

The Newsletter of the Popular Astronomy Club ESTABLISHED 1936

lection

March 2021

EAGU

President's Corner: March 2021



Welcome to the March edition of "Reflections". This month's edition is indeed a special one. During Terry Dufek's convalescence, Paul Levesque has graciously volunteered to serve as your interim newsletter editor. I am sure you

will agree with me that Paul has done a great job with the March issue.

For the past four years, Terry has done an outstanding job as Newsletter editor and club secretary. You may recall he received the 2018 Mabel Sterns Newsletter Editor Award. This is one of the Astronomical League's most prestigious awards and the fact that one of our own garnered this honor is something of which we can all be very proud.

So, while we all wish for Terry's convalescence to be a quick one, we realize in the meantime that he leaves very big shoes for Paul to fill. I would encourage you all to give Paul your support. Particularly as the weather improves (hopefully) and we get more opportunities to engage in club activities and observing sessions, please remember to provide Paul with pictures and observing notes for inclusion in the newsletter.

As I write this introduction, the pandemic has shown signs of diminishing and things are beginning to open up again. Perhaps it is time to be hopeful that we might be able to slowly and carefully return to normal club activities.

After discussing this with the staff at Butterworth Center, we plan to have a "hybrid" club meeting for the March 8th meeting. By hybrid, we plan to have both inperson and Zoom components for the meeting.

For those of you who want to continue attending by means of Zoom, you can still do

so, just as we have been for the past year. For those of you who would like to attend in person, we will meet in the Butterworth Center's library as we had been doing before the pandemic.

There are limitations however. The maximum number of attendees is 26 and everyone attending in person must wear a mask and socially distance to minimize risk of transmitting the virus. So, if you want to join the meeting in person, I request that you please contact me in advance so we can be sure not to exceed the seating limit of 26.

For those of you who do not have good access to high-speed internet, the in-person option will be a godsend. It's nice to have a choice.

In addition to a short business meeting, the March 8th meeting will feature a smorgasbord of short presentations by club members. Your vice president, Dino Milani, tells me there are already three speakers ready to present, but it is not too late for you to reserve a spot if you have a topic or presentation of some sort to present to the club. Any topic is fair game: New equipment, space missions, astronomical objects, observations, astrophotography, you name it, we want to hear about it!

To volunteer, please contact Dino or myself. This is your opportunity to make a big splash in the astronomical community. Whether you are a presenter or an attendee, you won't want to miss this meeting. It will be a good one.

In the meantime, please enjoy this month's newsletter and keep looking up!

The prestigious Mabel Sterns Newsletter Award for Outstanding Club Newsletter was presented to Terry Dufek in 2018.





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FROM THE EDITOR

As most of you may have heard, Terry Dufek, the editor of "Reflections," underwent major surgery recently and is receiving continuing treatment and therapy as he deals with a serious health condition.

In Terry's absence, I volunteered to edit the newsletter on an interim basis. I join all of you in wishing Terry a full recovery and hoping that he is able to resume his normal activities soon. Terry is a long-time active member of PAC who has made many friends through the club, and who's contributed greatly to advancing amateur astronomy in the Quad Cities community.

This month's issue of "Reflections" may look a little different than what you're used to, and I hope you like it. But I believe that the newsletter doesn't belong to me, or to Terry for that matter – it belongs to all of you, the members and followers of PAC. Your comments, criticisms and contributions are welcome; send them to:

levesque5562@att.net.

Thank you all, and thank you, Terry, for your work in creating an award-winning newsletter.

Paul Levesque

CLICKING ON THIS IMAGE IN THE NEWSLETTER SHOULD TAKE YOU TO A LIVE INTERNET LINK



ANNOUNCEMENTS / INFO



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 Rules

NCRAL WINTER Seasonal Messier List

NCRAL SPRING Seasonal Messier List

NCRAL SUMMER Seasonal Messier List

NCRAL AUTUMN Seasonal Messier List



Popular Astronomy Club Officers



PRESIDENT - Alan Sheidler 3528 56th Street Court, Moline, IL, 61265 Phone: (309) 797-3120

VICE PRESIDENT – Dino Milani 2317 29 1/2 Street, Rock Island, IL, 61201 Phone: (309) 269-4735

SECRETARY - Terry Dufek 2812 W. 65th Street, Davenport, IA, 52806 Phone: (563) 386-3509

TREASURER – Dale Hachtel 1617 Elm Shore Drive, Port Byron IL, 61275 Phone: (614) 935-5748

ALCOR – Roy E. Gustafson 11 Deer Run Road, Orion, IL, 61273 Phone: (309)526-3592

DIRECTOR OF OBSERVATORIES -

Rusty Case 2123 W. 16th Street, Davenport, IA, 52804 Phone: (563) 349-2444

PAST PRESIDENT -

Wayland Bauer 3256 Pleasant Drive, Bettendorf, IA., 52722 Phone: (563) 332-4032

NEWSLETTER EDITOR -

Terry Dufek 2812 W. 65th Street, Davenport, IA, 52806 Phone: (563) 386-3509

If you have questions or request, or want more information on PAC, send an e-mail to: popularastronomyclub@gmail.com

PAC members show their support for Terry Dufek

All too often, bad things happen to good people, and that was certainly the case recently when Terry Dufek, long-time member of the Popular Astronomy Club, suddenly faced a serious health issue that led to surgery and hospitalization. While Terry has come home and reports he is now feeling better, he still has a long road ahead of him, with more treatment and therapy to come.

But when good people do have bad things happen to them, other good people often step



Terry Dufek gets some needed rest with his cat, Franklin. He's also shown with his sister, Pam, who served as his advocate, and who received flowers for her birthday.

up to help. That also was certainly the case with Terry Dufek, who has received much assistance from his fellow members of PAC.

PAC members got Terry to the hospital, cleared snow from his driveway and sidewalk, helped adapt his home, did other chores and errands, provided him with reading material, and have sent get-well cards and messages of support.



PAC member Rusty Case installed grab bars in Terry Dufek's bathroom.

Terry wants his friends in PAC to know that he greatly appreciates all that you've done for him, and that your kindness will never be forgotten.

Because Terry isn't out of the woods yet, your continued support is needed. Please help him if you can, and please keep sending thoughts, prayers, well wishes and other expressions of hope and love.

An interest in amateur astronomy may have brought us together, but what we've done for Terry shows that this club is about more than just staring at the sky. It truly is a privilege to be a member of a group that cares for one another.

Paul Levesque

HERE COMES THE SUN

PAC president Alan Sheidler took this photo of the sun on February 23, a clear day when the temperatures soared into the 40s. He reports shooting the photo in white light with an ETX-90 telescope and D7500 camera. Settings were 1/400 second exposure time at ISO 400. A few sunspot groupings can be seen, indicating a higher level of solar activity. In any case, more solar energy will reach the Northern Hemisphere this month, meaning that spring has sprung.



OUR SKY IN PERSPECTIVE PAC hopes to resume public events in 2021

The year 2020 was a disappointment for the Popular Astronomy Club. The club in a normal year would have held two to three dozen public observing sessions. Last year, the club held none.

Now in early 2021, with people being vaccinated against COVID 19, the club is eagerly anticipating the opportunity to provide the public with the chance to see the night sky through its telescopes. In addition to the viewing, the club members will describe what you are seeing. Check the club's website (popularastronomyclub.org) to see when public observations will start.

While you wait for public observations to
start, you can begin viewing on your own. Smart
phones have a great variety of astronomy apps
that will show you what is available to be seen.astronomy you
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sites, like skymaps.com. If you go to this site you
will find "The Evening Sky Map." It not only pro-
vides a map, but also lists the objects that can be
seen with the naked eye, binoculars or tele-
scopes. Find darkest area close to you and use the
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We start wit

Binoculars are often mentioned as the best way to learn about astronomy. Unlike most telescopes they also offer multiple uses: Bird watching, sporting events and scenery. Many of you may have received gift cards for Christmas. Think about applying the gift cards to buying binoculars.

Binoculars come described with two numbers such as 8x32; 10x40. The first number is the magnification power. In the examples 8 and 10 refer to objects being 8 or 10 times closer than seen by your eyes alone. Some astronomers call these first numbers the "frustration factor." The larger number gives greater magnification, but higher magnification means a smaller field of view. The larger the number, the harder it is to keep a celestial object steadily in view. If you go 12 or beyond, you will need a pair of binoculars that can be placed on a tripod.

The second number refers to the diameter of the front lenses expressed in millimeters. The



size of the lens determines the size of the area being viewed. The field of view also determines the amount of light the lenses will gather. For astronomy you like to gather as much light as possible but can still hold the binoculars steady. If you will plan on multiple uses the 10x40 or 10x50 are good options and are available in a range of prices.

When we look up at the stars & Moon, we are actually seeing a tiny, tiny part of the whole universe we live in. Let's try to gain an understanding of the size of the universe by picturing a Russian doll that has several small dolls nested inside one large doll.

We start with the smallest doll in the innermost position. This part is often referred to as the "Inner Solar System" which consists of the Sun and four rocky planets and their moons: Mercury, Venus, Earth, and Mars. The next larger doll going out is called the "Outer Solar System," consists of the gas giants: Jupiter, Saturn, Uranus, and Neptune. Some astronomers still like to include Pluto (now called a dwarf planet) in this group. These first two sections (dolls) are separated by an asteroid belt. Beyond these planets we find the Kuiper Belt and the huge Oort Cloud. These two belts and Oort Cloud are home to many of the comets that occasionally travel through the Inner and Outer Solar Systems.

"Local Stars" make up the third section as we think of the universe. This includes stars from 3-4 light years away to around 25 light years away. A light year is a measurement of distance - how far light travels in a year. The speed of light is 671

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Our Sky in Perspective

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million mph. You can do the math as to how far that would be for a year! Many of these stars can be seen by simply looking up. The darker the area, you are in the more stars you will see.

The fourth section becomes much larger, as it is the "Milky Way Galaxy." The Milky Way, a spiral type galaxy, is home to our Solar System, several hundred billion stars and is 100,000 light years from side to side. Some astronomers place our Solar System in one of the outer spirals.

For the purpose of this article we now come to an area that contains millions of galaxies. The Andromeda Galaxy is the closest to Earth and can be seen by the unaided eye in areas with dark skies. There is more and more space in each of these sections.

Finally, we reach the outer most of the sec-

tions, comparable to the largest Russian Doll, the Universe. All the galaxies are separated by great distances and the Universe is believed to be expanding!

Amateur astronomers have their favorite sections to observe. If you join us for one of our public observing sessions on the third Saturday nights of months March through November, you would have opportunities to observe our Moon, and dependent on the month many of our planets, plus some "Deep Sky Objects" found in the sections three through five. These would include star clusters, both open and globular; galaxies, double stars, and planetary nebula. Every so often there are bonus events like meteor showers, lunar eclipses, and solar eclipses.

Wayland Bauer

REVIEW: 'Challenger: The Final Flight'

Though the Netflix documentary "Challenger: The Final Flight" has been out since September, I finally got a chance to see it on Super Bowl weekend. If you haven't seen it yet, I join with most critics in highly recommending that you do so.

The documentary is divided into four episodes, each about 45 minutes long. It is rich in archival film footage and photographs, and features interviews with many people directly involved in the launch of the Space Shuttle Challenger on January 26, 1986, and the resulting accident that took the lives of all seven astronauts aboard, including school teacher Christa McAuliffe, whose story is one of the main focuses of the documentary.

Many of the interviews pack a strong emotional punch, and it appeared that some interviewees wanted to unburden themselves and get their stories on the record before they took those stories to the grave. Their words, combined with the raw facts of the tragedy, create a gripping tale that offers up a rich combination of guilt, denial, hubris, courage, bureaucratic blindness, political expediency, heartfelt remembrance, and – ultimately – profound sadness.



The documentary foreshadows how all the issues that led to the Challenger tragedy recurred 17 years later, when seven more astronauts perished aboard the Space Shuttle Columbia when it broke up during reentry. It's also a nostalgia trip for those of us who remember the early Space Shuttle era, and then are shocked to realize that it all happened about four decades ago.

The take-away message I got from "Challenger: The Final Flight" is that, for all its science and technology, space travel is ultimately a human endeavor, defined by all the strengths and weaknesses that make us human. Due to our nature, space travel will always come at a cost, and whether that cost is worth it or not is up to us. **Paul Levesque**

Women in astronomy: A look forward and a look back

Let's be honest: Astronomy, like most science and technology fields, has long been dominated by men. That was the case back in Galileo's day, and it largely remains the case today.

Slowly but surely, though, astronomy is becoming less male-dominated. Studies show that more than a third of professional astronomers in the younger age cohort are women, and women could achieve parity with men in astronomy in a few decades if present trends continue.

The Popular Astronomy Club has done its part to encourage women in astronomy by inviting some female professionals in the field – including some Quad Cities natives – to give presentations to the club.

The Quad Citians who've made presentations to PAC include Tiffany Fields, a telescope operator at the Burke-Gaffney Observatory in Nova Scotia who spoke at the 2019 North Central Region Astronomical League conference in Moline, and Lisa Wells, a remote observer at the Canada -France-Hawaii Telescope on Mauna Kea in Hawaii.

Later this year, PAC has scheduled an appearance by Katie Melbourne, a Bettendorf native who earned a degree in astrophysics from Yale University in 2019 – made possible, in part, by a PAC-sponsored scholarship – and who is currently both pursuing a doctorate at the Uni-



This illustration depicts Maria Mitchell using a telescope to discover a comet that became known as "Miss Mitchell's Comet."

versity of Colorado and working with the James Webb Space Telescope team at Ball Aerospace in Colorado.

PAC's schedule for 2021 also includes a presentation by Russet McMillian, an astronomy professor at New Mexico State University and operations manager at the Apache Point Observatory in New Mexico. Our 2020 list of presenters included Adeene Denton, a planetary scientist at Purdue University who hopes to become an astronaut someday.

March is Women's History Month, which makes it a good time to both celebrate women who are breaking barriers today and hoping to do so tomorrow, and to look back at the trailblazers who overcame more daunting barriers in the past.

One woman from the past who's rightly earned acclaim for her contributions to astronomy is Maria Mitchell, born in 1818



Quad Cities native Lisa Wells, who works at an observatory on Mauna Kea in Hawaii, is among the women in astronomy who've made presentations to PAC.

on the island of Nantucket off the coast of Massachusetts.

Nantucket in the 19th century was a major fishing and whaling port. Men from the island often went on ocean voyages that lasted for months, even years (sadly, some never returned). This meant that the women of Nantucket, by necessity, had to learn to stand on their own two feet without male assistance.

Besides being surrounded by independent women, Maria was also the daughter of William Mitchell, a schoolteacher and avid amateur astronomer. The Mitchell family, which grew to ten children, practiced the Quaker faith, which places a high value on education and, even back then, believed in educating boys and girls on an equal basis.

Maria Mitchell showed an interest in astronomy at a young age, and her father encouraged this interest by showing her how to use a telescope and other astronomical instruments. That ability paid off on October 1, 1847, when Mitchell went to a rooftop observatory built by her father, peered through the telescope, and found

Women in astronomy

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an object she later confirmed to be a comet.

The comet became known as "Miss Mitchell's Comet" and vaulted its discoverer to instant fame. She was awarded a gold medal by the king of Denmark for using a telescope to find a comet, and is generally credited as being the first American to discover a comet and only the second woman to ever do so. In 1848, Mitchell became the first woman elected to the American Academy of Arts and Sciences.

Famous Americans such as Ralph Waldo Emerson, Herman Melville and Frederick Douglass visited Mitchell in Nantucket, where she worked for the U.S. Coast Survey tracking the movement of planets in order to use their positions to aid sailors in navigation.

Though she lacked a college degree, Mitchell was hired by Vassar College in Poughkeepsie, New York, as a professor of astronomy, and is believed to be the first American woman to hold that position. Mitchell was also named director of the Vassar Observatory, where she and her students did pioneering work in astrophotography.

Under Mitchell's direction, the Vassar Observatory became the first to take daily photographs of the sun. These images helped prove that sunspots were cavities on the sun's surface, rather than clouds floating above it. Vassar became a center of astronomical research and trained many students who went on to advance the study of astronomy and mathematics.

Mitchell retired from Vassar in 1888 and died a year later. She became the namesake of a World War II liberty ship, a crater on the moon, and a commuter rail line that runs to Poughkeepsie. Her legacy is preserved at the Maria Mitchell Natural History Museum in Nantucket.

Maria Mitchell's story shows that encouraging and nurturing a girl's interest in astronomy can yield great results. Let's hope there are more young women out there who will follow in the footsteps of Maria Mitchell and the female astronomers of today, and take science to a new level.

Paul Levesque

THE PACMO IN WINTER

The Popular Astronomy Club Mobile Observatory — known to its friends as the PACMOremains covered by a tarp, stored at Sun-Rhys in Coal Valley, trying to survive what has been a long, cold winter for all of us. But the PACMO will come out of storage soon, ready for its 22nd year of spreading the knowledge, and joy, of astronomy in the community. We all hope that the pandemic which caused the cancellation of most public events last year will ease soon, and allow us to get the PACMO out of storage and back on the road where it belongs.

Photo by Alan Sheidler



BOOK REPORT

'The Last Stargazers: The Enduring Story of Astronomy's Vanishing Explorers'



I recently read a book called "The Last Stargazers; The Enduring Story of Astronomy's Vanishing Explorers", by Emily Levesque. If you're interested in learning about the life of a professional astronomer, this is the book for you. The author is a professional astronomer who received a degree from MIT, and her Ph.D.

from the University of Hawaii. She has traveled to some of the world's best-known observatories to obtain data for her studies. While I found the beginning and end of the book to be somewhat slow, much of the middle made for interesting reading.

I thought the book would talk a lot about the dying breed of astronomers who actually spend time directly at the telescope, but by and large this wasn't what the book was about. She does talk about how professional astronomers are turning more and more to remote and robotic observing, but a good portion of the book makes clear that an astronomer's job can be every bit as interesting as any other job or profession. Some of the things that can be learned about in this book are:

- Astronomers have automobile accidents at observatories (someone once filed an accident report stating that "a telescope hit my car").
- Quite a few astronomers actually have some degree of music training. She mentioned rock star Brian May, who is a co-founder and lead guitarist of a rock band called Queen, as an astronomer who is a professional musician as well. May's website does state that he achieved a Ph.D. in astronomy from Imperial College, London, in 2007. Sadly, it seems that professional astronomers don't trust anyone who en-

joys classical music, so I guess that means I'm untrustworthy (long live Mozart!).

- Astronomy can be a hazardous, and even fatal, vocation. Levesque talks about astronomer's encounters with tarantulas and scorpions, and other assorted hazards. She also talks at considerable length about the death of Marc Aaronson at the Kitt Peak Mayall four-meter telescope on April 30th, 1987. He died when the moving dome shutter slammed a door into him, killing him instantly.
- There are also other stories that will keep you entertained. She mentions one astronomer at Cerro Tololo Observatory who suddenly noticed that the seeing had deteriorated rapidly, and couldn't figure out what was going on. The astronomer decided to walk down to see if anything was wrong. There certainly was something wrong; the telescope walls were on fire! A leaking instrument sprayed a glycol solution on the walls, and a short in the interior wiring ignited it.

As far as errors in the book go, I didn't notice many. The only one that really stood out to me confirmed that professional astronomers don't always know their constellations well. She talks about an astronomer who thought he discovered a really bright new star in the constellation Scorpius (it turned out to be Mercury). Sadly, she called the constellation Scorpio. So, some of us amateurs can do a better job of identifying the proper name of constellations!

I really enjoyed the book. If you want to get some idea of what the professional astronomer can encounter in his/her career, I encourage you to read this book. **Ken Boquist**

To find out more about Emily Levesque (who is not related to the interim editor of this newsletter and is shown at right) by visiting her website: emlevesque.com.



ASTRONOMY AND SPACE HISTORY – IT HAPPENED IN MARCH

March 2, 1972: The Pioneer 10 space probe is launched on a mission that made it the first spacecraft to travel beyond the asteroid belt and, eventually, out of the Solar



System. Radio contact was maintained with the probe until January 23, 2003. Pioneer 10 may be best known for carrying a plaque that was designed to be read by intelligent life forms from another planet, a feature that had been advocated by Carl Sagan.

March 2, 1978: Vladimir Remek of Czechoslovakia is launched aboard Soyuz 28, making him the first person to travel in space who wasn't a citizen of the United States or the Soviet Union.

March 3, 1915: Congress passes legislation that establishes a federal agency named the National Advisory Committee for Aeronautics (NACA); the agency is dissolved in 1958 and absorbed into a new agency called the National Aeronautics and Space Administration (NASA).

March 13, 1781: Using a 6.2-inch reflecting telescope, William Hershel observes Uranus, which he initially mistakes for a comet but later verifies is a planet, the first known outside the classical planets (Mercury, Venus, Mars, Jupiter, Saturn). While your middle school buddies may have told you that Uranus is a little over two feet



from the Earth, the planet is in fact about 1.8 billion miles away on average. Though very dim, it is visible to the naked eye under the right conditions.

ALSO: On March 10, 1977, a team of astronomers from the Massachusetts Institute of Technology discover that Uranus, like Saturn, is orbited by rings. **March 13, 1989**: Subatomic particles from an intense solar storm reach Earth's atmosphere, producing auroras that are seen as far south as Central America and causing a power surge that results in an electrical blackout affecting most of the Canadian province of Quebec.

March 16, 1926: From a farm in Auburn, Massachusetts, Robert Goddard successfully launches a liquid-fueled rocket for the first time. The rocket remains aloft for less than three seconds and travels a little over 180 feet, landing in a cabbage field. This modest beginning would yield



impressive results decades later when liquid propellants are used to fire rockets into outer space.

March 17, 1958: NASA launches Vanguard 1, the second American satellite and fourth all-time, as well as the first ever to use solar power. Today, Vanguard 1 remains in orbit, making it the oldest man-made object in space.



March 18, 1965: Soviet cosmonaut Alexei Leonov leaves the Voskhod 2 space capsule and, using a tether connected to the craft, becomes the first



person to conduct a spacewalk. Leonov would also make space history 10 years later when he commands a Soyuz spacecraft that docks with an Apollo spacecraft, the first joint American-Soviet space mission and the first ever with an international crew.

March 28, 1997: A homepage set up for Comet Hale-Bopp becomes the first NASA website to receive more than one million hits in one day.



HEART AND SOUL

These gorgeous photos of the Heart Nebula (IC 1805, top) and Soul Nebula (IC 1848) were taken by Jim Rutenbeck, with an ASI1600mm camera using a 300mm fl f4 Canon telephoto lens. About a third of the individual exposures are taken through a Ha filter, a third through an OIII filter and a third through a SII filter. The exposures are assigned to red, green and blue and combined to create the color photo. (This is referred to as the "Hubble palette" since most images taken by the Hubble telescope are processed in this way.) Each object required about six hours of exposure time. Another great photo by Jim Rutenbeck can be found on page 14.



Ken Boquist took these photos of the moon on February 20 - a night when the seeing was good and the temperatures were actually above zero. Ken used his 9.25'' f/10 Schmidt-Cassegrain operating at f/20; each picture is a stack of 750 frames out of 3,000 each. Go to page 12 to see one more photo, plus a guide to these photos.

Guide to Ken Boquist's 'Moonshots'

(1) Apollo 15 Landing Site: I'm currently working on a new Astronomical League observing program called "Lunar Evolution". One of the requirements for completion is to image or sketch all six Apollo landing sites. The Apollo 15 landing site is marked with an "x" just right of center of the picture. The "x" is just right of a rille named Rima Hadley (rima is Latin for "rille"). A rille is a channel where lava once flowed, or a collapsed lava tube. This rille can be seen under reasonably good seeing conditions, but it requires really good seeing conditions to see that part of the rille that is to the immediate left of the "x".

(2) Apollo 16 Landing Site: The "X" at center marks the landing site of Apollo 16. For those wanting to locate this landing site for themselves, the best way to find this site is to look for Descartes, and then start moving north (up).

(3) Moretus: Moretus is the largest crater in the image, located just below and slightly left of the center. Moretus is very much a Tycho lookalike. Its oval shape is due to perspective. Because of its proximity to the lunar limb, we don't see it from above as much as we do many other craters.

(4) Maginus: This is one of the Moon's more prominent craters. It is not as well known as it should be because of its proximity to Tycho. A comparison of Maginus and Tycho provide clues to their relative ages. Maginus has numerous craterlets on its rim and surface. Tycho doesn't. The amount of craterlets in and surrounding a larger crater is an indication of its relative age. Thus, one would expect Maginus to be the older of the two.

(5) Deslandres: This is one of my favorite craters. It is the large, heavily worn and battered crater filling most of the center. The heavily worn surface and walls are a very good indication that this is one of the oldest craters on the moon. In case you're wondering, there is a Hell in the solar system. It just happens to be within Deslandres.

(6) Rupes Recta: Rupes Recta is more commonly known as the "Straight Wall". It is the long dark streak towards the upper left portion of the image. Rupes Recta is the best example of a lunar fault. Even though it appears to



be fairly steep, it actually has a moderate slope. According to the Rukl's lunar atlas, Rupes Recta is 110 km in length, about 2.5 km in width, and about 240-300 meters high. To the left of Rupes Recta is another rille called Rima Birt. Birt is the large crater just right of the lower end of the rille.

(7) Ptolemaeus, Alphonsus, and Arzachel: This is one of the best-known crater groupings on the moon. Ptolemaeus is the largest crater in the image. Numerous tiny little white patches are visible on its surface. These are just very small craterlets. Just below and slightly left is Alphonsus (the second largest crater). Three dark patches can be seen on Alphonsus' floor at 2, 5, and 9 o'clock. These patches are "dark-halo" craters. These craters are the subject of some controversy. Some astronomers think these are volcanic cinder cones, while others think they are just underlying darker surface materials that were exposed when their craterlets formed. Below Alphonsus is Arzachel (the third largest crater). Arzachel sports a prominent off-center central peak, and a nice rille on the right side of the floor. Finally, just below and left of Alphonsus is Alpetragius. Alpetragius has a vey prominent, unusually-shaped central peak. Some observers call Alpetragius the "bird's nest" because of its appearance. The central peak is an egg sitting in the nest.

ASTRO-TRIVIA QUESTION



Uniformed members of the U.S. Army are called soldiers; members of the Navy are called sailors; and members of the Marine Corp, of course, are marines. What do you call members of the newest branch of our military, the U.S. Space Force? Answer on page 18



March 2021

Stars are people too.

In last month's Skyward, I included that four-word phrase, but the first time I used it was actually in an article about the life of the star Betelgeuse, for Astronomy magazine. When I met Richard Berry, the editor at the time, he began by reciting those words: "Stars are people too." He added that he accepted the article for publication in his magazine after he read those words. (It turns out that wasn't my only unusual experience with that magazine. A few years later David Eicher, the current editor, and I witnessed a construction crew blowing up a freeway overpass near the magazine's headquarters in Milwaukee.)

As I explained last month, stars live out their lives much as do. They are born in gaseous stellar nurseries, or diffuse nebulae. In our sky two of the most famous nebulae appear are in summer, the Lagoon Nebula in Sagittarius, and in winter, the Orion Nebula. The little stars within the nebula vary in brightness, usually by a few tenths of a magnitude, but they can change quite quickly. There are a few others in the Hyades star cluster in Taurus, the bull. I saw one star there change rapidly over a period of a few minutes. These stars mimic the behavior and misbehavior of human youth.

Also like us, stars settle down as they grow older. Our Sun is an example of a star in middle age. It has shone steadily for almost five billion years and will continue this way for another several billion. Except for a cycle of eleven years during which the numbers of sunspots, which are storms on the face of the Sun, rise and fall, the Sun behaves constantly and predictably. There are vague hints of a 12,000-year cycle dating back to biblical times but I have not found any evidence for this.

As our Sun enters old age it will begin to act erratically again. Its hydrogen supply will be almost exhausted. It will begin to fuse its helium. At some point during its red giant phase, it will suffer a helium flash. This event might feature only a few minutes of strong helium fusion, but during which the Sun briefly will emit an enormous amount of energy equivalent to that of our whole galaxy.

As it continues its red giant phase it might vary in

brightness by several magnitudes over many months.

Mira, a star in Cetus the whale, is such a star. A Mira star's core begins to contract under the force of its own gravity and whatever hydrogen is left will ignite into a shell around the core. Mira, like other red giants, was once a Sun-like star that has used up its supply of hydrogen. Once the helium is exhausted, its core will be left with heavier elements like oxygen and carbon. The outer layers of these old stars will explode as novae every few hundreds or thousands of years. Eventually, with their outer layers gone, the core will become a white dwarf star.

If a star is much more massive than our Sun, it would end its life far more dramatically—as a supernova. Such an event is really catastrophic. There are two kinds. In the first, the smaller member of a two-star system will keep on attracting material from its larger companion. But instead of repeated nova explosions, the small star will get more and more massive. When that star's core reaches a certain limit, in less than a second, the star finally will collapse on itself and will blow itself apart.

The other kind involves a very massive star, say three or four times the mass of the Sun. Just like in the smaller star, its supply of hydrogen will be gone. With little helium left the still contracting

continued on page 14



The constellation Orion rises behind an observatory. The Orion Nebula, located below the belt, is a stellar nursery where stars are born; the bright star on the far left, Betelgeuse, is nearing the end of its life and is expected to explode into a supernova.

Skyward: Stars are people too

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core is left with carbon and oxygen. When the core reaches a certain temperature, the remaining carbon will ignite all at once tear the star apart.

If the star is very massive, say nine or ten times the mass of the Sun, its very hot core allows the carbon to ignite and burn as before, but gradually, not all at once. Heavier elements like phosphorus and sulfur will be formed in shorter and shorter intervals, until silicon is generated.

After just one day, the silicon will fuse into iron. Iron cannot fuse to anything heavier.

Instead, in less than a second the core will crash in on itself. In the resulting explosion, the star's outer layers will be blown away.

The brightness rise is so dramatic that the single supernova will outshine its entire galaxy. What is left is either a very dense neutron star, where a cubic inch of matter would weigh as ton or more here on Earth, or in the most massive stars, a black hole from which even light cannot escape.

Although stars do not have consciousness like we do, they lead extraordinary lives that are well worth our appreciation and study. Don't forget: Stars are people too.

Here's a member photo of a star nursery



This photo by Jim Rutenbeck shows NGC281, also called the Pacman Nebula. NC281 contains "Bok globules," curious structures about one light-year across that were first discovered in the 1940s by astronomer Bart Bok. Bok thought that the globules contained newborn stars, a hypothesis that has been since confirmed. Here are the specs on Jim's photo: Telescope: 10-inch f4.7 Newtonian with Baader coma corrector; Mount: AP1200 GEM; Camera: ZWO ASI 1600mm; Narrow band Ha, OIII and SII filters; Total of 27.5 minute exposures; **Processed in Astro Pixel Processor with color** adjustment in Photoshop.

Sirius and Procyon

Taking the Dog Stars for a Springtime Walk

March skies feature many dazzling stars and constellations, glimmering high in the night, but two of the brightest stars are the focus of our attention this month: Sirius and Procyon, the dog stars!

Sirius is the brightest star in the nighttime sky, in large part because it is one of the closest stars to our solar system at 8.6 light years away. Compared to our Sun, Sirius possesses twice the mass and is much younger.

Sirius is estimated to be several hundred *million* years old, just a fraction of the Sun's 4.6 *billion* years. Near Sirius - around the width of a hand with fingers splayed out, held away at arm's length - you'll find Procyon, the 8th brightest star in the night sky.

Procyon is another one of our Sun's closest neighbors, though a little farther away than Sirius, 11.5 light years away. While less massive than Sirius, it is much older and unusually luminous for a star of its type, leading astronomers to suspect that it may "soon" – at some point millions of years from now – swell into a giant star as it nears the end of its stellar life.

Sirius and Procyon are nicknamed the "Dog Stars," an apt name as they are the brightest stars in their respective constellations – Canis Major and Canis Minor – whose names translate to "Big Dog" and "Little Dog."

Not everyone sees them as canine companions. As two of the brightest stars in the sky, they feature prominently in the sky stories of cultures around the world. Sirius also captures the imaginations of people today: when rising or setting near the horizon, its brilliance mixes with our atmosphere's turbulence, causing the star's light to shimmer with wildly flickering color. This vivid, eerie sight was an indication to ancient peoples of changes in the seasons, and even triggers UFO reports in the modern era!

Both of these bright stars have unseen companions: tiny, dense white dwarf stars, the remnants of supermassive companion stars. Interestingly, both of these dim companions were



inferred from careful studies of their parent stars' movements in the 1800s, before they were ever directly observed! They are a challenging observation, even with a large telescope, since their parent stars are so very bright that their light overwhelms the much dimmer light of their tiny companions.

The white dwarf stars, just like their parent stars, have differences: Sirius B is younger, brighter, and more energetic than Procyon B. Careful observations of these nearby systems over hundreds of years have helped advance the fields of: astrometry, the precise measurement of stars; stellar evolution; and astroseismology, the study of the internal structure of stars via their oscillations. Discover more about our stellar neighborhood at nasa.gov!

David Prosper

This article is courtesy of NASA's Night Sky Network program, which supports astronomy clubs across the USA and is dedicated to astronomy outreach. Visit nightsky.jpl.nasa.gov to learn more.



Astronomical League www.astroleague.org/outreach; duplication is allowed and encouraged for all free distribution.



A MOON WITH MANY NAMES

Per Native American tradition, the full moon in March is known as the "Worm Moon," as it comes at the time of year when the ground softens and earthworms begin to emerge. Some northern tribes referred to it as the "Full Crow Moon," when the cawing of crows signals the end of winter, or the "Full Crust Moon," because the snow cover becomes crusted from thawing by day and freezing at night. Yet another name it goes by is the "Full Sap Moon," since it occurs when maple trees are tapped. In the Christian tradition, a March full moon that occurs after the spring equinox is called the "Paschal Moon," and Easter is observed on the following Sunday, which falls on April 4 this year. However, Orthodox Christians, who still use the Julian calendar to set the date of Easter, won't observe Easter 2021 until May 2.



WELCOME TO THE CLUB

RENEWALS: John Douglas; Thomas and Sue Ervin; Matt Nielssen; Jim Rutenbeck; Gail and Thom Sederquist

NEW MEMBER: Ron Mullen

Astronomical League Observing Programs

If you'd like to earn some recognition for your observing skills, the Astronomical League currently offers more than 70 different observing



programs. The programs are designed to provide goals and directions for your observations and cover a full range of observable objects and skill and experience levels. You can earns certificates and pins for completing the programs. Click on the link above to find an alphabetical list of observing programs, from "Active Galactic Nuclei" to "Youth Astronomer.

Note that his year, in celebration of its 75th anniversary, is offering a special challenge to observers; complete this program, and you can earn the 75th Astronomical League Anniversary Certification.

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SUBMISSIONS WELCOME!

We want to hear from you! If you have an article or photos to submit, or other items of interest, send them along to Reflections. Please send what you have to share no later than the 25th of the month, sooner if possible. **Thank you!**



the Astronomical League website



PAC belongs to the North Central Region of the Astronomical League; click here to check out NCRAL's website.



Uniformed members of the U.S. Space Force are called **guardians.**

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Date: March 8th, 2021

Event: Regular Meeting @ 7 p.m. Location: Zoom / Butterworth Center Program : Business Meeting 'Smorgasbord' of Presentations by Members Constellation Report by Ally Nordick: Orion All these events, dates and times are tentative and subject to change! Please check your emails for any updates and changes!

The meeting on March 8 will be the first in almost a year that will be held in-person. Attendance at the Butterworth Center will be limited, and the meeting will be available virtually via Zoom. PAC may also resume public events soon. More information can be found in the 'President's Corner' column on page 1 of this newsletter. MORE UPCOMING EVENTS:

- **April 12:** PAC Regular Meeting at the Butterworth Center / Zoom at 7:00 p.m. Presentation via Zoom: "Skywatchers of Ancient North America" by Bill Iseminger, former Assistant Site Manager at Cahokia Mounds Museum
- April 17: Outreach at Niabi Zoo; sunset
- May 10: PAC Regular Meeting at the Butterworth Center / Zoom at 7:00 p.m. Presentation via Zoom: "NASA Solar Missions" by Dr. Therese Kucera, astrophysicist with NASA's Goddard Space Flight Center in Greenbelt, Maryland
- May 15: Outreach at Niabi Zoo; sunset
- June 14: PAC Regular Meeting at the Butterworth Center / Zoom at 7:00 p.m. Presentation via Zoom: "Association of Lunar and Planetary Observers" by Matthew Will, Secretary and Treasurer of ALPO.
- June 19: Outreach at Niabi Zoo; sunset



YOUR CHANCE TO SHINE!

PAC members are needed to provide constellation reports and other presentations, write newspaper and newsletter articles, and assist with events. You can sign up at a regular meeting or by contacting Alan Sheidler or Dino Milani: adsheidler@gmail.com / dinomilani@qconguard.com. See page 20 to find available slots.

MONTH	NEWSPAPER ARTICLES	CONSTELLATION REPORT	PROGRAM
MAR 2021	Paul Levesque	Ally Nordick (Orion)	Business Meeting; Smorgasbord of Member Presentations
APR 2021	Roy Gustafson	AVAILABLE	Presentation: "Sky watchers of Ancient North America" by Bill Iseminger, Cahokia Mounds State Historic Site
MAY 2021	Dave Smith	AVAILABLE	Presentation: "NASA Solar Missions" by Dr. Therese Kucera, Goddard Space Flight Center
JUN 2021	Frank Stonestreet	AVAILABLE	Presentation: "Association of Lunar and Planetary Observers" by Matthew Will, ALPO Secretary & Treasurer
JUL 2021	AVAILABLE	AVAILABLE	Green Bank Observatory. Green Bank, West Virginia - Virtual Tour and Current Projects
AUG 2021	AVAILABLE	AVAILABLE	Annual PAC Picnic
SEPT 2021	AVAILABLE	AVAILABLE	Business Meeting; Smorgasbord of Member Presentations
OCT 2021	AVAILABLE	AVAILABLE	Annual PAC Banquet; Presentation: "Lunar Laser Ranging Project" by Dr. Russet McMillan, Apache Point Observatory, New Mexico
NOV 2021	AVAILABLE	AVAILABLE	Presentation: "M Dwarf Stars and the James Webb Space Telescope" by Katie Melbourne, Ball Aerospace Systems, Broomfield, Colorado
DEC 2021	AVAILABLE	AVAILABLE	The Year in Review — Roy Gustafson

SUMMARY OF FEBRUARY MEETING

The February 8 virtual meeting of the Popular Astronomy Club featured a presentation titled "Space: Year in Review" by Larry Boyle of the Chicago Society for Space Studies. Larry gave us a recap of manned and unmanned space missions for 2020 carried out by the United States and other nations. He also gave us a look ahead at 2021, including three Mars missions scheduled for this month. More than 30 people signed in for the meeting, including guests from the Quad Cities Astronomical Society and the Peoria Astronomical Society.

Club president Alan Sheidler then talked about upcoming events, including the next club meeting on March 8. The plan is to do this meeting as a "hybrid" event, with virtual participants joining via Zoom and limited live attendance at the Butterworth Center. The meeting will be a "smorgasbord" meeting with short presentations from club members after a brief business meeting.

FROM THE PAC CONSTITUTION: "(The Popular Astronomy Club) is designed to secure the pleasures and benefits of an association of persons interested in amateur astronomy; to promote the science of astronomy; to promote astronomical work and craftsmanship in its various fields; to correlate amateur activities; and to act as interpreter of astronomical developments and events to the public. Our association is thus organized exclusively for such educational, and scientific purposes."