Welcome to another edition of “Reflections”, the universe’s best astronomy newsletter. This issue has some great articles about astronomical events occurring during the month of February. For starters, this month will be a great one for those of us who love to observe planets. During the first half of the month, right after sunset, the planet Mercury will be about as high in the sky as it will be and an ideal object for your telescope. While you are observing Mercury (closest to the horizon), three other planets will also be visible, strung out like pearls on the ecliptic: Neptune, Venus and Uranus. Venus, a dramatically bright naked eye object, will serve as a guidepost to finding the other planets dwelling nearby in the southwestern sky. If you have a clear horizon in that direction, draw an imaginary line between Venus and where the sun dipped below the horizon. Follow this down and your eye will catch a fairly bright magnitude -0.5 “star”, which will in fact be the planet Mercury. A pair of binoculars might help you pick it out of the glare of early twilight. If you have a telescope, you might be able to discern Mercury’s disk. A bit higher in the sky, the planet Neptune is very much dimmer at magnitude 8. Binoculars or a telescope will be needed to see it. Finally, follow the ecliptic up past Venus to find Uranus, which at magnitude 5.8 is easier to find, but you will still want to use a pair of binoculars. A telescope will reveal Uranus’ diminutive pale blue disk.

If you happen to be an early riser, February’s morning sky has some treats in store for you. Saturn, Jupiter and Mars will be visible before sunrise. February’s big event will be the occultation of Mars by the moon on the 18th. If you have never seen an occultation, you should put this on your calendar. Binoculars will help you see Mars as the moon approaches, but if you have a telescope, I recommend you get it ready for this event.

I have not yet observed the occultation of a planet but I did observe the occultation of the bright star Aldebaran on the
evening of October 18th, 2016. I’ve included a picture of this here. I recall waiting and watching as the moon slowly lumbered toward Aldebaran and being amazed at being able to actually perceive the moon’s motion in real time, and then being even more amazed when all of a sudden, Aldebaran simply “winked out” of existence as the moon swept past it. Because stars are so far away, they actually have no discernable angular size from our vantage point. Thus, the moon was able to cover it in a mere fraction of a second. This will not be the case with Mars however. Mars will have a definite size and should require some time (15 seconds or so?) to be “eclipsed”. I want to see this, so I am hoping for clear weather. Stay tuned to your email as we will be putting out information closer to the time of the occultation. I can hardly wait!

Finally, I would like to discuss Betelgeuse. There has been a lot of social media reports about how much this bright star in Orion has dimmed so dramatically of late. There also has been a lot of hubbub about this massive star going supernova at any minute—and I would love to see that happen too, but, I went back into my archive of astrophotos and found an image of Orion from 2012. I was curious if I could “see” a difference in the brightness of Betelgeuse between then and now. On the evening of January 20th, I took another picture of Orion from my front yard. Unfortunately, the camera settings were not the same so the images are not directly comparable, but nevertheless, we can compare the relative brightness of the stars to each other in each image. I’m including these images here for you to examine yourself. What do you think? Is Betelgeuse noticeably dimmer now? It might be the camera settings, but to me it looks maybe a little bit dimmer and a lot less red in color. Does that mean it’s getting ready to explode? What do you think? Keep looking up!

Alan Sheidler

(Continued in next column)
LOOKING FOR OLDER ISSUES OF REFLECTIONS NEWSLETTER?
Click HERE

HISTORY OF PAC?
Click HERE

Popular Astronomy Club on Facebook?
Click HERE

SUBMISSIONS
If you have an article or photos to submit or items of interest, we encourage you to send them in by the 25th of the month. Links to stories are welcome also. Thank you!

Astronomical League Observing Programs
The Astronomical League provides many different Observing Programs. These Observing Programs are designed to provide a direction for your observations and to provide a goal. The Observing Programs have certificates and pins to recognize the observers’ accomplishments and for demonstrating their observing skills with a variety of instruments and objects
Click Here

Thank you For Renewing
Dave Smith

MORE INFORMATION HERE!
The sun, with all those planets revolving around it and dependent on it, can still ripen a bunch of grapes as if it had nothing else in the universe to do.

- Galileo Galilei

"Every star that you see in the sky might be a Sun to someone."

- Carl Sagan

Astronomy Picture of the Day (APOD) added a new photo to the album: APOD 2019 December. December 24 at 11:18 PM

APOD: An Annular Solar Eclipse over New Mexico (2019 Dec 25)
Image Credit & Copyright: Colleen Piniski
https://apod.nasa.gov/apod/ap191225.html
Stop abbreviating 2020. Police say it leaves you open to fraud and can cost you big!

Link to Story HERE

BBC’s The Sky At Night
Guide to Comets Asteroids

CLICK HERE FOR LINK TO YOUTUBE
Sun, it is summer for that hemisphere. When the Earth’s axis points away, winter can be expected. Since the tilt of the axis is 23.12 degrees, the north pole never points directly at the Sun, but on the summer solstice it points as close as it can, and on the winter solstice as far as it can. Midway between these two times, in spring and autumn, the spin axis of the Earth points 90 degrees away from the Sun. This means that on this date, day and night have about the same length: 12 hours each, more or less.

Why should this tilt of the Earth’s axis matter to our climate? To understand this, take a piece of paper and a flashlight. Shine the light from the flashlight straight onto the paper, so you see an illuminated circle. All the light from the flashlight is in that circle. Now slowly tilt the paper, so the circle elongates into an ellipse. All the light is still in that ellipse, but the ellipse is spread out over more paper. The density of light drops. In other words, the amount of light per square centimeter drops (the number of square centimeters increases, while the total amount of light stays the same).

The same is true on the Earth. When the Sun is overhead, the light is falling straight on you, and so more light (and more heat) hit each square centimeter of the ground. When the Sun is lower in the sky, the light gets more spread out over the surface of the Earth, and less heat (per square centimeter) can be absorbed. Since the Earth’s axis is tilted, the Sun is higher when you are on the part of the Earth where the axis points towards the Sun, and lower on the part of the Earth where the axis points away from the Sun.

For the Northern Hemisphere, the axis points most toward the Sun in June (specifically around June 21), and away from the Sun around December 21. This corresponds to the Winter and Summer Solstice (solstice is Latin for "the sun stands"), or the midpoints of winter and summer. For the Southern Hemisphere, this is reversed.

For both hemispheres, the Earth is 90 degrees away from the sun around March 21 and then again around September 21. This corresponds to the Fall

(continued in next column)
and Spring Equinox (equinox is Latin for "equal night"). Everyplace in the world has about 12 hours of daylight and 12 hours of night.

So why are sunrise and sunset not exactly 12 hours apart on the Equinox?

Day and night are not exactly of equal length at the time of the March and September equinoxes. The dates on which day and night are each 12 hours occur a few days before and after the equinoxes. The specific dates for this occurrence are different for different latitudes.

On the day of the equinox, the geometric center of the Sun's disk crosses the equator, and this point is above the horizon for 12 hours everywhere on the Earth. However, the Sun is not simply a geometric point. Sunrise is defined as the instant when the leading edge of the Sun's disk becomes visible on the horizon, whereas sunset is the instant when the trailing edge of the disk disappears below the horizon. At these times, the center of the disk is already below the horizon. Furthermore, atmospheric refraction (or bending) of the Sun's rays cause the Sun's disk to appear higher in the sky than it would if the Earth had no atmosphere. Thus, in the morning, the upper edge of the disk is visible for several minutes before the geometric edge of the disk reaches the horizon. Similarly, in the evening, the upper edge of the disk disappears several minutes after the geometric disk has passed below the horizon.

For observers within a couple of degrees of the equator, the period from sunrise to sunset is always several minutes longer than the night. At higher latitudes in the Northern Hemisphere, the date of equal day and night occurs before the March equinox. Daytime continues to be longer than nighttime until after the September equinox. In the Southern Hemisphere, the dates of equal day and night occur before the September equinox and after the March equinox.

Is it true that you can stand an egg on end

(continued in next column)
After a vote by the board of directors on December 30th, via email (by a majority), it was decided to sell the Paul Castle refractor and mount to Steven Sinksen. He took possession of the telescope on December 30th, 2019 and will also get the mount from the observatory at a later date.

Paul Castle Refractor sold

Rusty and I met at the Paul Castle Observatory last night in the hopes that we might do some observing. Alas, there were lots of clouds. But while we waited to see if it would clear off, we temporarily installed a wedge on the existing wooden pier. *(This wedge is designed for Meade SCTs and I have used it a couple of times with my 10" LX200).* We need to get some small lag screws and drill holes to properly anchor this down before we can actually put a scope on there. We also will need to get it polar aligned.

I would propose at the next opportunity, we go ahead and finish anchoring this wedge and then install either my 10" LX200 or the club’s 7" Mak LX200 and see what we think. This might be a good thing to try out temporarily with the existing wooden pier and help solidify our plans before we commit ourselves to something more permanent. What do you think? Thanks. Al.

An Experiment at Paul Castle
NCRAL Seasonal Messier Marathon Program

NCRAL’s Seasonal Messier Marathon observing program is NOT designed to qualify observers for the Astronomical League’s Messier Observing program; the two programs are unrelated and observing requirements are quite different. In the NCRAL program, the main requirement is to quickly observe and essentially check off items from one of four seasonal lists of Messier objects as noted in the section to follow.

NCRAL recognition will consist a suitable printed certificate and a 3/4-inch enameled star pin (a different color for each season). There will be no direct cost to the membership for participating in the award program; the cost of the program (pins, certificates, mailers, postage) will be borne by the Region as a benefit of affiliation. Relevant program documents are linked below.

NCRAL Seasonal Messier Marathon Program Rules
NCRAL WINTER Seasonal Messier List
NCRAL SPRING Seasonal Messier List
NCRAL SUMMER Seasonal Messier List
NCRAL AUTUMN Seasonal Messier List

Downloadable Calendar HERE!
Winter Observing Brings Some Great Viewing

By Sara Sheidler

Although February brings cold, snow, and clouds to the Mid West, it also offers some great astronomical viewing on those infrequent clear evenings and early mornings. As far as planet viewing, there are four planets to watch in the evening sky and three in the early morning sky before sunrise.

Early February, 30 minutes after sunset finds bright Mercury easily visible low in the southwestern sky. Slightly higher and to the left of Mercury is dazzling Venus which is another easy to spot planet in the sky. By February 10 Mercury has climbed to its highest point and then will dip lower to the horizon on each passing night. Venus however continues to climb throughout February. If you have binoculars or a small telescope you might be able to find dim blue-gray Neptune just below Venus early in the month. By mid-February Neptune will no longer be visible as it sinks below the horizon. Uranus is a bit easier to spot since it is seven times brighter than Neptune. This elusive blue-green planet can be found once you’ve found Aries the Ram in the southwestern sky. If you’ve been following Venus as it moves upward each night, Uranus is also moving downward and the two planets will have a close encounter the second week of February.

February is also an excellent month for viewing more deep sky objects including open clusters. A few of these spectacular objects are the Beehive Cluster (M44), the Pleiades (M45), and the splendid Double Cluster in Perseus. There are 18 open clusters visible in February! Globular clusters can be viewed much later in the night. Speaking of globular clusters, if you’d like to learn more about them then plan on coming to the Popular Astronomy Club monthly meeting on February 10th at 7:00 pm at the Butterworth Center, Moline, Illinois as that will be the topic that night. Everyone with an interest in Astronomy is welcome to attend our meetings. For more information please visit our website: www.popularastronomyclub.org.
For those of us who are not astronomers, the phrase first light means dawn. If we are up early to go fishing, hunting, or to search for a missing person, we awake at first light. For sky watchers, first light has an entirely different meaning. Instead, it celebrates the first time starlight enters a new telescope or the inside walls of a new observatory. On Sunday evening, December 15, David Rossetter, one of the United States’ most famous amateur astronomers, celebrated first light for his new observatory, completed after he relocated to the Tucson area. Wendee and I were there, along with some neighbors, friends, and the new executive director of the International Dark Sky Association.

The object David selected as the first thing to be observed from his brand-new observatory was Messier 15, one of the grandest globular star clusters in the entire sky. It is different from the object I traditionally use for my new telescopes, the planet Jupiter. Last fall, for example, I pointed Eureka, a brand new telescope, at Jupiter for its first light ceremony.

Jupiter shines at us from about 50 light minutes away, meaning that light reflected from the Sun leaves it and takes about 50 minutes to reach us. The globular cluster Messier 15, is much much farther away. It shines at us from well beyond the stars of its home constellation of Pegasus, from a distance of at least 33,000 light years, and at magnitude 6.2, it is barely visible to the unaided eye on a very dark night.

I was very glad to see M15 using David’s giant 25-inch diameter reflector from his new observatory, for I recall seeing it frequently at our Adirondack Astronomy Retreat. At the first Star Night of the Montreal Centre of the Royal Astronomical Society of Canada, my first one since becoming a member, I was assigned Messier 15, the globular star cluster that was discovered by Jean-Dominique Miraldi in 1746, and added by the comet hunter Charles Messier to his catalogue in 1764. I recently wrote about that experience in my autobiography:

“At Star Night that September I was assigned to point my telescope at M15, the beautiful globular cluster in Pegasus. I recall doing my homework about that cluster. I learned that its distance was listed at about 33,000 light years. We now know that M15 is also one of the oldest globular star clusters in the Milky Way, dating from at least 12 billion years ago. We also suspect now that the central portion of M15 underwent a collapse of its core deep in the past, and that its central core consists of a huge number of stars orbiting a massive black hole. Most of this information is more recent. Back then the pertinent facts were that the cluster had a membership of upwards of a hundred thousand stars.” (A Nightwatchman’s Journey, p. 68.)

Years later, I wrote: “On a beautiful clear night at one of our Adirondack Astronomy Retreats, I peered through Fritz, David Rossetter’s 25-inch Obsession Dobsonian reflector. The telescope was pointing at Messier 15 in the Pegasus constellation, but what I had was not just a view. It was an extended leisurely stroll among the stars of this cluster. I made some left turns, walked up hills, crossed bridges and explored valleys all decked with uncountable stars.” (A Nightwatchman’s Journey, p. 289.)

I thoroughly enjoyed another look at the beautiful and mysterious Messier 15 from David’s new observatory on that night. I especially enjoy showing younger people this fabulous cluster of so many stars. As each new generation is introduced to it, may Messier 15’s myriad stars shine for a distant and newer generation, or from another observatory as it undergoes its first light.

The photograph of Messier 15 was taken by Tim B. Hunter, famed astrophotographer who lives in Tucson, Arizona.

(Continued in next column)
UPCOMING EVENTS

February 10th, 2019
Event: PAC regular meeting
Location: Butterworth Center at 7:00 PM.
Constellation Report: Paul Levesque
Program: Terry Dufek—Globular Clusters

- March 9th, 2020 PAC Business meeting at Butterworth Center at 7:00 PM.
- March 21st, 2020 Niabi Outreach at sunset
- April 13th, 2020 PAC regular meeting at Butterworth Center at 7:00 PM.
- April 18th, 2020 Niabi Outreach at sunset
- May 9th, 2020 Illiniwek Campground 6:00 pm (rain date May 23rd)
- May 11th, 2020 PAC regular meeting at Butterworth Center at 7:00 PM.
- May 16th, 2020 Niabi Outreach at sunset
- June 6, 2020 Giant Goose Conservation Area "Youth Day", Atkinson, Illinois - 8:00 am - noon, canceled if raining. Informational Tables and Solar Observing
- June 8th, 2020 PAC business meeting at Butterworth Center at 7:00 PM
- June 20th, 2020 Niabi Outreach at sunset
- July 13th, 2020 PAC regular meeting at Butterworth Center at 7:00 PM  program: Mr. Dick Koos, "Go For Landing". Mr. Koos will discuss his NASA work with program alarm simulation and it's influence on Apollo 11.
- July 18th, 2020 Niabi Outreach at sunset
- August 1st, 2020 Illiniwek Campground 8:00 –11:00 pm (rain date August 22nd)
- August 8th, 2020 PAC Annual Picnic
- August 15th, 2020 Niabi Outreach at sunset
- September 14th, 2020 PAC business meeting at Butterworth Center at 7:00 PM
- September 19th, 2020 Niabi Outreach at sunset
- October 17th, 2020 Niabi Outreach at sunset
- October 24th, 2020 PAC Annual Banquet
- November 9th, 2020 PAC regular meeting at Butterworth Center at 7:00 PM
- November 21st, 2020 Niabi Outreach at sunset
- December 14th, 2020 PAC Business meeting at Butterworth Center at 7:00 PM.

Mark your calendars and watch upcoming e-mails for more information!

Check out the North Central Region of the Astronomical League (NCRAL) online HERE!
# SIGN UP REPORT

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**Editors Note:** If you are interested in contributing/participating in the above programs, sign ups are available at the monthly meeting or please let The Vice President and Editor know what you are good to go with. Any corrections please send to Vice President and Editor. This will be updated every issue.

*Thank you*

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### SMORGASBORD

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The Sun is in Capricorn on the 1st, moving into Aquarius on the 17th.

Mercury starts off in Capricorn on the 1st. It is (mag. -0.99, dia. 5.72", Illum 83.1%). At 5:45pm, it can be glimpsed 7º 30' above the W-SW horizon. It stays in this position until the 12th, gaining an altitude of about 13º 39'. It then slides back toward inferior conjunction with the Sun on the 25th.

Venus is in Aquarius on the 1st. It is 32º above the SW horizon at 5:30 pm. (mag. -4.11, dia. 15.41", Illum 73%). It gains a little altitude through the month, at the same time while slightly brightening. The 4-day old Moon is close by (6º 33”) on the 27th.

Mars is in Ophiuchus on the 1st. It is low in the SE (16º 27’) at 6:00 AM. (mag. -1.52, dia. 4.82", Illum 93.2%) On the 18th, Mars is occulted by the Moon starting at 6 am and ending at 7:30 am (see next page). At the start, the Moon will be nestled between the Trifid Nebula and the Lagoon Nebula.

Jupiter starts off the month in Sagittarius. It is 7º off the SE horizon at 6:30 am. (mag. -1.87, dia. 32.52")

Saturn, in Sagittarius slowly emerges from the Sun’s glare to be low on the SE horizon (6º 19’) on February 19th (mag. .58, dia. 15" (rings 35.29") It makes a nice combination with Jupiter and the Moon (see next page). The Moon is close to Saturn (2º 32') on the next night.

Uranus is in Aries on the 1st. It is 9º 46’ west of the 1st quarter Moon. It is 58º above the southern horizon at 6 pm. (mag. 5.80, dia. 3.53") The planet slowly slides west through out the mon to near Venus. It makes a nice conjunction with a 4.8-day old moon and Venus on the 27th.

Neptune, in Aquarius, on the 1st, lies just 6° west of Venus. It slowly slides into the twilight throughout the month and passes by Mercury on the 14th by 5°

Pluto is in Sagittarius on February 1st. It is 1° 52’ from Saturn but lost in the Sun's glare.
Mars Occultation February 18th, 2020 starts 6:00:11 AM and ends 7:27:57 AM

Moon/ Mars will be situated Between The Trifid Nebula and The Lagoon Nebula at 6:00 am.

Saturn, Jupiter, and the Moon on February 19th, 2020 at 6:00 am
Mu Germanorum (mag. 2.85) comes very close to the Moon on February 5th, 2020 at 11:37 pm. Elsewhere, it might occult.

Good chance to catch Mercury in the evening sky on February 12th at 6PM. 11 degrees above the W-SW horizon.

Mars between the Lagoon and Triffid Nebuls on February 17th, 2020 at 4:30 am.
<table>
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<th>Name</th>
<th>Mag.</th>
<th>Rise</th>
<th>Transit</th>
<th>Set</th>
<th>Ang. Size</th>
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<tr>
<td>M 44 (Beehive Cluster)</td>
<td>3.83</td>
<td>16h44m</td>
<td>0h02m</td>
<td>7h20m</td>
<td>+0°35'00.00&quot;</td>
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<tr>
<td>Fornax Dwarf Galaxy</td>
<td>7.93</td>
<td>14h24m</td>
<td>18h00m</td>
<td>21h36m</td>
<td>+0°49'18.00&quot;</td>
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<tr>
<td>M 34 (Spiral Cluster)</td>
<td>5.33</td>
<td>8h13m</td>
<td>18h03m</td>
<td>3h53m</td>
<td>+0°12'30.00&quot;</td>
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<tr>
<td>IC 1848 (Soul Nebula)</td>
<td>6.64</td>
<td>—</td>
<td>18h12m</td>
<td>—</td>
<td>+0°25'00.00&quot;</td>
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<tr>
<td>NGC 1245 (Patrick Starfish Cluster)</td>
<td>8.53</td>
<td>7h19m</td>
<td>18h36m</td>
<td>5h52m</td>
<td>+0°15'00.00&quot;</td>
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<tr>
<td>NGC 1342 (Little Scorpion Cluster)</td>
<td>6.83</td>
<td>9h55m</td>
<td>18h52m</td>
<td>3h50m</td>
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<td>NGC 1432 (Maia Nebula)</td>
<td>4.02</td>
<td>11h28m</td>
<td>19h07m</td>
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<tr>
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<td>19h07m</td>
<td>2h46m</td>
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<tr>
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<td>1.34</td>
<td>11h29m</td>
<td>19h08m</td>
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<tr>
<td>NGC 1555 (Hind's Variable Nebula)</td>
<td>6.66</td>
<td>12h25m</td>
<td>19h43m</td>
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<tr>
<td>Hyades</td>
<td>0.66</td>
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<td>19h48m</td>
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<td>NGC 1579 (Northern Trifid Nebula)</td>
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<td>19h51m</td>
<td>4h33m</td>
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<td>NGC 1807 (Poor Man's Double Cluster)</td>
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<td>13h26m</td>
<td>20h32m</td>
<td>3h37m</td>
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<tr>
<td>NGC 1817 (Poor Man's Double Cluster)</td>
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<td>20h33m</td>
<td>3h39m</td>
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<tr>
<td>IC 405 (Flaming Star Nebula)</td>
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<td>M 38 (Starfish Cluster)</td>
<td>6.56</td>
<td>12h04m</td>
<td>20h50m</td>
<td>5h36m</td>
<td>+0°07'30.00&quot;</td>
</tr>
<tr>
<td>NGC 1980 (The Lost Jewel of Orion)</td>
<td>2.80</td>
<td>15h13m</td>
<td>20h56m</td>
<td>2h39m</td>
<td>+3°30'00.00&quot;</td>
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<tr>
<td>M 42 (Great Orion Nebula)</td>
<td>4.29</td>
<td>15h11m</td>
<td>20h56m</td>
<td>2h41m</td>
<td>+1°15'00.00&quot;</td>
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<tr>
<td>NGC 1981 (Coal Car Cluster)</td>
<td>4.49</td>
<td>15h08m</td>
<td>20h56m</td>
<td>2h44m</td>
<td>+0°12'30.00&quot;</td>
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<tr>
<td>M 1 (Crab Nebula)</td>
<td>8.58</td>
<td>13h27m</td>
<td>20h56m</td>
<td>4h24m</td>
<td>+0°06'00.00&quot;</td>
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<tr>
<td>M 36 (Pinwheel Cluster)</td>
<td>6.17</td>
<td>12h24m</td>
<td>20h57m</td>
<td>5h31m</td>
<td>+0°05'00.00&quot;</td>
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<tr>
<td>M 78 (Casper the Friendly Ghost Nebula)</td>
<td>8.57</td>
<td>15h04m</td>
<td>21h08m</td>
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<tr>
<td>M 37 (January Salt-and-Pepper Cluster)</td>
<td>5.77</td>
<td>12h50m</td>
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<td>M 35 (Shoe-Buckle Cluster)</td>
<td>5.30</td>
<td>13h51m</td>
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<td>NGC 2194 (Intergalactic Wanderer)</td>
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<tr>
<td>NGC 2232 (Double Wedge Cluster)</td>
<td>4.32</td>
<td>16h01m</td>
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<td>+0°14'30.00&quot;</td>
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<tr>
<td>NGC 2244 (Rosette Nebula)</td>
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<tr>
<td>IC 448</td>
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<tr>
<td>NGC 2264 (Christmas Tree Cluster)</td>
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<td>22h02m</td>
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<td>+0°08'30.00&quot;</td>
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<tr>
<td>M 41 (Little Beehive Cluster)</td>
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<td>17h21m</td>
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<td>+0°19'30.00&quot;</td>
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<tr>
<td>NGC 2281 (Broken Heart Cluster)</td>
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<tr>
<td>NGC 2301 (Hagrid's Dragon Cluster)</td>
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<tr>
<td>M 50 (Heart-Shaped Cluster)</td>
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<tr>
<td>IC 2177 (Seagull Nebula)</td>
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<tr>
<td>NGC 2343 (Double mint Cluster)</td>
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<tr>
<td>NGC 2353 (Avery's Island)</td>
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<td>17h09m</td>
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<td>4h03m</td>
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<tr>
<td>NGC 2420 (Twinkling Comet Cluster)</td>
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<td>15h33m</td>
<td>23h00m</td>
<td>6h26m</td>
<td>+0°03'30.00&quot;</td>
</tr>
</tbody>
</table>

* Data from Stellarium
Navigating the February Night Sky

For observers in the middle northern latitudes, this chart is suitable for mid February at 8 p.m. or late February at 7 p.m.

The stars plotted represent those which can be seen from areas suffering from moderate light pollution. In larger cities, less than 100 stars are visible, while from dark, rural areas well over ten times that amount are found.

The Ecliptic represents the plane of the solar system. The sun, the moon, and the major planets all lie on or near this imaginary line in the sky.

Navigating the February night sky: Simply start with what you know or with what you can easily find.

1. Above the northeast horizon rises the Big Dipper. Draw a line from its two end bowl stars upwards to the North Star.
2. Face south. Overhead twinkles the bright star Capella in Auriga. Jump northwestward along the Milky Way first to Perseus, then to the "W" of Cassiopeia. Next jump southeastward from Cassiopeia to the twin stars of Castor and Pollux in Gemini.
3. Directly south of Capella stands the constellation of Orion with its three Belt stars, its bright red star Betelgeuse, and its bright blue-white star Rigel.
4. Use Orion's three Belt stars to point northwest to the red star Aldebaran and the Hyades star cluster, then to the Pleiades star cluster. Travel southeast from the Belt stars to the brightest star in the night sky, Sirius, a member of the Winter Triangle.

Binocular Highlights
- A: Examine the stars of two naked eye star clusters, the Pleiades and the Hyades.
- B: Between the "W" of Cassiopeia and Perseus lies the Double Cluster.
- C: The three westernmost stars of Cassiopeia's "W" point south to M31, the Andromeda Galaxy, a "fuzzy" oval.
- D: M42 in Orion is a star forming nebula. E: Look south of Sirius for the star cluster M41. F: M44, a star cluster barely visible to the naked eye, lies southeast of Pollux.

Astronomical League www.astroleague.org/outreach; duplication is allowed and encouraged for all free distribution.
If you can observe only one evening celestial event this month, consider this one:
...The dimming of Betelgeuse...
- 90 minutes after sunset, face south and look half way between the horizon and the zenith for Orion.
- On the southwest corner of Orion shines blue Rigel, the fifth brightest star visible from mid-latitudes.
- On the constellation’s opposing corner lies Betelgeuse, a semi-regular variable star that is typically either the 8th, 9th, or 10th brightest star. Generally, it is not quite as bright as Procyon shining to its east.
- Since October, Betelgeuse has been dimming reaching a historic minimum. In late January, it shone about as bright as Castor, dropping to about 23rd place!
- Try comparing the brightness of Betelgeuse with that of neighboring stars, in particular Alnitak and Castor. (Alnitak is the easternmost belt star of Orion. Castor can be found by drawing a line from Rigel through Betelgeuse and extending it 1-2/3 that distance.)
- Don’t look directly at Betelgeuse, but either mid-way between it and the comparison star, or quickly glance to it, then to the comparison star.

**What is your comparative brightness estimation of Betelgeuse?**

So, why has it dimmed? It could be a variation on its complex brightness cycle. Or it could be that the star is close to undergoing a supernova explosion. Most astrophysicists favor the former, but hope for the latter!

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### Planetary Alignments in February

<table>
<thead>
<tr>
<th>Phenomenon</th>
<th>Date and Time</th>
<th>Object 1</th>
<th>Object 2</th>
<th>Separation</th>
<th>Solar Elongation</th>
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<tbody>
<tr>
<td>Conjunction</td>
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<td>Neptune</td>
<td>Mercury</td>
<td>+5°45′22.3&quot;</td>
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<tr>
<td>Occultation</td>
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<td>Moon</td>
<td>Mars</td>
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<td>+43°01′09.3&quot;</td>
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<td>Saturn</td>
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<td>Moon</td>
<td>Neptune</td>
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<td>Conjunction</td>
<td>2020-02-28 08:25:53</td>
<td>Moon</td>
<td>Uranus</td>
<td>+4°49′46.1&quot;</td>
<td>+54°32′26.1&quot;</td>
</tr>
</tbody>
</table>

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Facing South on an early evening in February.
Spotlight: Messier 41— the Little Beehive

- M 41 is an open cluster in the constellation Canis Major.
- The cluster was discovered by Giovanni Batista Hodierna before 1654 and was perhaps known to Aristotle about 325 BC.
- M 41’s distance from Earth 2316 LY
- Magnitude 4.5
- M41 lies about four degrees almost exactly south of Sirius, and forms a triangle with it and Nu² Canis Majoris—all three can be seen in the same field in binoculars.
- The cluster itself covers an area around the size of the full moon.
- It contains about 100 stars including several red giants and a number of white dwarfs.
- The cluster is estimated to be moving away from us at 23.3 km/s.
- The diameter of the cluster is between 25 and 26 light years.
- It is estimated to be 190 million years old, and cluster properties and dynamics suggest a total life expectancy of 500 million years for this cluster, before it will have disintegrated.
- The cluster is relatively loose and can be resolved in a small telescope.
- It is best observed at low magnifications. 10×50 binoculars show a large faint patch of light, while larger binoculars resolve some of the stars in the cluster.
- Small telescopes (4-inch) resolve about 50 stars, while 6-inch and 8-inch telescopes show many more fainter members.
What happens when a star dies? Stargazers are paying close attention to the red giant star Betelgeuse since it recently dimmed in brightness, causing speculation that it may soon end in a brilliant supernova. While it likely won’t explode quite yet, we can preview its fate by observing the nearby Crab Nebula.

Betelgeuse, despite its recent dimming, is still easy to find as the red-hued shoulder star of Orion. A known variable star, Betelgeuse usually competes for the position of the brightest star in Orion with brilliant blue-white Rigel, but recently its brightness has faded to below that of nearby Aldebaran, in Taurus. Betelgeuse is a young star, estimated to be a few million years old, but due to its giant size it leads a fast and furious life. This massive star, known as a supergiant, exhausted the hydrogen fuel in its core and began to fuse helium instead, which caused the outer layers of the star to cool and swell dramatically in size. Betelgeuse is one of the only stars for which we have any kind of detailed surface observations due to its huge size – somewhere between the diameter of the orbits of Mars and Jupiter - and relatively close distance of about 642 light-years. Betelgeuse is also a “runaway star,” with its remarkable speed possibly triggered by merging with a smaller companion star. If that is the case, Betelgeuse may actually have millions of years left! So, Betelgeuse

(continued on next page)
The Crab Nebula (M1) is relatively close to Betelgeuse in the sky, in the nearby constellation of Taurus. Its ghostly, spidery gas clouds result from a massive explosion; a supernova observed by astronomers in 1054! A backyard telescope allows you to see some details, but only advanced telescopes reveal the rapidly spinning neutron star found in its center: the last stellar remnant from that cataclysmic event. These gas clouds were created during the giant star’s violent demise and expand ever outward to enrich the universe with heavy elements like silicon, iron, and nickel. These element-rich clouds are like a cosmic fertilizer, making rocky planets like our own Earth possible. Supernova also send out powerful shock waves that help trigger star formation. In fact, if it wasn’t for a long-ago supernova, our solar system - along with all of us - wouldn’t exist! You can learn much more about the Crab Nebula and its neutron star in a new video from NASA’s Universe of Learning, created from observations by the Great Observatories of Hubble, Chandra, and Spitzer: [bit.ly/CrabNebulaVisual](bit.ly/CrabNebulaVisual)

Our last three articles covered the life cycle of stars from observing two neighboring constellations: Orion and Taurus! Our stargazing took us to the “baby stars” found in the stellar nursery of the Orion Nebula, onwards to the teenage stars of the Pleiades and young adult stars of the Hyades, and ended with dying Betelgeuse and the stellar corpse of the Crab Nebula. Want to know more about the life cycle of stars? Explore stellar evolution with “The Lives of Stars” activity and handout: [bit.ly/starlifeanddeath](bit.ly/starlifeanddeath).

Check out NASA’s most up to date observations of supernova and their remains at [nasa.gov](nasa.gov)

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Spot Betelgeuse and the Crab Nebula after sunset! A telescope is needed to spot the ghostly Crab.
Will Bright Star Betelgeuse Finally Explode?

January 3, 2020

Thick, persistent dust disc challenges planet formation theory

December 29th, 2020

TESS Catches Super flares from 400 Solar-Type Stars

January 6th, 2020

New Study Looks at Why Neptune-Sized and Larger Exoplanets are Rare

January 3rd, 2020
Astronomers find wandering massive black holes in dwarf galaxies

January 6th, 2020

Planet WASP-12b is on a death spiral, say scientists

January 8th, 2020

Meteorite contains the oldest material on Earth: 7-billion-year-old stardust

January 13th 2020

Hubble finds evidence for widely held ‘cold dark matter’ theory

December 12th, 2020
Astronomers Detect a Burst of Gravitational Waves From The Direction of Betelgeuse
January 20th, 2020

Mars’ water was mineral-rich and salty
January 21st, 2020

Hottest known exoplanet’s dayside atmosphere a toasty 4,300 C
January 27th, 2020

Astronomers find more bizarre objects orbiting Milky Way’s black hole
January 16th, 2020
At the meeting, you (Al) mentioned how you were trying to get the Trapezium to show up in your images of M42. I took advantage of the clear skies (I think, although I suspect there may have been high thin clouds) Tuesday night, and did some further experimenting with live high dynamic range imaging of M42 with my new DS287c color camera. I think I did pretty well if you look at the attached image with the long file name. I wanted to capture both the four main stars of the Trapezium, as well as capture the inner details without blowing out the image. This is the end result of probably stacking over 300 individual images while steadily increasing gain, and then exposure during the stacking process. I've included a copy of the four snaps I took during the session that shows how the image “developed” during the process. It is kind of neat to see the image “develop” right before your eyes at the computer.

As far as exposure details go, I don’t have much information. I was racing the clock before I had to put the scope away, and the process proceeds at a very fast pace. What I can say is that I initially started out with an exposure of probably 300 milliseconds, which only shows the Trapezium stars themselves nicely separated. This probably went on for perhaps 20-30 frames at a gain of 1 before I started increasing the gain at intervals of about 5 (maximum gain is 50) every so often. Once the gain reached the midpoint, I then started increasing the exposure times to further “develop” the image. This process is a constant process, so I didn’t have the time to write down details as I went along.

Anyway, I thought you might be interested in seeing what I came up with.

Ken Boquist

More photos on next page
Photos by Ken Boquist
President Alan Sheidler called the January regular monthly meeting of the Popular Astronomy Club to order at the Butterworth Center at 7:00 p.m. local time, on January 13th, 2020. We had 22 members and no guests or visitors attending.

- Ken Boquist commented about the Elon Musk satellites which were beginning to interfere with observations and photography. (pesky satellites)
- Photo presented of the Paul Castle outing from late December (story in last issue)

**OBSERVATIONS**
- Shown were photos of: the Crab Nebula (All), M36- the Pinwheel cluster (Al), M37- the Salt and Pepper Cluster (Al), M 38- the Starfish Cluster (Al), M42- the Orion Nebula (Al), M66– spiral galaxy in Leo (Ken), NGC2174– Monkey head Nebula (Ken), NGC 2903– spiral galaxy in Leo (Ken) and Trapezium (Al).

**OUTREACH**
- No new requests for outreach have been received
- Have not been contacted about imagination station this year

**AWARDS**
- Rusty received his received his award from Al for completing the NCRAL Autumn Seasonal Messier Marathon. He has also completed the Winter marathon which is pending.

**SIGN UP SHEET**
- Was passed around

**OCULTATION:**
- Terry brought up information about the upcoming occultation of Mars and the Moon on February 18th. Possibly getting together to observe it?

**NCRAL 2020**
- Al reminded members about the upcoming

(continued in next column)