NORTHERN LIGHTS

NORTH CENTRAL REGION OF THE ASTRONOMICAL LEAGUE

Summer 2020 – Volume 5, Number 1

INSIDE THIS ISSUE OF *Northern Lights*

NCRAL CHAIR'S MESSAGE

The Coronavirus pandemic has had a considerable negative effect on human lives, not the least of which has been some 120,000 deaths in the USA alone. Our clubs, our Region, the Astronomical League (AL), and amateur astronomy in general, have been impacted in so many ways.

Consistent with the directive from the AL national office, our NCRAL Vision 2020 hosts – Northern Cross Science Foundation – understandably canceled the Region's annual convention. I suspect that the Region's affiliates did much the same with their meetings and public events. Gone are face-to-face club meetings, public observing sessions, several statewide star parties, and much more. All of this is most unfortunate. At least some of our observers have continued to get out under the stars alone, with family, or in small groups (following social distancing rules of course) because their interest in observing the heavens has not died with the pandemic. Other amateur astronomers have moved online promoting the hobby through writing and images using social media.

The public has, in the main, spent considerable time sheltering at home in order to remain safe. One fortunate aspect of this sheltering-in-place phenomenon from my point of view as the Facebook manager for my club (and the Region) is that members of the public have begun to re-discover what it means to have a hobby. I regularly post descriptions of celestial events worth viewing using the unaided eye or binoculars from urban settings. The number of my club's Facebook followers has increased considerably over the past few months, and we now have over 1,000. Perhaps this aspect of the pandemic will redound to the benefit of amateur astronomy. Who knows?

As one consequence of the pandemic, I have updated TCAA Guide #3 – *Astronomy as a Hobby* – which is freely available for download along with several other guides. The main update in TCAA Guide #3 consists of the addition of the article that appears later in this newsletter titled *The Joys of Amateur Astronomy.* I have also finished a project I started in 1991. It has resulted in the creation of a 42-page TCAA Guide #10 – *Introduction to Spherical Astronomy*. Please visit the TCAA website at http://tcaa.us/TCAAGuides.aspx for your downloads.

Another consequence of the pandemic in my case is that I have made considerable progress in my Astronomical Bucket List work. I've narrowed it down to 200 objects in what I am now calling my *Deep Sky Astronomical Bucket List*. I'll probably work on other variants in the future that deal with other another theme. See my article about bucket lists further on in this issue of ***Northern Lights***.

I'm happy to report that spring's National Astronomy Day did not go entirely by-the-by. One shining example of dealing effectively with the pandemic is the **Northwest Suburban Astronomers** who, on May 2nd, hosted a *Virtual Astronomy Day* with three online presentations. This event was publicized on the Region's Facebook page, so if you missed it you might want to follow us on Facebook. You also may gain direct access to the video by going online to YouTube at https://www.youtube.com/watch?v=oe2ysBzvyww Also, the Twin City Amateur Astronomers (TCAA) started making their cancelled public viewing session talks available online. You can see two fine examples of these public talks at https://www.youtube.com/watch?v=fGhYM0nhrXo (about 2020 sky events) and https://youtu.be/SBorm9K6HLQ (about navigation with stars).

All of these activities are great examples of ingenuity of individual affiliates within the Region, all of which can serve as examples for other affiliates, and all of which can serve as incubators of new ideas for sharing our love for astronomy.

Because of the rescheduling of the NCRAL Vision 2020 convention to 2022 (NCRAL 2021 is taking place in Green Bay as scheduled), I am making another command decision with regard to the Region. In consultation with our elected officers, I have asked Secretary-Treasurer Roy Gustafson to serve an additional year in that capacity which he has most graciously agreed to do. Had NCRAL 2020 taken place as expected, we would have elected a secretary-treasurer to a new two-year term. Because this important position cannot go unfilled, Roy has most graciously agreed to serve until NCRAL 2021 in Green Bay when either he or his replacement will be elected to complete the second year of the unexpired two-year term.

As noted in the Spring 2020 issue of this newsletter, our Region has continued with the 2020 awards and grants programs despite the pandemic. The winners of these awards and the mini grant were noted formally with a 20-minute YouTube video released via the Region's Facebook page on May 1st In the event that you missed it, you may view the video at https://www.youtube.com/watch?v=8g3oZVX6uss

The 2020 award recipients are again announced in a separate article later in this issue of ***Northern Lights***. The 2020 Region Award plaque and Newsletter Editors Award certificate will be presented at NCRAL 2021. Checks associated with the 2020 Newsletter Editor Award ($50) and Mini Grant ($250) already have been forwarded to the recipients. Congratulations to all of our winners!

As you probably know by now, the Astronomical League national convention scheduled for July 16-18, 2020 in Albuquerque, New Mexico, has been postponed. It has been rescheduled for August 4-7, 2021. Save these new dates and visit the convention website at http://alcon2020.info/ for details.

Jeff Hunt's articles about the planets and stars continue to grace the pages of this newsletter. I feel personally indebted to Jeff for all his hard work making calculations, preparing charts, and writing up his work. What a shining example of someone who loves and shares sky watching!

Later in this issue of ***Northern Lights***, you will find an abbreviated *NCRAL Region Report*, an annual version of which must be sent to the national office at the end of June each year. The 2019-2020 *NCRAL Report* details what the Region has been doing and accomplished during the time span indicated. The list of accomplishments of the Region is considerable, so don't forget to take a look.

Wishing you clear skies and a safe summer,

Carl J. Wenning
NCRAL Chair (2017-2021)
carlwenning@gmail.com

NCRAL Financial Statement

Check #	Date	Description	Check Amount	Deposit	Daily Balance	Monthly Balance	
	31-Mar-2020					$9,058.03	March
	30-Apr-2020					$9,058.03	April
1012	26-May-2020	Northwest Suburban Astronomers (Newsletter Award)	$50.00		$9,008.03	$9,008.03	
1013	26-May-2020	Twin Cities Amateur Astronomers (mini grant)	$250.00		$8,758.03	$8,758.03	
	31-May-2020					$8,758.03	May

2020 NCRAL Award Winners and Grantee

~ by Carl Wenning, NCRAL Chair ~

I have had the distinct pleasure of presenting NCRAL Awards and mini grants at our Regional Conventions since becoming Regional Chair. While I was not able to do so this spring at NCRAL Vision 2020 due to its postponement, I nonetheless take great delight here in announcing the 2020 award recipients and grantee.

The following award narratives were taken in part from the nominations of these two worthy candidates. A grants announcement video was first made available on the NCRAL Facebook page on May 1st and has subsequently been viewed 104 times (as of June 15th). This video is currently available on YouTube at https://www.youtube.com/watch?v=8g3oZVX6uss

NCRAL REGION AWARD

Lee Green, Twin City Amateur Astronomers

Lee Green is an outstanding and well-rounded amateur astronomer who exemplifies what it means to provide leadership and service, and to be an active observer.

Leadership: Lee served as TCAA president from 2008-2010. While TCAA President, Lee presided over the multi-year planning process that led to the first NCRAL convention that the TCAA hosted – NCRAL 2010. After his term as president, Lee continued on the TCAA Board of Directors serving as Secretary until February 2016. Lee first became a member of the TCAA Board of Directors in 2007.

Service: Lee has served as club webmaster for many, many years – certainly more than a decade. He worked with the previous webmaster to transition to our current web site. He authored many of the features that are present on our current site, including content management, event registration, and event promotions. As Webmaster, Lee maintains our record of outreach events for the club.

NCRAL 2020 Region Award Recipient Lee Green of the TCAA

Lee wrote a variety of articles for our newsletter ***The OBSERVER*** *of the Twin City Amateur Astronomers*, a newsletter whose editors have twice won the AL's Mabel Sterns Newsletter Editor Award. Lee's writings include a constellation-of-the-month series that ran monthly and reviewed all 88 constellations. Over the years he has had some 140 articles published in our newsletter.

Lee is the TCAA's outreach representative, par excellence! Over the past 11 years Lee has, as a NASA Solar System Ambassador, presented approximately 400 of the 950 astronomy-related events offered by the TCAA. These events find him going to schools, churches, libraries, camps, nature centers, and picnics. He almost always presented a PowerPoint program and observed with or demonstrated his C14 telescope. All such events provided outreach to over 18,000 attendees.

Lee identified the opportunity, prepared the application, and initiated activities to help our club join the NASA Night Sky Network (NSN). Today he acts a one of the primary coordinators in representing the club by attending many of the training events. Through these efforts, we were selected as a winning club in one of the recent NSN giveaways, and we received a Sunspotter which is used with many daylight events.

Observing: Lee is an AL-recognized Master Observer. He has completed 10 AL observing programs and has received the corresponding certificates and pins and is actively pursuing more. Lee has been present with his C14 telescope at nearly every public viewing session for the past decade. He sets up his telescope cloudy or clear. If the sky is overcast, he explains how the telescope works. If clear, he showcases celestial objects.

Honors: Lee has been formally recognized by the TCAA with many awards including the following major award: *G. Weldon Schuette Society of Outstanding Amateur Astronomers* (2010). This award recognizes a TCAA member who has demonstrated great skill in observing, dedication to the club's education and public outreach efforts, and commitment to providing service to the membership. In 2012, Lee was honored with the TCAA's *John & Bertha Kieviet Founder's Award* which is conferred by the TCAA only rarely on those who have contributed significant leadership and service to the club.

Lee Green is a very active member of a very active club. He has shown tremendous dedication to amateur astronomy, the TCAA, and the public as shown by his record of leadership, service, and observing. He is an exceptionally well qualified candidate and most worthy recipient of the 2020 NCRAL Region Award.

NCRAL 2020 Newsletter Editor Award Recipient Edith Auchter of the Northwest Suburban Astronomers

NCRAL NEWSLETTER EDITOR AWARD

Edith Auchter, Northwest Suburban Astronomers

Edith Auchter has been newsletter editor for the Northwest Suburban Astronomers (NSA) since January 1985. During these 35+ years, she has produced some 425 issues of ***Celestial Log***! As noted by NSA President Michael Schiller, "This represents countless hours of work and an incredible selfless dedication to our club and its members."

Of course, it would not have been possible for Edith to produce an outstanding newsletter filled with stories and images representing the day-to-day activities of the NSA were she not actively involved in the club's events over the years.

Both Edith and her husband Tom also are extremely dedicated to amateur astronomy in general as well. Edith and Tom spend 6 to 8 weeks each summer at a national park in Nevada most generously sharing their love of astronomy with others. Most recently, Edith was involved with her club's first *Virtual Astronomy Day* event presented online on May 2nd.

NCRAL's Newsletter Editor Award was developed to shine the limelight on those such as Edith who so often labor in obscurity and not frequently enough receive recognition for their contributions. Congratulations to both Edith and the NSA. Edith's award certificate will be presented at NCRAL 2021. The $50 award in Edith's honor has been sent to the NSA in recognition of other member's contributions to their outstanding newsletter – ***Celestial Log***.

AFFILIATE RECRUITMENT MINI GRANT

Twin City Amateur Astronomers, $250

Following very successful activities with the inaugural NCRAL *Membership Recruitment & Retention* Mini Grant in 2019 (see the Autumn 2019 and Winter 2020 issues of ***Northern Lights*** for complete details), the Twin City Amateur Astronomers again applied for an NCRAL Mini Grant. This time, however, the focus was on affiliate recruitment. Following discussions with the fledgling Illinois State University Astronomy Club (ISUAC) in Normal, Illinois, the TCAA (Bloomington-Normal, Illinois) worked out an agreement upon which the grant application was based.

With reception of the 2020 NCRAL mini grant, the TCAA will now establish a formal long-term mentorship with the ISUAC in an effort to help student members become competent "sidewalk amateur astronomers," dedicated AL observers, and active NCRAL members.

The ISUAC formed about five years ago. Since then, the club's members have spent nearly all of their time on campus and under the dome of the ISU Planetarium. Being in the center of a large urban campus, much of the ISUAC members' time has been spent struggling to find meaningful projects directly related to astronomy. None of the ISUAC members can be called amateur astronomers in the fullest sense of the words. Few have any meaningful observing experience, and none has any significant observing prowess. None know how to use a telescope properly. Most student members (about 20) have limited or no transportation making access to a dark sky difficult and

infrequent. Still, the membership's interest in astronomy remains high. The ISUAC is a perfect candidate for recruitment into the AL and, by default, NCRAL.

The TCAA has several highly competent observers, including AL Master Observers. All will serve as resources in this project. The TCAA will work with the ISU Planetarium director to develop ISUAC members into competent amateur astronomers, some of whom might go on to give sky lectures in the Planetarium following initial training.

The ISU Planetarium has several on-campus telescopic resources that are underutilized (1 portable 8-inch Dobsonian telescope, 2 portable C8 telescopes, 2 portable 10-inch Odyssey telescopes, solar filters, and a high-end Hα filter for use with the C8). ISUAC members will be trained to use these instruments and be taught how to conduct "sidewalk amateur astronomy" activities (both daytime and nighttime) on the ISU campus. ISU has a student population of over 20,000 students, the vast majority of whom live on or very near the pedestrian campus.

The $250 grant from NCRAL will be used to provide for the following:

- A small "get to know one another" social that would include refreshments.
- Material resources (e.g., solar glasses, star maps, accessories for existing telescopes, etc.) for giving away or use during sidewalk astronomy events on campus.
- Printed fliers, brochures, etc. for use to publicize sidewalk astronomy events and well as Astronomy Day displays.
- Payment of one-half the ISUAC's first-year membership in the Astronomical League ($5.00 annually per member plus a $10.00 society fee = $110/2 = $55). The other half will be paid for by the TCAA.

Benchmarks for success of this mini grant are the following:

- The ISUAC will join the AL by the end of the 2020-2021 academic year (May 2021).
- The ISUAC members will present periodic (at least monthly) sidewalk amateur astronomy programs on campus during the warmer autumn and spring months.
- The TCAA membership will regularly interface with the ISUAC for training, including observing from rural locales.

League News!

AL Library Telescope Give Away – The Astronomical League is giving away up to eleven Library Telescopes this year! Through the vision of the Horkheimer Charitable Fund, the Astronomical League is again offering a free Library Telescope to a lucky Astronomical League club in each of the ten AL regions and to one Member-at-Large.

This wonderful program consists of an Orion 4.5-inch StarBlast Dobsonian or a Zhumell Z114 (or equivalent) and a Celestron 8-24 mm zoom eyepiece (or equivalent), and a name plate commemorating the late Jack Horkheimer. The value of this opportunity is approximately $300; the potential of the program is enormous.

Submit your completed entry form electronically so that the Astronomical League national office receives it by July 14, 2020. If mailed, the entry must be postmarked no later than July 10, 2020. The winning entry for each region will be selected July 18, the date when ALCon 2020 was scheduled. Full details of this wonderful program can be found at https://www.astroleague.org/conte…/library-telescope-program. To apply to possibly win one of these telescopes, go to this URL: http://shorturl.at/fCHO1

The Library Telescope Program is a great club project, one that brings members together while benefiting their community. Indeed, it is the perfect outreach program!

League Sales – Check out the new offerings for June and more at http://store.astroleague.org

2020 Dues – The deadline for club dues is June 30. A dues statement will be sent to club ALCors and Presidents shortly. Please try to remit payment promptly.

Election Ballots – Ballots for League officers will be sent just after the dues statements. This year the offices on the ballot are for president and vice president. The deadline is July 1.

The Role of Your Club's ALCor – The ALCor is a club's liaison between the League and the club. Communications from the League are sent to the ALCor for sharing with the affiliate membership. Please make sure club roster updates are sent to rosters@astroleague.org in a timely fashion so members get mailings from the League.

Regional Virtual Meetings with Society ALCors and Officers – The Executive Committee of the AL recently suggested that electronic meetings be scheduled with the ALCors and club officers in each of the regions. This is an attempt to improve the communication between affiliates in the regions and the League. More information will follow soon.

AL Council Meeting AL Council Meeting – The AL National Council Meeting is tentatively scheduled for Thursday, July 16, 2020. It will be held electronically. The official invitation will be sent to Council members soon (e.g. NCRAL Chair and Region Rep.).

NCRAL Seasonal Messier Marathon Awards – Spring 2020

The following individuals have qualified for NCRAL's **Spring Mini Messier Marathon** certificate and pin:

#1 Rusty Case, Popular Astronomy Club
#2 Lisa Wentzel, Twin City Amateur Astronomers
#3 Carl Wenning, Twin City Amateur Astronomers
#4 Alan Sheidler, Popular Astronomy Club
#5 Eric Sheidler, Popular Astronomy Club
#6 Devanand Chatrathi, Twin City Amateur Astronomers
#7 Wayland Bauer, Popular Astronomy Club
#8 Dale Hachtel, Popular Astronomy Club

PAC members gather for Messier observing Friday, June 12th.

Noteworthy!

The following NCRAL members were recognized in the June 2020 issue of the Astronomical League's ***Reflector*** magazine for having completed observing programs:

Binocular Messier Observing Program:
Ken Hugill, Minnesota Astronomical Society
Binocular Variable Star Observing Program:
Kevin Carr, Minnesota Astronomical Society
Citizen Science Observing Program:
Douglas Slauson, Observational Gold Class 1, Variable Stars, Cedar Amateur Astronomers
Deep Sky Binocular Observing Program:
Jeffrey S. Moorhouse, La Crosse Area Astronomical Society
Herschel II Observing Program:
William Kocken, Device Aided, Minnesota Astronomical Society
Lunar I Observing Program:
John Zimitsch, Minnesota Astronomical Society
Planetary Nebular Observing Program:
Ken Boquist, Popular Astronomy Club
Sketching Observing Program:
Brian Chopp, Neville Public Museum Astronomical Society
Universe Sample Observing Program:
Jeffrey S. Moorhouse, Telescope, La Crosse Area Astronomical Society

MASTER OBSERVER PROGRESSION

Observer Award:
Brian Chopp, Neville Public Museum Astronomical Society
Advanced Observer Award:
Kevin Carr, Minnesota Astronomical Society

Dave Tosteson of the Minnesota Astronomical Society had *The elements of surprise: The neutron star merger of GW 170817* published in the June 2020 issue of ***Reflector.***

Should your NCRAL affiliate have short announcements such as award winners, newly-elected officers, or member accomplishments that are worthy of note, please send notification to NCRAL Chair Carl Wenning (carlwenning@gmail.com) who compiles the content of this newsletter. Members-at-Large are encouraged to let us know of their accomplishments as well! Congratulations to our cognoscenti.

NCRAL Region Report for 2019-2020 (Abridged)

Each year during the month of June, Regional Chairs of NCRAL must submit to the Astronomical League national office an annual report covering the interval from July 1 of one year to June 30 of the following year. The report essentially constitutes a State of the Region report and helps to assess the health of various Regions and set directions for the following year. The NCRAL Region Report for 2019-2020 was submitted to the national office recently.

What follows is an abridged edition – abridged here so as not to duplicate information already available elsewhere in this issue of ***Northern Lights***. NCRAL's Region Reports for 2017-2018, 2018-2019, and 2019-2020 may be found in their entirety on the NCRAL website at the following URL: https://ncral.wordpress.com/reports/

Response to Coronavirus Pandemic:

- All Region-sponsored events of were officially canceled due to the pandemic.
- The Region's annual convention, NCRAL Visions 2020, was rescheduled to spring 2022.
- The Region continued with its awards programs despite COVID-19. Awards that would have been made at the NCRAL 2020 convention were announced online. A YouTube video can be seen here: https://www.youtube.com/watch?v=8g3oZVX6uss Presentations of 2020 award plaques and certificates will be made formally at the NCRAL 2021 convention.
- A number of affiliates used online communications to hold membership meetings, give public presentations, and conduct business.

NCRAL Awards:

- Lee Green of the Twin City Amateur Astronomers (Illinois) received the *2020 NCRAL Region Award* in recognition of his service to amateur astronomy.
- Edith Auchter of Northwest Suburban Astronomers (Illinois) received the *2020 NCRAL Newsletter Editor Award* for producing ***Celestial Log***.
- The Twin City Amateur Astronomers (Illinois) received the inaugural *NCRAL Mini Grant for Affiliate Recruitment* ($250). Their mission is to work with a nascent Illinois State University Astronomy Club in cooperation with the ISU Planetarium to train a new generation of amateur astronomers, encourage presentation of sky lectures in the planetarium, promote and support sidewalk amateur astronomy viewing sessions on campus, and to become members of the Astronomical League.
- There were no applicants for this year's *NCRAL Mini Grant for Membership Recruitment and Retention.* Both mini grants treat NCRAL affiliates as incubators of innovative ideas to support the hobby of amateur astronomy. Successful activities have the potential of influencing the Region and the whole of the Astronomical League. Grant outcomes are fully documented in the Region's ***Northern Lights*** newsletter.

Region Administrative Updates:

- Because elections could not be held at NCRAL 2020 due to its postponement to 2022, Regional Chair Carl Wenning made command decisions to reappoint on an interim basis the current Secretary/Treasurer and Regional Representative. Positions will be voted on during NCRAL 2021.
- The Region has confirmed hosts for NCRAL conventions through 2023.
- The Region completed is fourth consecutive year of publishing quarterly issues of ***Northern Lights***, the Region's newsletter. Back issues are accessible on the Region's website at https://ncral.wordpress.com/newsletter-archive/
- NCRAL awarded its first *Seasonal Messier Mini Marathon* observing program certificates and pins for the autumn observing season. Additional completion occurred during winter and spring.
- NCRAL has drafted a *Deep Sky Astronomical Bucket List* observing program. It features over 200 "must be seen" clusters, nebulas, galaxies, supernova remnants, and quasars – ostensibly the best of the best in the night sky. Variants are in the offing. This will not be forwarded to the AL due to the fact that it duplicates to a significant degree two approved AL programs (Messier and Caldwell) that have different observing and recording criteria.
- NCRAL has produced a one-page document titled, *The Benefits of NCRAL Membership*, that explains why clubs should affiliate with or remain affiliated with the Astronomical League and by default the North Central Region. The document can be found at the following URL: https://ncral.wordpress.com/about-2/

Electronic Communications:

- The Region utilizes a self-subscribed email list for disseminating the ***Northern Lights*** newsletter and other communications. Just over 425 of the Region's approximately 1,850 members are subscribed. See https://goo.gl/gsS8SF
- The Region maintains an active Facebook page in which celestial events and items worthy of note a listed regularly. See https://www.facebook.com/northcentralregionastronomicalleague/
- The Region maintains an extensive and ever-expanding website that is regularly updated. See www.ncral.wordpress.com

NCRAL Affiliate and Member Accomplishments:

- The Twin City Amateur Astronomers successfully completed an inaugural NCRAL mini-grant program for membership recruitment and retention ($250). This gained the club more than two dozen new members. The project and outcomes were fully described Autumn 2019 and Winter 2020 issue of ***Northern Lights***.
- The Northwest Suburban Astronomers successfully hosted an online *Virtual Astronomy Day* on Saturday, May 2, 2020.
- Two Regional authors had a total of four articles published in the Astronomical League's ***Reflector*** magazine during the past four quarters:
    - Sara Sheidler, Popular Astronomy Club, *NCRAL Report* (From Around the League), September 2019.
    - Dave Tosteson, Chicago City, Minnesota, *Gravitational Lenses,* December 2019.
    - Dave Tosteson, Chicago City, Minnesota, *Meet the New Boss,* March 2020.
    - Dave Tosteson, Chicago City, Minnesota, *The Elements of Surprise: The Neutron Star Merger of GW 170817,* June 2020.
- Numerous NCRAL affiliate members earned AL observing club pins and certificates.
- The Twin City Amateur Astronomers have made available to the NCRAL membership ten of their *Guides to Amateur Astronomy* that are freely available for download at http://tcaa.us/TCAAGuides.aspx.
    - Guide #1 – *Introduction to Amateur Astronomy* (56 pages)
    - Guide #2 – *TCAA Membership and Benefits* (16 pages)
    - Guide #3 – *Astronomy as a Hobby* (14 pages)
    - Guide #4 – *The Art of Sky Interpretation* (16 pages)
    - Guide #5 – Coordinating Public Viewing Sessions (5 pages)
    - Guide #6 – *Have a Successful Observing Session* (7 pages)
    - Guide #7 – *Buying Binoculars and Telescopes* (15 pages)
    - Guide #8 – *Optimizing Deep Sky Observations* (11 pages)
    - Guide #9 – *Astrophotography 101* (draft, 3 pages)
    - Guide #10 – *Introduction to Spherical Astronomy* (42 pages)

Star Parties & Club Events:

- Several statewide star parties scheduled within the region during the first half of 2020 were cancelled due to the Coronavirus pandemic.
- In the main, most if not all affiliate-sponsored public club events were cancelled due to the pandemic. Several events for autumn are still pending, but these star parties are not sponsored by the Region.

Objectives for 2020-2021:

The current objectives for 2020-2021 are to increase individual memberships in NCRAL-affiliated clubs, societies, and associations, to promote the regional affiliate's involvement in NCRAL events, and increase the number of astronomy clubs participating in the Astronomical League and, by default, the Region.

- Continue development of two *Astronomical Bucket List* observing programs (Deep Sky & Stellar) for NCRAL membership only.
- To obtain, if possible, Federal 501(c)(3) non-profit status so that contributions to the North Central Region will be tax-deductible to the extent permitted by law.

Respectfully submitted,

Carl J. Wenning
NCRAL Chair (2017-2021)

ASTRONOMICAL BUCKET LISTS

~ by Carl J. Wenning, NCRAL Chair (2017-2021) ~

As promised during the NCRAL 2019 business meeting Moline, I have continued to work on my proposal for an astronomical bucket list – a group of objects one really should not miss during a lifetime of observing. On my way to becoming an Astronomical League Master Observer, I came across many impressive objects I'd never seen before. I realized that for years I had been viewing the same things again and again, especially during public observing sessions that admittedly take up a lot of my observing time. During such sessions, I most commonly would observe well-known Messier and solar system objects. Consequently, I had not even seen many of the other impressive celestial objects such as the Caroline's Rose open cluster and the quasar 3C 273.

During the past 3-4 years I have observed nearly 800 candidate objects in an effort to develop an astronomical bucket list. I recently decided to develop two astronomical bucket lists, each with a different theme. The need for two lists (and maybe more) became apparent when the original observing list had burgeoned to over 550 objects! I've now finished assembling my *Astronomical Bucket List* that fortunately contains only 200 of the best and brightest deep sky objects. It is therefore known as the *Deep Sky Astronomical Bucket List*.

Gone from the original astronomical bucket list are things such as prominent binary stars, peculiar stars, bright stars, constellations, and asterisms. These will be included in a second bucket list focusing on such things. The current deep sky list contains approximately 30 bright nebulas, 16 elliptical galaxies, 33 globular clusters, 3 irregular galaxies, 44 open clusters, 15 planetary nebulas, 1 quasar, 57 spiral galaxies, and 1 super nova remnant so called. I say "approximately" because several objects are double galaxies or double clusters.

The new *Deep Sky Astronomical Bucket List* also consists of this: 109 Messier objects (M40 not included), 67 Caldwell objects (those north of declination $-35°$), and the remaining 24 objects other deep sky wonders that are in the author's opinion should be seen but are too often overlooked. Keep in mind that this bucket list is based on my personal opinion of what is best to see and only informal. The list has not been approved for use by the Region and will not be approved by the Astronomical League because it basically replicates two of their major observing programs. The list is currently available in the form of an Excel spreadsheet from the author and can be obtained by emailing carlwenning@gmail.com. A basic observing guide to accompany this list has been developed.

I'll provide additional information in the future as I continue to work on the astronomical bucket list observing programs. I will then offer lists to the NCRAL membership for consideration of approval at NCRAL 2021 about a year from now. *The Deep Sky Astronomical Bucket List* will not be offered to the Astronomical League for approval as a nationally recognized program. This is so because it replicates two major AL observing programs (Messier and Caldwell) and has considerably relaxed conditions for finding and observing these lists' objects. Another of the major differences will be found in the nature of the observing records required. Though available to everyone, the astronomical bucket list is oriented toward older, more experienced observers and requires an indication of significance of the object observed as well as a "final reflection" as though seeing the object for the last time.

Name	M	C	NGC	IC	Const	RA (J2000)	Dec (J2000)	Type	Mag
NGC 7814		43	7814		Peg	00h 03m 15.00s	16° 08' 44.00"	SGal	10.5
NGC 0040		2	40		Cep	00h 13m 00.91s	72° 31' 19.97"	PN	10.6
NGC 0147		17	147		Cas	00h 33m 12.10s	48° 30' 32.00"	EGal	9.7
NGC 0185		18	185		Cas	00h 38m 58.00s	48° 20' 15.00"	EGal	9.2
M 110	110		205		And	00h 40m 22.10s	41° 41' 07.00"	EGal	8.1
M 032	32		221		And	00h 42m 41.80s	40° 51' 55.00"	EGal	7.9
Andromeda Galaxy	31		224		And	00h 42m 44.30s	41° 16' 08.00"	SGal	3.3
Skull Nebula		56	246		Cet	00h 47m 03.80s	-11° 52' 21.69"	PN	7.8
NGC 0247		62	247		Cet	00h 47m 08.60s	-20° 45' 38.00"	SGal	9.1
NGC 0188		1	188		Cep	00h 47m 28.00s	85° 14' 53.4"	OCl	8.1

A Sampling of the Deep Sky Astronomical Bucket List

THE JOYS OF AMATEUR ASTRONOMY

~ by Carl J. Wenning, NCRAL Chair (2017-2021)

The joys of amateur astronomy can be described readily with five words: *knowing*, *observing*, *experiencing, sharing,* and *serving*. Most knowledgeable, experienced, and dedicated amateur astronomers have benefited from most if not all of these joys. As an Astronomical League Master Observer with a broad base of experiences, I am one of those individuals. I feel duty-bound to share what my 60+ years as an amateur astronomer have revealed to me so that others can experience the same delights that I have known. This article provides a summary of the joys of amateur astronomy to help new and less engaged amateur astronomers determine what they might be missing. Whether you are new to amateur astronomy or already involved, what joy or joys might you be missing? Let's find out.

Knowing – From the time of the ancients onward, generation upon generation has looked up at night to the heavens above in awe. Under the proper conditions, what we experience today can bring amateur astronomers even greater joy than that experienced by those before us because we know more about this world, this multi-layered sky. Allow me to explain.

The *first layer* of the sky consists of those things that can be seen with the unaided eye – the constellations and the appearance and motions of the sun, moon, planets, stars, and Milky Way. This is the layer of the sky that the ancients experienced. We see the star-studded constellations and Milky Way move silently overhead at night as part of a giant celestial clockwork. We see the sun cross the sky and note the moon change place daily and exhibit a complete set of phases monthly. We experience eclipses of the sun and moon and view the transits of planets across the face of the sun.

We observe occultations of stars and planets by the moon. We see planets moving forward and backward – prograde and retrograde – among the constellations of the zodiac. We see individual stars, colorful, scintillating, and sometimes changing in brightness. We see meteors and comets. We see the Milky Way from our vantage point within an assemblage of hundreds of billions of stars, crisscrossed by dust lanes, in a place that we call home. Under skies untouched by light pollution, we can still see what the ancients saw, and do so with even greater joy because the mystery (and sometimes the fear) has been replaced by knowledge.

The *second layer* of the sky consists of things contained within the Milky Way. Here we see the life stories of stars played out – their births, their lives, and their deaths. Today we know that stars are other suns, boiling caldrons of radiant plasma, and so much more. We see binary stars and know through study the details about individual components. Those smudges of light we so often see are reflection and emission nebulas, star clusters, planetary nebulas, and supernova remnants. Through study we have come to known star clusters and have surmised how individual stars are born, live out their lives, and die even though the process takes place over billions of years. We come to know about planetary nebulas, white dwarves, novae, supernovae, and black holes – stars whose lives have ended in the most peculiar ways. Most of these sights are within reach of readily available amateur telescopes and viewing them adds to the joys of amateur astronomy.

Amateur Astronomy Today. Image credit Wikipedia

The *third layer* of the sky is the cosmos on a grand scale with its nearly countless number of galaxies located far beyond the boundary of the Milky Way. While we can see a few brighter, nearby galaxies without telescopes under the proper conditions, we can rely on professional astronomers to examine their motion and know that the universe is expanding from an explosive start that occurred some 13.8 billion years ago. On the scale of our local group of galaxies, we find that the stars within galaxies don't move as they should suggesting to us that a vast amount of the matter in the universe is "dark" and virtually undetectable, much like the Cheshire Cat from *Alice in Wonderland* who we know only from its smile. On the grand scale, we have come to conclude there is a mysterious "dark energy" forcing the universe to

expand faster and faster. Like the universe that surrounds us, astronomy is endlessly fascinating.

Observing – The wonders that one can behold during an evening of viewing through a telescope – the moon, planets, comets, asteroids, stars, clusters, nebulas, galaxies, and quasars – can be stunning to behold. The wonder is increased by actually seeing the object with our own eyes rather than viewing an image of it. Nowhere is this more obvious than with those who think about what they see – those who observe rather than merely see. Those who observe using both eye and mind experience more joy than those who see with the eye alone. Additional joy comes from knowledge of the fact that we are experiencing photons that have traveled for vast periods of time over the great voids of space to end their trips in our eyes. Observing celestial objects about which we are well informed can be endlessly fascinating to those who observe, even after viewing the same object time and again. Each season – spring, summer, autumn, and winter – holds its own surprises that are renewed on an annual basis just by looking up.

Another of the joys of observing is the sense of accomplishment experienced by those who have completed an Astronomical League observing program. These observing programs typically consist of a whole group of objects such as asteroids, comets, binary stars, open and globular clusters, and various types of galaxies. Some groups deal with a variety of things such as Messier objects, Herschel objects, Caldwell objects, and so forth. The Astronomical League's observing programs (see https://www.astroleague.org/observing.html) are activities with which all amateur astronomers should be involved if possible. These programs not only provide a sense of accomplishment and pride when completed, but also serve as motivation to joyfully discover and learn more about the heavens above.

Observing the starry night sky with others adds another joyful dimension to amateur astronomy. The camaraderie, the *esprit de corps,* of amateur astronomy develops and is experienced when viewing with others. It's fun to share one's eyepiece and personal enthusiasm and experience the excitement of others when comparing observations using more than one telescope. While some amateur astronomers like to view together – teaching and learning as they go – other amateur astronomers find that astrophotography provides a sense of satisfaction and joy as well.

Imaging, the process of taking photographs of celestial objects, is just as fascinating for many amateur astronomers as is visual observing and the sharing of observations. What the eye cannot reveal, the telescope and camera can and do. For instance, while viewing a galaxy through a fair-sized telescope (8"-12" aperture), observers usually see what appear to be "faint fuzzies." Some are circular, oval, and even lenticular, and most are quite diffuse. Some have almost stellar cores, and spiral patterns can be directly observed with the aid of a telescope in a few. What is more, however, is the fact that photographs reveal what the eye simply cannot detect on its own. Cameras have the ability to gather light in a way that the human eye cannot. Images produced through the use of cameras and telescopes offer new spectacles that visual observers cannot enjoy in any other way.

M101, The Pinwheel Galaxy. Image credit Scott Wade, TCAA

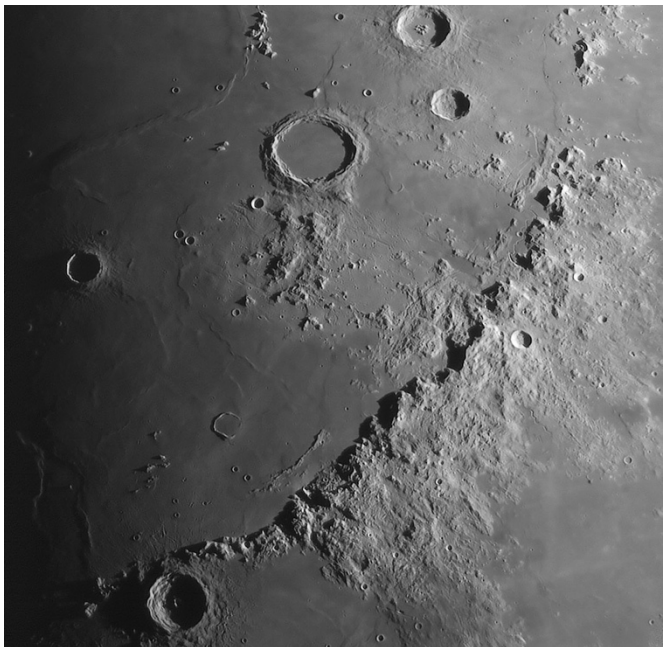
Astrophotographers are sometimes ready to point out that many things go missing when directly observed with the eye, that they can see what the eye and telescope together cannot reveal. They get a tremendous sense of accomplishment after many hours of stacking and processing images and often find delight in sharing their work with others.

Taking nice pictures of celestial objects aren't the only things that amateur astronomers do today. Some study the motions of binary stars, find and track asteroids and comets, perform visual or photographic photometry on variable stars, take spectra, and even develop and use radio telescopes. The variety of things that our more expert amateurs do sometimes approaches what professionals do. Amateurs are taking advantage of the technology of professionals, if only on a smaller scale.

The Solar Spectrum, by Tim Stone, Twin City Amateur Astronomers

Experiencing – Experiencing the technological marvels of modern amateur astronomy can also be a great source of joy.

To technophiles, amateur astronomy is often a way to ride the crest of the wave associated with technological advancement. Today we have goto telescopes, auto finders, auto trackers, digital still and video cameras, image stabilizers, observing aids and telescope controllers on cell phone, tablets, and computers. Image acquisition, stacking, and processing software abounds. Today's amateur astronomer can rival the imaging capacities of the world's largest professional observatories only a generation ago.



The Lunar Surface. Image credit Tim Stone, TCAA.

Telescope making was quite the rage from the 1930s onward. Amateurs began to build larger and larger reflecting telescopes. Later, the rocker-box Dobsonian telescope design led to the development of light-bucket telescopes with 17.5" apertures and above not all that uncommon. With the advent of commercial telescope makers in the 1960s and continued growth ever since, it became possible to acquire at reasonable prices instruments of many different sizes and designs that satisfy every desire and need. It's not terribly uncommon today to find amateur groups in possession of telescopes from 24" to 32" in diameter some of which are nothing short of professional grade.

A half century ago the standard amateur telescope was either a 60mm refractor or a 4.25" reflector. Anything larger was probably home built and then everything had to be found by using setting circles, star hopping, and sweeping. In addition to developments in the production of apochromatic optics, the production of mounts also flourished. The observing equipment available today to amateur astronomers is little short of amazing. As a result, it's not at all unusual for an observer to view 50 to 60 objects in the course of an hour or two using computer technology with modern goto mounts. Amateur astronomers today tend to see much more than they did in the not so distant past.

Small commercial observatories became available to amateur astronomers starting in the 1970s. Today it's not uncommon to find domed and roll-off-roof observatories owned by clubs and even individuals. In some cases, rotating domes are interfaced with the telescopes within so that the proper alignment between the optical axis of the telescope and dome slot is precisely maintained. Some amateur observatories are so advanced that they can be operated remotely with little to no human intervention.

Because of vast improvements in remote control via computer networks, it is now possible to utilize telescopes around the world – both optical and radio – from the convenience of one's home. I personally have utilized photographic telescopes in Chile, Australia, and elsewhere to image the night sky that I cannot directly observe from my home in Illinois. I once regularly used the 60-foot diameter radio telescope at the National Radio Astronomy Observatory in Green Bank, West Virginia, to observe quasars and other radio emitters using my desktop computer. All this came by way of being an amateur astronomer.

Another of the great joys associated with amateur astronomy is experiencing world travel, at least for those so disposed. Many amateurs have traveled the world in recent years to view total solar eclipses from remote locations, some of which they would never have visited were it not for the possibility of seeing a striking solar-lunar phenomenon. Not only do they view the moon crossing over the face of the sun, they make memories that last a lifetime. The encounters with amazing cultures, languages, foods, and historical locations all serve to making these memories. They also meet many kindred spirits along the way with whom they will or have experienced the celestial wonders. Many lifetime friendships are forged as a result of these experiences.

So it is with attending astronomy conventions at the state, regional, or national levels. Attending NCRAL or AL conventions is a highlight for some amateur astronomers each year. Experiencing amateur astronomy through the eyes of others, meeting well-known speakers, visiting club and other important astronomical facilities also can bring the convention attendee lots of joy.

Sharing – Another of the many joys that amateur astronomers experience is sharing their love of all things astronomical with those who are not amateur astronomers. This is the joy of public outreach which typically takes the form of participating in public viewing sessions where opportunities to give presentations, sky lectures, and showcase celestial objects through their telescopes to visitors

are involved. Many members of astronomy clubs go home feeling quite fulfilled for having participated in public viewings sessions. The memories of the oohs and ahhs of someone who has seen Saturn or the moon for the first time tend to stick with those who made it possible. Answering questions and feeling the satisfaction of one who knows and is seen as an authority are reasons enough for joy.

Not to be forgotten is the use of media to promote amateur astronomy. Not a few among us will write weekly or monthly columns for newsletters, newspapers, listservs, and various forms of social media. For instance, some will use inexpensive software to create stunning views of the night sky, illustrating a particular point that can be exported for use with Facebook, Twitter, and the like. Being creative – both visually and in a literary sense – brings joy to many amateur astronomers.

There is yet another joy of sharing, and it is that which comes from educating one's club members – by either giving whole group presentations to active or and even "armchair amateur astronomers," or working one-on-one with eager new members. There is much satisfaction in teaching others about astronomy and how to become a practicing amateur astronomer. While it's fun working with adults, it can be particularly enjoyable to work with youth. Youth are so impressionable and eager to learn that even their career paths can be greatly influenced by working with knowledgeable and experienced amateur astronomers.

TCAA class funded by NCRAL Mini Grant. Image credit C. Wenning

Serving – Serving one's local, regional, or national astronomy groups is an excellent outlet for those with specialized interests. For instance, some members relish the leadership roles of Board member or president in their clubs, and those "on their way up" in the leadership ranks often serve as vice presidents or in some other official capacity. Those with writing interests and skills often serve as secretaries, newsletter editors, historians, and web masters. Some groups have even gone on to host regional and national conventions for Astronomical League, and certain individuals have even become national officers.

Northern Lights *newsletter masthead. Image credit T. Dufek, PAC*

Knowing, observing, experiencing, sharing, and *serving* are the keys to the joys of amateur astronomy. Participation also can be *rewarding*. For instance, those who like to observe the heavens or provide other services can easily earn rewards in the form of plaques, certificates, pins, and recognitions from the Astronomical League, their Region, or their astronomy club.

Astronomical League has a plethora of awards in addition to those associated with its many observing programs. There are so many awards, that readers are directed to the following link: https://www.astroleague.org/al/awards/awards.html. It should be mentioned that a number of NCRAL members have been recognized with AL awards in recent years through several of these prestigious national award programs.

Additionally, NCRAL presents annually its *Region Award* that is uses to recognize those who have experienced the joys of amateur astronomy through the acts of *knowing, observing, experiencing, sharing,* and *serving.* The recipients of the NCRAL Region Award are the de facto authorities when it comes to the joys of amateur astronomy because they are so involved in every phase of amateur astronomy. The Region also awards annually the NCRAL *Newsletter Editor Award* in recognition of dedicated service. The Region also has its Seasonal Messier Mini Marathon observing program along with its certificates and pins. All award winners are recognized in the pages of the Region's ***Northern Lights*** newsletter.

Some NCRAL affiliates also have awards. My own club, for instance, has four honorary awards: *Lifelong Honorary Membership*, membership in the *G. Weldon Schuette Society of Outstanding Amateur Astronomers*, the *Kieviet Founders Award*, and the *Miller Family Award*. Many clubs present similar awards to their members in recognition of various aspects of service or expertise. All these awards also are a source of joy to amateur astronomers both when they are presented and when the announcements appear in a club's publications.

So, there you have my perspective on the joys of amateur astronomy. While this list might not be all inclusive, it does suggest the abundance of joy that amateur astronomers can experience, but only if they immerse themselves fully in the hobby of amateur astronomy.

FUTURE NCRAL CONVENTIONS

During NCRAL's annual business meeting the Region receives offers for hosting upcoming conventions. The following affiliates have agreed to hosting future conventions. We are in need for hosts for 2024 and the years beyond. It's never too early to start planning to host.

- 2021 Green Bay, WI: Neville Public Museum Astronomical Society (confirmed)
- 2022 Port Washington, WI: Northern Cross Science Foundation (confirmed)
- 2023 Bloomington-Normal, IL: Twin City Amateur Astronomers (confirmed)
- 2024 **OPEN**

If your club has never hosted an NCRAL Regional convention, please consider doing so in 2024 or later. While it is a considerable amount of work, it can be quite rewarding – even fun. It provides an opportunity to showcase your group's facilities and accomplishments, build club camaraderie, and to get to personally know interesting guest speakers. You can also use such an event to grow your club's membership.

Remember, NCRAL now has its own convention planning guide. The ***NCRAL Convention Planning Guide*** has three sections. Section 1 deals with the "preliminaries" of what it takes to host a Regional convention. Section 2 deals with programming information. Section 3 deals with budgeting information. The guide was developed by experienced hosts of NCRAL conventions in conjunction with one future host who asked lots of excellent questions. To download the planning guide, you may access it through the NCRAL website the following URL: https://ncral.wordpress.com/conventions/. Look for the link at the bottom of the page.

Please contact NCRAL Chair Carl Wenning at carlwenning@gmail.com should you have any questions or wish to toss your hat into the ring for hosting a future NCRAL convention.

NCRAL SEASONAL MESSIER MARATHON OBSERVING PROGRAM

Don't overlook or forget about the NCRAL Seasonal Messier Marathon! The Seasonal Messier Marathon observing program is NCRAL's introduction to viewing the Messier objects. This program is intended to serve as motivation to get NCRAL-affiliated members out under the stars to observe.

The program permits the use of goto telescopes to find the objects and, as such, the program must not be seen as proof of observing prowess. NCRAL will permit Astronomical League's Messier observing program to serve that purpose. Still, for those who have asked for some sort of demarcation, NCRAL observing certificates will hence forth include the words "manual" or "assisted."

Up-to-date details about the Region's four observing program and helpful observing record sheets can now be found on the NCRAL website: https://ncral.wordpress.com/awards/. Below are the seasonal observing lists followed by some helpful observing notes.

Autumn: M55, M69, M70, M75, M11, M26, M56, M57, M71, M27, M29, M39, M2, M72, M73, M15, M30, M52, M103, M31, M32, M110, M33, M74, M77, M34, and M76. (27 objects)

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)

Spring: M95, M96, M105, M53, M64, M85, M88, M91, M98, M99, M100, M49, M58, M59, M60, M61, M84, M86, M87, M89, M90, M104, M3, M51, M63, M94, M106, and M68 (28 objects)

Summer: M83, M102, M5, M13, M92, M9, M10, M12, M14, M19, M62, M107, M4, M6, M7, M80, M16, M8, M17, M18, M20, M21, M22, M23, M24, M25, M28, and M54. (28 objects)

OBSERVING NOTES:

- ***Autumn:*** This season's objects span a wide range of right ascension and declination. With several objects located in Sagittarius and disappearing into the glare of the sun by mid-autumn (M55, M69, and M70), it is best to complete the autumn observing program before the end of October. After that they will be too near the sun to observe during late autumn evenings.
- ***Winter:*** It probably would be best to begin the winter Marathon around mid-February or later. Any earlier in the year, observers will have to wait until late into the night for all winter objects to have risen high enough in the sky to observe. With winter weather moderating in March, it wouldn't be too late to start then so long as observations are completed by the March equinox.
- ***Spring:*** This season's object span a rather narrow region of right ascension, with most of the objects being associated with or in proximity to the Virgo-Coma cluster of galaxies. At the start of spring, an observing run beginning near the end of astronomical twilight should allow observers to view all objects by around 10:30 PM. By mid-April, all objects should be well enough placed at the end of astronomical twilight allowing for their fastest possible observation.
- ***Summer:*** All summer Marathon objects are above the horizon at the end of astronomical twilight on the first day of summer. The westernmost and southernmost of the object on this season's list is M83 that tends to set rather early during the night and early in the season. It would be best to conduct the summer Messier Marathon closer to the start of the season. Waiting too late in the season to start could result in the loss of M83 from view.

ADD YOUR EMAIL ADDRESS TO THE NCRAL MEMBER DATABASE

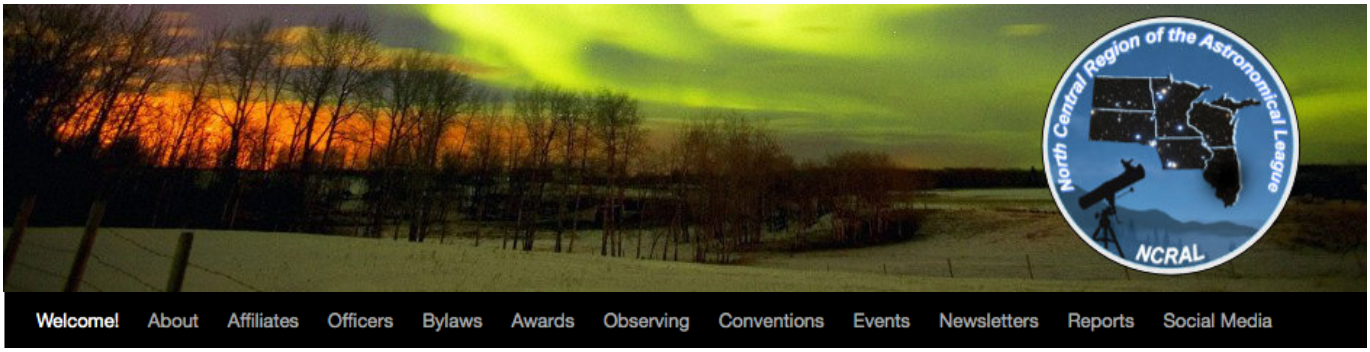
Did you know that just over 425 of some 1,850 NCRAL members are receiving this newsletter via email? That's only 23% of the membership. Please help NCRAL get its newsletter out to the membership by encouraging fellow club members to add their email addresses to the NCRAL member database. Editors, please include this information in your affiliate's newsletter.

When one adds his or her email address to the NCRAL member database, he or she will receive direct notifications about the availability of ***Northern Lights***. In addition, subscribers will receive important and timely announcements about Regional conventions, star parties, and so forth. Only blind addressing (Bcc:) will be used with this email list so that others will not see your email address. Email addresses will never be shared with or sold to outside entities.

No one will add your email address to this list for you, so you'll need to do it yourself. Sign-up takes only about a minute. You'll need to provide your name, email address, astronomy club affiliation (or indicate A.L. membership-at-large) and let us know if you hold specific positions within your club. Go to the following case-sensitive URL to add your information to our database at https://goo.gl/gsS8SF today so you won't miss important future communications.

UPDATED NCRAL WEBSITE

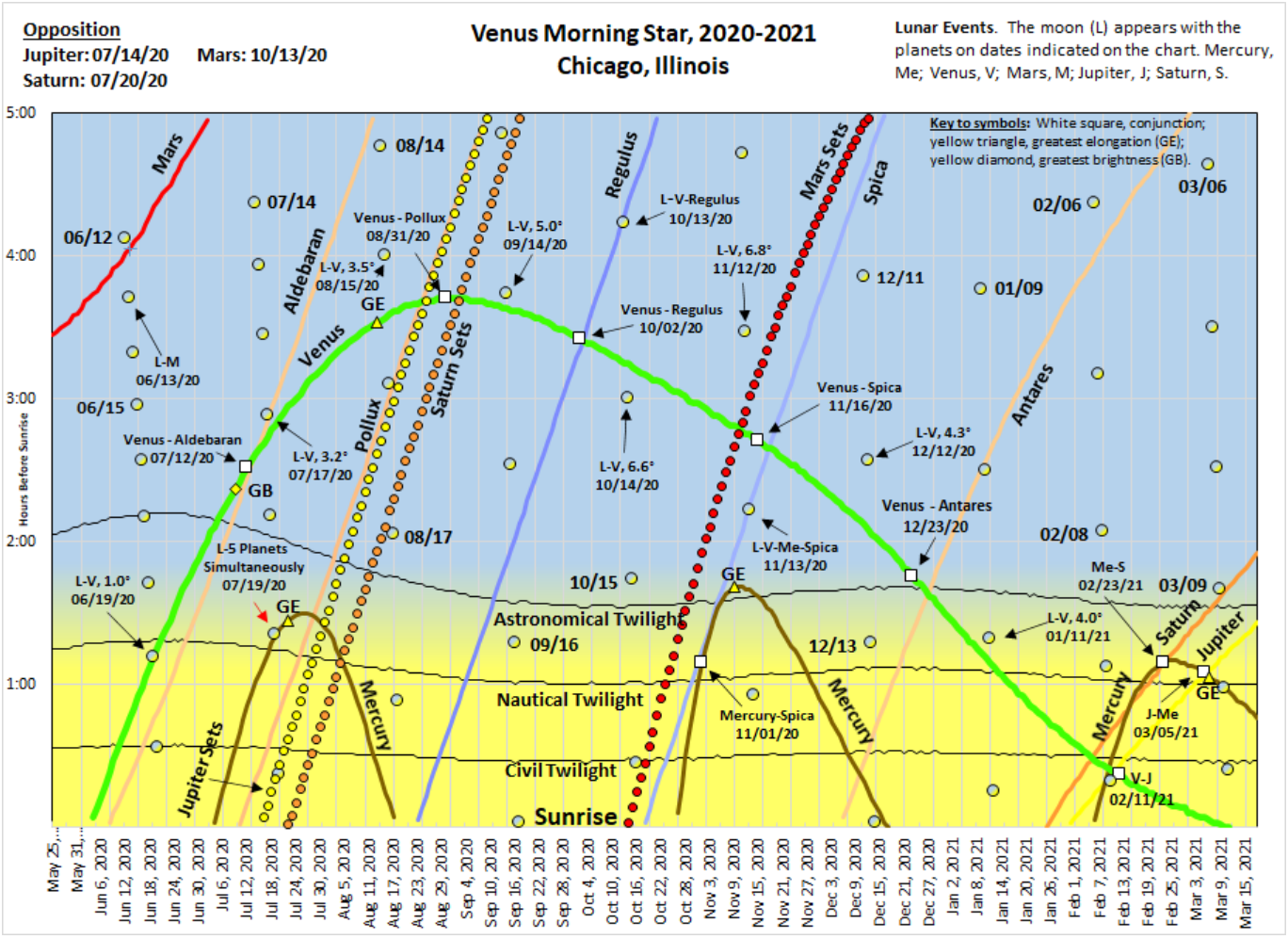
~ by Jeff Setzer ~



Did you know that NCRAL has its own website and that it has recently been updated? It's true, and its undergoing constant improvement! Point your browser to ncral.wordpress.com and you'll see a central repository for information about our Region and affiliates, the Region's Bylaws, back issues of ***Northern Lights***, information about observing programs, awards, and grants, and much more. Will the website progress from an occasionally used reference to something more? That's entirely up to you, dear reader. If you have ideas or submissions, contact me at astrosetz@hotmail.com

VENUS AS A MORNING STAR, 2020-2021

~ BY JEFFREY L. HUNT ~



This chart displays the difference in the rising time of Venus and sunrise along with the moon, naked eye planets and bright stars near the ecliptic. The setting differences of Jupiter, Saturn, and Mars compared to sunrise are displayed. The three phases of twilight are graphed as well.

Venus makes a grand entrance into the morning sky after its inferior conjunction on June 3, 2020, at 12:44 p.m. CDT. It races into the morning sky and a week after conjunction it rises at Civil Twilight, 32 minutes before sunrise. After mid-June, Venus gleams from low in the east-northeast sky during mid-twilight. The closest Venus – Moon grouping of this apparition occurs on the morning of June 19. By early July, Venus rises before the beginning of twilight and appears higher in the sky as sunrise approaches.

During July, Venus moves through the Hyades, with an Aldebaran conjunction on July 12. Watch the planet move through the star cluster with a binocular, during several mornings leading up to the Venus – Aldebaran conjunction.

On July 19, the lunar crescent and five planets are simultaneously spread across the sky with Jupiter low in the western sky and Mercury low in the eastern sky. Venus, Mars, and Saturn are scattered between them. The details are in the daily note.

Other highlights of the Venus apparition include a grouping with the Beehive cluster in mid-September that includes the crescent moon on September 14; two mornings in October when Venus is about 0.5° from Regulus; a widely spaced Venus – Spica conjunction during mid-November; and an extremely close conjunction with Beta Scorpii in December. Mercury makes an appearance during November, but the gaps with Venus are very wide. At the end of the apparition, Venus passes Mercury, Saturn, and Jupiter.

Although they are near the sun, attempt to view the Venus – Jupiter Epoch (close) Conjunction during the day.

Venus reaches its superior conjunction on March 26, 2021, then slowly moves into the evening sky.

The chart above, calculated from data from the U.S. Naval Observatory for Chicago, Illinois, shows the difference in rising time between Venus (green line) and the sun during the planet's morning apparition. The three phases of twilight are included. Other bright stars that appear near the ecliptic are graphed as well as the time differences for the other bright planets. The moon's rising time differences are displayed as circles. All this activity occurs in the eastern sky. The setting time differences (circles) for Jupiter, Saturn, and Mars are included as well. When the planets set in the west at sunrise, they are at opposition. For Jupiter, this occurs on July 14, 2020, followed by Saturn six days later. Mars' opposition occurs on October 13, 2020. Every date after their opposition dates the planets, set in the west before sunrise until they disappear from the top of the chart, setting over 5 hours before sunrise.

When the Venus line crosses the lines of other objects, they rise at the same time. A conjunction occurs near the intersection. It is important to note that because two objects rise at the same time, they may not appear close together in the sky. While Antares, Aldebaran, and Pollux generally lie near the ecliptic, the conjunctions with planets can have gaps of several degrees. As an extreme example, Sirius and Venus rise within a few minutes of each other on September 15, 2020. Venus rises in the east-northeast and Sirius in the east-southeast. They are over 40° apart. Objects are selected for the graph that appear near the ecliptic. For this reason, Sirius is not graphed.

If a moon circle is displayed near one of the rising lines, a conjunction may occur on that date, or on the day before or day after the date the moon and that object are plotted together. Notes are on the graph to indicate the dates when the moon is near Venus, along with their angular separations. The closest grouping occurs on June 19, 2020, when they are separated by 1.0°. While they are low in the sky, the scene is that of a classic artist's celestial painting. Other groupings occur when the moon is higher in a darker sky. Details are in the daily notes.

With the focus on Venus, conjunctions with stars are indicated with boxes on the Venus curve. The greatest morning (west) elongations of Venus and Mercury are indicated with yellow triangles and "GE" labels.

The midpoint (July 8) of the interval of Venus' greatest brightness is marked with a yellow diamond shape and the "GB" label. While not a formal designation, the change in apparent magnitude is hardly distinguishable to the unaided eye during this period that runs from June 29 through July 17. The midpoint is near the date of the planet's greatest illuminated extent (July 10). This occurs when the illuminated portion of the planet covers the largest area of the sky. This means the planet is very bright, at its theoretical maximum brightness. For a technical explanation, see https:/tinyurl.com/venus-greatest-illuminated.

In the daily notes that follow, five numbers are included that describe some Venusian observational characteristics. They include: the apparent magnitude of Venus; the planet's apparent size in arc seconds; the phase of the planet displayed as a percentage of the planetary disk that is illuminated; the distance to Venus from Earth in Astronomical Units; and the time difference in minutes between the rising of Venus and sunrise.

When a daily note includes the moon, the lunar age (days past the New phase) and the phase – expressed as a percentage of the lunar disk illuminated – are included.

Specific times in the notes are for Chicago, Illinois. Make any necessary changes for latitude, longitude, or time zone differences.

This apparition of Venus begins as this issue of the ***Northern Lights*** is published. Some of the June events may have passed when this is distributed.

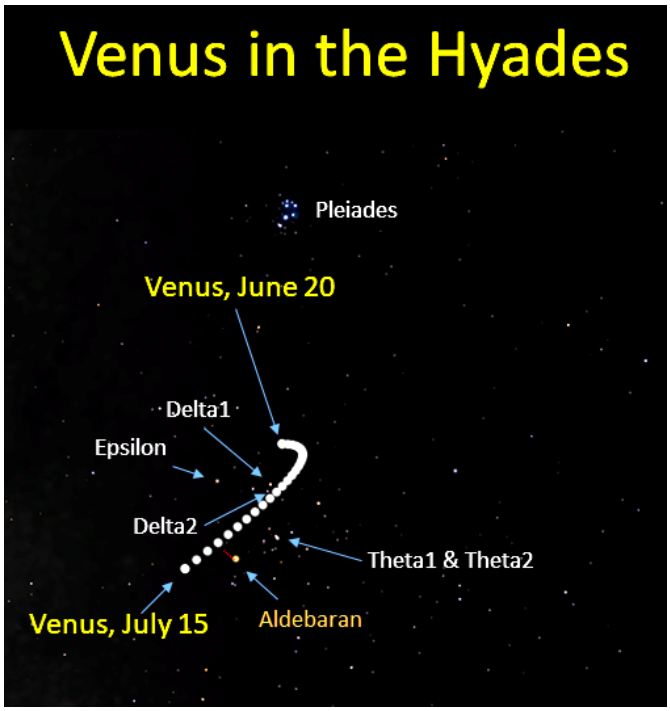
June 19, 2020: The moon makes its closest pass with Venus during this apparition. They are 1.0° apart.

Into the Morning Sky

- After its inferior conjunction, Venus pops into the morning sky. It rises five minutes earlier each morning and it is visible low in the east-northeast. Be sure to view it with the moon on June 19. Continue to watch it as it appears higher in the

sky at the same time each morning and Aldebaran and the Hyades appear through the morning twilight.

- **June 19**: (−4.4, 51”, 8%, 0.32AU, 72m) Forty-five minutes before sunrise, the old moon (27.8d, 4%), about 4° up in the east-northeast, is 1.0° to the lower left of Venus. Find a clear horizon to view the pair.
- **June 21**: (−4.5, 50”, 10%, 0.33AU, 80m) Venus rises at Nautical Twilight, when the sun is 12° below the horizon. Forty-five minutes before sunrise, the planet is about 4° up in the east-northeast.
- **June 26**: (−4.6, 46”, 14%, 0.36AU, 100m) Forty-five minutes before sunrise, Venus is about 8° up in the east-northeast. This brilliant planet is 4.9° to the upper right of Aldebaran (α Tau, m = 0.8) and 9.2° below Alcyone (η Tau, m = 2.8), the brightest star in the Pleiades star cluster. A binocular helps seeing the star cluster and Aldebaran.
- **June 29**: (−4.7, 44”, 17%, 0.38AU, 110m) During the next 18 mornings, Venus displays its greatest brightness. While the photometric brightness increases, your eye likely does not see any difference in the visual intensity of the planet. Forty-five minutes before sunrise, Venus – over 10° in altitude in the east-northeast – is 4.6° to the upper right of Aldebaran. Use a binocular to see the star. Four naked eye planets – Venus, Mars, Saturn, and Jupiter – are scattered across the sky along 131° of ecliptic longitude. Dimmer Uranus, Neptune, and Pluto are in the sky between Venus and Jupiter as well.



Venus in the Hyades, June 20 – July 15. The planet moves through the cluster and near Aldebaran. Venus passes the star on July 12.

Venus in Taurus

During July and early August, Venus moves through Taurus – from the Hyades to Zeta Tauri, the Bull’s Southern horn. As Venus moves through the star cluster, note the planet’s position each morning compared to the starfield. While near Zeta Tauri, Venus passes near the Crab Nebula. While not well-suited for observing, the supernova remnant’s location can be noted for viewing later in the year when it is higher in the sky before morning twilight begins. While in the period of greatest brightness, Venus maintains nearly consistent apparent magnitude to our unaided eyes, −4.7, for most of the interval, diminishing slightly during early August. The apparent size decreases to 26” in diameter. While that occurs, the Venusian phase increases to 46% – a thin morning crescent to a thick morning crescent – and the distance increases to 0.60 Astronomical Unit. Venus’ rising time increases 84 minutes to 201 minutes before sunrise. Unless specified each note is for one hour before sunrise.

- **July 1**: (−4.7, 43”, 19%, 0.39AU, 117m) One hour before sunrise, Venus, over 9° in altitude in the east-northeast, is 4.2° to the upper right of Aldebaran and 1.1° to the upper right of Delta1 Tauri (δ1 Tau, m =3.8). Use a binocular to watch Venus move through the Hyades.
- **July 2**: (−4.7, 42”, 20%, 0.40AU, 120m) Venus rises two hours before sunrise. One hour later, nearly 10° in altitude, brilliant Venus is 4.0° to the upper right of α Tau and 0.9° to the upper right of δ1 Tau.
- **July 3**: (−4.7, 41”, 21%, 0.40AU, 124m) Venus, over 10° up in the east-northeast, is 3.7° to the upper right of α Tau and 0.6° to the upper right of δ1 Tau.
- **July 4**: (−4.7, 41”, 22%, 0.41AU, 126m) Nearly 11° in altitude in the east-northeast, Venus is 3.4° to the upper right of α Tau and 0.4° to the right of δ1 Tau.
- **July 5**: (−4.7, 41”, 23%, 0.42AU, 130m) Venus rises at Astronomical Twilight, when the sun is 18° below the horizon. It continues to rise before twilight begins until December 26, 2020. One hour before sunrise, Venus, nearly 12° up in the east-northeast is 3.1° to the upper right of Aldebaran and 0.8° to the lower right of δ1 Tau.
- **July 6**: (−4.7, 40”, 24%, 0.42AU, 133m) Venus, 12.0° up in the east-northeast, is 2.7° to the upper right of Aldebaran and 0.5° below δ1 Tau. The planet is inside the “V” of Taurus.
- **July 7**: (−4.7, 39”, 25%, 0.43AU, 136m) Over 12° in altitude in the east-northeast, Venus is 2.3° to the upper right of Aldebaran, 0.8° to the lower left of δ1 Tau, and 0.6° to the lower left of Delta2 Tauri (δ2 Tau, m = 4.8). Continue to watch Venus move through the cluster with a binocular. Observe that Venus and the three stars are nearly in a line that starts at α Tau and ends at δ1 Tau.

- July 8: (−4.7, 38”, 26%, 0.44AU, 139m) Brilliant Venus is over 13° in altitude in the east-northeast. It is 2.0° to the upper right of Aldebaran and 0.9° below Delta3 Tauri (δ3 Tau, m = 4.3). The planet is at the midpoint of its interval of greatest brightness. On the rising chart, this is marked with a yellow diamond and labelled “GB.”
- **July 9**: (−4.7, 38”, 26%, 0.44AU, 142m) Nearly 14° up in the east-northeast, Venus is 1.6° to the upper right of Aldebaran and 1.2° to the lower left of δ3 Tau. Venus is on a line between the two stars.
- **July 10**: (−4.7, 37”, 27%, 0.45AU, 145m) Venus, over 14° in altitude in the east-northeast, is 1.2° above α Tau. Also note that the brilliant planet is to the right of a line that connects Aldebaran and Epsilon Tauri (ε Tau, m = 3.5). Venus is at its greatest illuminated extent. For a technical explanation, see https://tinyurl.com/venus-greatest-illuminated.
- **July 11**: (−4.7, 37”, 28%, 0.46AU, 148m) Nearly 15° up in the east-northeast, brilliant Venus is 1.0° to the upper left of Aldebaran. The planet is to the left of a line that connects Aldebaran and ε Tau.
- **July 12**: (−4.7, 36”, 29%, 0.46AU, 151m) This morning is the Venus – Aldebaran conjunction. One hour before sunrise, locate Venus 15° up in the east. It is 0.9° to the upper left of α Tau.
- **July 13**: (−4.7, 35”, 30%, 0.47AU, 154m) Brilliant Venus is nearly 16° up in the east, 1.2° to the left of α Tau.
- **July 14**: (−4.7, 35”, 30%, 0.48AU, 157m) Venus is at its farthest southern celestial latitude of this apparition, −4.52°. Over 16° in altitude in the east one hour before sunrise, Venus is 1.6° to the lower left of α Tau. Jupiter (m = −0.8) is at opposition. This morning it is nearly 12° up in the southwest, 6.8° to the lower right of Saturn. This evening, Jupiter rises at sunset, is in the sky all night, and sets at sunrise tomorrow morning.
- **July 15**: (−4.7, 34”, 31%, 0.49AU, 159m) Locate Venus nearly 17° up in the east, 2.1° to the lower left of α Tau.
- **July 16**: (−4.7, 34”, 32%, 0.49AU, 161m) One hour before sunrise, Venus, over 17° in altitude in the east, is 2.6° to the lower left of α Tau. The moon (25.2d, 19%) enters the scene, 9.9° to the upper right of Venus.
- **July 17**: (−4.7, 33”, 33%, 0.50AU, 164m) Venus is over 17° up in the east. The crescent moon (26.1d, 12%) is 3.2° to the left of Venus, while α Tau is 3.2° to the upper right of the brilliant planet. This morning marks the end of the interval of Venus’ greatest brightness. The Venus – Aldebaran gap tomorrow is 3.8°. Start looking for the five naked eye planets with the crescent moon. The optimal view is on the morning of July 19.

July 17, 2020: The moon appears 3.2° from Venus. The brilliant planet is 3.2° from Aldebaran.

- **July 19**: (−4.6, 32”, 34%, 0.52AU, 169m) Forty-five minutes before sunrise, see the five naked eye planets with the crescent moon. Brilliant Venus is 21° up in the east, 4.5° to the lower left of Aldebaran. The moon (28.1d, 2%) is about 5° up in the east-northeast, 5.0° to the left of Mercury (m = 0.8). The Venus – moon gap is 27°. Mars (m = −0.8) is over 47° in altitude in the south-southeast. Jupiter (m = −2.7) – five days past its opposition – and Saturn (m = 0.1), one day before its opposition, are in the southwest. Jupiter is about 4° in altitude and Saturn is 7.0° to Jupiter’s upper left. The gap between the moon and Jupiter is over 170° of ecliptic longitude. Dimmer Uranus, Neptune, and Pluto are scattered along the ecliptic between Venus and Jupiter. During the next few mornings five planets are visible – along with Uranus, Neptune and Pluto with optical assistance – but without the moon. Additionally, Jupiter is quickly leaving the sky. On successive mornings, look 3-4 minutes earlier each day. You may catch all of them in the sky until about July 25. Find clear horizons to view Mercury, Saturn, and Jupiter.
- **July 20**: (−4.6, 32”, 35%, 0.52AU, 172m) One hour before sunrise, Venus, 19.0° up in the east, is 5.2° to the lower left of α Tau and 10.1° to the upper right of Zeta Tauri (ζ Tau, m = 3.0), the Southern Horn of Taurus. During the next few mornings, look for Betelgeuse (α Ori, m = 0.4) low in the eastern sky, less than 10° to the left of the east mark. Venus is nearly 18° above the star. Orion’s other shoulder, Bellatrix (γ Ori, m = 1.6) is about 12° up in the east. During the next week, begin looking for Rigel (β Ori, m = 0.2), low

in the sky, about 15° to the right of the east cardinal point. To view these stars, find a clear horizon. Saturn is at opposition, nearly 14° up in the southwest at this time interval. It is 7.0° to the upper left of bright Jupiter. This evening, Saturn rises at sunset, crosses the meridian around local midnight, and sets at sunrise tomorrow morning.

- **July 27**: (−4.6, 29", 40%, 0.58AU, 187m) Brilliant Venus is nearly 22° up in the east, one hour before sunrise. It is 5.1° to the upper right of ζ Tau and 10.3° to the lower left of α Tau. The planet is rising more than three hours before sunrise, about 2:30 a.m. CDT. Venus – ζ Tau gaps until the conjunction: **Jul 28**, 4.3°; **Jul 29**, 3.6°; **Jul 30**, 2.9°; **Jul 31**, 2.3°; **Aug 1**, 1.9°.
- **August 2**: (−4.5, 27", 44%, 0.62AU, 198m) Venus passes 1.7° to the lower right of ζ Tau. One hour before sunrise, find Venus nearly 24° up in the east. Venus – ζ Tau gaps after the conjunction: **Aug 3**, 2.0°; **Aug 4**, 2.6°; **Aug 5**, 3.3°; **Aug 6**, 4.1°; **Aug 7**, 4.9°.
- **August 3**: (−4.5, 27", 43%, 0.63AU, 199m) One hour before sunrise, Venus, nearly 24° up in the east, is 2.0° below ζ Tau. If you've not observed the Crab Nebula (M1, NGC 1952), Venus and the star may help you find its location in the starfield. While this is a stretch for the nebula's low altitude and a bright sky from the moon in the west, M1 is 1.1° above the star – nearly on the same line that connects Venus to ζ Tau and extended above the star. A look with a low-power eyepiece should help you find the starfield so that you can return later in the year when Taurus is higher in a moonless sky.

Venus at Greatest Elongation

As Venus reaches its greatest morning elongation on August 12, 2020, it rises over three hours before sunrise. On the rising chart this is noted with a yellow triangle and labelled as "GE." Venus moves through northern Orion and into Gemini. Early in this interval, Venus displays a morning half phase, 50% illuminated. The planet's apparent size decreases to 20", and the planet moves over 0.20 Astronomical Unit farther away. While Venus is with the Twins, Sirius makes its first morning appearance. About this time, the crescent moon joins Venus. During August 2020, Venus rises at its earliest time and at its maximum time difference interval before sunrise.

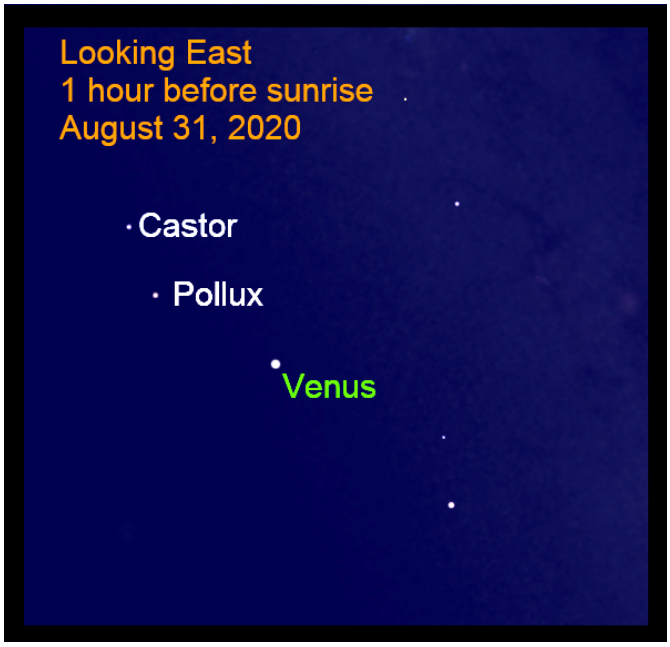
- **August 5**: (−4.5, 26", 46%, 0.65AU, 202m) Venus moves into northern Orion, in the club area. Venus crosses the constellation in 8 days. One hour before sunrise, Venus is 25° up in the east. It is 1.1° to the upper right of Chi1 Orionis (χ1 Ori, m = 4.4) and over 12° to the upper left of Betelgeuse.
- **August 9**: (−4.5, 24", 48%, 0.68AU, 208m) Venus reaches its earliest rising time, 2:25 a.m. CDT. It rises at this time through August 17. As Venus rises higher and before morning twilight gets too bright, with a binocular, look for Venus 4.5° to the lower right of M35 (NGC 2168). The gap is a little smaller tomorrow morning.
- **August 12**: (−4.4, 24", 50%, 0.70AU, 211m) One hour before sunrise, Venus is nearly 26° up in the east and 5.9° above Gamma Geminorum (γ Gem, m =1.9). Through a telescope during the next few mornings, Venus is 50% illuminated showing a morning half phase. At 7:14 p.m. CDT, Venus reaches its greatest western elongation (45.8°).
- **August 13**: (−4.4, 24", 50%, 0.71AU, 212m) Venus moves into Gemini. At one hour before sunrise, the planet is over 26° up in the east. In the starfield, Venus is 2.4° to the lower right of Mu Geminorum (μ Gem, m = 2.8) and 5.2° above γ Gem. Begin looking for Sirius (α CMa, m = −1.4) in the southeast. Procyon (α CMi, m = 0.4) rises 27 minutes before Sirius (in Chicago). When you first spot Procyon, Sirius is visible a few days later. Depending on your latitude, the first appearance or heliacal rising occurs around this date. A ***Sky & Telescope*** article (https://bit.ly/sirius_heliacal) describes the observing factors for this first annual rising of Sirius. You'll need an unobstructed horizon and amazingly clear weather to see it at its earliest possible date.

August 15, 2020: The moon appears 3.5° to the upper left of Venus.

- **August 15**: (−4.4, 23", 51%, 0.73AU, 214m) One hour before sunrise, brilliant Venus is over 27° up in the east. The waning crescent moon (25.6d, 16%) is 3.5° to the upper left of Venus. With a binocular notice that Venus is 0.2° to the

lower left of Nu Geminorum (ν Gem, m = 4.1) and 4.1° to the upper left of γ Gem.

- **August 17**: (−4.4, 22”, 52%, 0.74AU, 217m) One hour before sunrise, Venus, nearly 27° up in the east, is 3.7° to the upper left of γ Gem.
- **August 21**: (−4.4, 22”, 55%, 0.77AU, 219m). Venus passes between Pollux (β Gem, m = 1.2) and γ Gem. The bright planet is 5.6° to the lower left of γ Gem and nearly 14° to the upper right of β Gem. One hour before sunrise, find Venus over 27° up in the east.
- **August 23**: (−4.3, 21”, 56%, 0.79AU, 220m) One hour before sunrise, Venus, over 27° up in the east in Gemini, is 0.5° to the lower right of Zeta Geminorum (ζ Gem, m = 4.0).
- **August 27**: (−4.3, 20”, 57%, 0.82AU, 221m). Locate Venus nearly 28° up in the east, one hour before sunrise. It is 2.2° to the lower right of Delta Geminorum (δ Gem, m = 3.5).
- **August 28**: (−4.3, 20”, 58%, 83AU, 222m) Venus is at its maximum rising time interval before sunrise, 222 minutes. This continues through September 4. Afterwards, the interval decreases, slowly at first, until Venus disappears into morning twilight and superior conjunction in about seven months. This morning, one hour before sunrise, Venus is nearly 28° up in the east, 9.3° to the lower right of Pollux.



August 31, 2020: Venus passes Pollux in a wide conjunction. The brilliant planet is 8.6° from the star.

- **August 31**: (−4.3, 20”, 59%, 0.85AU, 222m) Venus passes 8.6° to the lower right of Pollux. One hour before sunrise, Venus is nearly 28° up in the east.

Venus and the Beehive Cluster

After Venus makes its wide pass of Pollux, it moves into Cancer. During mid-September, the planet is near the Beehive cluster. Through a telescope, watch the planet’s morning gibbous phase increase to 68% illumination while the planet’s apparent size decreases to 17” in diameter. The planet’s distance increases to 1.0 Astronomical Unit. On September 14, the crescent moon joins the scene.

- **September 4**: (−4.3, 19”, 61%, 0.88AU, 222m) Venus moves into Cancer, over 9° to the lower right of Pollux and over 11° to the upper right of Delta Cancri (δ Cnc, m = 3.9). Delta is 1.8° below the Beehive Cluster (M44, NGC 2632). Watch Venus approach this region with a binocular.
- **September 11**: (−4.2, 18”, 64%, 0.93AU, 219m). One hour before sunrise, Venus – nearly 28° up in the east – is 0.5° to the upper right of Theta Cancri (θ Cnc, m = 5.3). Use a binocular to spot Venus in the starfield that includes M44.
- **September 13**: (−4.2, 18”, 65%, 0.95AU, 218m) Venus passes 2.3° to the lower right of the Beehive cluster. The planet is also 1.5° to the upper right of δ Cnc. The waning crescent moon (25.1d, 20%) is over 10° above Venus.

September 14, 2020: The moon appears 5.0° from Venus with the Beehive Cluster nearby.

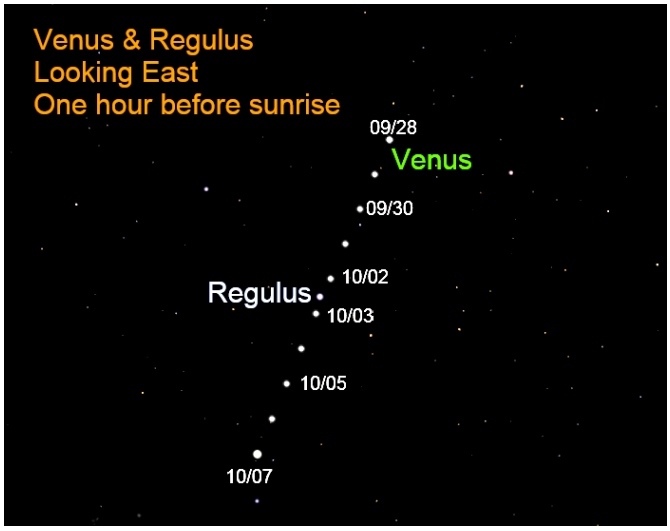
- **September 14**: (−4.2, 18”, 65%, 0.96AU, 218m) Venus is 5.0° to the right of the crescent moon (26.2d, 12%) and 0.9° to the lower right of δ Cnc. With a binocular observe that the Beehive cluster is 2.7° to the upper left of Venus.

- **September 17**: (−4.2, 17”, 67%, 0.98AU, 217m) One hour before sunrise, Venus is about 28° up in the east. It is 1.2° to the upper left of Omicron Cancri (o Cnc, m = 5.2). Additionally, Venus nearly lines up with Alpha Cancri (α Cnc, m = 4.2) and Zeta Hydrae (ζ Hya, m = 3.1). Venus is 4.7° to the upper left of α Cnc and 10.6° to the upper left of ζ Hya. The trio is nearly lined up again tomorrow morning.
- **September 21**: (−4.1, 17”, 68%, 1.0AU, 214m) Venus, in western Cancer, is over 27° up in the east. It is 0.5° to the upper left of Pi Cancri (π Cnc, m = 5.3). Use a binocular to spot the star with Venus.

A Close Venus – Regulus Conjunction

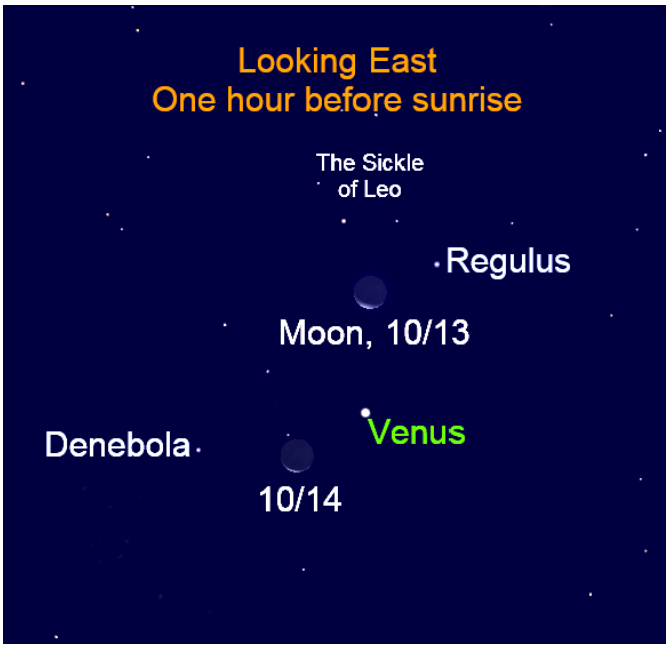
Venus moves into Leo for nearly a month’s traverse of these stars. As the planet crosses the constellation, it rises 25 minutes later by the time it moves into Virgo. At the same time interval before sunrise, it is lower in the sky. During early October, Venus passes Regulus closely. The planet’s distance increases 20% and dims slightly as its phase increases to 78% illumination by month’s end. The moon passes through at mid-month. Venus passes Denebola widely as it leaves the constellation.

- **September 23**: (−4.1, 16”, 68%, 1.02AU, 213m) Venus moves into Leo, 11.0° to the upper right of Regulus (α Leo, m = 1.4). Venus moves across the constellation in 29 days. One hour before sunrise, the brilliant planet is nearly 27° up in the east.



October 2 & 3, 2020: Venus passes Regulus in the eastern sky, one hour before sunrise. Watch the brilliant planet approach, pass closely, and move away from the star. The chart displays the planet’s relative motion, September 28 – October 7.

- **September 25**: (−4.1, 16”, 70%, 1.03AU, 211m) Venus passes 3.1° to the upper left of Xi Leonis (ξ Leo, m = 5.0). One hour before sunrise, Venus is less than 27° in altitude in the east. Use a binocular to see Venus and the star at this hour.
- **September 28**: (−4.1, 16”, 71%, 1.06AU, 209m) One hour before sunrise, Venus is over 26° up in the east. It is 3.8° to the upper left of Omicron Leonis (o Leo, m = 3.5). This morning Venus is 5.2° to the upper right of Regulus. Gaps until the conjunction: **Sep 29**, 4.0°; **Sep 30**, 2.9°; **Oct 1**, 1.7°.
- **October 2 & 3**: (−4.1, 15”, 72%, 1.08AU, 205m) Venus passes Regulus. The gaps: **Oct 2**, 0.6°, Venus upper right of star; **Oct 3**, 0.6°, Venus lower left of star. Find them over 25° up in the east, one hour before sunrise. Venus – Regulus gaps after the closest mornings: **Oct 4**, 1.7°; **Oct 5**, 2.9°; **Oct 6**, 4.0°; **Oct 7**, 5.2°.
- **October 8**: (−4.1, 15”, 74%, 1.12AU, 200m) Venus passes 0.5° to the upper left of Rho Leonis (ρ Leo, m = 3.8). One hour before sunrise, find Venus nearly 25° up in the east.
- **October 13**: (−4.0, 14”, 76%, 1.16AU, 195m). One hour before sunrise, the crescent moon (25.7d, 16%) is 8.8° above Venus, 24.0° up in the east. Look for Mars (m = −2.6) at its opposition. This morning, at this time interval, it is about 18° up in the west. This evening it rises at sunset and appears in the sky all night, setting at sunrise tomorrow morning. Through a telescope, Mars’ apparent size is over 50% larger than Venus’ apparent diameter.



October 13 & 14, 2020: The moon appears near Venus in the early morning sky. Regulus is nearby.

- **October 14**: (−4.0, 14”, 76%, 1.16AU, 195m) One hour before sunrise, Venus is less than 24° up in the east, 6.6° to the upper right of the moon (26.8d, 8%). Through a

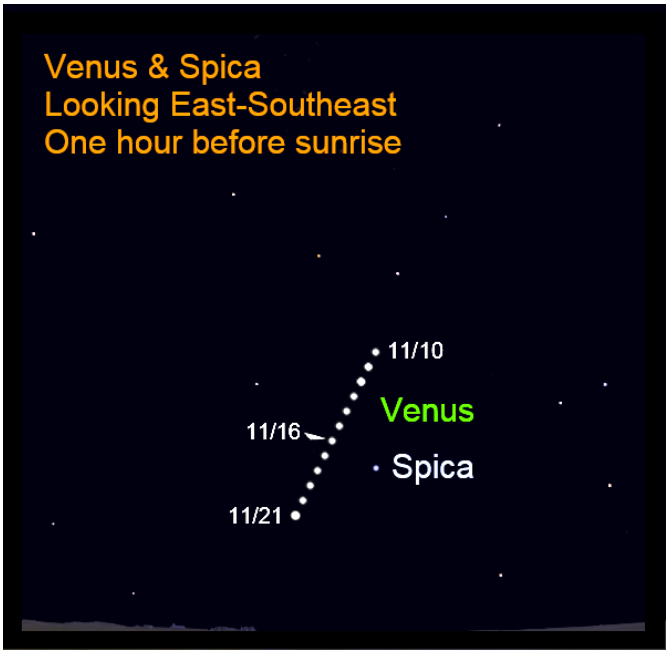
telescope, the planet's phase is a morning gibbous, 76% illuminated.

- **October 15**: (−4.0, 14", 76%, 1.17AU, 193m) One hour before sunrise, Venus – about 24° up in the east – is 0.3° to the lower right of Chi Leonis (χ Leo, m = 4.6). A binocular helps you see the star with the brilliant planet.
- **October 18**: (−4.0, 14", 77%, 1.19AU, 190m) Venus is 0.7° to the upper right of Sigma Leonis (σ Leo, m = 4.0). One hour before sunrise, Venus is over 23° up in the east-southeast.
- **October 21**: (−4.0, 14", 78%, 1.21AU, 188m) Venus passes 10.9° to the lower right of Denebola (β Leo, m = 2.1). One hour before sunrise, find the brilliant planet over 22° up in the east-southeast.

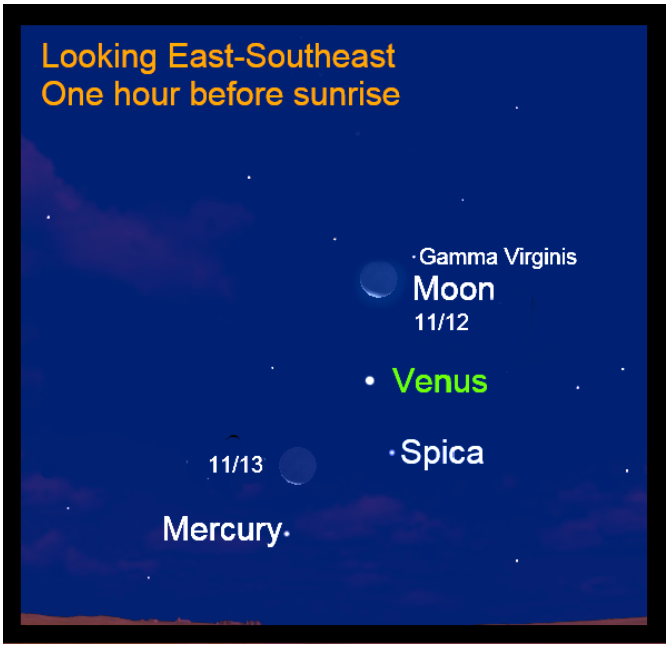
Mercury Joins Venus and Spica

As Venus moves into Virgo, speedy Mercury begins its best morning apparition of the year as it passes Spica. Venus loses over 40 minutes of rising time compared to the sun. The Venus – Mercury gap remains fairly wide. On November 12 and 13, the moon joins the view with the two planets and Spica. Venus passes nearly 4° from Spica after the crescent moon leaves the area. Venus' distance from Earth increases to 1.41 Astronomical Units as its gibbous phase increases to 88%, yet the size decreases to 12" in diameter. Watch the motion of Venus through the starry background with a binocular.

- **October 23**: (−4.0, 14" , 79%, 1.22AU, 186m) Venus moves into Virgo, 3.2° to the lower right of Nu Virginis (ν Vir, m = 4.0). It moves through the constellation in 36 days. One hour before sunrise, the brilliant planet is over 22° up in the east-southeast, 3.1° above Beta Virginis (β Vir, m = 3.6). Use a binocular to track Venus as it moves against the starry background.
- **October 25**: (−4.0, 14", 80%, 1.23AU, 183m) Venus passes 0.9° to the upper left of β Vir. One hour before sunrise, find them nearly 22° in altitude in the east-southeast.
- **November 1**: (−4.0, 13", 82%, 1.27AU, 177m). Venus passes 0.3° to the lower left of Eta Virginis (η Vir, m = 3.9). One hour before sunrise, find them over 20° up in the east-southeast.
- **November 5**: (−4.0, 13", 83%, 1.30AU, 173m) One hour before sunrise, Venus – nearly 20° in altitude in the east-southeast – is 1.1° to the lower right of Gamma Virginis (γ Vir, m = 3.4). Fifteen minutes later, Mercury (m = 0.1) – about 8° up in the east-southeast - is over 15° to the lower left of Venus and 4.5° to the left of Spica (α Vir, m = 1.0). Mercury is in its best morning appearance of the year. It reaches its greatest elongation on November 10. For a few days either side of its greatest elongation, Mercury rises before morning twilight begins; it appears less than 10° in altitude at about 45 minutes before sunrise. The planet is fairly bright and it appears to the lower left of Spica. The Venus – Mercury gaps: **Nov 6**, 15.1°; **Nov 7**, 14.4°; **Nov 8**, 13.9°; **Nov 9**, 13.5°; **Nov 10**, 13.2°; **Nov 11**, 13.0°.



November 10 – 21, 2020: Venus passes Spica in a wide conjunction on November 16. This chart displays the motion of the brilliant planet for several days around the closest separation.



November 12 & 13, 2020: The moon passes Venus and Spica in the east-southeast before sunrise. Mercury is nearby.

- **November 12**: (−3.9, 12", 84%, 1.34AU, 165m) One hour before sunrise, brilliant Venus – about 18° up in the east-

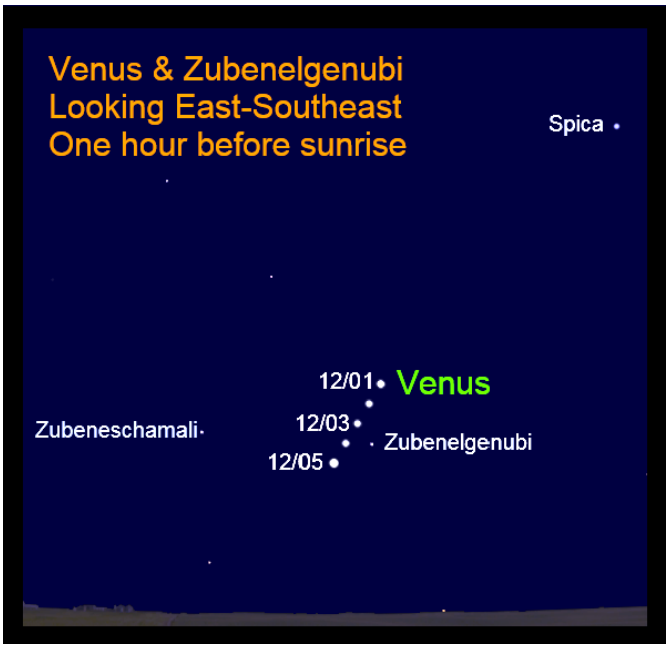
southeast – is 0.3° to the lower left of Theta Virginis (θ Vir, m = 4.4). The crescent moon (26.4d, 11%) is 6.5° above Venus. Forty-five minutes before sunrise, Mercury (m = −0.7) is 12.9° to the lower left of Venus and 8.7° to the lower left of Spica.

- **November 13**: (−3.9, 12”, 85%, 1.34AU, 165m) One hour before sunrise, sparkling Venus – nearly 18° up in the east-southeast – is 8.1° to the upper right of the old moon (27.5d, 4%) and 5.5° to the upper left of Spica. The lunar crescent is 6.9° to the lower left of Spica and 5.1° above Mercury. The Venus – Mercury gap is 13.0°. Venus closes in on Spica for a wide conjunction. The gaps: **Nov 14**, 4.7°; **Nov 15**, 4.1°.
- **November 16**: (−3.9, 12”, 85%, 1.36AU, 161m) Venus is at its northern most celestial latitude for this apparition, 1.78°. It passes 3.8° to the upper left of Spica. After the conjunction the Venus – Spica gaps grow: **Nov 17**, 3.9°; **Nov 18**, 4.3°; **Nov 19**, 5.0°; **Nov 20**, 5.9°; **Nov 21**, 6.9°. Forty-five minutes before sunrise, Venus is over 19° in altitude in the east-southeast and 13.0° to the upper right of Mercury. The planets continue to appear in the east-southeast sky. Their gaps: **Nov 17**, 13.2°; **Nov 18**, 13.3°; **Nov 19**, 13.6°; **Nov 20**, 13.8°.
- **November 21**: (−3.9, 12”, 87%, 1.38AU, 155m) Forty-five minutes before sunrise, Venus, about 18° up in the east-southeast, is 6.9° to the lower left of Spica and 14.1° to the upper right of Mercury, that is about 6° in altitude.
- **November 25**: (−3.9, 12”, 88%, 1.40AU, 150m) Venus passes 1.1° to the lower right of Kappa Virginis (κ Vir, m = 4.2). One hour before sunrise, find Venus less than 15° in altitude in the east-southeast. A binocular helps find the nearby star. Tomorrow morning observe that Venus is nearly between κ Vir and Lambda Virginis (λ Vir, m = 4.5).
- **November 27**: (−3.9, 12”, 88%, 1.41AU, 147m) Venus passes 1.2° to the upper left of λ Vir. One hour before sunrise find them 14.0° up in the east-southeast. Use a binocular to observe the dimmer star.

Venus Balances in Libra

While Libra is a separate constellation, it once was part of the Scorpion. Venus passes between the classic pincers in early December. The moon passes through before mid-month. The planet’s rising time difference decreases to two hours before sunrise as Venus leaves the constellation. The planet’s distance increases to 1.50 Astronomical Units from Earth as its phase increases to 91%.

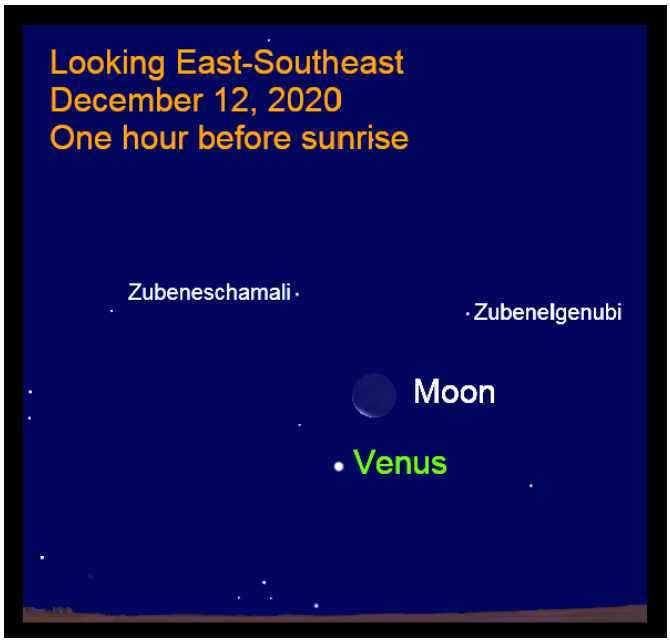
- **November 28**: (−3.9, 12”, 88%, 1.42AU, 146m) Venus moves into Libra. The planet’s speedy apparent travel carries it across the constellation in 20 days. One hour before sunrise, it is nearly 14° up in the east-southeast, 6.8° to the upper right of Zubenelgenubi (α Lib, m = 2.8). Venus – α Lib gaps until the conjunction: **Nov 29**, 5.6°; **Nov 30**, 4.4°; **Dec 1**, 3.2°; **Dec 2**, 2.2°.



December 1 – 5, 2020: Brilliant Venus passes Zubenelgenubi on December 3. This chart shows the motion of Venus compared to the star for a few days around the conjunction date.

- **December 3**: (−3.9, 12”, 89%, 1.44AU, 139m) Venus passes 1.3° to the upper left of Zubenelgenubi. At the same time, Venus is 0.5° to the lower right of Mu Librae (μ Lib, m = 5.3). Use a binocular to see μ Lib. One hour before sunrise Venus is over 12° up in the east-southeast.
- **December 6**: (−3.9, 12”, 90%, 1.46AU, 134m) Venus is 0.6° above Nu Librae (ν Lib, m = 5.2). Use a binocular to see Venus in the starfield. One hour before sunrise, Venus is about 12° in altitude in the southeast.
- **December 10**: (−3.9, 11”, 90%, 1.47AU, 129m) One hour before sunrise, brilliant Venus is over 10° up in the southeast. Use a binocular to observe that it is between Gamma Librae (γ Lib, m = 3.9) and Iota Librae (ι Lib, m = 4.5). Venus is about 3° from each star.
- **December 12**: (−3.9, 11”, 91%, 1.48AU, 125m) One hour before sunrise, locate the crescent moon (27.1d, 6%), 4.3° to the upper right of Venus, nearly 10° up in the southeast.
- **December 15**: (−3.9, 11”, 91%, 1.50AU, 120m) Venus rises two hours before sunrise. One hour later it is nearly 9° up in the southeast. With a binocular observe that it is 2.2° to the lower right of Theta Librae (θ Lib, m = 4.1). At this time the brilliant planet is 3.7° to the upper right of Beta Scorpii. (β Sco, m = 2.6). Watch Venus close the gap during the next two mornings: **Dec 16**, 2.4°; **Dec 17**, 1.2°.

December 16 – 20, 2020: Venus passes Beta Scorpii in a close conjunction. This chart shows the motion of Venus relative to the starfield during five days.



December 12, 2020: A striking crescent moon is 4.3° to the upper right of Venus.

A Quick Passage Through Scorpius

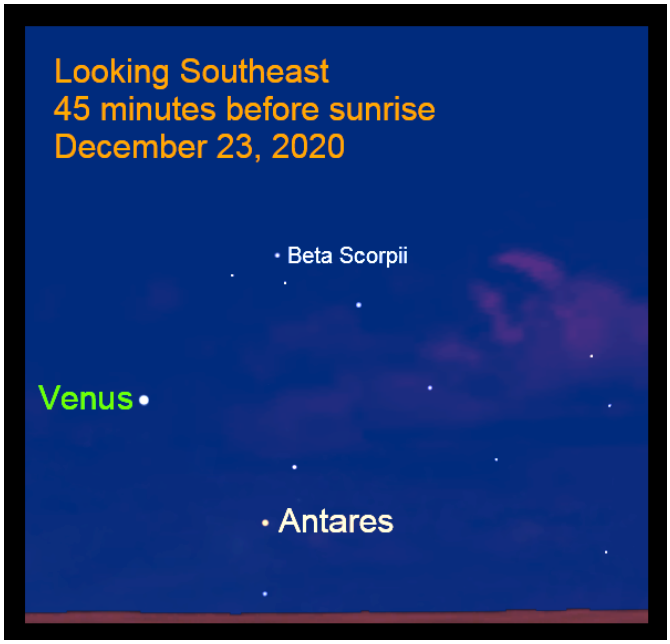
The ecliptic in Scorpius is short. As Venus passes between the constellation's boundaries, it has a close conjunction with Beta Scorpii. Watch it move through the starfield.

- **December 18**: (−3.9, 11", 92%, 1.51AU, 115m) Venus moves into Scorpius. It crosses the constellation in four days. Forty-five minutes before sunrise, Venus – over 10° up in the southeast – is 0.1° to the upper left of β Sco.
- **December 19**: (−3.9, 11", 92%, 1.51AU, 113m) Forty-five minutes before sunrise, find Venus nearly 10° up in the southeast. With a binocular observe that it is 0.5° to the lower right of Nu Scorpii (ν Sco, m = 4.0) and 1.3° to the lower left of β Sco.
- **December 21**: (−3.9, 11", 92%, 1.52AU, 109m) Forty-five minutes before sunrise, Venus is over 9° in altitude in the southeast. Venus is 0.7° to the right of Psi Scorpii (ψ Sco, m = 4.5). Use a binocular to see the star. This morning's test is whether Antares is visible. Venus is 6.2° to the upper left of Antares (α Sco, m =1.0). The star is less than 4° in altitude. You'll need exceptional observing conditions and a binocular to see it. This evening, about 45 minutes after sunset, look in the southwest for the Great Conjunction of Jupiter and Saturn. Jupiter is 0.1° to the lower left of Saturn.

A Wide Venus – Antares Conjunction

As Venus rises during brightening twilight, it passes through Ophiuchus and above Antares, although the star is very low in the sky. On January 11, 2021, the moon makes one last pass of this apparition. The pair appears low in the sky. By month's end, Venus rises after morning twilight begins.

- **December 22**: (−3.9, 11", 93%, 1.52AU, 108m) Forty-five minutes before sunrise, find Venus 9.0° up in the southeast. This morning the planet is in Ophiuchus, 5.8° to the upper left of Antares. The star is about 4° above the horizon. Find a location with a clear horizon. A binocular helps find the star.
- **December 23**: (−3.9, 11", 93%, 1.53AU, 105m) Venus passes 5.0° to the upper left of Antares. Forty-five minutes before sunrise, Antares is nearly 5° up in the southeast. As with yesterday's observation, find a clear horizon and use a binocular. Can you see the star without optical aid? In three mornings (December 26), Venus rises before the beginning of morning twilight. (See diagram next page.)
- **December 31**: (−3.9, 11" 94%, 1.56AU, 90m). Thirty minutes before sunrise – about the time of Civil Twilight – Venus is 8.0° up in the southeast.
- **January 3, 2021**: (−3.9, 11", 94%, 1.57AU, 84m) Venus reaches its most southerly rising azimuth, 121°, through January 21. Forty-five minutes before sunrise, find Venus over 5° up in the southeast.



December 23, 2020: Venus passes 5.0° to the upper left of Antares during mid-twilight. The star is low in the sky.

- **January 11**: (−3.9, 10”, 95%, 1.60AU, 69m) Forty-five minutes before sunrise, attempt to view Venus about 3° up in the southeast. The old moon (27.7d, 4%) is 4.0° to the right of the brilliant planet. Watch them as they rise.
- **January 12**: (−3.9, 10”, 96%, 1.60AU, 67m) Venus is at its most southerly declination, −23.18°. Thirty minutes before sunrise, it is 5.1° up in the southeast.

January 11, 2021: The moon appears 4.0° to the right of Venus. Find a clear horizon to view the pair.

A Long Slide Into Twilight

Venus begins a slow fade into bright morning twilight that carries it to its superior conjunction on March 26, 2021, rising about 1 minute later each morning. It appears near the southeast horizon.

- **January 14**: (−3.9, 10”, 96%, 1.60AU, 64m) Venus rises before Nautical Twilight, 64 minutes before sunrise. It is less than 5° in altitude in the southeast at 30 minutes before sunrise. **Depending on the weather and the view from your location, Venus may be visible low in the southeast until January 20 (or later) without optical assistance at about 30 minutes before sunrise. What is the last date that you see the planet without a binocular or telescope before sunrise?**
- **February 6**: Venus rises before Civil Twilight, 28 minutes before sunrise.

A Daytime Venus – Jupiter Epoch Conjunction

As the planet moves deeper into morning twilight it has conjunctions with Saturn (February 6, 2021) and an Epoch (close) Conjunction with Jupiter (February 11, 2021) when the planets rise less than 25 minutes before sunrise. If you observe the Venus – Jupiter conjunction, the best views occur when it is near the meridian. The separation is 0.4°! At 11:30 a.m. CST use a telescope or binocular to find Venus 30° up in the south. Jupiter is to the upper right of Venus. In a telescope both should be visible in an eyepiece that produces less than 80x magnification and an apparent field of view of 50° or larger. **The usual warning about viewing objects near the sun with an optical device that collects the sun’s intensity applies here. Venus is 10° west of the sun. Observe this event with great caution!**

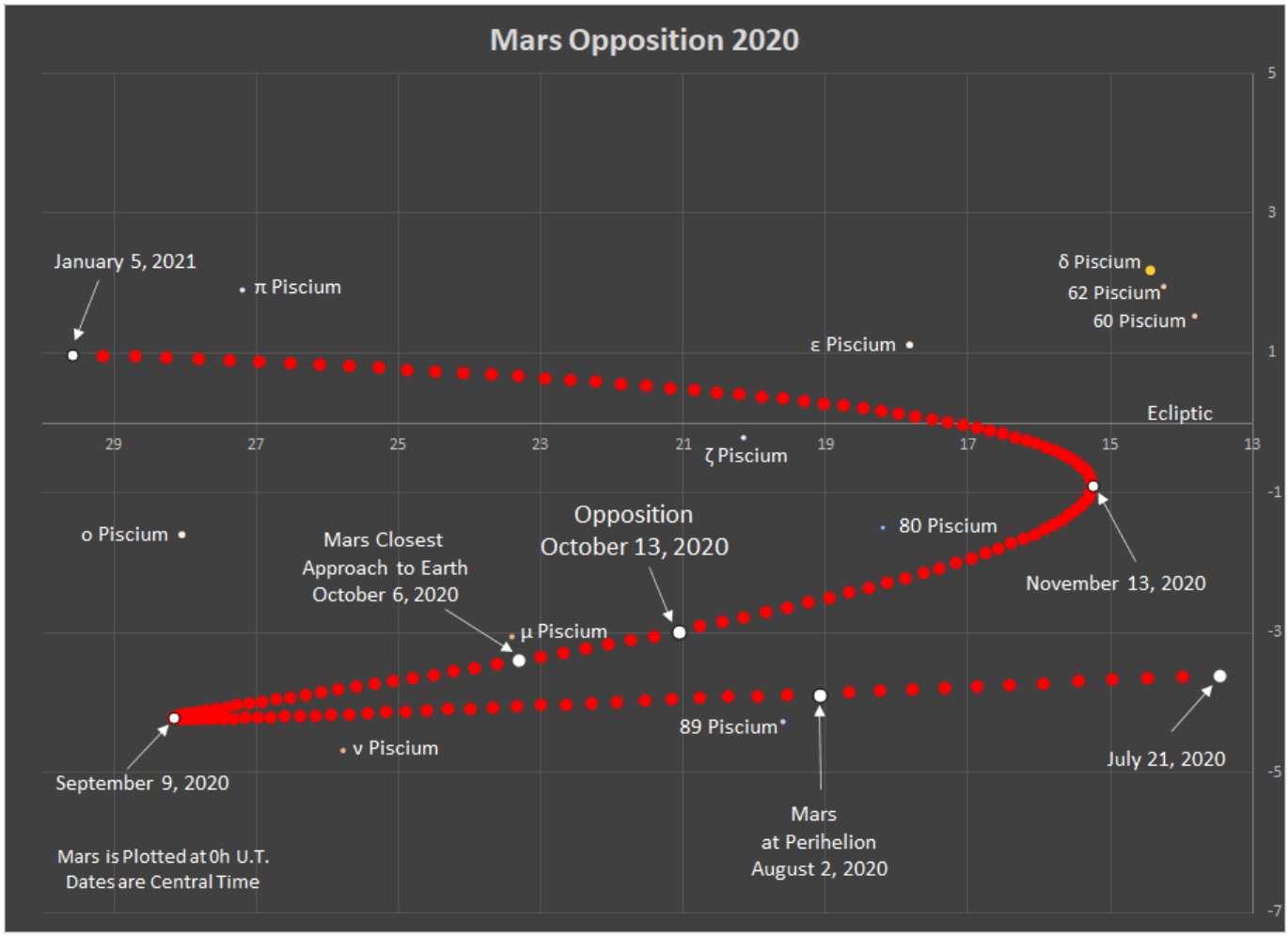
Mercury passes Venus (February 13, 2021) in a wide conjunction, 4.5°, clearly a difficult conjunction to observe during daylight.

Venus reaches its superior conjunction on March 26, 2021, and slowly makes its way into the evening sky.

Venus 2020-2021 morning apparition promises opportunities to see the brilliant planet with the ecliptic’s brightest stars. This includes a slow passage through the Hyades and an appearance near the Beehive. The apparition ends with a daytime Venus – Jupiter Epoch Conjunction. The moon makes classic appearances with the bright planet. The closest occurs during June 2020, but other groupings set the scene as portrayed in paintings. In this time of physical distancing, observing helps us connect to our place in the universe. A striking display of Venus helps us reflect on our views of humanity and our planet.

MARS AT OPPOSITION 2020

~ by Jeffrey L. Hunt ~



This chart shows the apparent motion of Mars during a 168-day interval that includes the planet's opposition.

Mars reaches opposition on October 13, 2020, among the dim stars of southeastern Pisces. At opposition, Mars is 22.3" in diameter. This opposition occurs at the end of a span of 91 days, with the three Bright Outer Planets (Jupiter, Saturn, and Mars) passing their oppositions. Jupiter and Saturn are at their oppositions during a span of 6 days in July 2020.

Mars' opposition occurs 72 days after it passes its perihelion (August 2, 2020), while the previous opposition occurred 49 days before perihelion (September 15, 2018). The July 27, 2018, event was called a "perihelic" opposition.

The accompanying charts show two perspectives of the planet's motion from July 21, 2020, to January 5, 2021. The first chart shows the apparent motions of Mars as seen against the starry background in southeastern Pisces. The second chart shows the view of a section of Earth's orbital path and Mars' orbit as viewed from north of the ecliptic.

Here are some sources for planning your Mars observing:

- For the latest news in observable Martian features and observing conditions, see the Association of Lunar and Planetary Observers (ALPO) website:

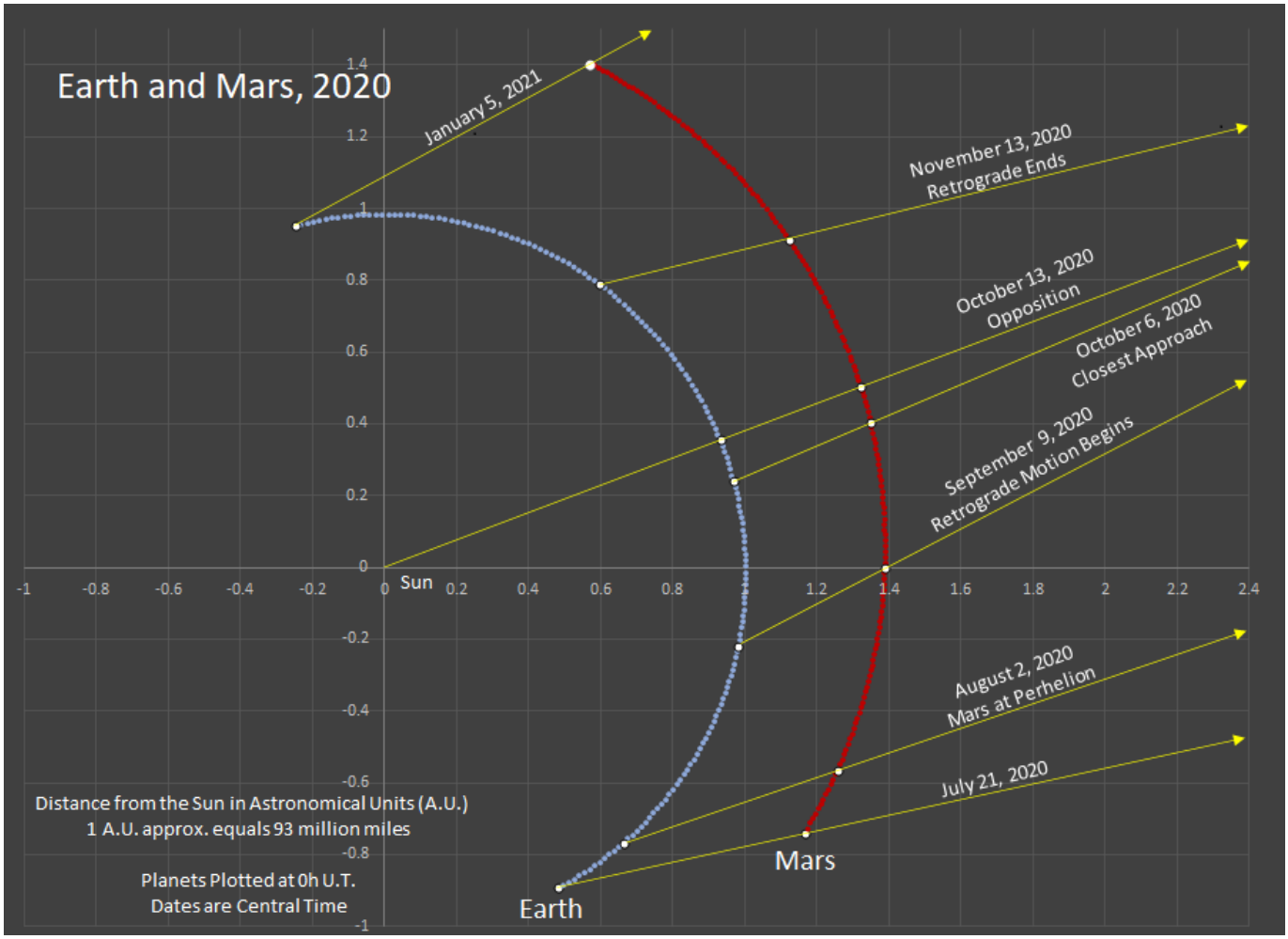
  http://www.alpo-astronomy.org/marsblog/

- Another source from ALPO describes large-scale events of the planet's apparition:

  http://www.alpo-astronomy.org/marsblog/wp-content/uploads/2020/02/CalendarOfEventsCORRECTED.pdf

- From *Sky and Telescope*: To determine what is visible on the Martian surface on any date and time:

  https://is.gd/marsprofiler



This chart views the motions of Earth and Mars from north of the ecliptic during the same time interval as the retrograde chart above.

As the sequence opens, five naked eye planets are in the morning sky, along with Uranus, Neptune, and Pluto. At about 40 minutes before sunrise, the bright planets span nearly 168° of ecliptic longitude, stretching from horizon to horizon. Mercury (m = 0.4), a day before its greatest elongation, is quite low in the east-northeast. Use a binocular and find a clear horizon. Brilliant Venus (m = −4.6) is about 20° up in the east, to the lower left of Aldebaran. Mars (m = −0.9) is over 45° up in the south-southeast. Farther westward along the ecliptic, Saturn (m = 0.1) is about 10° up in the southwest. Bright Jupiter is 6.4° to Saturn's lower right. Because Mercury is low in the sky, start looking for Jupiter about an hour before sunrise. Work your way eastward across the sky to find Mercury with a binocular 10-20 minutes later. I've seen Jupiter just a few degrees above the horizon without optical assistance. It might be possible to see all of them in the sky together.

As for the dimmer planets, use larger apertures to look for them before twilight begins (about 3:30 a.m. CDT in Chicago. Make any necessary time allowances for your longitude and latitude.) Uranus (m = 5.8), over 30° up in the east, is in southern Aries. It is 0.6° to the lower right of 29 Arietis (29 Ari, m = 6.0). Farther west along the ecliptic, Neptune – over 40° up in the south-southeast – is among the dim stars of northeastern Aquarius. It is 3.3° to the upper left of Phi Aquarii (ϕ Aqr, m = 4.2). Another dim star 96 Aquarii (96 Aqr, m = 5.5) is 1.8° to the right of the planet. Difficult-to-locate Pluto (m = 14.2) is in the southwest, near Jupiter. At this time, it is only 14.0° up in the southwest, 2.2° to the upper left of the bright Giant Planet. If you have the aperture, look for it when it crosses the meridian at about 12:40 a.m. CDT (in Chicago).

In the daily notes that follow, the Mars' magnitude, apparent diameter, and distance from Earth in an Astronomical Unit (AU) are noted.

- **July 21, 2020**: (−0.9, 13.5", 0.70 AU) This is the first day displayed on the charts. See the text above for a description of the menagerie of morning planets. Bright Mars is moving

eastward against the starry background. As midnight approaches, the Red Planet is 5° up in the east.

- **August 2**: (−1.1, 14.9", 0.64 AU) Mars is at perihelion, 1.38 AU from the sun. As midnight approaches, it is 10° up in the east.
- **August 4**: (−1.2, 15.1", 0.62 AU) Mars passes 0.4° to the upper left of 89 Piscium (89 Psc, m = 5.1). As midnight approaches, the planet is 11° up in the east.
- **August 8**: (−1.3, 15.6", 0.60 AU) As midnight approaches the moon (19.5 days past the New phase, 73% illuminated) is 2.0° to the lower right of Mars that is about 13° in altitude in the east.
- **August 22**: (−1.6, 17.6", 0.54 AU) Mars passes 0.5° to the upper left of Nu Piscium (ν Psc, m = 4.4). Four hours after sunset, Mars is nearly 18° in altitude in the east.
- **September 5**: (−1.9, 19.6", 0.48 AU) Four hours after sunset, the moon (18.1d, 86%) – over 20° up in the east – is 0.7° below Mars.
- **September 9**: (−2.0, 20.3", 0.46 AU) Mars begins to retrograde; four hours after sunset, it is nearly 25° up in the east-southeast.

As Mars approaches its closest point to Earth and its opposition, variable star Mira (o Cet) is predicted to reach its maximum brightness. Predicted dates for the brightest phase range from mid-September to late in the month. The brightest magnitude is uncertain, ranging from 2.0 to 4.0. On September 15, Mira is about 12° to the lower left of Mars. For the latest observations of Mira's brightness, check with the American Association of Variable Star Observers (AAVSO) (https://www.aavso.org/).

- **October 2**: (−2.5, 22.5", 0.42 AU) Three hours after sunset, Mars is 24° up in the east-southeast. The bright gibbous moon (15.7d, 98%) is 1.3° to the lower right of the planet.
- **October 6**: (−2.6, 22.6", 0.42 AU) Earth and Mars are at their closest. The planet passes 0.4° to the lower right of Mu Piscium (μ Psc, m = 4.8). Three hours after sunset, the Red Planet is over 25° in altitude in the east-southeast.
- **October 13**: (−2.6, 22.3", 0.42 AU) Mars is at opposition, 1.43 AU from the sun and 0.419 AU from Earth. Three hours after sunset, the planet is over 30° up in the east-southeast.
- **October 23**: (−2.4, 21.4", 0.44 AU) Mars passes 0.6° to the lower right of 80 Piscium (80 Psc, m = 5.5). Two hours after sunset, Mars is over 25° in altitude in the east-southeast.
- **October 29**: (−2.2, 20.4", 0.46 AU) Two hours after sunset, the bright moon (13.2d, 98%) is nearly 26° up in the east-southeast. Mars is 4.8° to the upper right of the gibbous moon.
- **November 13**: (−1.7, 17.6", 0.53 AU) Mars' retrograde ends. Two hours after sunset, the planet is nearly 40° up in the southeast.
- **November 25**: (−1.3, 15.4", 0.61 AU) At the end of evening twilight, Mars is over 40° in altitude in the southeast. The moon (10.8d, 84%) is 5.1° to the lower left of Mars.
- **December 4**: (−1.0, 13.9", 0.67 AU) Mars passes 1.0° below Epsilon Piscium (ε Psc, m = 4.2). At the end of evening twilight, Mars is over 45° in altitude in the southeast.
- **December 12**: (−0.7, 12.7", 0.74 AU) Mars passes 0.6° above Zeta Piscium (ζ Psc, m = 5.2). At the end of evening twilight, find the Red Planet 50° up in the southeast.
- **December 21**: (−0.5, 11.6", 0.81 AU) Forty-five minutes after sunset, Mars is nearly 48° up in the southeast. The half-full moon (7.3d, 50%), over 40° up in the south-southeast, is about 24° to the lower right of Mars. This is the evening of the once-every-generation Great Conjunction of Jupiter (m = −2.0) and Saturn (m = 0.6). The conjunction is about 14° in altitude above the southwest horizon. Mars and the conjunction are separated by nearly 83° of ecliptic longitude.
- **December 23**: (−0.5, 11.3", 0.83 AU) At the end of evening twilight, Mars is 55° up in the south-southeast. The moon (9.3d, 69%) is 5.6° to the lower left of Mars.
- **December 31**: (−0.2, 10.4", 0.90 AU) Mars passes 1.0° to the lower left of Pi Piscium (π Psc, m = 5.5). At the end of evening twilight, Mars is nearly 60° in altitude in the south-southeast.
- **January 5, 2021**: (−0.1, 9.9", 0.94 AU). This is the last day displayed on the charts. At the end of evening twilight, Mars is 60° in altitude in the south-southeast.

The sequence ends with Jupiter and Saturn approaching their solar conjunctions. The giant planetary pair is 15 days past the December 21, 2020, Great conjunction. Jupiter is 1.7° east of Saturn. During mid-twilight, Jupiter is about 6° up in the southwest. Along with Mercury, Jupiter and Saturn are less than 20° east of the sun. Mars is over 85° of ecliptic longitude from Jupiter. In the morning sky, Venus is about 5° up in the southeast during morning twilight. While the sun is between them, Venus is 37° in ecliptic longitude from Jupiter.

Mars heads toward brighter star fields during 2021. During March, it passes the Pleiades and the Hyades, and moves between the Bull's horns in mid-April. Mars strolls through the Beehive Cluster in late June, although the pair is low in the west-northwest during evening twilight. During mid-July, Venus passes Mars in the western evening sky. Later in the month, Mars passes Regulus with Venus higher in the sky, although the Mars – Regulus pair is very low in the sky during mid-twilight. Then, Mars makes a slow slide into evening twilight. It reaches its solar conjunction on October 7, 2021. The next opposition is December 7, 2022. Mars is farther away, 0.549 AU. This is followed by the January 15, 2025, opposition, when the Martian distance increases to 0.734 AU.

REGIONAL OFFICER & LEADER CONTACT INFORMATION

Chair (2-year term): Carl Wenning (term expires Spring 2021, in second term)

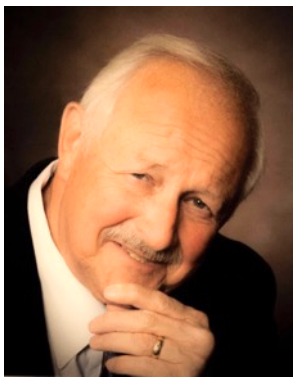
Bio: Carl has been an amateur astronomer since being introduced to the sky by his grandfather during July 1957. Today he is an A.L. Master observer. He has been involved with the Twin City Astronomers of Bloomington-Normal (Illinois) since September 1978. He currently serves as the club's secretary, historian, and editor of ***The OBSERVER*** newsletter for which he received the AL's 2017 Mabel Sterns Newsletter Editor Award. Carl was planetarium director (1978-2000) and physics teacher educator (1994-2008) at Illinois State University. He continues to teach physics and physics education course in retirement.

Contact: carlwenning@gmail.com

Vice Chair (2-year term): Bill Davidson (term expires Spring 2021, in first term) and **Regional Representative to the Astronomical League (3-year term):** Bill Davidson (Interim 2019-2020)

Bio: In the days of the Apollo missions, Bill first observed the moon (and sunspots!) with a 50x, 60mm JC Penny's refractor telescope. Not discouraged, 40 years later, he built and observes with a 6.25-inch achromatic doublet objective, f/10, 1600 mm focal length refracting telescope. He recently retired as a college mathematics instructor, has been a member of the Rochester Astronomy Club (Minnesota) for 20 years, and serves as editor of the club's award-winning newsletter *RochesterSkies.*

Contact: rochesterskies@outlook.com



Secretary-Treasurer (2-year term): Roy Gustafson (Interim 2020-2021)

Bio: Roy, a member of Popular Astronomy Club (Quad Cities), got interested in astronomy when visiting the Adler Planetarium in Chicago when he was in 2nd Grade. The stars projected by the Zeiss Projector hooked him and started him on the path of astronomy. He has been active in outreach and has presented astronomy programs to over 20,000 people. He was awarded the Master Outreach award from the Astronomical League. Roy travels with his telescopes and has observed both Transits of Venus and last year the Total Solar Eclipse. Roy also taught astronomy at Black Hawk Junior College in Moline, IL. Roy retired from John Deere & Company after 32 years of service.

Contact: astroroy46@gmail.com

NCRAL Webmaster: Jeff Setzer (appointed)

Bio: Jeff has been an amateur astronomer since 1984 and has been part of the Northern Cross Science Foundation (Wisconsin) since that time. He is a longtime member of their Board of Directors, has held several office positions, and is currently their President. He has completed several Astronomical League observing programs, made his own telescopes and optics, and is a self-described telescope nut. You will often find him at star parties with his 22" Starmaster and TeleVue 85 telescopes.

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***Northern Lights* Editor-in-Chief:** Jim Gibbs (appointed)

Bio: Jim has been observing the starry skies since he was 10 years old and on and off ever since. His primary affiliation is with the Twin City Amateur Astronomers (Illinois) where he has been a member for 5 years. He is also a member of the Fox Valley Astronomical Society where he has held several leadership positions. He is an avid amateur astronomer who enjoys observing and especially imaging around the TCAA dark sites and travelling around finding other dark sites. He is a software engineer and currently is concentrating in growing his small consulting business.

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