov. 17	12:56	I.Tr.I
	13:18	I.Sh.I
	15:05	I.Tr.E
	15:29	I.Sh.E
	20:44	III.Tr.I
	21:57	III.Tr.E
	22:04	III.Sh.I
	23:45	III.Sh.E
Nov. 18	5:42	II.Tr.I
	6:26	II.Sh.I
	7:56	II.Tr.E
	8:46	II.Sh.E
	10:14	I.Oc.D
	12:47	I.Ec.R
Nov. 19	7:22	I.Tr.I
	7:47	I.Sh.I
	9:31	I.Tr.E
	9:58	I.Sh.E
	23:56	II.Oc.D
Nov. 20	3:08	II.Ec.R
	4:40	I.Oc.D
	7:16	I.Ec.R
Nov. 21	1:49	I.Tr.I
	2:16	I.Sh.I
	3:58	I.Tr.E
	4:26	I.Sh.E
	10:10	III.Oc.D
	11:30	III.Oc.R
	11:54	III.Ec.D
	13:37	III.Ec.R
	18:49	II.Tr.I
	19:44	II.Sh.I
	21:03	II.Tr.E
	22:03	II.Sh.E
	23:06	I.Oc.D
Nov. 22	1:45	I.Ec.R
	20:15	I.Tr.I
	20:45	I.Sh.I
	22:24	I.Tr.E
	22:55	I.Sh.E
Nov. 23	13:04	II.Oc.D
	16:27	II.Ec.R
	17:32	I.Oc.D
	20:13	I.Ec.R
Nov. 24	14:41	I.Tr.I
	15:14	I.Sh.I
	16:50	I.Tr.E
	17:24	I.Sh.E
Nov. 25	0:00	III.Tr.I
	1:20	III.Tr.E
	2:06	III.Sh.I
	3:47	III.Sh.E
	7:57	II.Tr.I
	9:02	II.Sh.I
	10:11	II.Tr.E
	11:21	II.Sh.E
	11:58	I.Oc.D
	14:42	I.Ec.R
Nov. 26	9:07	I.Tr.I
	9:43	I.Sh.I
	11:17	I.Tr.E
	11:53	I.Sh.E
Nov. 27	2:13	II.Oc.D
	5:47	II.Ec.R
	6:24	I.Oc.D
	9:11	I.Ec.R
Nov. 28	3:34	I.Tr.I
	4:12	I.Sh.I
	5:43	I.Tr.E
	6:22	I.Sh.E
	13:27	III.Oc.D
	14:53	III.Oc.R
	15:55	III.Ec.D
	17:38	III.Ec.R
	21:04	II.Tr.I
	22:20	II.Sh.I
	23:20	II.Tr.E
Nov. 29	0:39	II.Sh.E
	0:51	I.Oc.D
	3:39	I.Ec.R
	22:00	I.Tr.I
	22:41	I.Sh.I
Nov. 30	0:10	I.Tr.E
	0:51	I.Sh.E
	15:21	II.Oc.D
	19:06	II.Ec.R
	19:17	I.Oc.D
	22:08	I.Ec.R

Every day, interesting events happen between Jupiter's satellites and the planet's disk or shadow. The first columns give the date and mid-time of the event, in Universal Time (which is 5 hours ahead of Eastern Standard Time). Next is the satellite involved: **I** for Io, **II** Europa, **III** Ganymede, or **IV** Callisto. Next is the type of event: **Oc** for an occultation of the satellite behind Jupiter's limb, **Ec** for an eclipse by Jupiter's shadow, **Tr** for a transit across the planet's face, or **Sh** for the satellite casting its own shadow onto Jupiter. An occultation or eclipse begins when the satellite disappears **(D)** and ends when it reappears **(R)**. A transit or shadow passage begins at ingress **(I)** and ends at egress **(E)**. Each event is gradual, taking up to several minutes. Predictions courtesy IMCCE / Paris Observatory.

Phenomena of Jupiter's Moons - chart from Sky & Telescope



Europa reappearing from eclipse by Jupiter's shadow on 11/19/23 - Stellarium



Io transit and shadow on Jupiter's surface on 11/20/23 - Stellarium

In addition to making some fun observations of Jupiter and its moons, we can also follow what science missions are in the works for the king of the planets and his accompanying moons. The Juno mission was launched in 2011 and has been at Jupiter since 2016 studying the planet's weather, magnetic environment, and formation history. Juno is still active and has recently been doing close fly-bys of the moons Io and Europa. You can see the latest news about Juno by following this **link**. The European Space Agency (ESA) recently launched JUICE or Jupiter Icy Moons Explorer on April 14, 2023. JUICE will be studying Jupiter and three of its icy moons, Europa, Ganymede and Callisto. During the mission, the spacecraft will actually enter into orbit around Ganymede, the Solar System's largest moon. This will be the first time a spacecraft has orbited a moon other than Earth's Moon. You can learn more about the JUICE mission **here**.

A little less than a year from now, NASA is scheduled to launch its Europa Clipper probe on October 6, 2024. This $5 billion spacecraft will explore Europa and try to determine if its

underground ocean is habitable. If everything goes according to plan, it will reach Jupiter in April of 2030 and enter into a long, elliptical orbit taking it far away from the intense Jovian radiation. The spacecraft will make about 50 close fly-bys of Europa in an attempt to study nearly the entire surface of the icy moon. You can follow the Europa Clipper mission **here**.

November will be a great month to get out whatever equipment you have to get an up-close view of Jupiter and its "mini Solar System" of moons. Perhaps you can share the view with a neighbor or friend who has never seen the sight that Galileo first viewed centuries ago that changed our understanding of the Cosmos!

The Queen Speaks

Robin Byrne

Happy Birthday Christian Doppler

This month, we celebrate the life of a man whose discovery has come in handy in many different ways. Christian Andreas Doppler was born November 29, 1803 in Salzburg, Austria. Despite coming from a long line of stonemasons, because of being sickly most of his life, Christian pursued a different career path.

Christian started school in Salzburg, and then moved on to a secondary school in Linz. On the advice of one of his teachers, who felt Christian had a talent for mathematics, Doppler's parents sent him to the Vienna Polytechnic Institute in 1822, where he excelled. After graduating in 1825, Doppler attended the Salzburg Lyceum and then the University of Vienna to study mathematics, astronomy, and mechanics. He graduated in 1829.

Doppler's first job after graduation was as an assistant to one of the professors of mathematics at the University of Vienna, Professor A. Burg. During his four years as Burg's assistant,

Doppler worked on his own research, and published four papers in the field of mathematics. At this point, Doppler was 30 years old, and felt he should have a more substantial job, so he left the university.

Photographic portrait of Christian Doppler (1803-1853)

However, it turns out that finding a new position was not going to be easy. So, in the interim, Doppler worked as a bookkeeper in a factory that spun cotton. After 18 months of this dreary occupation, Doppler was afraid that there was no hope of finding a position, so he started to make plans to emigrate to the United States. Just as it looked like he was ready to go, a job offer as a math teacher at the Technical Secondary School in Prague arose. Starting in March of 1835, he took the job. However, he didn't really enjoy teaching high school level mathematics.

In 1836, Doppler married Mathilde Sturm. Over the next nine years, they would have five children: two daughters and three sons. Now that he had a family to support, for some extra money, Doppler began teaching a course on a part-time basis for the Prague Polytechnic Institute.

Despite his talents, Doppler was not well-regarded by his fellow mathematicians, which made his attempts to get better positions difficult. Bernard Bolzano, a well-regarded

mathematician of the time, was one of the few who saw Doppler's potential. Bolzano wrote of Doppler,

> Mr. Doppler has already demonstrated his very promising abilities to the scientific community through his numerous published works in mathematics and physics. The expectations raised by his hitherto published works would multiply when one enters into personal acquaintance with him. You are not only struck by how many highly interesting and fruitful ideas ... that so young a scientist is able to produce, but you also convince yourself with the greatest pleasure that this exceptional spiritual power combines with an amiable character ... and with that pure love of science and truth ...

Perhaps because of the endorsement from Bolzano, in 1837, Doppler was hired by the Prague Polytechnic Institute as an Associate Professor of Mathematics. Four years later, he was promoted to Full Professor.

In 1842, Christian Doppler first wrote about the effect which now carries his name. In a paper titled "On the colored light of

binary stars and some other stars in the heavens," he proposed that the frequency or wavelength of light is affected by both the motion of the object emitting the light and by the motion of the observer. He used the analogy of a ship traveling out to sea. As the ship meets the water waves approaching shore, the ship encounters the waves at a higher frequency than if stationary. Similarly, if the ship is moving toward the shore, then it will encounter the waves at a lower frequency. In the paper, he predicted that,

> It is almost to be accepted with certainty that this will, in the not too distant future, offer astronomers a welcome means to determine the movements and distances of such stars which ... until this moment hardly presented the hope of such measurements and determinations.

Doppler knew that both sound and light travel as waves, so he tested his hypothesis using sound. Employing the skills of two trumpet players, one rode on a moving train, while the other remained stationary on the train platform. Both blew the same

note. However, the trumpet on the train was heard as a higher pitch as the train approached, and a lower pitch as the train departed. Doppler, incorrectly, supposed that this same effect could also explain why stars appear different colors. Despite this idea being wrong, Doppler was correct about the motion changing the observed wavelength and frequency.

During this time, Doppler was still teaching at the Polytechnic Institute, but it was a grueling job. His duties included giving written and oral exams to hundreds of students at a time, and the students often complained that he was overly difficult and graded harshly. Doppler was reprimanded by the school's administration, and the students were allowed to retake their exams. Doppler felt this was unjust and demanded that the reprimand be withdrawn. In 1844, the reprimand was withdrawn, but by this time his poor health was in decline, and Doppler had to take a leave of absence for two years.

Doppler continued publishing papers over the years, with over 50 articles on mathematics, astronomy, and physics attributed

to him during this time. After his return to the Polytechnic Institute, Doppler was not enthusiastic about continuing there considering his earlier harsh treatment, so he began looking for a new position. In 1847, he moved to the Academy of Mines and Forests in Banska Stiavnica, Hungary as Professor of Mathematics, Physics, and Mechanics.

Unfortunately, less than a year after moving to his new position, the Hungarian Revolution broke out. Surrounded by unrest and battles, Doppler sought refuge in Vienna in 1849. There, he was appointed the first director of the Institute of Physics at Vienna University.

Less than two years after moving to Vienna, Doppler's continuously declining health took a further turn for the worse. His lungs, long since damaged by the dust he inhaled as a child in his father's stonemasonry shop, began to fail. In November of 1852, Doppler went to Venice, in the hope that the climate there would help him to improve. Within a month, it was clear that he was not getting any better. His wife had, at first,

remained in Vienna with their children, but his deterioration reached the point where she knew he wouldn't survive. She joined him in Venice, and was with him when he died on March 17, 1853.

Christian Doppler's legacy of the Doppler Shift continues to be a useful tool in so many ways. For astronomers, the ability to measure how fast distant objects in space move is remarkable, and allows us to determine the masses of planets and stars, discover planets orbiting other stars, and determine the distance to galaxies in the far reaches of the universe. Meanwhile, here on Earth, the Doppler Effect is used by meteorologists to monitor the weather and better make predictions for impending tornadoes and other severe storms. And, perhaps unfortunately for some, police find it very useful in measuring how fast your car is traveling, so that they can more accurately determine how big your speeding fine should be.

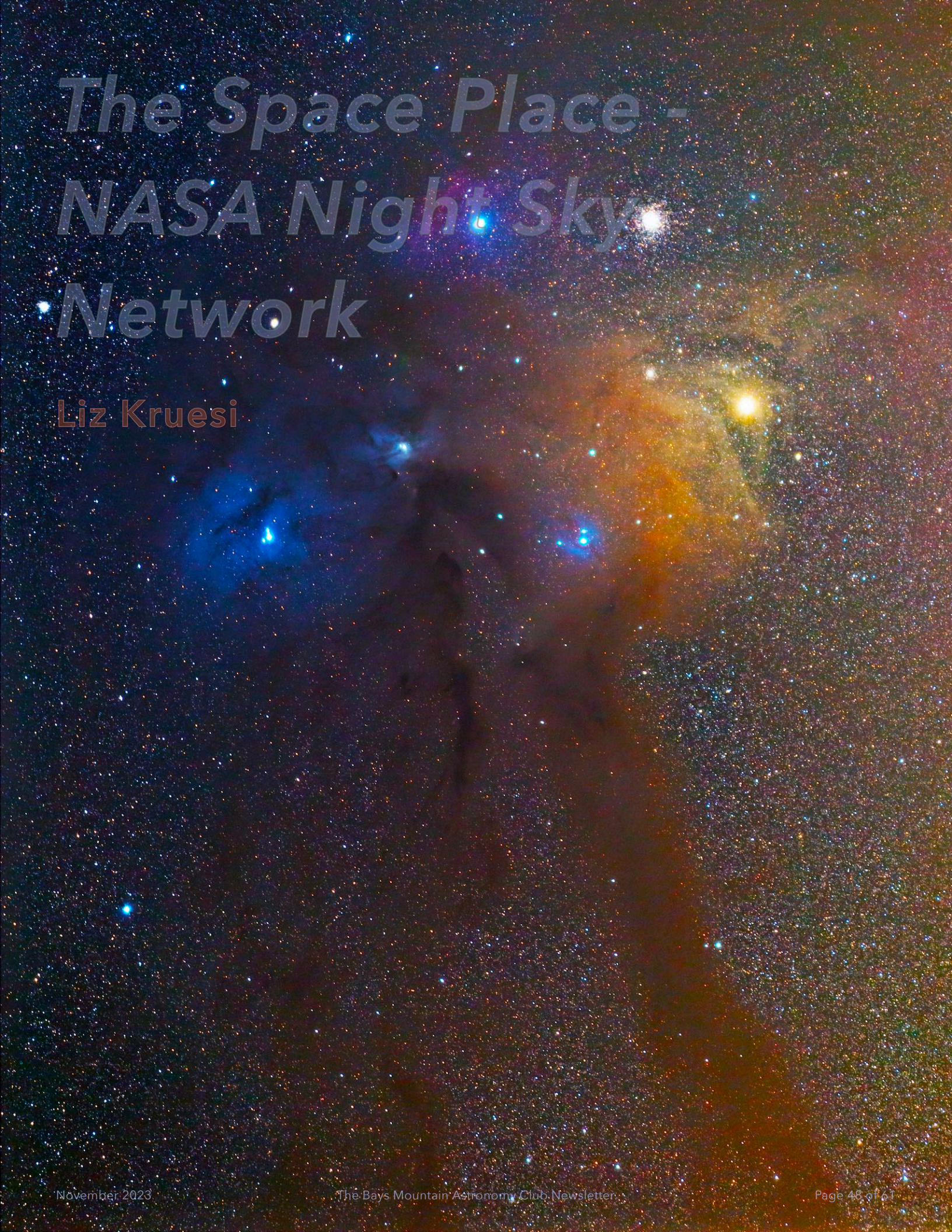
While that last application may make some of you wince, for the most part, this phenomenon first proposed by Christian Doppler is an amazingly useful and versatile tool, that can be used by a wide range of professions. So when you are out gazing at galaxies through a telescope, and you read about how far away they are, odds are that the reason we know that distance is partly thanks to this month's honoree - Christian Doppler.

References:

Christian Doppler - **Wikipedia**

Christian Andreas Doppler - MacTutor, Written by J J O'Connor and E F Robertson, April 1998

The Discovery of the Doppler Effect - European Space Agency, September 2019

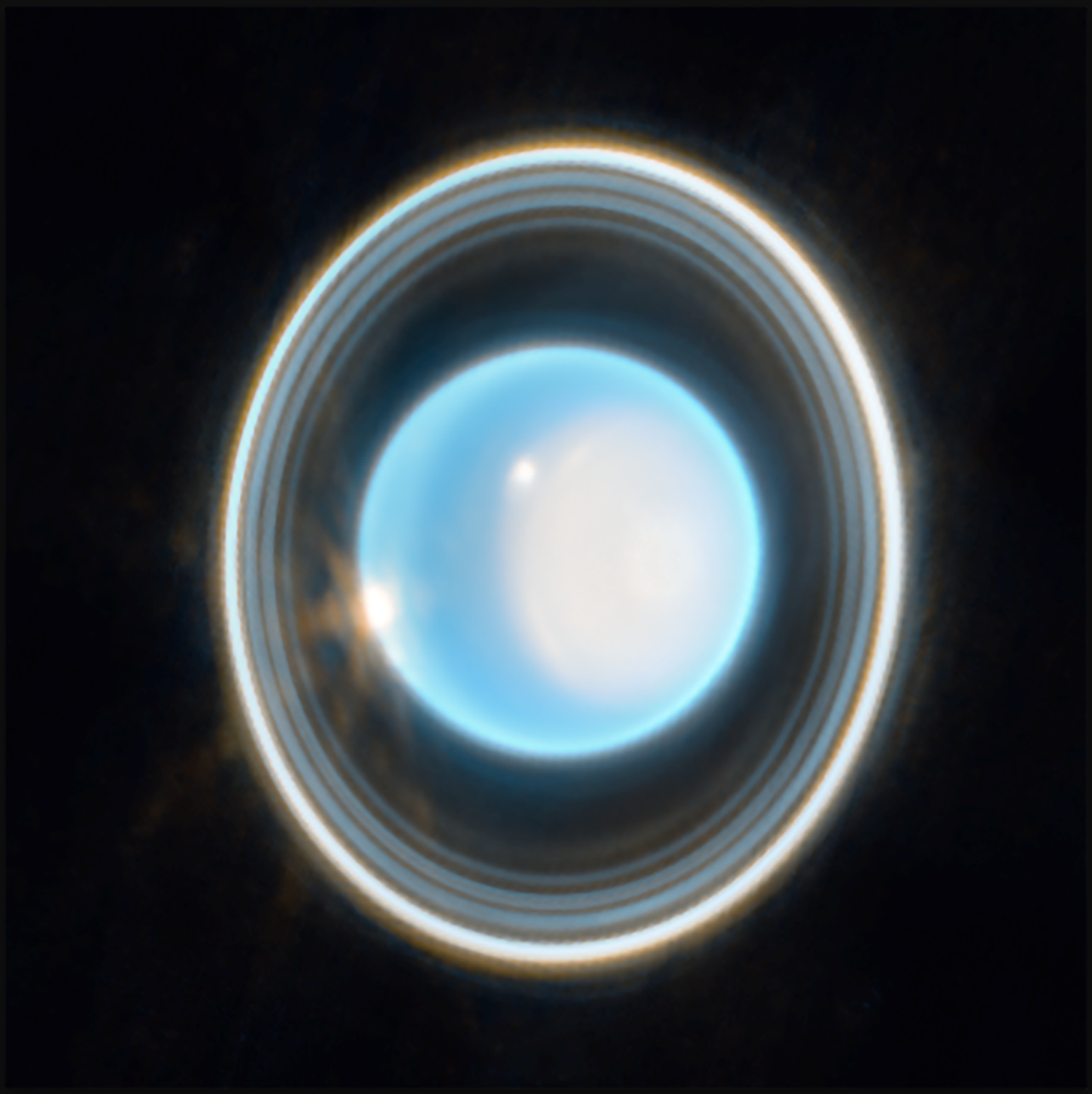


The Space Place - NASA Night Sky Network

Liz Kruesi

Spy the Seventh Planet, Uranus

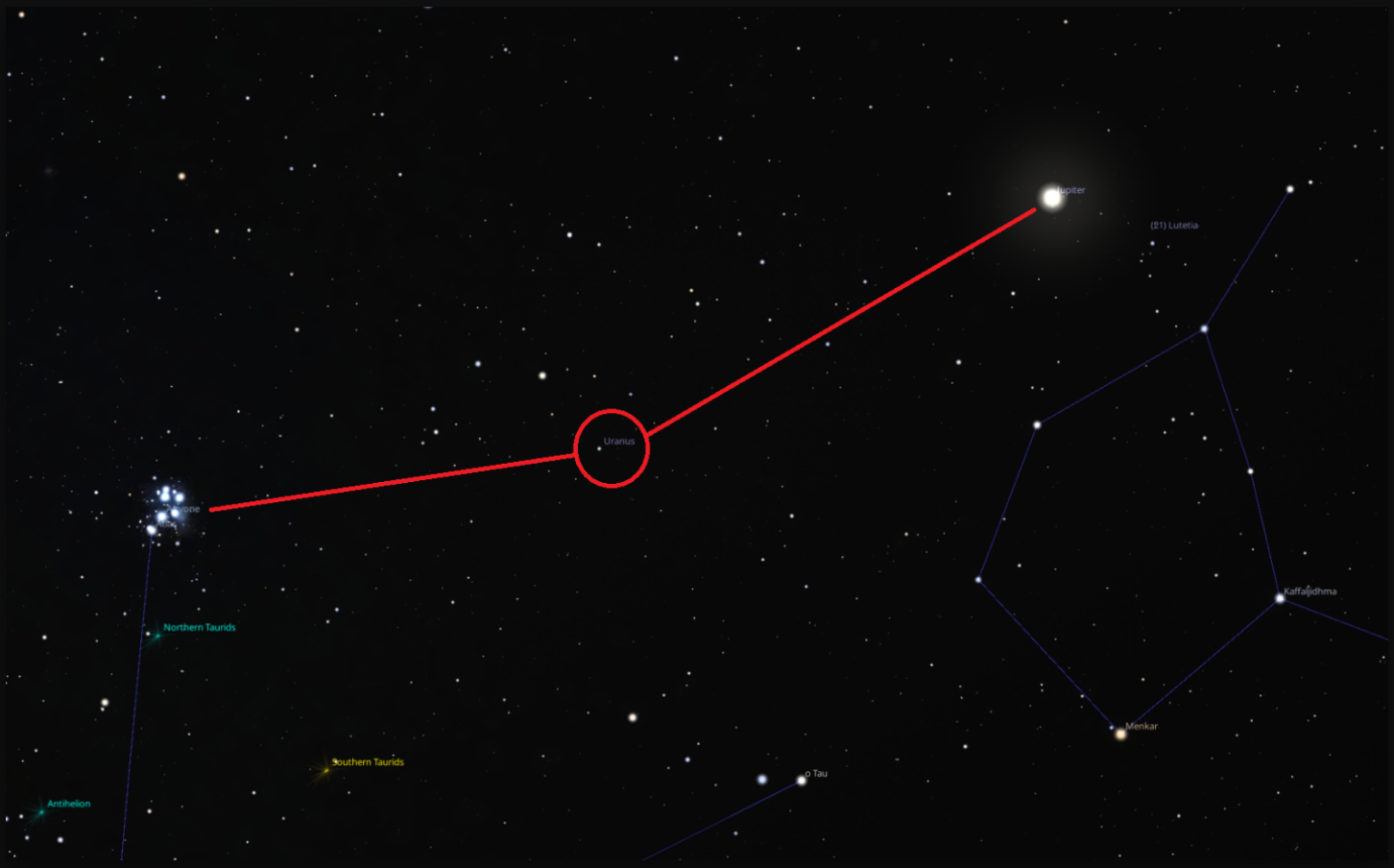
You might be familiar with Saturn as the Solar System's ringed planet, with its enormous amount of dust and ice bits circling the giant planet. But Uranus, the next planet out from the Sun, hosts an impressive ring system as well. The seventh planet was the first discovered telescopically instead of with unaided eyes, and it was astronomer extraordinaire William Herschel who discovered Uranus March 13, 1781. Nearly two centuries passed before an infrared telescope aboard a military cargo aircraft revealed the planet had rings in 1977.



Uranus hosts 13 faint rings, 11 of which are visible in this JWST image. The planet was 19.67 times the Earth-Sun distance from our planet (1.83 billion miles) when JWST captured exposures through two near-Infrared filters on February 6, 2023. The white region in the right side of Uranus is one of the planet's polar caps. This icy world orbits the Sun differently from the rest of the solar system's planets – Uranus rolls along on its side.
[NASA, ESA, CSA, STScI; Image Processing: Joseph DePasquale (STScI)]

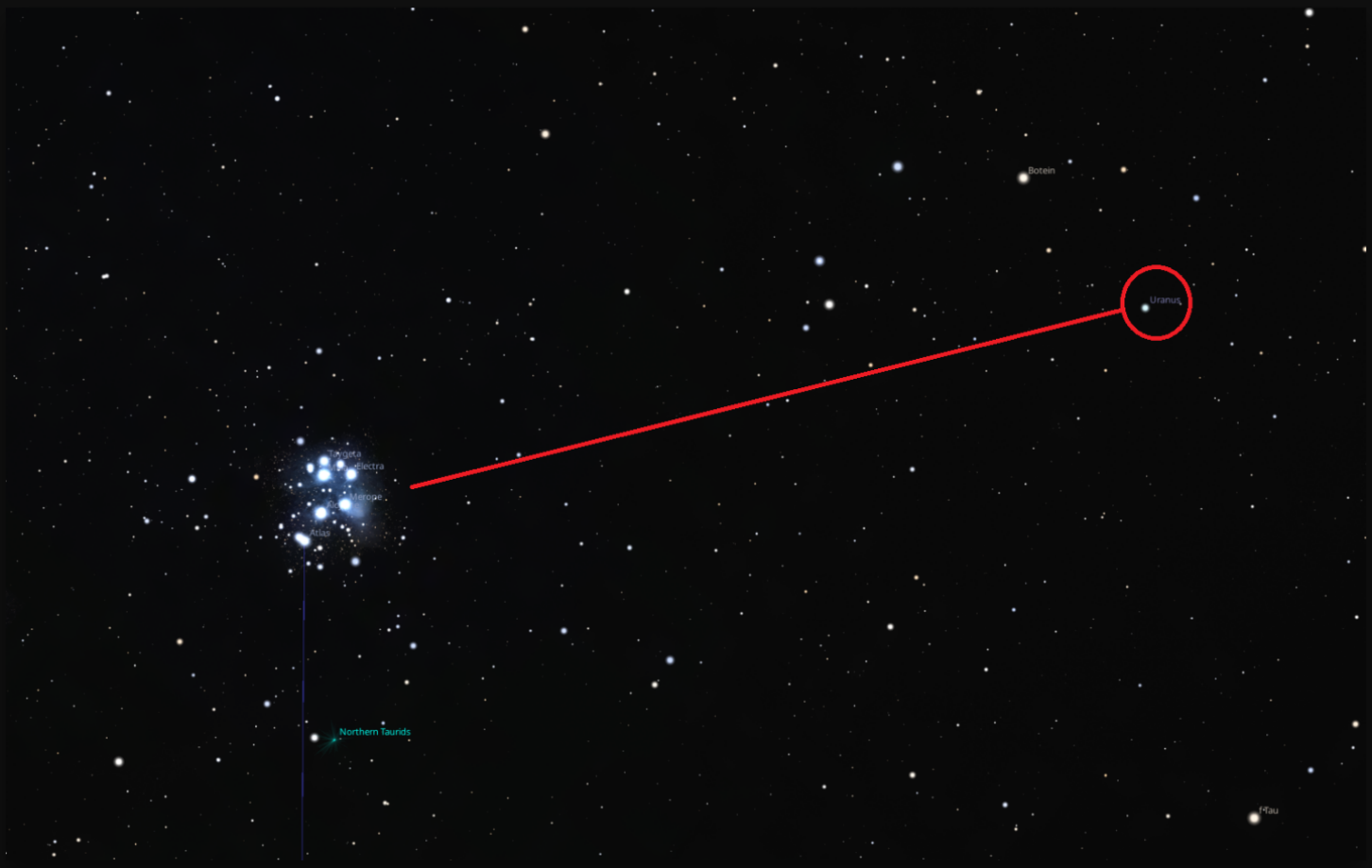
Since that discovery, multiple observatories have revealed more details of Uranus and its ring system. Most recently, the NASA-led JWST space observatory captured the planet and its rings in detail. This recent **image** combines just 12 minutes of exposure in two filters to reveal 11 of the planet's 13 rings. Even some of the planet's atmospheric features are visible in this image. Even with advanced imaging like that from JWST, much of Uranus remains a mystery, including why it orbits the Sun on its side. This is because only one spacecraft has ever visited this planet: NASA's **Voyager 2**, which flew by the distant planet in the mid-1980s.

Planetary scientists are hoping to change that soon, though. Scientists recommended in a **report** released last year from the National Academies of Sciences, Engineering, and Medicine that Uranus be the focus on the next big planetary science spacecraft mission. Such a large-scale mission would gain insight into this icy giant planet and the similar Solar System planet, Neptune.



Sky map picturing M45, Uranus and Jupiter, Stellarium

If you want to catch a view of Uranus with your own eyes, now is prime time to view it. This ice giant planet lies perfectly positioned in mid-November, at so-called “opposition,” when its position in its orbit places it on the other side of the Sun from Earth. That location means our star’s light reflects off Uranus’ icy atmosphere, and the planet appears as its brightest.



Sky map picturing M45 and Uranus, Stellarium

To find it, look overhead just after midnight on November 13. Uranus will lie about halfway between the brilliant planet Jupiter and the diffuse glow of the Pleiades star cluster (M45). While Uranus may look like a bright blinking star in the night sky, its blue-green hue gives away its identity. Binoculars or a telescope will improve the view.

For more about this oddball planet, visit NASA's Uranus **page**.

This article is distributed by NASA Night Sky Network

The Night Sky Network program supports astronomy clubs across the USA dedicated to astronomy outreach. Visit **nightsky** to find local clubs, events, and more!

BMAC Calendar & More

Calendar:

MAC Meetings:

- Friday, December 1, 2023 - 7p - Topic TBA.
- Friday, February 2, 2024 - 7p - Topic TBA.
- Friday, March 1, 2024 - 7p - Topic TBA.
- Friday, April 12, 2024 - 7p - Topic TBA.
- Friday, May 3, 2024 - 7p - Topic TBA.
- Friday, June 7, 2024 - 7p - Topic TBA.
- Friday, August 2, 2024 - 7p - Topic TBA.

SunWatch:

- Every clear Saturday & Sunday - 3p-3:30p - March-October - By the Dam
  - View the Sun safely with a white-light view if clear.; Free.
  - You must have completed the Park Volunteer Program in order to help with the public program. If you have, and have been trained, please show up at least 30 minutes prior to the official start time.

StarWatch:

- November 4, 2023 - 7p
- November 11, 18 & 25, 2023 - 6p
  - View the night sky with large telescopes at the observatories. If poor weather, an alternate live tour of the night sky will be held in the planetarium theater. Free.
  - You must have completed the Park Volunteer Program in order to help with the public program. If you have, and have been trained, please show up at least 30 minutes prior to the official start time.

pecial Events:

- **BMAC Dinner - January 2024 - Day & Time TBD**
  - Look for an e-mail with the latest information.
- **Astronomy Day - May 18, 2024 - 1p-4p; 8:30p-9:30p**
  - Come help share the fun of astronomy with the public. There will be tables with different themed topics plus solar and night viewing.
- **Annual Club Picnic - July 2024**
  - Date and site location will be sent directly to full BMAC members. BMACers and their families are welcome to enjoy an evening of astronomy-themed games and activities along with a potluck dinner and observing.
- **StarFest 2024 - November 2024**
  - Our 39th annual astronomy convention / star gathering for the Southeast United States. Three days of astronomy fun, 5 meals, 4 keynote speakers, unique T-shirt and more!
  - **Pre-registration by Oct. 2024 with full payment is mandatory for attendance. Sorry, no walk-ins nor "visits."**
  - Link for all the StarFest info including registration and hotel reservation links.

Regular Contributors:

William Troxel

Robin Byrne

Greg Penner

Adam Thanz

William is the current chair of the club. He enjoys everything to do with astronomy, including sharing this exciting and interesting hobby with anyone that will listen! He has been a member since 2010.

Robin Byrne has been writing the science history column since 1992 and was chair in 1997. She is an Associate Professor of Astronomy & Physics at Northeast State Community College (NSCC).

Greg Penner is a semi-retired architect living in the Tri-Cities area since 2018. He has enjoyed astronomy since childhood when he received a “department store telescope” and viewed Saturn for the first time. He has been a member since 2018.

Adam Thanz has been the BMAC Newsletter Editor for all but a small number of issues since 1992. He is the Planetarium Director at Bays Mountain Park and an astronomy adjunct instructor at NSCC since 2000.

Connection:

Bays Mountain Astronomy Club:

- 853 Bays Mountain Park Road; Kingsport, TN 37650
- (423) 229-9447 - **Park Site** - **Club Site**
- Newsletter edited by **Adam Thanz**

Dues:

- Dues are highly supplemented by the Bays Mountain Park Association and volunteerism by the club. As such, our dues are kept at an extremely low cost.
- $16 / person / year
- $6 / each additional family member
- Note: if you are a Park Member (which incurs a separate, additional fee), then a 50% reduction in BMAC dues are applied.
- Dues can be paid in many ways. The easiest way is to pay via the CivicRec online portal. If you are a current member, please log in with your e-mail address and reset your password if you have not already done so. You can then update your membership. Here's the direct **link**. If you want to add family members, then add them via the internal link. You can also pay at the gift shop, by mail or over the phone.

Chapter Background Image Credits:

- **Cover image of Southern Milky Way by Adam Thanz.**
  - *Sony A7ii with Zeiss Batis 2.8/18 lens, f/2.8, 8 sec., ISO 6,400, August 9, 2020.*
- **Table of Contents image of Comet NEOWISE (C/2020 F3) by Adam Thanz**
  - *Sony A7ii with Sony FE 2.8/90 Macro G OSS lens, f/2.8, 8 sec., ISO 4,000, July 15, 2020.*
- **Cosmic Reflections image of the Summer Triangle area of the Milky Way by William Troxel.**
  - *Image captured July 23, 2016.*
- **BMAC Notes painting of the Moon with moon glow by Christa Cartwright.**
  - *Painting based on a photograph of the Moon Christa captured July 2020.*
- **Stellar Observations image of Crescent Nebula by David Reagan.**
  - *This image was taken with a 140mm refractor in his suburban backyard using an AstroPhysics 900 mount, 8.7 hours of 5 minute Ha and OIII subexposures, combined in AstroPixelProcessor as an HOO image and processed in Lightroom and Photoshop. Image captured in 2022.*
- **The Queen Speaks image of a solar halo by Robin Byrne.**
  - *iPhone 7, June 8, 2020.*
- **The Space Place - NASA Night Sky Network image of the Rho Ophiuchi cloud complex by Brandon Stroupe.**
  - *Canon 6D with Canon 2.8/70-200mm lens, f/2.8 @200mm, 20 x 120 sec. exposures, ISO 1,000, stacked in Deepsky Stacker, processed in Adobe Photoshop CC, Skywatcher Star Adventure mount, September 19, 2015.*
- **BMAC Calendar & More image of the Moon by Greg Penner.**
  - *iPhone shooting through a 9mm eyepiece and 12.5" Truss Tube Dobsonian @212x.*
- **All background images used with permission by their authors.**