RochesterSkies

Issue #33 Winter Edition ©2023

Rochester Astronomy Club Founded in 1997

As we enter the winter season in Minnesota, we must prepare for the frosty nights ahead. The clear skies may be perfect for observing, but staying warm in these freezing temperatures is crucial. To ensure a comfortable and safe stargazing experience, taking the necessary measures to keep yourself warm is essential. Here are some helpful tips to keep in mind.

Winter Issue

1. Avoid wearing cotton or polyester/cotton blends as underwear or socks in cold weather. Instead, opt for thick polypropylene long johns or arctic-weight wool/polypropylene blend long johns. *Cotton does not wick sweat away from your skin*, leading to rapid loss of body heat and increasing the risk of hypothermia.

2. Dressing in layers is recommended, with multiple thin garments that trap heat better than a few thick ones. For temperatures below 25 degrees, it is recommended to wear the following:

- **W**ool / polypropylene or polypropylene long johns[link] (two Pairs for subzero temperatures.
- **P**olypropylene sock liners[link]
- Wool socks[link] (one or two pairs)
- **A** flannel shirt[link] (a synthetic fleece shirt would be even better)
- **J**eans (synthetic fleece pants[link] would be even better)
- **W**ool sweater[link]
- **F**leece layering jacket[link]
- **D**own-filled bibs[link]

- **D**own parka[link] **(rated to -40** degrees **with the bibs)**
- **B**alaclava[link]
- **W**ool/Thinsulate watch cap[link]
- Wool fingerless gloves[link]
- **P**ac boots[link] (rated to -40 degrees or -100 degrees for cold weather or snowy conditions)

3. Always bring extra layers for changing weather conditions. Add or remove layers as needed for temperature and activity level. Wait to put on heavy gear until ready to start, and adjust layers if feeling too warm or cold.

4. Cold feet and hands are a symptom of falling body temperature. The brain redirects blood from extremities to vital organs, and adding layers or drinking something hot can help.

continue

RAC Events

For more information go to *Rochesterskies.org*

NOV 5 *Sun* Standard time begins at 2 am.

NOV 14 *Tue* Monthly Club Meeting @ RCTC 7-9 pm.

NOV 17 *Fri* Public Presentation: ***Are we Alone?*** & Sky Observing @ Oxbow Park 6-7:30 pm.

RAC
Rochester Astronomy Club

DEC 15 *Fri* Public Presentation: ***Radio Astronomy*** & Sky Observing @ Oxbow Park 6-7:30 pm.

JAN 19 *Fri* Public Presentation: ***Supernovae*** & Sky Observing @ Oxbow Park 6-8 pm.

FEB 16 *Fri* Public Presentation: ***TBA*** & Sky Observing @ Oxbow Park 6-8 pm.

It's Cold Outside

5. Always wear a cap in cold weather to keep your head warm and avoid discomfort. A balaclava or watch cap is best for warmth and visibility. Stay protected from harsh elements with this simple and effective solution.

6. Temperature ratings for cold weather gear are based on the assumption that the wearer is actively exerting themselves. However, additional layers may still be necessary for passive activities like astronomy. Removing the liners from pac boots after use is essential to allow them to dry out, especially if you plan to use them again.

7. Stay hydrated, but avoid caffeine, a diuretic that reduces blood volume. This makes it harder for your body to maintain an average temperature. Instead, opt for bottled water or decaffeinated drinks on cold nights.

8. Cold weather can cause dry skin, so using lip balm and moisturizer is essential. Temperature ratings for cold gear assume active exertion, so additional layers may be needed for passive activities. Remove liners from pac boots to dry them out before reuse.

9. Chemical hand warmers are a great addition but do not replace proper clothing layers. My heavyweight parka has two pockets specifically designed for hand warmers, which is a nice feature to consider. Hand warmers can also be used to heat eyepiece cases.

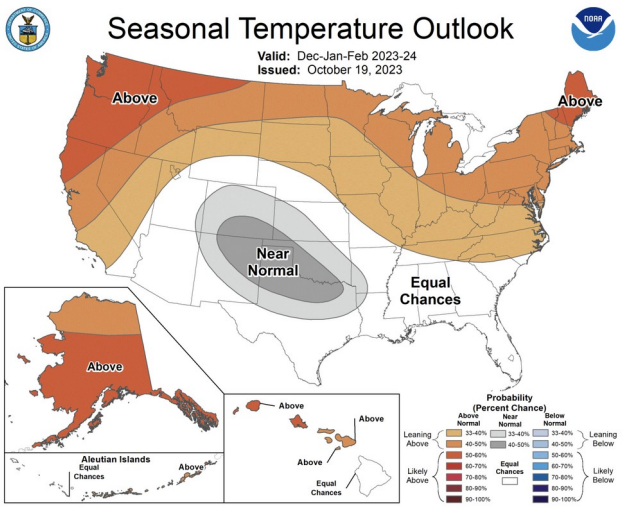
10. Staying warm in freezing temperatures requires intense calorie burning. Eat before heading out, and bring high-carbohydrate snacks. A thermos of hot soup can make extended observing sessions more enjoyable.

11. Better mobility and warmth with loose-fitting clothes. Avoid tight boots and ensure proper fit with inner layers.

12. If you need to warm up in your car, do not sit inside with the windows rolled up while the engine runs to avoid carbon monoxide poisoning.

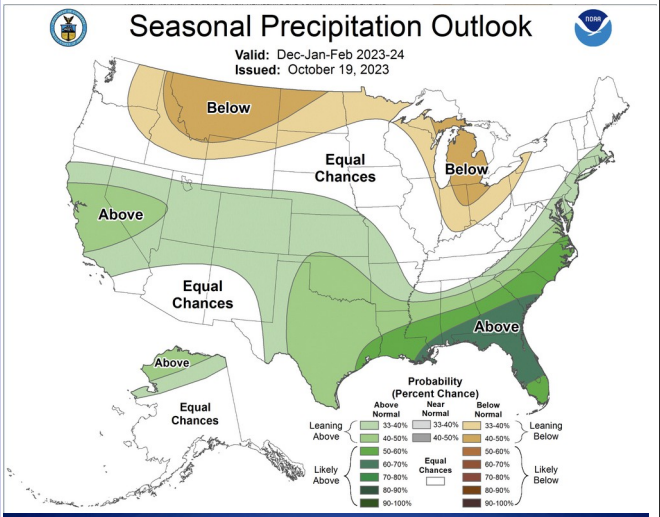
This article was initially written by the late Tom "Ironman" Dietz, a Northern Virginia Astronomy Club member, and edited by Bill Davidson.

Although RAC does not endorse Amazon, it utilizes the platform to showcase product examples.



The 2023-2024 U.S. Winter Outlook map for temperature shows the greatest chances for warmer-than-average conditions are in the northern tier of the continental United States. (Image credit: NOAA)
Download Image

Valid: Dec-Jan-Feb 2023-24
Issued: October 19, 2023



When you come across a word followed by [link], simply click on it, and you'll be taken to its corresponding webpage.

NCRAL Northern Lights[link]

I invite you to check out our regional newsletter, ***Northern Lights***, which features exciting observational programs, the latest astronomical news from the north-central states, essential updates from the Astronomical League, and so much more that you won't find anywhere else.

North Central Region of the Astronomical League Newsletter

Northern Lights. Autumn Issue Table of Content
EDITOR CARL WENNING

NCRAL SEASONAL MESSIER MARATHON OBSERVING PROGRAM

See Northern Lights[link] for information.

Records must include the name, email, and mailing address of observer and/or ALCor for sending the certificate and pin.

AUTUMN 2020 SEASONAL MESSIER MARATHON

Observer: *Member Name*
NCRAL Affiliation: *RAC*
Date(s) of Observation: *Sept 18-19, 2020*
Location: *Eagle Bluff, Lanesboro, MN*

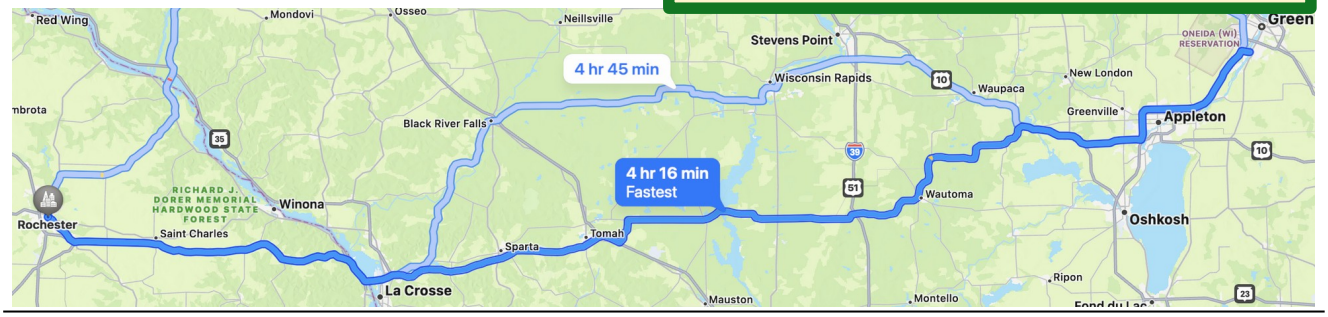
Telescope(s) used: *Meade 2080 non-goto*
Eyepiece(s) used: *28mm Plössl*
Magnification(s) used: *100x*
Field(s) of view: *0.65 degrees*
Moon phase: *new*
Seeing: *3/5*
Transparency: *4/5*

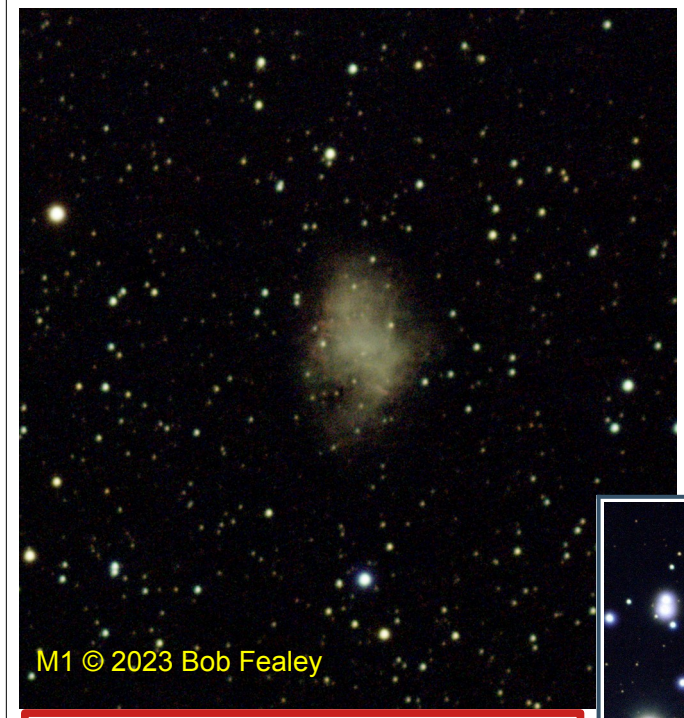
Sequence	Messier No.	Object Type	Common Name	Constellation	Time Observed
1	55	GCl	none	Sagittarius	8:22 PM
2	69	GCl	none	Sagittarius	8:30 PM
3	70	GCL	none	Sagittarius	8:37 PM
4	57	PlN	Ring Nebula	Lyra	8:43 PM
5	11	OCl	Wild Duck	Scutum	8:50 PM
6	31	Gal	Andromeda Galaxy	Andromeda	9:02 PM
7	27	PlN	Dumbbell Nebula		
8	26				

Winter: M1, M45, M36, M37, M38, M42, M43, M78, M79, M35, M41, M50, M46, M47, M93, M48, M44, M67, M40, M81, M82, M97, M101, M108, M109, M65, M66. (27 objects)

NCRAL 2024

Mark your calendars for the upcoming NCRAL convention hosted by the Neville Public Museum Astronomical Society at St. Norbert's College in De Pere, Wisconsin, on May 17-18. Keep an eye on our Northern Lights newsletter and the Region's Facebook[link] page for further information.



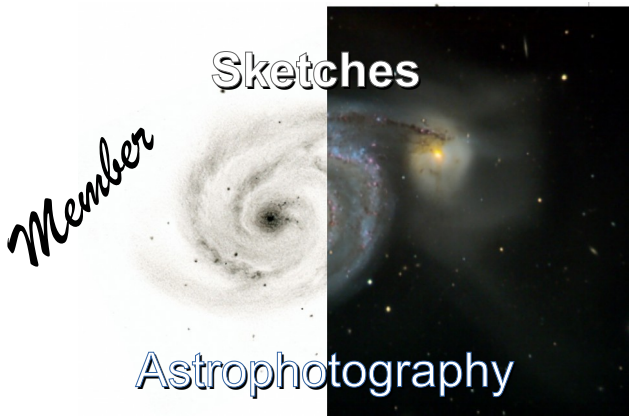


Scope: Astro-Tech 80 mm ED refractor (AT80ED)
Mount: Sky-Watcher Star Adventurer GTi
Camera: ZWO ASI183MC color astronomy camera
Exposure: Live stack of 137, 5 second frames (11.4 minutes)
Processing: Dark frame subtraction and color balance in Photoshop Elements

The distance to the **Crab Nebula** is about 2 kpc (6500 light years).

In 2007 a new distance for the **Orion Nebula** is 1,300 light-years.

Scope: Astro-Tech 80 mm ED refractor (AT80ED)
Mount: Sky-Watcher Star Adventurer GTi
Camera: ZWO ASI183MC color astronomy camera
Exposure: Live stack of 58, 5 second frames (4.8 minutes)
Processing: Dark frame subtraction and color balance in Photoshop Elements



Sketch of M51 © 2010 by Howard Banich. Photo of M51 © 2009 Fort Lewis College - Dept of Physics & Engineering

"All we ever see of stars are their old photographs."

- Alan Moore

September Meeting

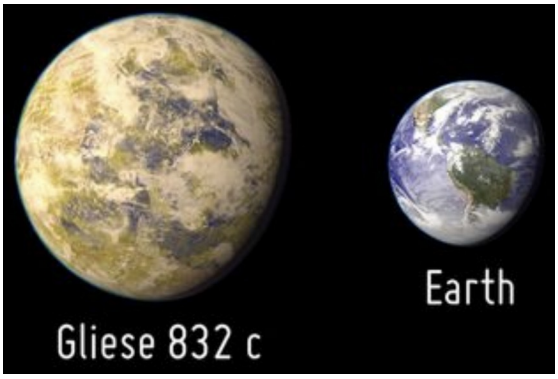
Exoplanets

Mayo High School Planetarium
Ben Joslin, Planetarium Director

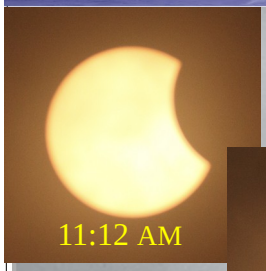
The meeting was chaired by John Attewell, Vice President, who oversaw the proceedings. The attendees shared their astronomical observations from the previous weeks while the plans for the upcoming partial solar eclipse were discussed and finalized. The membership was updated on the planning for Star BQ 2023, which is a significant event within the organization. The potential location of Eagle Bluff was considered, but the chosen event time slot was unavailable. Root River County Park was also considered, but its specific rules would have diminished the experience. The participating membership unanimously agreed to postpone the event until next year. Afterward, Ben Joslin, Mayo High School Planetarium Director, was introduced and presented information on himself, the planetarium, and the video presentation.

The planetarium video showcased various stars that hosted planetary systems and explored the likelihood of exoplanets existing in the habitable zone, where conditions are optimal for sustaining life. According to current data, 5528 exoplanets have been identified, distributed among 4,120 planetary systems. Among these, 69 exoplanets have been directly detected through imaging.

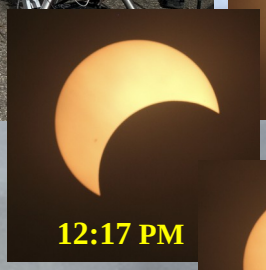
John announced the October meeting was canceled.

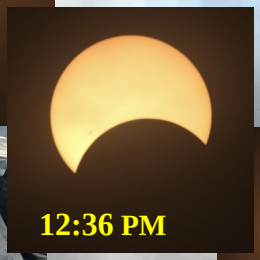


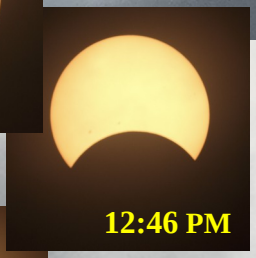
October 14th Partial Solar Eclipse
RAC at Watson Field

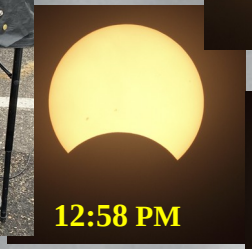


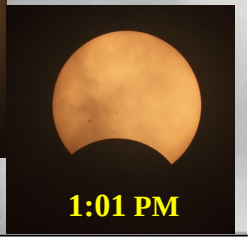
L to R: Jeff Nolan, Brandon Wyman, Jay McLaren, and John Martin

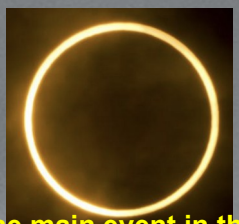








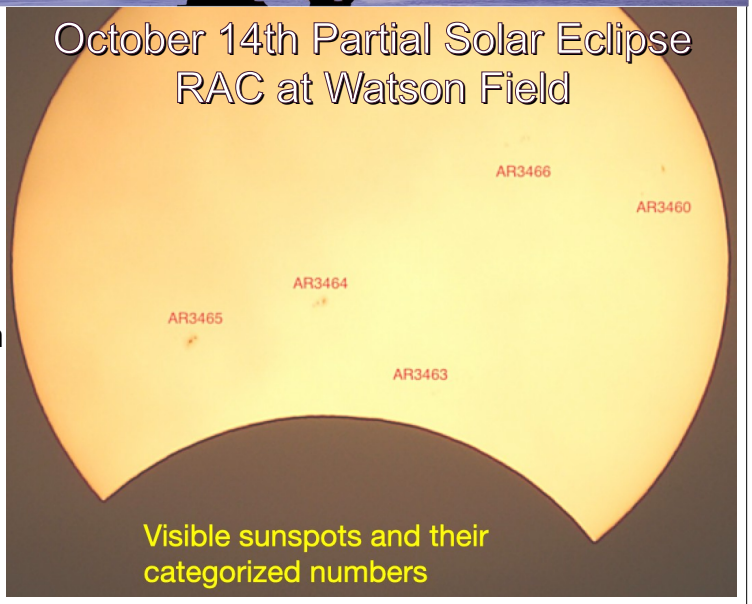




The main event in the western and southwesten states.

RAC appreciates the photographic documentation of the eclipse's progression, which Mike Carlin has shared with us. Thank you for your effort and contribution.

On the morning of the 14th, the forecast indicated that the skies would be overcast, which was concerning for those eagerly anticipating the partial eclipse in the area. However, John Martin, the eclipse coordinator, emailed the club members mid-morning to inform them of a viewing station he had organized at Watson Field's parking lot despite the unfavorable weather forecast. As the eclipse approached, the stratus clouds gradually dissipated, allowing intermittent blue skies to emerge, providing adequate viewing visibility.



Upon arriving at the observation site, Mike Carlin had already set up a computer connected to one of his telescopes to download eclipse images. Jay McLaren and John Martin were discussing the eclipse while viewing it through solar glasses. Jeff Nolan was in the process of setting up his Zhumell Dobsonian and attaching a glass solar filter. Bob Fealey arrived with his Orion Sky Blaster 4.5 and utilized a ZWO camera and phone to capture images. John Martin had set up a Coronado solar telescope attached to a tracking device for optimal viewing when the sun was available. Despite the location being amid Saturday morning soccer games, some individuals still made their way over to view the eclipse through the available solar glasses and various telescopes.

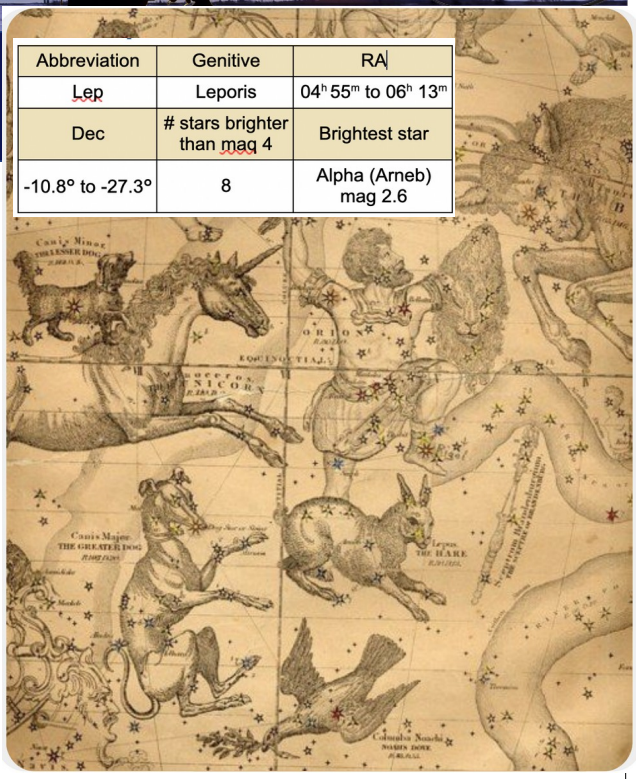
“Get your solar glasses ready, folks. The clear patch is coming!”

Astrolabe

by Bill Davidson

Lepus, the Hare

Abbreviation	Genitive	RA
Lep	Leporis	04^h 55^m to 06^h 13^m
Dec	# stars brighter than mag 4	Brightest star
-10.8° to -27.3°	8	Alpha (Arneb) mag 2.6

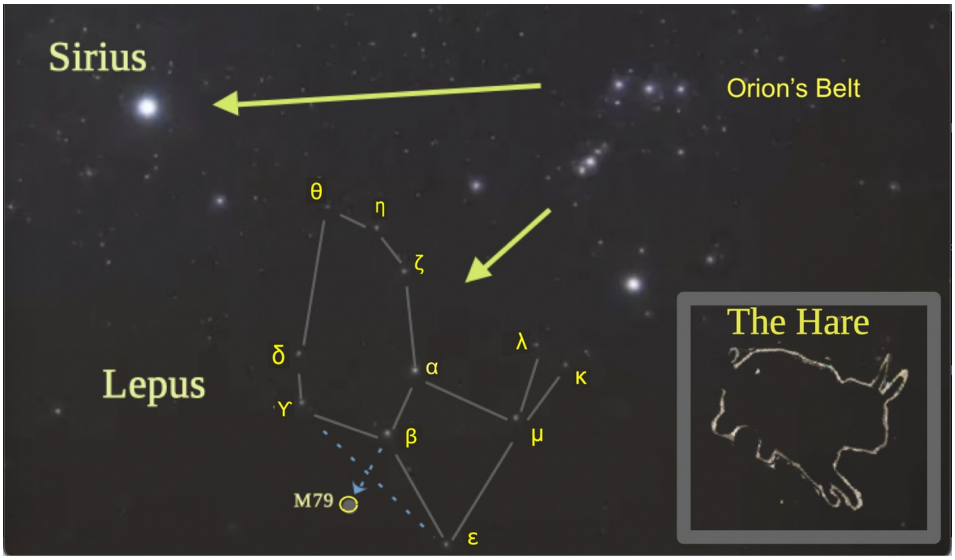


Could it be that the Greek astronomer Ptolemy crafted a tale in the stars of Lepus (Latin for 'hare'), where a helpless rabbit is chased by Orion and his loyal hunting companions, Canis Major and Canis Minor, only to be met with the daunting charge of Taurus the Bull? Probably not, but the story is fun to imagine. The asterism was identified as one of Ptolemy's 48 constellations that he identified in the 2nd century.

No Greek myths are associated with Lepus, although it seems fitting that the hare should appear close to Orion, the Hunter. Orion is typically depicted raising his shield against Taurus the Bull in atlases. At the same time, his prey, the fleet-footed hare, apparently takes advantage of his distraction and flees, chased by Orion's hounds.

While it's not a particularly large or bright constellation, it's easily found to the south of Orion and is visible from the northern hemisphere from mid-December to Late January. There are five notable stars to view, each with intriguing attributes.

α Leporis (Arneb) is a solitary F0 Ib yellow-white supergiant with an estimated mass roughly 14 times that of the Sun and a radius 129 times that of the Sun or 1.66 AU. It's 2,200 LY away.



β Leporis, also known as Nihal, is classified as a G5 II star and has a mass of approximately 3.5 solar masses. This star is located about 160 light-years from Earth and is part of a binary star system. The companion star is located only 2.5 seconds of arc away. While it may be an eclipsing double, it is more likely that the divergence in magnitude measurements is due to the challenges of observing dim stars with bright, nearby companions that over power them. It is currently unknown whether this binary system is part of a more extensive multiple-star system.

continue

The **γ Leporis** system is a wide double star that can be resolved using 10x50 binoculars. The primary star is a sun-like star, slightly more massive, with a creamy white color and twice the brightness of the orange secondary star. They are separated by 864 AUs and have an orbital period of approximately 18,000 years. It's 29 light-years away.

HR 1771 is situated just over 4° degrees southwest of **β Leporis (Nihal)**, making it visible through binoculars in the same field of view. It is a genuine multiple-star system and can be separated with low-power 35x. The system comprises two components with magnitudes of 5.1 and 6.6, respectively. The primary is a yellow giant; approximately 378 AUs separate the two components.

R Leporis is situated 3.5° northwest of **μ Leporis**. To observe the star's distinct red hue, defocusing the image to allow its light to spread across a broader field is recommended. The star is particularly striking during minima. Its discoverer, John Russell Hind, described it in 1845 as resembling "a drop of blood on a black field." R Leporis is one of the reddest stars known and is a favorite among observers. It is categorized as a long-period variable, with a magnitude range of 5.5 to 11.7 over 430 days. At its brightest, R Leporis can be observed through binoculars, although an average magnitude of 8.1 is required for telescope viewing.

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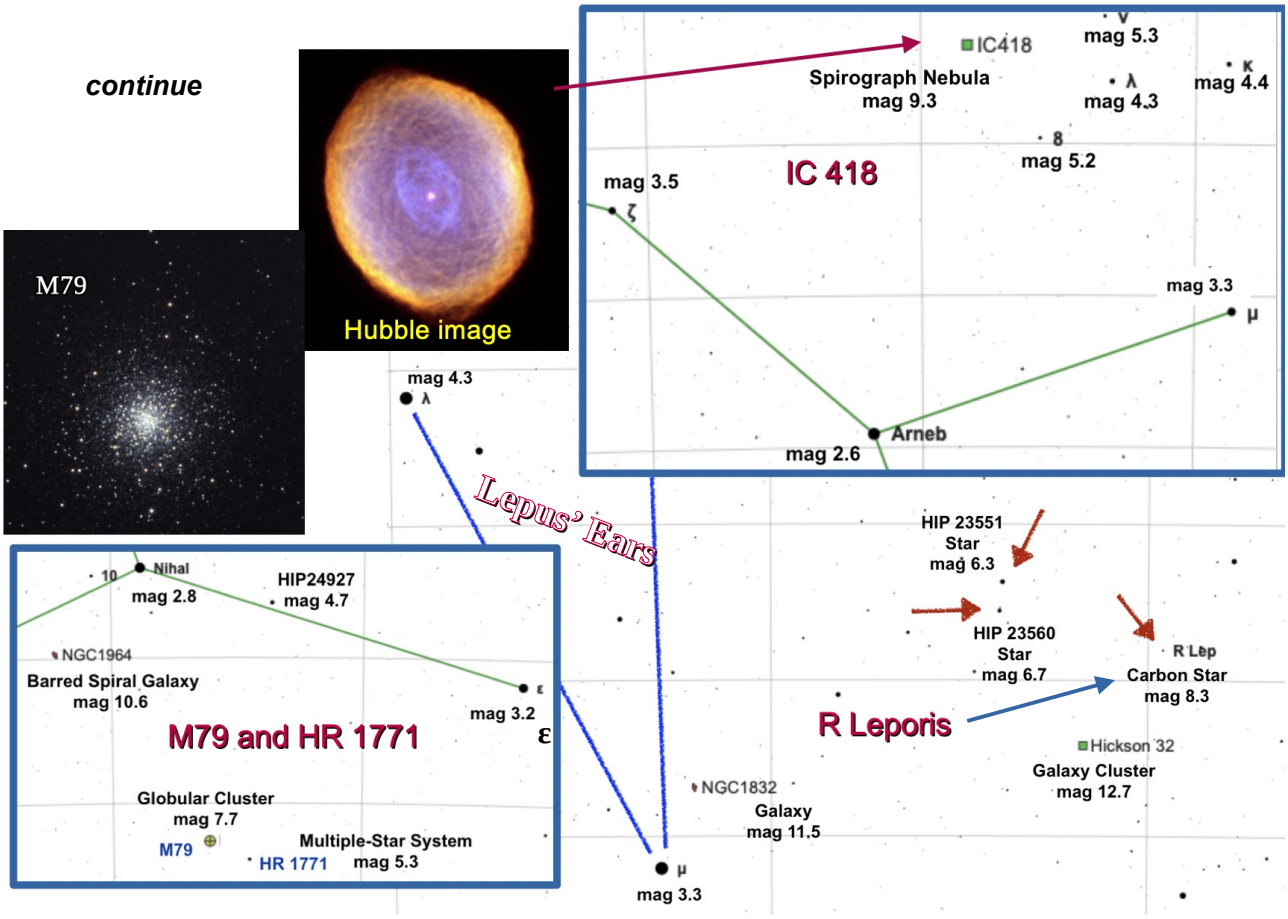
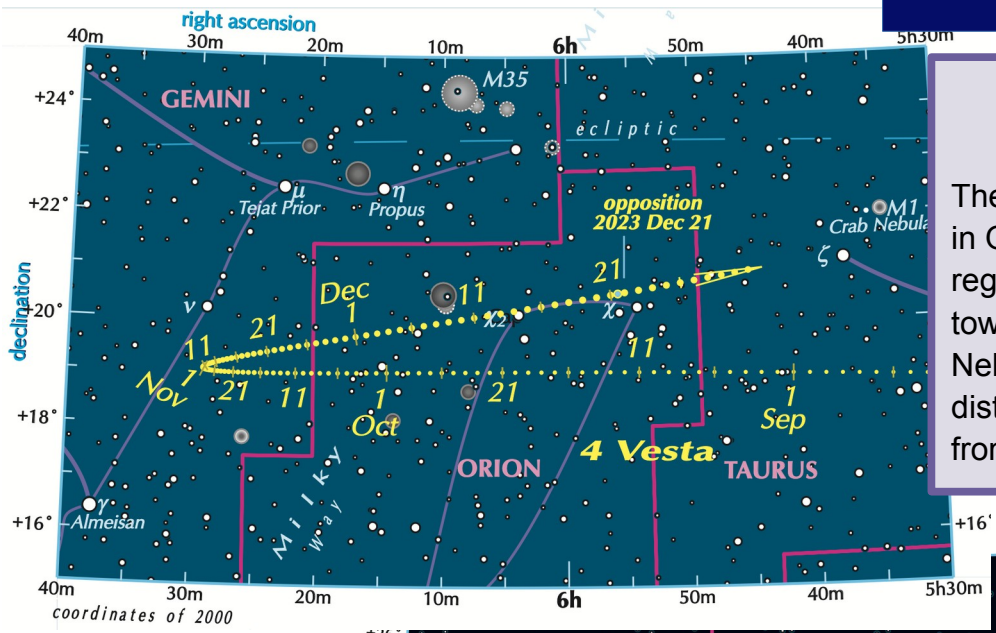


Designation	Mag	R.A.	Dec.	Type	Min Equip.
α Leporis / Arneb	2.6	05h 32m 43s	-17° 46m 20s	White Supergiant	Binoculars
β Leporis / Nihal	2.8	05h 28m 14s	-20° 45m 32s	Possible Binary	Binoculars
γ Leporis	3.6	05h 44m 27s	-22° 27m 00s	Multiple Star	Binoculars
HR 1771 / HIP 25045	5.1	05h 21m 22s	-24° 46m 22s	Multiple Star	Telescope
R Leporis	8.1	04h 59m 36s	-14° 48m 22s	Carbon Star	Telescope
M79 / NGC 1904	7.7	05h 24m 10s	-24° 31m 27s	Globular Star Cluster	Binoculars
NGC 2017	6.8	05h 39m 16s	-17° 50m 54s	Open Star Cluster	Binoculars
IC 418	9.3	05h 27m 28s	-12° 41m 50s	Planetary Nebula	Telescope

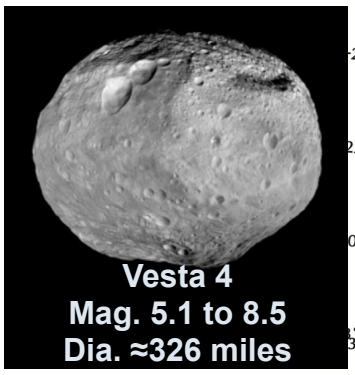
IC 418, known as the Spirograph Nebula, is a planetary nebula that boasts a bright 10.2 magnitude central star. While the nebula's distance is uncertain, the most reliable estimates place it at 2500 ly, extending to 6500 ly.

Astrolabe is a series of articles that delve into the lesser-known and often overlooked constellations, exploring their abundance of astronomical information. The primary objective is to expand the observer's familiarity with the night sky by providing in-depth technical details and analysis.

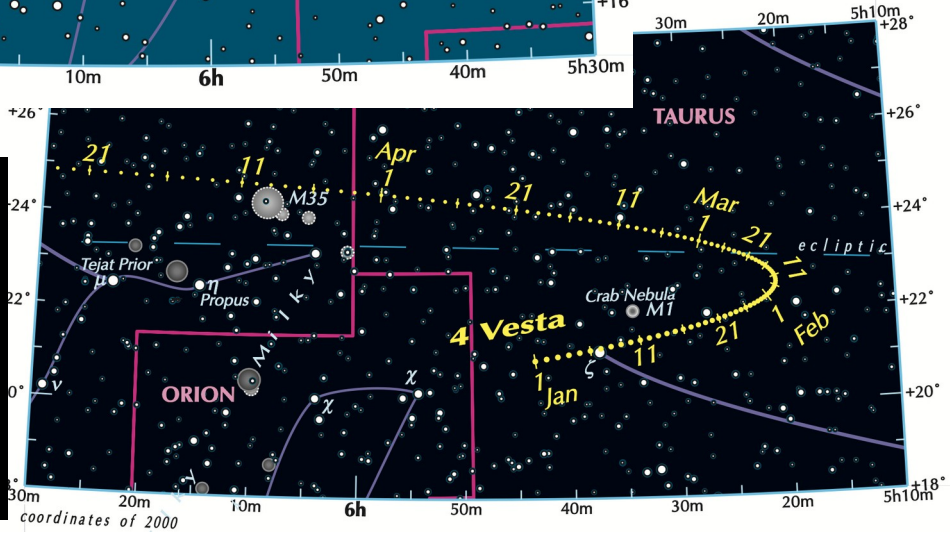


Inner Planet Vesta 4

The asteroid is located in Orion's northern region, with a trajectory towards the Crab Nebula (M1) at a distance of 2.03 AU from Earth.



Vesta 4
Mag. 5.1 to 8.5
Dia. ≈326 miles



Planetary Nebula – The Future of Our Sun

By John Attewell, Ph.D.

In the last edition of Rochester Skies, John Attewell, Vice President of the Rochester Astronomy Club, provided a comprehensive breakdown of the intricate life cycle of stars. As part of his presentation, he highlighted our very own Sun as a critical and illuminating example.

Even though they are incredibly hot, white dwarfs that form at the center of planetary nebula are too small to fuse carbon and oxygen further. These "exposed cores" slowly cool until they emit no more radiation. They are then classed as a black dwarf. How many black dwarfs exist today? None! Some estimates say it will take over a trillion years for a white dwarf to cool enough to become a black dwarf. The universe is only 13.7 billion years old, so we must wait long before the first black dwarfs exist.

Three of these planetaries are only visible from very low latitudes. But, from my location in Minnesota, three of them (the Cat's Eye Nebula, the Blue Snowball Nebula, and the Blinking Planetary Nebula) can be seen in the early evening throughout the year because they are circumpolar. The Jewel Bug Nebula and the Ring Nebula (M57) are in my evening sky from June through November, and the rest can be maximally targeted during shorter periods throughout the year.

NGC 2392, the Eskimo/Clown Face/Lion Nebula by HST in 1999.

The Helix and Dumbbell Nebula are the only planetaries visible as disks through 7x50 binoculars from high latitudes. The remaining northern planetaries of Table 1 requires at least a small telescope.

continued

Name	Common Name	Apparent Magnitude	Magnitude of White Dwarf	Angular Size (seconds)	Distance (ly)	RA Hours	RA Minutes	Dec Degrees	Dec Minutes
NGC 7293	Helix Nebula	7.0	13.5	900	650	22	29.6	-20	48.0
NGC 6853	Dumbbell Nebula (M27)	7.5	13.9	330	417	19	59.6	22	43.0
NGC 3918	Blue Planetary	8.0	14.6	16	4,900	11	50.3	-57	11.0
NGC 7009	Saturn Nebula	8.0	12.8	28	3,000	21	4.2	-11	22.0
NGC 0246	Dogg Nebula	8.5	12.0	225	1,600	0	47.0	-11	53.0
NGC 3132	Eight-Burst Planetary	8.5	10.1	45	2,000	10	7.7	-40	26.0
NGC 6543	Cat's Eye Nebula	8.5	11.1	20	3,300	17	58.6	66	38.0
NGC 6572	Blue Raquetball Nebula	8.5	13.6	14	4,900	18	12.0	6	51.2
NGC 6210	Turtle Nebula	9.0	12.7	16	5,400	16	44.5	23	49.0
NGC 6720	Ring Nebula (M57)	9.0	15.3	70	2,567	18	53.6	33	2.0
NGC 7027	Jewel Bug Nebula	9.0	16.3	14	3,000	21	7.0	42	14.2
NGC 7662	Blue Snowball Nebula	9.0	13.2	20	4,000	23	25.9	42	33.0
NGC 1360	Robin's Egg Nebula	9.5	11.4	380	1,145	3	33.3	-25	52.0
NGC 1535	Cleopatra's Eye Nebula	9.5	12.2	18	6,500	4	14.2	-12	44.0
NGC 2392	Eskimo/Clown Face/Lion Nebula	9.5	10.5	45	6,520	7	29.2	20	55.0
NGC 2867	Royal Aqua Nebula	9.5	16.6	15	7,270	9	21.0	-58	18.0
NGC 3242	Ghost of Jupiter Nebula	9.5	12.3	40	4,800	10	24.8	-18	38.0
NGC 6826	Blinking Planetary Nebula	9.5	10.4	25	2,000	19	44.8	50	31.0

Apparent Magnitude Versus Surface Brightness

The Helix Nebula is an extreme example of an essential concept for observing all planetaries. The quoted apparent magnitude of 7.0 is misleading. Light intensity for a star is concentrated into a single point, so its listed apparent magnitude represents what our eye can detect. But for objects like planetary nebulae, the sum of its emitted light is spread out over its surface area. That spreading is called 'surface brightness.' Surface brightness is measured as the luminosity emitted per unit surface area[1]. Table 1 shows that the Helix Nebula has a magnitude of 7.0 (relatively bright) but that its light is spread out over a circular area with a diameter of 900 arc-seconds. That means that the light for the Helix Nebula is spread out over an area half the size of a full moon, so it has a low surface brightness. The surface brightness is not often quoted in tables because the calculation depends on the specific viewing conditions, mainly the background airglow (light pollution) and declination (a component of atmospheric interference). If you want to observe The Helix with binoculars from high latitudes, having a very dark sky is best.

Magnification

If you want to see more than just a fuzzy blotch, you can bring out further details by increasing the power of your eyepiece. It would be best to have at least 100x to see more detail for the objects in Table 1. Planetaries with higher surface brightness are perfect targets to crank the magnification. The disk halo is often enhanced, and the complex structure of nebular tendrils and bright knots are revealed. Also, try to see if you can spy the white dwarf at the center. Table 1 gives the visual magnitude for some of these central stars, but remember, most of the energy produced by these stars is not in the visible range.

Planetary Nebula – The Future of Our Sun

Filters

Observation of all planetaries is further aided using a filter. As mentioned earlier, planetary nebulae have three emission lines. One emission line is from hydrogen (called "H-alpha" or "Hα"). Its spectral color is red. The other two lines are "green" and emitted by doubly ionized oxygen (called "O III" in spectroscopic notation). Telescopic filters for either Hα or O III increase the contrast and make planetary nebulae easier to see. You cannot use both filters as they would cancel each other out. Since O III is much stronger than Hα, it is the filter of choice for observing planetary nebula[2]. O III filters also help suppress the light from field stars surrounding the nebula and cause some light pollution. O III filters cost about $100 for a 1.25" diameter eyepiece to $200 for a 2" eyepiece.

continue

Hubble Space Telescope image of the Blue Racquetball Nebula (NGC 6572). Credit: ESA/Hubble and NASA.

1 Surface area for these objects is measured in square arc-seconds. This concept is also important for observing other non-point objects like galaxies, reflection nebulas, dark nebulas, and even planets.

2 O III filters are also used to increase the contrast of supernova remnants because they emit this type of light.

While not as specific as OIII filters, 'Ultra-HighContrast' (UHC) filters are also helpful. They generally allow wavelengths from a broader range (484-506 nm) to pass. These UHC filters are usually described as all-around dark-sky nebular filters and are cheaper than OIII filters. This wavelength window excludes many emissions from light pollution sources, allowing the two emission lines from O III and the "Hβ" emission lines to pass. But do not be fooled; Hβ is different from the Hα. The Hα emission line is standard for planetary nebula but is filtered out with UHC filters. The Hβ emission line (centered at 486nm) is most useful for "reflection" nebula but not much help for planetary nebulae.

There is a unique filter technique used to locate hard-to-find planetaries. It is called "flashing." Hold the filter between your thumb and forefinger. While viewing through a low-power eyepiece, move the filter back and forth across the field of view. The brightness of the planetary remains the same while the background stars dim when the filter is applied and alternately brighten when the filter is removed. Neat trick!

Filters are beneficial during public observing events. Most first-time observers can distinguish a planetary nebula from background stars, but many cannot. I remember my first encounter with someone who could not see M57. The planetary was perfectly obvious to me, but try as she might, my student could not see the object until a filter was applied. The filter made M57 appear with a satisfactory exclamation of "Oh! There it is!"

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Aperture

Of course, we are constantly nursing our budgets for "aperture sickness." Larger objectives greatly enhance the viewing of any nebula. As the aperture increases, the contrast of the edge of the inner disk increases, as well as the diameter of the faint outer shell. The brightness of the outer nebular envelope also increases. Apertures of at least 6" are needed to define the interior edge of most nebular disks. Bumping up to 8" begins to bring out the blue/green color from excited oxygen. At 10" of aperture, the red of glowing hydrogen may become observable. Everyone's eye is different; some observers may need more aperture to see color. At large apertures and high magnification (300X), you may even see a dark hollowed-out area around the central white dwarf of some older nebulae or a mottled core in younger nebulae. Increased aperture and magnification increase your chances of detecting the tiny white dwarf, the leftover ash from more youthful days.

Messier 27 - The Dumbbell Nebula (NGC 6853). Image from a ground-based telescope at Westview Observatory in Cridersville, OH.

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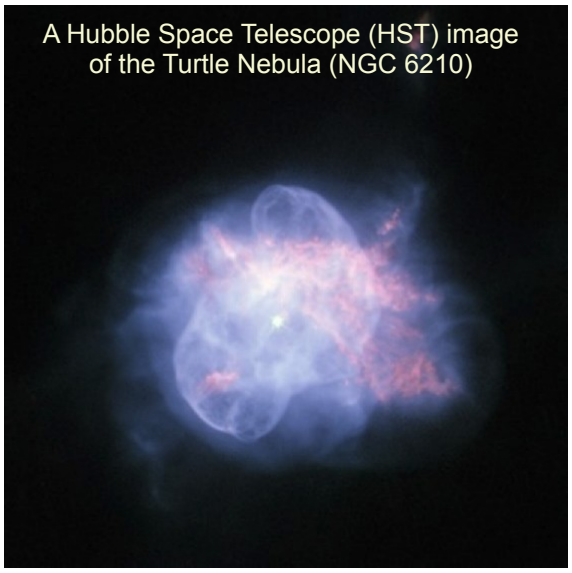
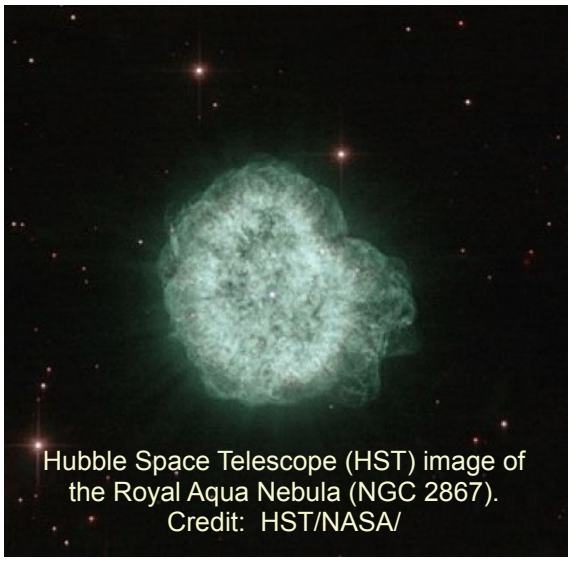
By John Attewell, Ph.D.



A Hubble Space Telescope (HST) image of the Turtle Nebula (NGC 6210)



Hubble Space Telescope (HST) image of the Royal Aqua Nebula (NGC 2867). Credit: HST/NASA/

References

Anguiano, Borja, "Ask Astro." *Astronomy Magazine*, Vol. 45, no.9, September 2017, p. 45.

Harrington, Phil, "The life and death of stars in Scorpius." *Astronomy Magazine*, Vol. 46, no.5, May 2019, pp. 32-35.

Kaler, Jim, "How Stars are Born and Die." *Astronomy Magazine*, Vol. 47, no.7, July 2020, pp. 16-23.

Klesman, Alison, "Ask Astro: QI When Will the Sun Become a Black Dwarf?" *Astronomy Magazine*, Vol. 47, no.4, April 2020, pp. 70-71.

Lang, Kenneth R., 2013. *The Life and Death of Stars*. New York, NY: Cambridge University Press.

Rhymeswithorange, "100 Brightest Planetary Nebulae (Spreadsheet)." Cloudy Nights[link]. 18 March 2011.

Talcott, Richard, "Sizing Up Planetary Nebula." *Astronomy Magazine*, Vol. 45, no. 1, January 2017, pp. 44-45.

RAC Lunar Eclipse Outreach 20 Feb 2008

An early arriving guest takes in her very first view of Saturn!

I asked one little boy to describe what he saw and he replied, "Wow, it looks just like Saturn!"

--- Duane Deal at Mayo High School

Rochester's Sky

November

5th Daylight Saving Time Ends 2:00 am. Move clocks back 1 hr. UTC -6 hrs.

9th Conjunction of Moon and Venus. Binoculars will provide an excellent view.

10th Comet C/2023 H2 (Lemmon) closet approach to Earth at 0.19 AU. Highest at 18:00, 50° above W horizon in Hercules. Binoculars will provide viewing.

12th Northern Taurid Meteor Shower. Peak with no Moon.

13th Uranus at Opposition. optimally positioned for observing. View with binoculars halfway btw Pleiades and Jupiter for the green 'star.'

14th Leonid Meteor Shower. Peak with 5 day old Moon.

17th Conjunction of Moon and Saturn. Separation 2° 43'.

21st Conjunction of Moon and Jupiter.

25th Orionid Meteor Shower reaches peak but the moon will be near full.

December

9th Conjunction of the Moon and Venus. Morning sky around 4:00 CST. Separation 3° 38'.

14th Geminid Meteor Shower. Peaks with best display around 2:00 CST.

17th Conjunction of Moon and Saturn. Separation 2° 28'. Binoculars will provide best infield view.

21st Astroid 4 Vesta at Opposition. Highest point in the sky at 00:08 CST, 66° above your southern horizon. Binoculars should be able to locate the astroid (see image below).

21st Winter Solstice. Shortest daylight at 8h 53', compared to the Summer Solstice at 15h 29'.

January

2nd Earth at Perihelion. Earth is closest point to the Sun.

4th Quadrantid Meteor Shower. Peak is before dawn in Boötes.

8th Mercury at Highest Altitude in Morning Sky. Tricky to observe at sunrise.

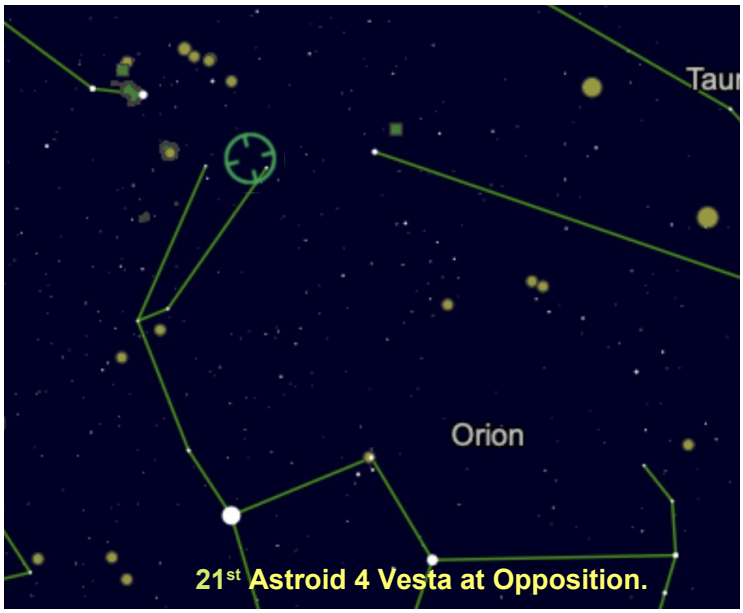
8th Lunar occultation of Antares. It will begin with the disappearance of Antares (Alpha Scorpii) behind the Moon at 08:02 CST, though in daylight. Its reappearance will be visible at 09:18 CST, though in daylight. Caution in observing with the Sun nearby.

14th Conjunction of the Moon and Saturn

18th Conjunction of the Moon and Jupiter. The pair will be visible from soon after it rises, at 11:41, until it sets at 01:26.

Rochester's Moon Phases

2023 Nov	5:◑,	13:●,	20:◐,	27:○
Dec	4:◑,	12:●,	19:◐,	26:○
2024 Jan	3:◑,	11:●,	17:◐,	25:○
Feb	2:◑,	9:●,	16:◐,	24:○
Mar	3:◑,	10:●,	16:◐,	25:○



21st Astroid 4 Vesta at Opposition.

Rochester's Sky

All times are local, accounting for CDT and CST corrections. Times reflect early in the event, not the start. Data collected from SkySafari 6 Pro. The * symbol indicates the event is in process. **Bold** indicates two or more events occurring near the same time.

GRS: GREAT RED SPOT **IS**: IO SHADOW
ES: EUROPE SHADOW **GS**: GANYMEDE SHADOW

NOVEMBER 2023

Date	GRS Transit	Transit of Moon	Date	GRS Transit	Transit of Moon	Date	GRS Transit	Transit of Moon
1			**11**	04:00, 18:15		**21**	02:30, 22:30	
2	02:30, 22:30		**12**	**00:00**, 20:00	IS **00:00**	**22**	18:00	
3	18:30	IS 04:45 ES 20:30	**13**		IS 18:30	**23**		
4	04:15, 23:50	IS 23:20	**14**	01:45, 21:30		**24**	00:00, 19:45	GS 20:30
5	19:30		**15**	17:30		**25**	16:45*	ES 03:30
6	05:00	IS 17:30*	**16**	03:15, 23:15		**26**	01:30, 21:30	IS 04:00
7	00:30, 20:30		**17**	19:00	GS 16:30*	**27**	17:15*	IS 22:15
8	06:15*		**18**		ES 00:30	**28**	03:15, 23:00	ES 16:30*
9	02:30, 22:00		**19**	00:45, 20:30	IS 02:00	**29**	18:45	IS 17:00
10	18:15	ES 22:00	**20**	18:00*	IS 20:15	**30**	16:15*	

DECEMBER 2023

Date	GRS Transit	Transit of Moon	Date	GRS Transit	Transit of Moon	Date	GRS Transit	Transit of Moon
1	00:30, 20:30		**11**	18:45	02:15	**21**	**01:20,** 17:05	
2		GS 00:30	**12**		21:45	**22**	22:50	
3	02:10, 22:10		**13**	00:30, **20:25**	**20:40**	**23**	18:35	
4	18:00		**14**			**24**		
5	23:30	IS 00:10	**15**	22:00		**25**	00:35, 20:20	
6	**19:00**	**IS 19:00**	**16**			**26**		
7			**17**	23:35		**27**	22:05	
8	01:15, 21:00		**18**	19:35		**28**	17:50	
9			**19**			**29**	23:30	IS 19:05
10	23:00		**20**	**00:20**	**ES 00:20** **IS 22:40**	**30**	19:30	
						31		

JANUARY 2024

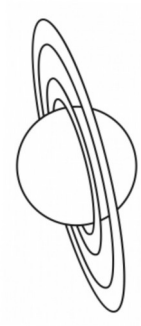
Date	GRS Transit	Transit of Moon	Date	GRS Transit	Transit of Moon	Date	GRS Transit	Transit of Moon
1	21:10		**11**	19:20		**21**	18:20*	IS 19:20
2	18:30*		**12**		IS 23:00	**22**		
3	22:40		**13**	**21:00**	**ES 21:30**	**23**	19:20	
4	18:40		**14**	**18:00***	**IS 18:00***	**24**		
5		IS 21:00	**15**	22:40		**25**	21:00	
6	**20:20**	**ES 18:50** **GS 20:30**	**16**	18:40		**26**	18:15*	
7			**17**			**27**	22:30	
8	21:50		**18**	20:10		**28**	18:40	IS 21:15
9	18:00		**19**			**29**		
10	23:30		**20**	21:50		**30**	20:00	
						31		

'Moons' of the Solar System

Words can go in any direction. Words can share letters as they cross over each other.

C	G	F	X	P	R	O	M	E	T	H	E	U	S	O
H	A	A	I	O	H	N	U	W	X	C	L	H	L	N
A	H	L	N	C	F	D	I	O	N	E	K	J	C	V
R	F	T	L	Y	K	H	E	U	R	O	P	A	U	G
O	O	E	C	I	M	L	S	I	A	P	E	T	U	S
N	K	Q	A	E	S	E	M	Y	M	I	M	A	S	E
S	O	B	O	H	P	T	D	O	C	O	R	H	N	D
I	K	C	A	Y	G	J	O	E	N	I	S	X	A	D
J	X	Z	D	P	H	O	E	B	E	A	I	C	M	L
O	H	Y	N	E	B	S	Z	L	S	J	T	Y	A	E
E	M	G	A	R	H	E	A	E	Y	I	J	I	L	I
S	D	T	R	I	T	O	N	S	Y	H	T	E	T	R
W	O	P	I	O	B	E	R	O	N	O	F	R	H	B
J	D	Y	M	N	S	U	D	A	L	E	C	N	E	M
Y	N	R	C	U	T	A	I	N	A	T	I	T	A	U

Amalthea
Ariel
Charon
Deimos
Enceladus
Europa
Hyperion
Iapetus
Miranda
Nix
Phobos
Phoebe
Rhea
Tethys
Titania
Triton
Callisto
Dione
Ganymede
Mimas
Oberon
Prometheus
Titan
Umbriel



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