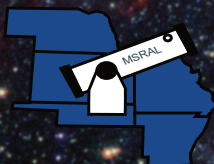


The Prairie Astronomer

March 2024 Volume 65, Issue #3

IN THIS ISSUE: T Coronae Borealis
Are Andromeda and the Milky Way Already Exchanging Stars?
Juno Measures Oxygen Production at Europa



Night Sky Network



The Newsletter of the Prairie Astronomy Club

The Prairie Astronomer



The next regular club meeting is March 26th at 7:30pm at Branched Oak Observatory

NEXT MEETING AND PROGRAM

“Beyond the Shadow: Exploring the Great North American Eclipse of 2024” presented by Michael Sibbersen. On April 8th we will experience the last Total Solar Eclipse in the United States until the year 2044. In this program, Michael will take the audience on a journey of discovery, exploring the importance and rarity of this phenomenon as well as some of the scientific experiments taking place during the eclipse. Tuesday March 26th at 7:30pm at Branched Oak Observatory.

UPCOMING PROGRAMS

For our April 30 program we welcome Robert Teeter, founder of Teeterscopes LLC who will talk about optimizing Dobsonian telescopes and some of the interesting builds he’s done over the years. Formed in 2002, Teeter’s Telescopes has been custom building dobsonian telescopes ranging from 8” F/6 to 24” F/3.5 and nearly every aperture and focal length combination between.

May: To be announced

June: Nearest Star Party

CONTENTS

4	President’s Message	21	Tom Miller Donation
5	Meeting Minutes	22	April Night Sky
7	Mantrap Skies ARP65	23	AL - Outreach
11	April Observing	24	Double Stars
12	Focus on Observing	25	Astrophotography
13	T CrB	27	Messier Marathon
15	Andromeda	29	From the Archives
17	Juno at Jupiter	31	Club Information

Cover: This image from NASA’s James Webb Space Telescope’s NIRCam (Near-Infrared Camera) of star-forming region NGC 604 shows how stellar winds from bright, hot, young stars carve out cavities in surrounding gas and dust. NASA, ESA, CSA, STScI



CALENDAR



Lincoln Parks & Recreation

Most of our club meetings are held at Hyde Memorial Observatory in Holmes Park.

The Observatory is owned and maintained by the City of Lincoln Parks and Recreation Department, but is operated by volunteers, many of whom are also members of the Prairie Astronomy Club.

PAC Meeting

Tuesday, March 26th, 7:30pm at Branched Oak Observatory. Program: "Beyond the Shadow: Exploring the Great North American Eclipse of 2024" presented by Michael Sibbersen.

PAC Meeting

Tuesday, April 30th, 7:30pm at Hyde Observatory Program: "Optimizing Dobsonian Telescopes" presented by Robert Teeter

PAC Meeting

Tuesday, May 28th, 7:30pm at Hyde Observatory

<https://www.prairieastronomyclub.org/event-calendar/>



www.prairieastronomyclub.org

2024 STAR PARTY DATES

	Date	Date
January	5	12
February	2	9
March	1	8
April	3/29	5
May	4/26	3
June	5/31	7
July	6/28	5
NSP	7/28	8/2
August	7/26	2
September	8/30	6
October	9/26	4
November	11/22	29
December	20	27

Dates in **BOLD** are closest to the New Moon.

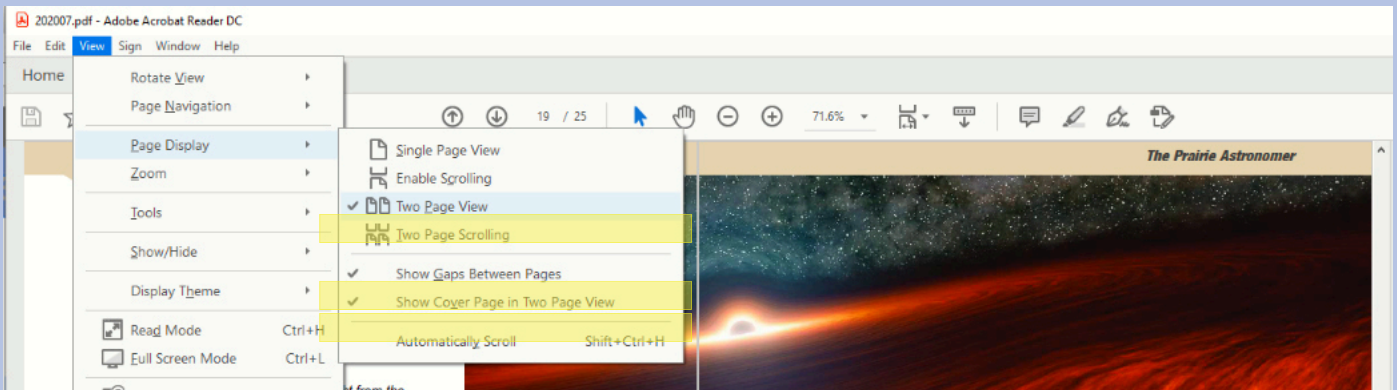
CLUB OFFICERS

President	Jason O'Flaherty jflaher@gmail.com
Vice President	Brett Boller proboller86@yahoo.com
2nd VP (Program Chair)	Bill Lohrberg wmlohrberg89@gmail.com
Secretary	Jim White jrwhite2188@gmail.com
Treasurer	John Reinert jr6@aol.com
Club Observing Chair	Jim Kvasnicka jim.kvasnicka@yahoo.com
Outreach Coordinator	Christine Parkyn cpparkyn@gmail.com
Website and Newsletter Editor	Mark Dahmke mark@dahmke.com

Notices

Newsletter Page View Format

How to Adjust Adobe Acrobat Settings for Two Page View



To view this newsletter in magazine spread format in Acrobat, select View ->Page Display->Two Page View. Acrobat will then show two pages side by side. Also make sure the checkboxes “Show Cover Page in Two Page View” and “Show Gaps Between Pages” are checked. If you have it setup correctly, the cover page will be displayed by itself and subsequent pages will be side by side with the odd numbered pages on the left.

PAC Newsletter Archive

Back issues of the *Prairie Astronomer* from 1962 to present are available online:
<https://newsletters.prairieastronomyclub.org/>

Pay Dues Online

<https://www.prairieastronomyclub.org/pay-dues-online/>

If you're already a member and are renewing within 30 days of your anniversary date, select the early renewal option for a discount.

PAC-LIST

Subscribe through [GoogleGroups](#) or contact Mark Dahmke to be added to the list. You'll need a Google/gmail account, but if you want to use a different email address, just associate that address with your google account to access Google Groups. Once subscribed, you can view message history through the GoogleGroups website.

To post messages to the list, send to this address: pac-list@googlegroups.com

The President's Message

Jason O'Flaherty

Dear PAC Members,

I hope this message finds you well as we journey through March, and look forward to one of the great celestial wonders coming in April: a total solar eclipse! This will be the last total solar eclipse in the US until 2044 and have about 2 minutes of totality longer than the 2017 eclipse. Even if you cannot travel to totality, the partial eclipse is still a great experience to share with your family and friends.

I'd like to remind you of our upcoming meeting on March 26th. It will take place at Branched Oak Observatory. We'll be celebrating the upcoming Solar Eclipse with a presentation by Michael Sibbernsen. As always, our meetings are open to the public, so please

spread the word and bring along any family members who might be interested. This will be the only opportunity for the general public in the Lincoln area to attend this program.

Hyde Observatory and Branched Oak Observatory will be open starting at Noon on April 8th during the Partial Solar Eclipse that Lincoln will be experiencing.

Additionally, please consider capturing photos and jotting down a note about your personal eclipse experience for the April Newsletter. You can submit them to Mark Dahmke. Your contributions help enrich our community and will become a part of our club's permanent record!



We're still looking for a presenter for our May meeting. If you have any suggestions, please get in touch with Bill Lohrberg or myself.

Thank you for your ongoing support and involvement in the Prairie Astronomy Club.

Clear Skies and Happy Observing!

Jason O'Flaherty

New Members

Welcome to the club!

Ronald Redder, Lincoln, NE

Meeting Minutes

Jim White

Jason O'Flaherty started the meeting at 7:32 p.m. Tonight's meeting is being held at Hyde Observatory and online via Zoom. We had a new member at the meeting tonight, Ron Redder, who joined the club today. We also had several guests at tonight's meeting. Tonight was our first formal meeting since November, December was the Holiday Party and January was our "How to use your telescope" class for members or guests who had recently acquired a telescope and wanted some help learning to setup and use their new scopes. We had five or six people bring in telescopes that they wanted help with and a number of club members to help them along with a couple of people just wanting to learn about the different types of telescopes because they were looking at getting a new scope.

Jason turned the meeting over to our observing chairperson, Jim

Kvasnicka, for his monthly observing report at 7:34. This month's star parties are March 1st at Branched Oak Observatory and March 8th at the Clatonia Recreation area about 1 ½ miles north of Clatonia. Jim's complete observing report can be found in this month's newsletter.

Jim turned the meeting over to John Reinert, our club treasurer, at 7:38 for his monthly treasurer's report. John had to move some of the club's funds from one account into the club checking account to avoid having to pay fees on the account. John has signup sheets available for guests and for those who may be interested in joining the club. The annual audit is overdue and John is working on getting that setup. The club's account balance is currently \$36,408.12. There was a question asked about what the plan might be for the money the club has accumulated. Some of the funds came from the sale of land that the club

once owned for an observing site. At one time there was talk of the club purchasing land for a new observing site but that hasn't happened up to this point. Some of the club's funds were used a few years ago to construct a concrete observing pad at Branched Oak Observatory and more recently the club had a storage building erected at Branched Oak Observatory to store club property, telescopes and related equipment. The use of the funds is ultimately up to the club body. John's report ended at 7:38 and the meeting was turned back over to Jason.

Jason went over membership details for guests and those who may be interested in joining the club. The club's meeting on March 26th will be held at Branched Oak Observatory and will be a solar eclipse program presented by Michael Sibbersen. The club bylaws are finally updated and finalized. Jason then did a brief

overview of the Night Sky Network and its relationship to the club and the advantages that it gives to club members. We have astronomy night coming up on April 6th at Morrill Hall at UNL and Don Hain will be helping with that and if anyone would like to help it would be

appreciated. Hyde Observatory will be open at noon on April 8th for the solar eclipse so if you would like to help and have a telescope with a proper solar filter please bring it out to Hyde and set it up on the lawn or just come out and volunteer your time. Tonight's meeting

adjourned at 7:40.

Tonight's program is a comparison of smart telescopes, exploring the emergence and impact of electronically assisted astronomy devices, presented by Jack Dunn via Zoom.



ALCON 2024

STARS AND ALL THAT JAZZ!

JULY 17-20, 2024




To register for ALCon, first click on the link, then choose "buy tickets."

<https://www.tickettailor.com/events/astronomicalsocietyofkansascity/1187693#>

It's ASKC's 100th anniversary! We are honored to be the official host for this year's Astronomical League Convention – ALCon 2024 – this July.

Held at the beautiful Overland Park DoubleTree Hotel

See you at ALCon!

Astronomical Society of Kansas City

ARP 65

The Mantrap Skies Image Catalog

Arp 65/NGC 90 is located in the southwest corner of Andromeda. It is a member of a rather large group of galaxies. I find various names for it but none include all of the galaxies. The group about 240 million light-years from us give or take a few million. I've noted the distances in the annotated image.

Arp 65 is rather near the center of the group. It is in Arp's atlas under the category: Spiral galaxies with small, high surface brightness companions. Arp's comment on this one reads: "Position of open spiral. Comps. lie off projected ends of both spiral arms." That would indicate he is talking about galaxies beyond the extended arms. I see one to the southeast that seems in line with the southern arm. I see two for the other arm but they lie below the arm though there's a slight bend in the arm that might lead to the first and dimmer of the two. I found nothing in the literature on this subject. Note that both spiral arms are double.

The galaxy is classified as SAB(s)c pec by NED, SAB(s)



Rick Johnson

Rick Johnson, a founding member of the Prairie Astronomy Club, passed away in January, 2019.

His legacy lives on through his comprehensive catalog of over 1600 images at www.mantrapskies.com.



ARP65, continued.

by the NGC project and SAB(s)b? pec by Seligman. It is listed as being discovered by William Parsons by the NGC project in 1854, but Seligman credits his assistant R. J. Mitchell as finding it on October 26, 1854. I measure its size, thanks to its long drawn out arms as 200,000 light-years. So while its diameter is almost that of NGC 80 its mass is far less.

Some sources consider it as interacting with NGC 93 to the east. NED and the NGC Project classifies it as S? while Seligman says Sab? pec. The NGC project also credits it to William Parsons (Earl of Rosse) while Seligman again says R. J. Mitchell on the same night as he found Arp 65.

South of these is a star that is listed as NGC 91. Again there's confusion over who found it. NGC Project credits Lord Rosse in one place and Herman Schultz in another. Schultz was director of Uppsala observatory. I find no connection with Lord Rosse. But Seligman credits it to R. J. Mitchel

on the same night as the other two. Since it is a mistake in the first place I suppose all this doesn't much matter.

There are 9 other NGC objects in this image. So here we go.

NGC 79 in the upper right corner is classified as E by NED, as E-So by the NGC project, and E0? by Seligman. All agree it was discovered by Guillaume Bigourdan on November 14, 1884.

NGC 80 is by far the most massive galaxy in the image. I measure it as a bit over 210,000 light-years across. NED and the NGC Project classifies it as SA0-: while Seligman says E/S0?. It was discovered by John Herschel on August 17, 1828.

NGC 81 is a tiny galaxy that NED doesn't even try to classify, the NGC project says simply S while Seligman says S0?. The latter seems about right to my eye. It was discovered by Ralph Copeland on November 15, 1873. He was one of Lord Rosse's assistants but I can't confirm he found this one while

working for the Lord though he did find most of his NGC objects there.

NGC 83 is another rather large elliptical. NED classifies it as E but Seligman says (R)S0?. It was discovered by John Herschel the same night as NGC 80.

NGC 85/NGC 85A is listed by NED and the NGC Project as S0 but Seligman again disagrees saying SB0/a? It was discovered by Ralph Copeland the same night as he found NGC 81.

NGC 85B/IC 1546. I'm sort of cheating here as the IC number is most likely its main number. Many catalogs don't recognize it under the NGC number though NED does so I'm going with it. It is classified as S? by NED (The NGC Project doesn't recognize it as an NGC object) while Seligman recognizes it only under the IC number and classifies it as Sbc?. It was discovered by Stephane Javelle on November 20, 1897.

NGC 86 is classified by NED as Sbc, S? by the NGC Project and S0/a?

by Seligman. Flip your three-sided coin on this one. It was discovered by Guillaume Bigourdan the same night as he found NGC 79, November 14, 1884.

NGC 94 is listed as S0 by NED and the NGC Project but as S0(s)a? by Seligman. It was discovered by Guillaume Bigourdan the same

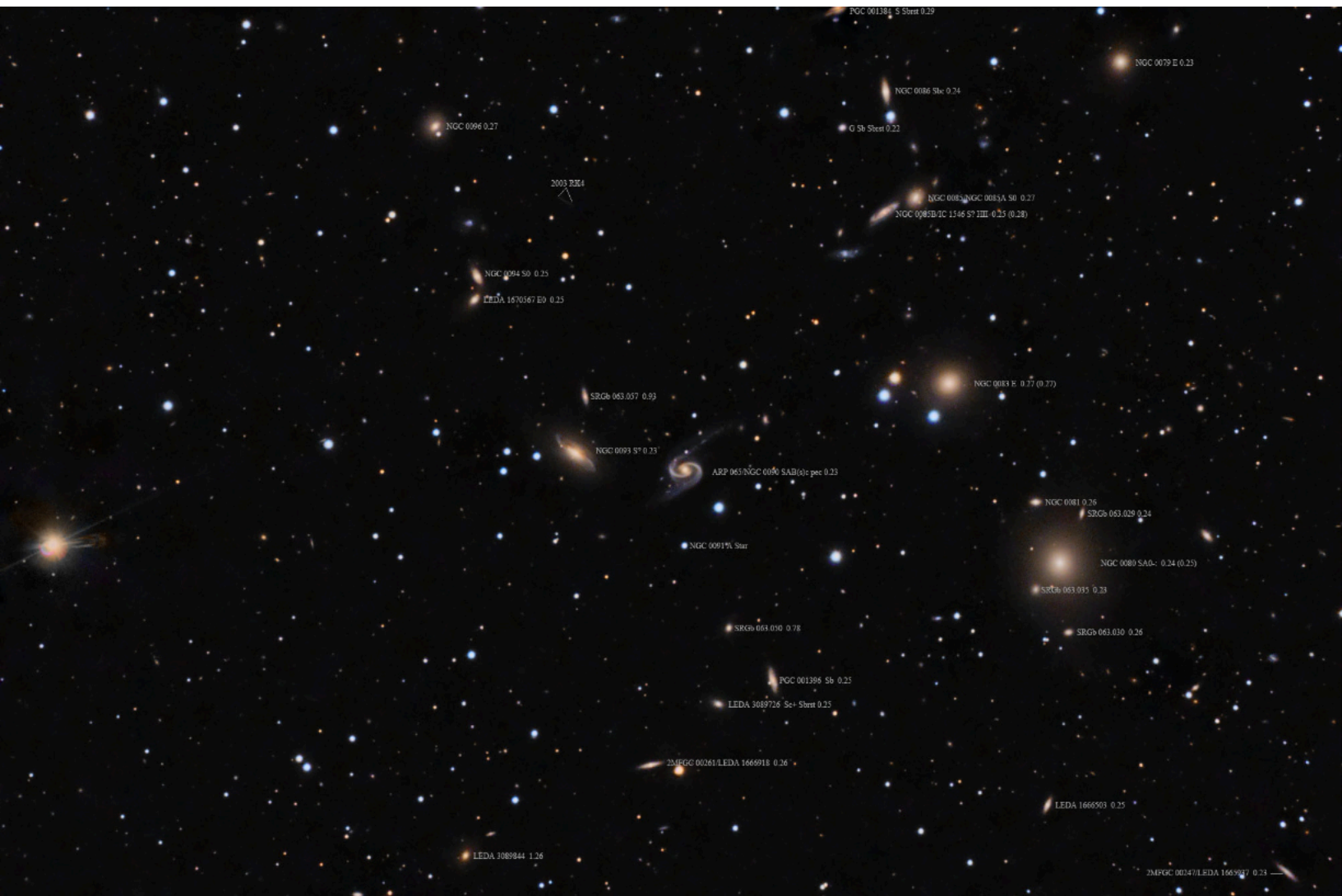
night as the others in this group but for NGC 96.

NGC 96 is not classified by NED, the NGC Project says S0 while Seligman says SB0? It too was discovered by Guillaume Bigourdan but on October 24, 1884.

Whew, that's 12 NGC objects in a 0.2 square degree field and I'm not

near the Virgo Cluster either. Details on other galaxies are in the annotated image when NED had redshift data.

This image dates back to September 2008 when my image processing software and skills were limited. I need to reprocess this one but for now, this will have to do.



April Observing

Jim Kvasnicka

This is a partial list of objects visible for the upcoming month.

Planets

Jupiter and Uranus: Lost in the evening twilight.

Mercury: Inferior conjunction on April 11th.

Mars and Saturn: Morning planets, not positioned well to see.

Venus and Neptune.: Not visible in April.

Total Solar Eclipse

Monday, April 8th. Lincoln will experience a partial eclipse starting at 13:38 pm with the maximum at 1:53 pm and ending at 3:08 pm.

Meteor Showers

Lyrids: Peaks the night of April 21-22, the Moon will hamper the viewing.

Messier List

M40: Multiple star in Ursa Major.

M65/M66: Part of the Leo Triplet Group.

M95/M96: Galaxies in Leo that fit in the same FOV.

M105: Galaxy in Leo.

M106: Galaxy in Canes Venatici.

M108/M109: Galaxies in Ursa Major.

Last Month: M41, M44, M46, M47, M48, M50, M67, M81, M82, M93

Next Month: M49, M51, M61, M63,



M64, M85,
M94, M101,
M102, M104

NGC and other Deep Sky Objects

NGC 2903: Elongated galaxy in Leo.

NGC 3077: Galaxy in Ursa Major.

NGC 3384: Galaxy in Leo.

NGC 3521: Elongated galaxy in Leo.

NGC 3631: Galaxy in Ursa Major.

NGC 3675: Elongated galaxy in Ursa Major.

Double Star Program List

Alpha Leonis: Regulus, white and yellow stars.

Gamma Leonis: Algieba, pair of yellow stars.

54 Leonis: Yellow primary with a greenish colored secondary.

Alpha Canum Venaticorum: Cor Caroli, bluish white and greenish yellow stars.

Zeta Ursa Majoris: Mizar, pair of white stars.

Gamma Virginis: Porrima, close pair of yellow stars.

24 Comae Berenices: Yellow primary with a pale blue secondary.

Delta Corvi: White and rose-colored stars.

Challenge Object

NGC 3577 and NGC 3583: Galaxy pair in Ursa Major.

Focus on Observing Programs

Jim Kvasnicka

Sketching Observing Program

Historically astronomers utilized sketches to record their observations and discoveries. With the advent of astrophotography you may wonder why anyone would want to sketch their observations. There is no reason to compare the two since they are different forms of recording information.

Astrophotography requires a sizable investment while sketching requires only paper, a pencil, and a few other inexpensive items.

There are many advantages to sketching astronomical objects:

- Sketching requires the observer to slow down to record what is being viewed.
- Sketching provides a permanent record of observations.
- Photographs are beautiful and detailed but they do not record what is actually observed at the eyepiece.
- Sketching brings out a feeling of accomplishment at having created a lasting impression of the object observed.

The Sketching Observing Program was not created for artist. It is for everyone regardless of their artistic ability. There are many tutorial links and resources you can access to help you improve your sketching skills.

The main focus of the Sketching Observing Program is not to make artist out of amateur astronomers, but to help them slow down the observing process and improve their observing skills.

The object list was created by members of the Haleakala Amateur Astronomers of Maui, Hawaii. The list includes lunar, planetary, double stars, nebula, open and globular clusters, and more. The list includes the relative sketching difficulty of the object. Level 1 is simple, Level 2 and 3 are more complex objects to sketch.

There are 114 objects on the list and to qualify for the Sketching Observing Program award you must sketch 75 of the 114 objects on the list. All sketches must be made from the eyepiece and not from photographs of the object. It is acceptable to clean up the sketches later but not add enhancements not seen at the eyepiece. Previous sketches are allowed at a maximum of 10. The usual information is required for your observations and can be found on the Astronomical League website under Observe. The list of all observing programs will be displayed and you can select the program you are working on.

Once you complete the Sketching Observing Program you will need to submit your observing logs to me for review. I will contact the Sketching Observing Program chair for approval. Once I receive your certificate and pin I will present them to you at the next PAC meeting.

If you have any questions regarding the Sketching Observing Program or need help getting started in any of the observing programs please ask me and I will be glad to help.

Announcing T CrB pre-eruption dip

Recurrent nova T CrB has just started its Pre-eruption Dip in March/April 2023, so the eruption should occur around 2024.4 ± 0.3

This article is from the [AAVSO website](#). Co-author Brad Schaefer presented a program at PAC about 20 years ago. Martin Gaskell forwarded this announcement for the newsletter.

T Coronae Borealis (T CrB) is a famous recurrent nova with known eruptions in the years 1217, 1787, 1866, and 1946. Many workers have realized that the rise in brightness from its low state (1954.5 to 2015.0) to its high state (2015.0 to the present) is a precursor and harbinger for an upcoming eruption around 2025.5 ± 1.3 or so (Munari et al. 2016; Schaefer 2023). A distinct and under-appreciated close-up harbinger is the unique and mysterious Pre-eruption Dip (Schaefer 2023). The Dip in 1945-1946 started around 1945.0 (1.1 ± 0.3 years before the 1946 eruption), with the B-band magnitude fading from near 10.5 to

12.0 mag, while the V-band magnitude faded from around 9.8 to 12.3 mag. This fading ended abruptly with the nova eruption.

In anticipation of the start of this Pre-eruption Dip, we have been frequently monitoring the up-to-date light curve as collected into the AAVSO International Database. The AAVSO B and V band light curves from 2021.0 to present, with 2-day binning, for 4330 B-band mags and 12734 V-band mags, all with CCD photometry, are linked below. The normal light curve since 2016 shows the usual ellipsoidal modulation, with a full amplitude of ~ 0.4 mag for a sinewave at half the orbital period. The light curve shows variations about this average curve on all time scales, with larger variations in the B-band than in the V-band, all arising from ordinary flickering always present since 1867. Starting around 2023.25, T CrB shows a systematic fade

from its long-time ellipsoidal variations. This fading is far outside of any historic variations since 2016. The fading in the blue was 0.4 mag in 2023.3 to 0.8 mag in 2023.5. The fading in the V-band was 0.25 mag in 2023.3, and 0.35 mag in 2023.5. The fading in the R and I bands are substantially smaller. This color dependency in the fading is consistent with increasing dust absorption, for a scenario featuring a recently discrete mass ejection in which dust formation occurs (much like for R CrB stars).

So the T CrB Pre-eruption Dip has already started in March/April of this year. If the Dip in 2023 is similar in timing to that in 1945, then the primary eruption should occur roughly 1.1 ± 0.3 years later, or in 2024.4 ± 0.3 . This prediction is substantially improved over the prior predictions based only on the 2015 rise to the high-state. Still, possible

deviations from the behavior in 1946 could create an early or a late eruption.

This announcement of the start of the Dip and the prediction of the eruption date (2024.4 ± 0.3) will hopefully be of use for researchers for making proposals with a wide variety of telescopes. Further, this serves as advance notice to take all

needed pre-eruption baselines, for example obtaining infrared fluxes and background nebulosity images over a wide field for later light echo detections. And it is not too late to try to understand the pre-eruption high-state, with it still being unclear whether the increased luminosity comes from increased accretion or from nuclear burning on

the white dwarf. For observations before the upcoming eruption, we particularly point to U-band photometry, UV spectrophotometry, and spectral line profiles, all for measuring the energetic physical mechanism of the Pre-eruption Dip, while long-running infrared photometry might detect dust formation.

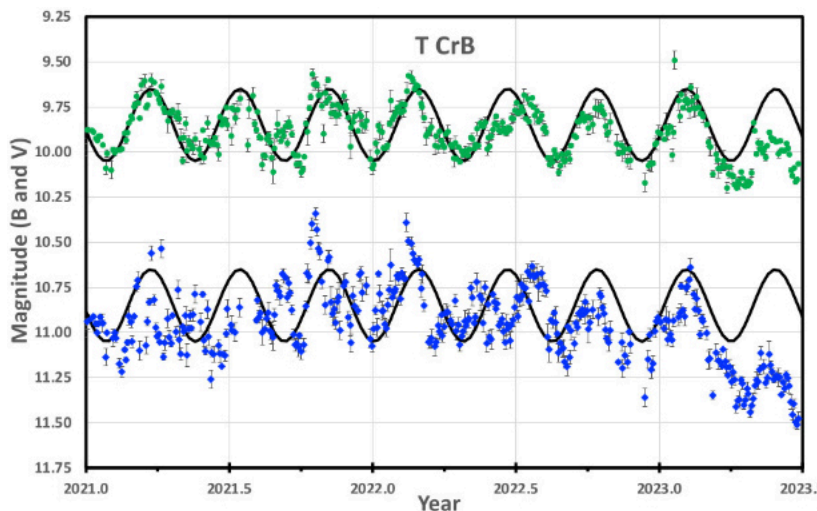


FIGURE 1. AAVSO B and V light curve for T CrB 2021.0--2023.5

This plot has 4330 Johnson B-band magnitudes (blue diamonds) and 12,734 Johnson V-band magnitudes (green diamonds) all with CCD cameras from 2021.0--2023.5, all binned into 2 day time bins. The usual ellipsoidal modulations (~ 0.4 mag full-amplitude as a

sinewave at half the orbital period) are shown as the thick black curves, one for each of the bands. The variations on all time-scales around the ellipsoidal light curves are normal for T CrB (even back to 1867), with these flickering being larger in the B-band. The point of this plot is to see that the T CrB brightness has been systematically fading from its long time average. This is most prominent in the B-band, looking at how the observed light curve is falling off from the long-time average light curve, ever since 2023.25 or so. The fading is greatly more than any historic occurrence (other than the 1945 Pre-eruption Dip), with this being far past measurement errors or any prior flickering/variability. In the last two weeks, the falloff has been at an accelerated rate of 0.18 mags in 14 days. Currently, T CrB is 0.8 mag fainter than expected in the B-band, and 0.35 mag fainter than expected in the V-band. This plot proves that T CrB is now well into its long expected Pre-eruption Dip, having started sometime around the end of March 2023.

Are Andromeda and the Milky Way Already Exchanging Stars?

Mark Thompson, [Universe Today](#)

I often drag out the amazing fact that the Andromeda Galaxy, that faint fuzzy blob just off the corner of the Square of Pegasus, is heading straight for us! Of course I continue to tell people it won't happen for a few billion years yet but a recent study suggests that we are already seeing hypervelocity stars that have been

ejected from Andromeda already. It is just possible that the two galaxies have already started to exchange stars long before they are expected to merge.

We tend to think of stars as stationery objects in the sky, except for their slow westward drift across the sky as the Earth rotates. The reality is different though, stars

do move but due to the vast distances in interstellar space, that motion is largely not noticeable. There are exceptions such as Barnard's star in the constellation Ophiuchus. This inconspicuous red dwarf star moves 10.39 seconds of arc each year (by comparison, the full Moon is 1,900 seconds or arc in diameter.)



Artist's illustration of Andromeda/Milky Way Merger. Credit: NASA; ESA; Z. Levay and R. van der Marel, STScI; T. Hallas; and A. Mellinger

Exchanging Stars, continued.

Another type of star can be observed, hypervelocity stars (HVSs), and these are among the fastest objects in the Galaxy. They are defined as stars that have a velocity which is of the order 1,000 km per second and by comparison, the Earth travels through space at a velocity of around 30 km per second! The first was discovered in 2005 but since then a number of HVSs have been found, and some of them have the potential to escape from the Milky Way.

Typically the motion of stars is the result of their motion around the centre of a galaxy. Our own star the Sun, takes 220 million years to complete one orbit of the centre of the Milky Way. The origin of the HVSs high velocity is believed to stem from gravitational interactions between binary stars and black holes. The idea was proposed by Jack Gilbert Hills is a stellar dynamicist, born on 15 May 1943. In this process, a black hole (stellar or the supermassive black hole at Galactic centre) captures one of a binary

star system while the other gets ejected at high velocity. Other theories include ejection of one of a binary star system when the other goes supernova or from galactic interactions.

To understand the interactions between the Milky Way and the Andromeda Galaxy the team (led by Lukas Gülzow from the Institute for Astrophysics in Germany) had to go through painstaking analyses. First they had to understand the relative motion for the two galaxies, they then had to model the gravitational potential of the entire system – this is the total acceleration acting upon an object at any position in either of the galaxies at any time. Finally the team could generate simulations of stellar motion to model the HVSs trajectories.

The study calculated the trajectories of 18 million HVSs for two different scenarios taking into account the two galaxies having equal mass and the other with the Milky Way having about half the mass of the Andromeda Galaxy. The starting positions of the

HVSs in the simulation were randomly generated around the centre of Andromeda. The ejection directions were random and the results showed that 0.013 and 0.011 percent of HVSs are now within a radius of 50kpc around the Milky Way centre. The explored the velocity of HVSs on arrival with both galaxy mass simulations and found that many approximately retain their initial velocity. Interestingly due to the time taken for the journey, a significant proportion may well evolve off the main sequence during their journey. Some of the HVSs slow down sufficiently to be captured by the Milky Way.

The team mapped the simulated position of stars against the sky and ran the data against high velocity star positions from Gaia data (Release 3) and found the simulated position distribution consistent with the Gaia data. The study concludes that it is highly likely that HVSs from Andromeda could indeed migrate to the Milky Way. Whilst they are not expected in their

Exchanging Stars, continued.

thousands, they are expected to distribute equally around the Milky Way centre. It might even

be possible to detect them based on stellar velocity and trajectories but further studies are

now required to take that next step.

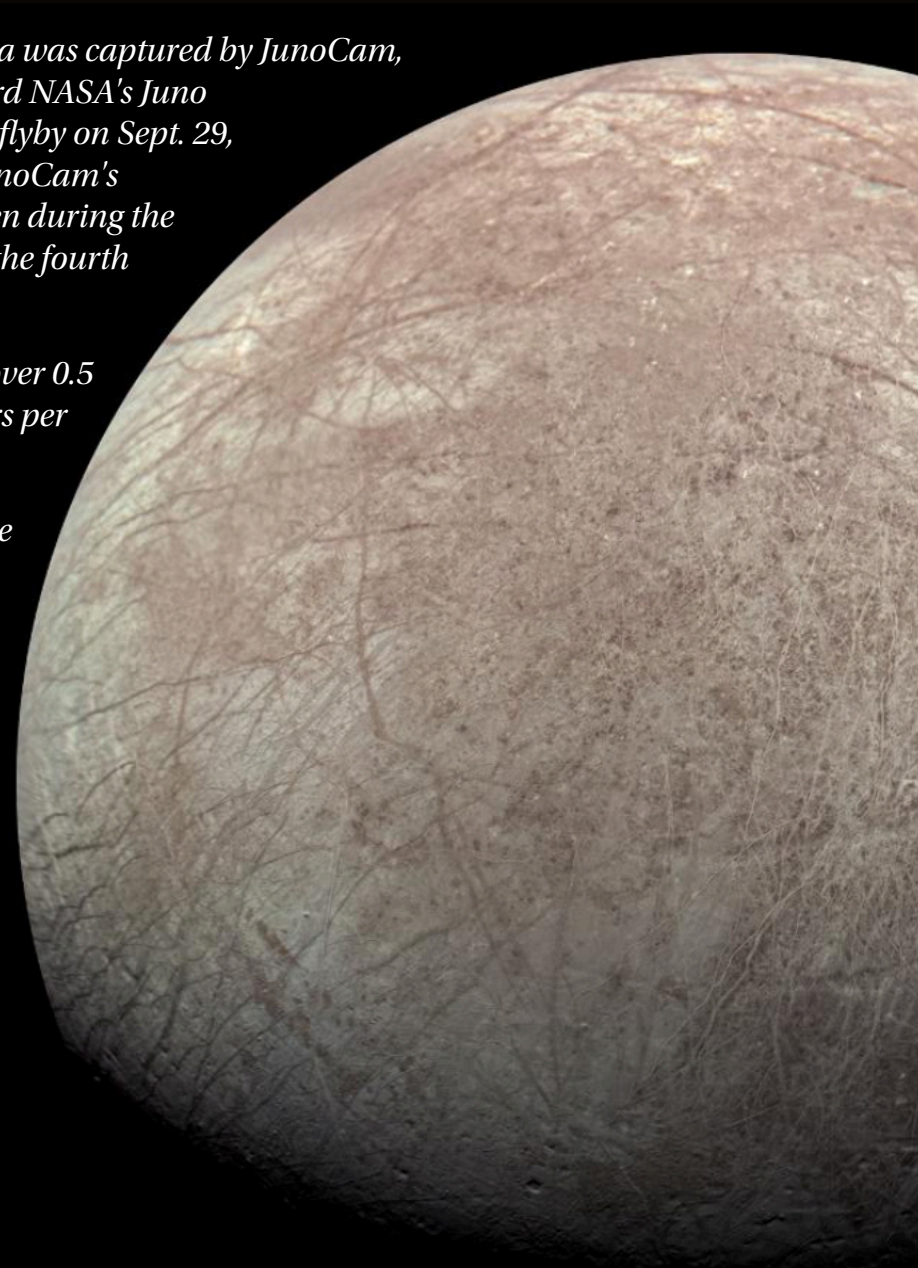
This view of Jupiter's icy moon Europa was captured by JunoCam, the public engagement camera aboard NASA's Juno spacecraft, during the mission's close flyby on Sept. 29, 2022. The picture is a composite of JunoCam's second, third, and fourth images taken during the flyby, as seen from the perspective of the fourth image. North is to the left.

The images have a resolution of just over 0.5 to 2.5 miles per pixel (1 to 4 kilometers per pixel).

As with our Moon and Earth, one side of Europa always faces Jupiter, and that is the side of Europa visible here. Europa's surface is crisscrossed by fractures, ridges, and bands, which have erased terrain older than about 90 million years.

Citizen scientist Kevin M. Gill processed the images to enhance the color and contrast.

Image data: NASA/JPL-Caltech/SwRI/MSSS Image processing: Kevin M. Gill CC BY 3.0



NASA's Juno Mission Measures Oxygen Production at Europa

The ice-covered Jovian moon generates 1,000 tons of oxygen every 24 hours – enough to keep a million humans breathing for a day.

Scientists with NASA's Juno mission to Jupiter have calculated the rate of oxygen being produced at the Jovian moon Europa to be substantially less than most previous studies. Published on March 4 in *Nature Astronomy*, the findings were derived by measuring hydrogen outgassing from the icy moon's

surface using data collected by the spacecraft's Jovian Auroral Distributions Experiment (JADE) instrument.

The paper's authors estimate the amount of oxygen produced to be around 26 pounds every second (12 kilograms per second). Previous estimates range from a few pounds to over 2,000 pounds per second (over 1,000 kilograms per second). Scientists believe that some of the oxygen produced in this manner could work its way into the moon's subsurface ocean as a possible source of metabolic energy.

With an equatorial diameter of 1,940 miles (3,100 kilometers), Europa is the fourth largest of Jupiter's 95 known moons and the smallest of the four Galilean satellites. Scientists believe a vast internal ocean of salty water lurks beneath its icy crust, and they are curious about the potential for life-supporting conditions to exist below

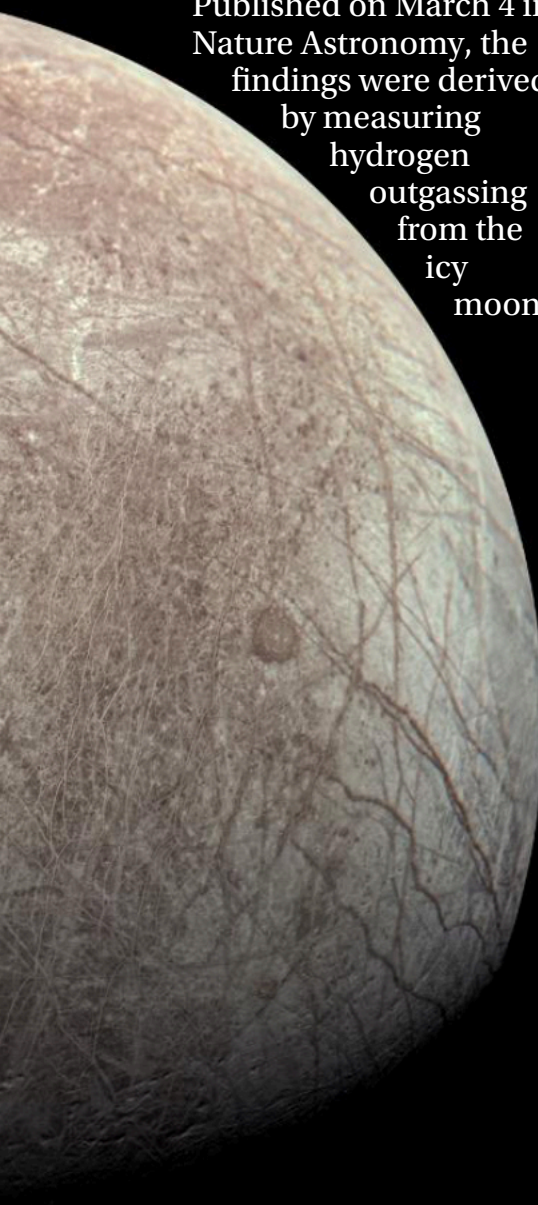
the surface.

This illustration shows charged particles from Jupiter impacting Europa's surface

This illustration shows charged particles from Jupiter impacting Europa's surface, splitting frozen water molecules into oxygen and hydrogen molecules. Scientists believe some of these newly created oxygen gases could migrate toward the moon's subsurface ocean, as depicted in the inset image.

Credit: NASA/JPL-Caltech/SWRI/PU

It is not just the water that has astrobiologists' attention: The Jovian moon's location plays an important role in biological possibilities as well. Europa's orbit places it right in the middle of the gas giant's radiation belts. Charged, or ionized, particles from Jupiter bombard the icy surface, splitting water molecules in two to generate oxygen that might find its way into the moon's ocean.



Juno, continued.

“Europa is like an ice ball slowly losing its water in a flowing stream. Except, in this case, the stream is a fluid of ionized particles swept around Jupiter by its extraordinary magnetic field,” said JADE scientist Jamey Szalay from Princeton University in New Jersey. “When these ionized particles impact Europa, they break up

the water-ice molecule by molecule on the surface to produce hydrogen and oxygen. In a way, the entire ice shell is being continuously eroded by waves of charged particles washing up upon it.”

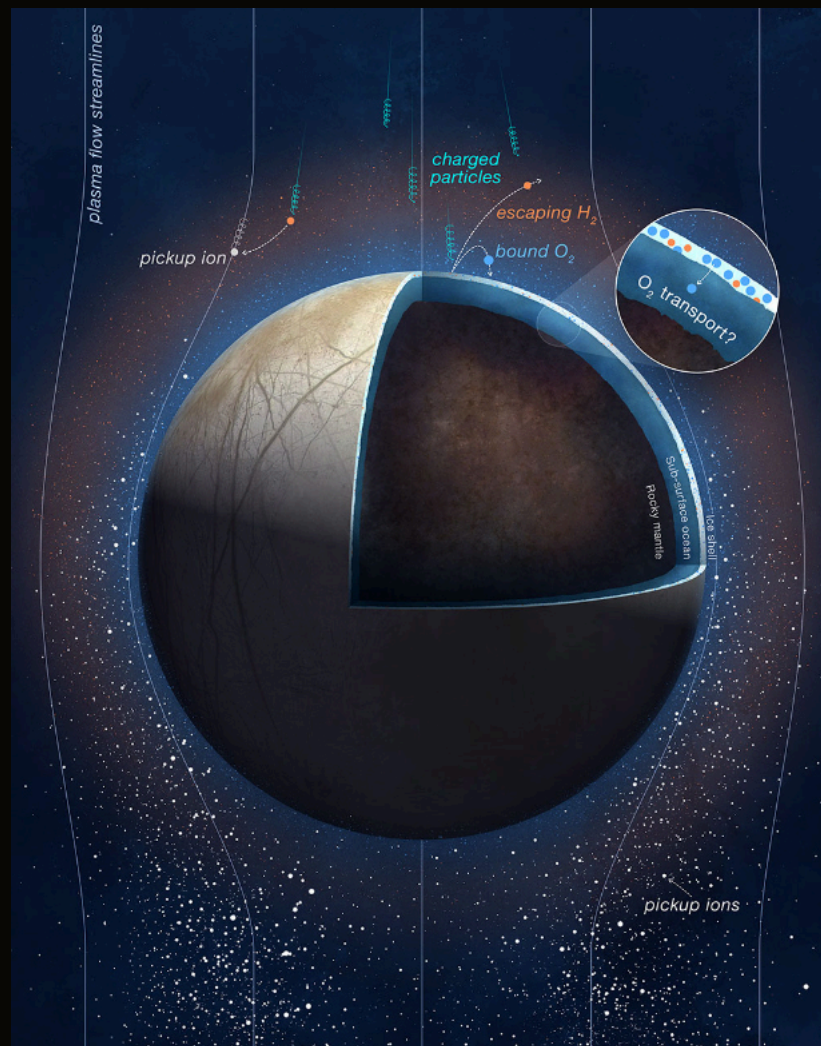
Capturing the Bombardment

As Juno flew within 220 miles (354 kilometers) of

Europa at 2:36 p.m. PDT Sept. 29, 2022, JADE identified and measured hydrogen and oxygen ions that had been created by the bombarding charged particles and then “picked up” by Jupiter’s magnetic field as it swept past the moon.

“Back when NASA’S Galileo mission flew by Europa, it opened our eyes to the complex and dynamic interaction Europa has with its environment. Juno brought a new capability to directly measure the composition of charged particles shed from Europa’s atmosphere, and we couldn’t wait to further peek behind the curtain of this exciting water world,” said Szalay. “But what we didn’t realize is that Juno’s observations would give us such a tight constraint on the amount of oxygen produced in Europa’s icy surface.”

Juno carries 11 state-of-the-art science instruments designed to study the Jovian system, including nine charged-particle and electromagnetic-wave sensors for studying



Juno, continued.

Jupiter's magnetosphere.

"Our ability to fly close to the Galilean satellites during our extended mission allowed us to start tackling a breadth of science, including some unique opportunities to contribute to the investigation of Europa's habitability," said Scott Bolton, Juno's principal investigator from the Southwest Research Institute in San Antonio. "And we're not done yet. More moon flybys and the first exploration of Jupiter's close ring and polar atmosphere are yet to come."

Oxygen production is one of many facets that NASA's Europa Clipper mission will investigate when it arrives at Jupiter in 2030. The mission has a sophisticated payload of nine science instruments to determine if Europa has conditions that could be suitable for life.

Now Bolton and the rest of the Juno mission team are setting their sights on another Jovian world, the volcano-festooned moon Io. On April 9, the spacecraft will come

within about 10,250 miles (16,500 kilometers) of its surface. The data Juno gathers will add to findings from past Io flybys, including two extremely close approaches of about 932 miles (1,500 kilometers) on Dec. 30, 2023, and Feb. 3, 2024.

More About the Mission

NASA's Jet Propulsion Laboratory, a division of Caltech in Pasadena, California, manages the Juno mission for the principal investigator, Scott Bolton, of the Southwest Research Institute in San Antonio. Juno is part of NASA's New Frontiers Program, which is managed at NASA's Marshall Space Flight Center in Huntsville, Alabama, for the agency's Science Mission Directorate in Washington. The Italian Space Agency (ASI) funded the Jovian InfraRed Auroral Mapper. Lockheed Martin Space in Denver built and operates the spacecraft.

More information about Juno is available at:

<https://www.nasa.gov/juno>

Tom Miller Donates Domes to Branched Oak Observatory

From Branched Oak Observatory:

"The secret is out... a MAJOR future addition to Branched Oak Observatory is on the horizon.

*Mr. Tom Miller of Lincoln, donated *two* 12.5' Ash brand domes to Branched Oak Observatory. Today, with the expert help of Barnhart Crane & Rigging, we were able to carefully move the domes from Miller Observatory to our facility. We wish to express our sincere THANK YOU to not only Tom Miller and*

Barnhart Crane & Rigging, but also Moen Steel Erection Inc., who financed this remarkable move. Both Barnhart and Moen are amazing companies, and we are fortunate to have them within the community.

As of now, the two domes will be stored on site at Branched Oak Observatory, and will remain here until we have constructed a new building for them to rest upon. We anticipate that this observatory will be used primarily for

astrophotography and university-level research. Visitors will, however, have the opportunity to visit the facility during our general public star parties.

And here is perhaps the best news... this is just ONE of a number of special surprises we have in store for our friends in astronomy.

Editor's Note: Tom Miller was a long-time member of PAC and co-founder of the Nebraska Star Party.

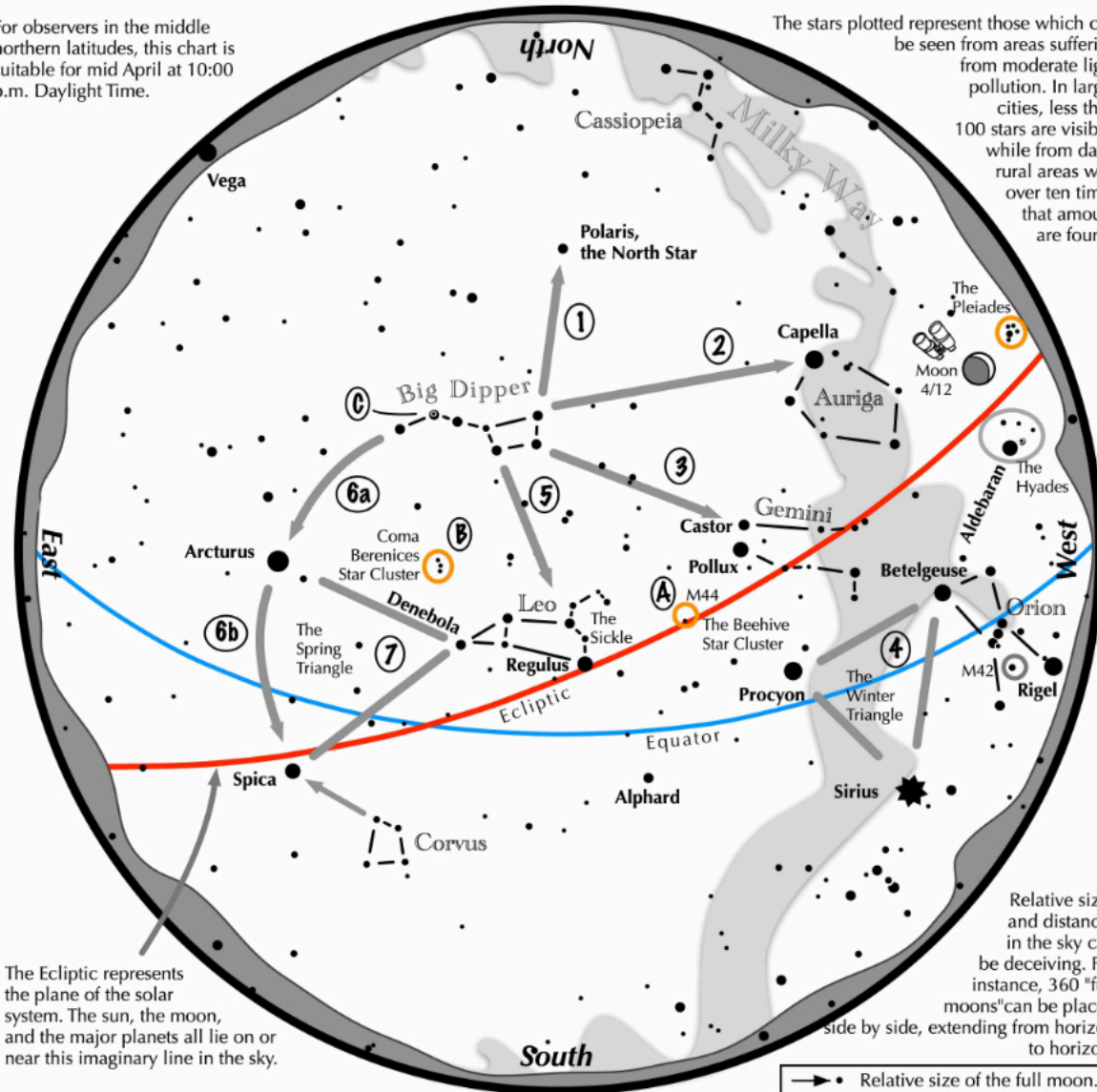


Navigating the April Night Sky

Navigating the April Night Sky, Northern Hemisphere

For observers in the middle northern latitudes, this chart is suitable for mid April at 10:00 p.m. Daylight Time.

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 April night sky: Simply start with what you know or with what you can easily find.

- 1 Extend an imaginary line north from the two stars at the tip of the Big Dipper's bowl. It passes Polaris, the North Star.
- 2 Draw another imaginary line west across the top two stars of the Dipper's bowl. It strikes Capella low in the northwest.
- 3 Through the two diagonal stars of the Dipper's bowl, draw a line pointing to the twin stars of Castor and Pollux in Gemini.
- 4 Look in the west-southwest for the bright Winter Triangle stars of Sirius, Procyon, and Betelgeuse.
- 5 Directly below the Dipper's bowl reclines the constellation Leo with its primary star, Regulus.
- 6 Follow the arc of the Dipper's handle. It first intersects Arcturus, then continues to Spica.
- 7 Arcturus, Spica, and Denebola form the Spring Triangle, a large equilateral triangle.

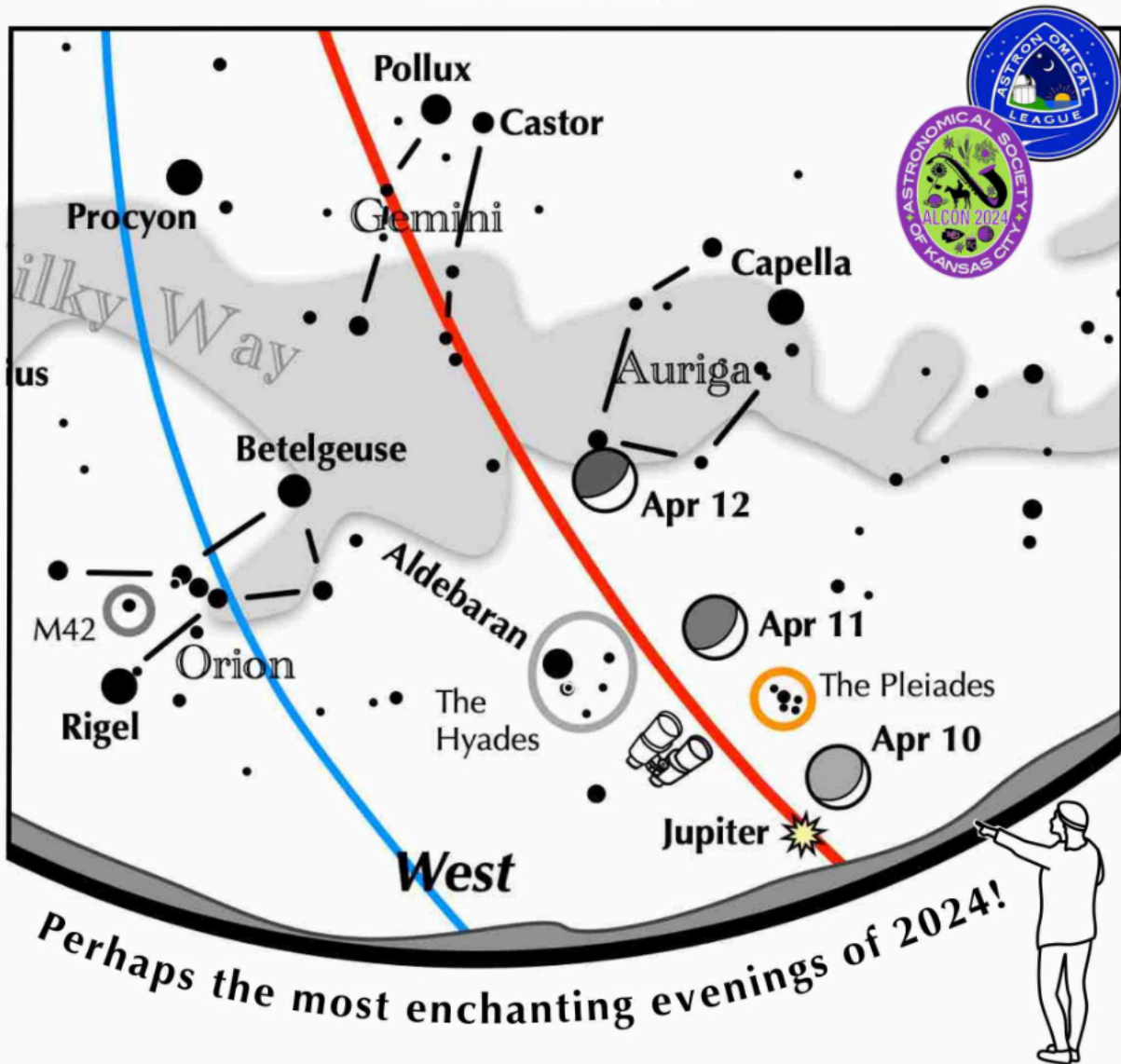
Binocular Highlights

- A: M44, a star cluster barely visible to the naked eye, lies to the southeast of Pollux.
- B: Look nearly overhead for the loose star cluster of Coma Berenices.
- C: In the Big Dipper's handle shines Mizar next to a dimmer star, Alcor.

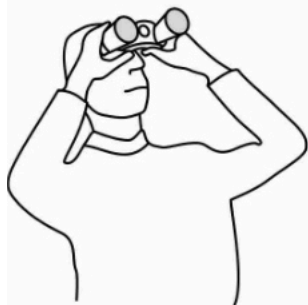


Duplication allowed and encouraged for all free distribution.

If you can see only one celestial event this April, see this one.



Perhaps the most enchanting evenings of 2024!

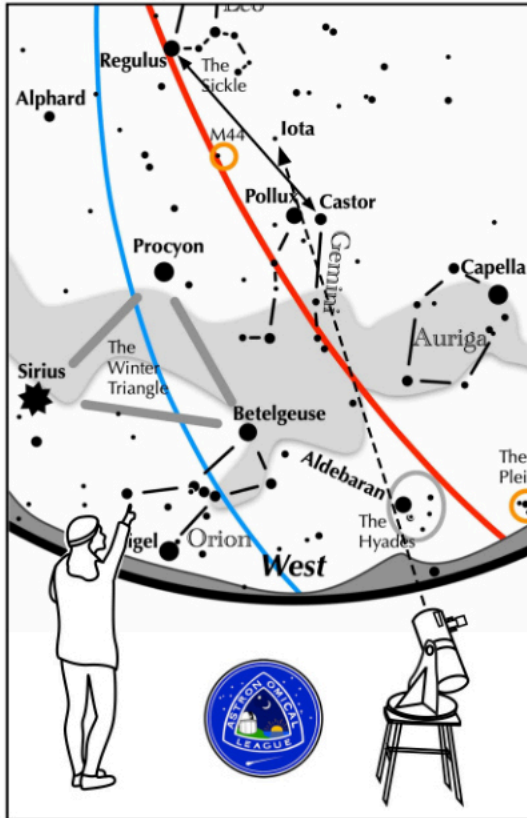


Enhance the scene – use binoculars!

On April 10, 11, and 12, look low in the west-northwest 60 minutes after sunset.

- The crescent moon, glowing full with earthshine, floats just above the horizon in the bright twilight on April 10. Next to it shines Jupiter, and above it lies the pretty Pleiades star cluster.
- On April 11, the slightly thicker, but more pronounced crescent moon moves between the Pleiades and the Hyades star clusters.
- On the third night, the crescent moon stands commandingly above the scene.

ASTRONOMICAL LEAGUE Double Star Activity



Other Suns: Iota Cancri

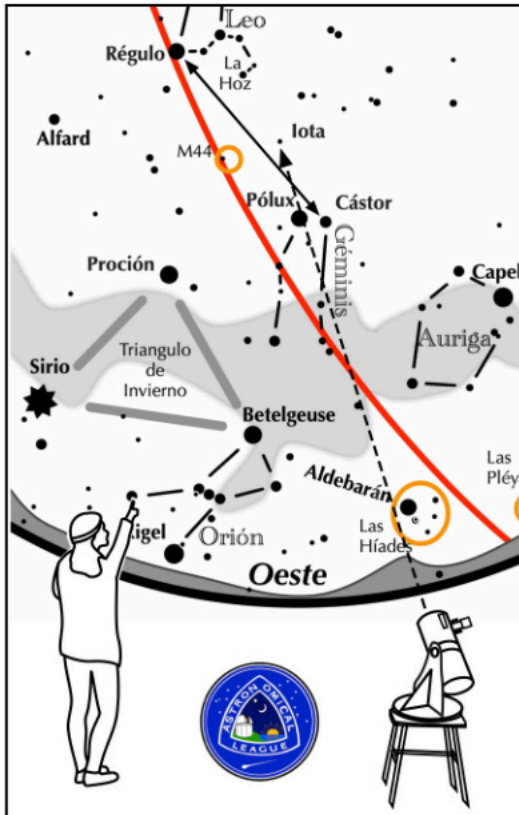
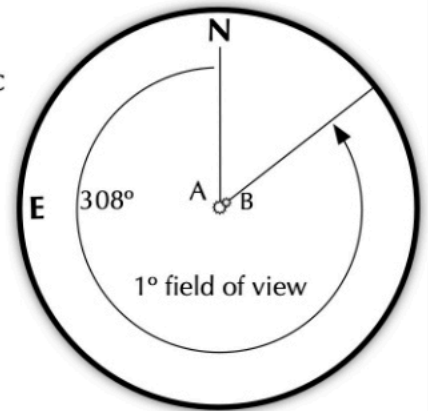
How to find Iota Cancri on an April evening

Face west. Look for the twin stars of Gemini, Castor and Pollux. Find Regulus. Iota lies about mid way between Castor and Regulus. It will be a moderately dim star.

Suggested magnification: >20x
Suggested aperture: >3 inches

Iota Cnc

A-B separation: 31 sec
A magnitude: 4.1
B magnitude: 6.0
Position Angle: 308°
Colors:
yellow
blue



Otros Soles: Iota Cancri

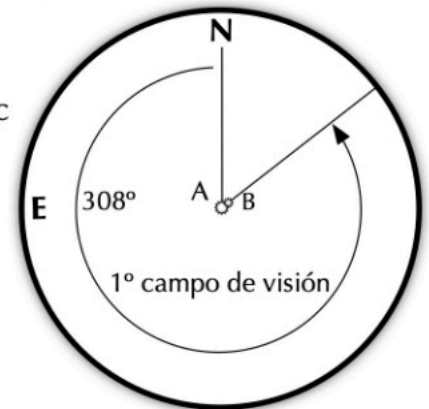
Cómo encontrar a Iota Cancri en una tarde de Abril

Mire hacia el oeste. Busque las estrellas gemelas de Géminis, Castor y Pólux. Encuentra a Regulus. Iota se encuentra a medio camino entre Cástor y Régulo. Será una estrella moderadamente tenue.

Ampliación sugerida: >20x,
Apertura sugerida: >75 mm

Iota Cancri

A-B separación: 31 sec
A magnitud: 4.1
B magnitud: 6.0
PA: 308°
Colores:
amarilla
azul



Astrophotography



*Pleiades by Leona Barratt
Vespera, 1.5 hour exposure
March, 2024*

Astrophotography



*12P/Pons-Brooks by David Dickinson
evScope, 16 minute exposure
March 15, 2024*

Nebraska Star Party

July 28th - August 2nd, 2024



JUST
IMAGINE

Merritt Reservoir • Nebraska • USA • Earth • Sol System • Orion-Cygnus Arm • Milky Way Galaxy

Messier Marathon at Branched Oak Observatory

March 13, 2024



Photos by Jeremy & Chantelli Bower, used with permission.

From the Archives

March, 1969

Nebraska Wesleyan's Olin Hall of Science

March 27, 1969

The Prairie Astronomer

Editorial Staff

Ed. Werner
M. Cole
R. Severns

Our February meeting was held in the new Olin science hall at Wesleyan. Thanks to Carroll Moore for providing a fine lecture hall for our club meeting. Prof. Moore also gave the club a fine demonstration of the new planetarium and its equipment.

He will observe the Moon and Pleiades graze at the location near Tobias Nebr. on March 22. As far as I know we will have three teams at different sites along the graze path. Anyone is welcome to come along and help. For further information call Ed. Werner or Monte Cole.

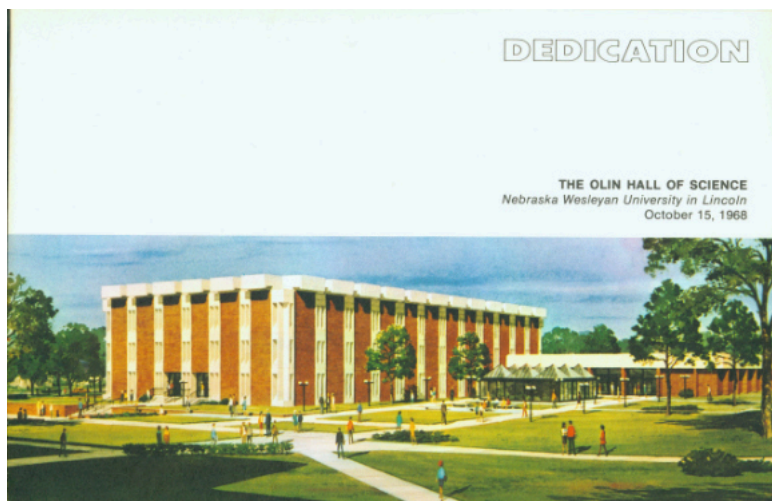
Remember to mark your calendar for the star party at my place on May 9, weather permitting.

Earl Moser,
President

When PAC formed and started to have regular meetings, they were held in the basement of the Van Fleet Hall of Science at Nebraska Wesleyan University. In 1963 they moved to Morrill Hall,

then back to Van Fleet until 1969, when construction was completed on Olin Hall. The MSRAL convention was held there in 1981. Olin Hall continued to be the home of the Prairie

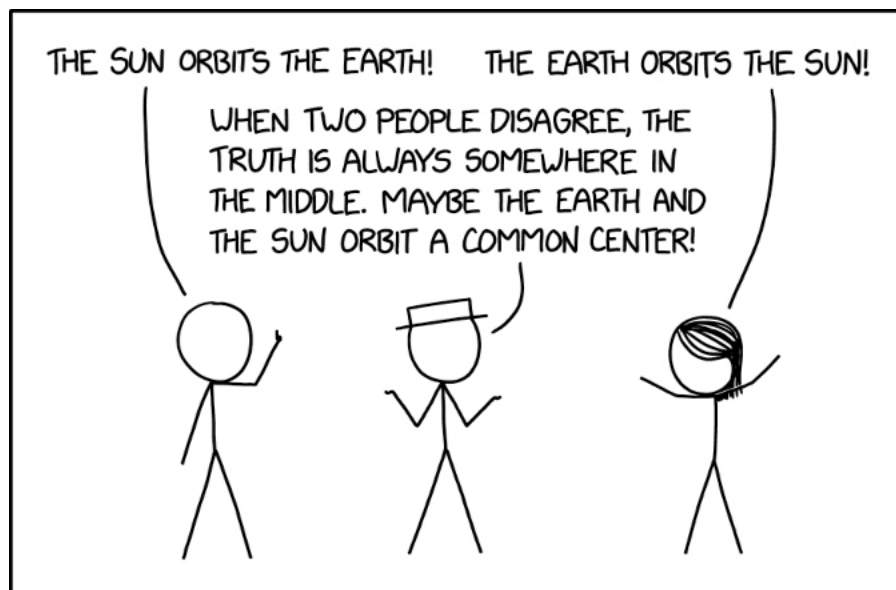
Astronomy Club until Hyde Observatory was built. The building was dedicated in 1968 and lasted just half a century, to be torn down in 2023.



Archives, continued.



PAC Hosted the 1981 Mid-States Astronomical League Convention at Olin Hall



IT'S ANNOYING WHEN PEOPLE ARE RIGHT BY ACCIDENT.

CLUB MEMBERSHIP INFO

REGULAR MEMBER - \$30.00 per year. Includes club newsletter, and 1 vote at club meetings, plus all other standard club privileges.

FAMILY MEMBER - \$35.00 per year. Same as regular member except gets 2 votes at club meetings.

STUDENT MEMBER - \$10.00 per year with volunteer requirement.

If you renew your membership prior to your annual renewal date, you will receive a 10% discount.

Club members are also eligible for special subscription discounts on Sky & Telescope Magazine.

CLUB TELESCOPES

To check out one of the club telescopes, please contact a club officer. Scopes can be checked out at a regular club meeting and kept for one month. Checkout can be extended for another month if there are no other requests for the telescope, but you must notify a club officer in advance.

100mm Orion refractor: Available

10 inch Meade Starfinder Dobsonian: Available.

13 inch Truss Dobsonian: Needs repair.

10 inch Zhumell: Needs mount.

Buy the book! The Prairie Astronomy Club: Fifty Years of Amateur Astronomy. Order online from Amazon or lulu.com.

ADDRESS

The Prairie Astronomer
c/o The Prairie Astronomy Club, Inc.
P.O. Box 5585
Lincoln, NE 68505-0585

info@prairieastronomyclub.org

The Prairie Astronomer is published monthly by the Prairie Astronomy Club, Inc. Membership expiration date is listed on the mailing label. Membership dues are: Regular \$30/yr, Family \$35/yr. Address all new memberships and renewals to: The Prairie Astronomy Club, Inc., PO Box 5585, Lincoln, NE 68505-0585. For other club information, please contact one of the club officers listed to the right. Newsletter comments and articles should be submitted to: Mark Dahmke, P. O. Box 5585, Lincoln, NE 68505 or mark@dahmke.com, no less than ten days prior to the club meeting. The Prairie Astronomy Club meets the last Tuesday of each month at Hyde Memorial Observatory in Lincoln, NE.

