

**Reflections** The Newsletter of the Popular Astronomy Club ESTABLISHED 1936

#### President's Corner: July 2021



Welcome to another issue of Reflections, the newsletter of the Popular Astronomy Club. With the advent of warm weather, club members have been getting together more often to observe. This year I have been chal-

lenging myself to complete the observing requirements of the Astronomical League's Planetary Nebula and Globular Cluster programs. I am making good progress on these and hope to satisfy the requirements soon and earn award recognition from the AL.

Meanwhile, I have also begun working on the AL's Carbon Star program too. Carbon stars are very interesting objects. They are late-type red giant stars whose atmospheres contain vast amounts of various types of carbon molecules such as C2, CO, CN, and CH. These carbon compounds manifest themselves in the form of soot, which acts as a filter, blocking the passage of short wavelengths of light (such as yellow, blue, and green) but allowing the longer red wavelengths to pass through. This filtering effect enhances the reddish color of these stars which would already tend to be red in appearance anyway due to their age.

So far, most of the carbon stars I have observed appear to be strikingly reddish or orange in color. This makes finding them fairly easy. The brighter ones really contrast with other stars that share the telescopic field of view. Another interesting aspect of these stars is that they are variable. My favorite carbon star so far is Y Canum Venaticorum (La Superba), which varies from magnitude 4.8 to 6.4 over a period of 157 days. Other carbon stars vary by even greater amounts, but this adds another dimension to these unusual objects.

On the evening of May 13th, using the club's Celestron CPC 1100, I punched in the celestial coordinates (RA/DEC) of La Superba expecting the scope to precisely center the object in the eyepiece view as it had for other objects that evening. To my amazement and consternation, La Superba was near the edge of the field of view (nowhere near the center of the field of view). Luckily La Superba is bright, red and impossible to miss if it shows up anywhere in the field of view, so it was easy to find and center using the scope's controls.

I have also noticed this inaccuracy of centering some of the other carbon stars, and especially the ones that are not in the telescope's database (which require entry of the RA/DEC coordinates). This got me to wondering what's going on?

The explanation has to do with something called precession. Precession is the gradual change in celestial coordinates due the gyration or "wobble" of the Earth's axis. Similar to the wobble of a rapidly spinning top, the Earth's rotation axis also rotates slowly about a fixed direction is space. This motion is called "luni-solar precession." It is caused by the effects of the Moon and the Sun on the Earth. The effect is small but over time causes the north pole of the Earth to rotate position in relation to the stars over a 25,800 year cycle. This effect, though small, must be accounted for if we are to achieve high accuracy in the pointing of a telescope.

The coordinates (RA/DEC) of the stars and galaxies are given in catalogues at a specified time or epoch. The catalogues you are most likely to see will be given for the year 2000 (epoch 2000.0). The coordinates are only precisely correct for the beginning of the year 2000. These table values of RA/DEC can be **Continued on Page 3**  July 2021

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# A NOTE FROM THE EDITOR

As you'll see elsewhere in this newsletter, I have been elected as secretary of the Popular Astronomy Club and have also been named as editor of "Reflections."

I am taking over for Terry Dufek, who unfortunately is unable to continue in these positions due to his health. I'd like to take this opportunity to extend my best wishes to Terry – who, by the way, is celebrating his birthday this month – and to thank him for providing me with a strong foundation to build on and for all the support he's provided me during the transition.

This issue of "Reflections" is chock-full of reports on PAC activities and of the beautiful work done by local amateur astronomers, showing that this is an active club that's making real contributions and a real difference in the community.

While I may be the editor, this is your newsletter – not mine – and I encourage you to send me your submissions, photos and feedback. I see "Reflections" as part of PAC's overall information and outreach program, and as another way of moving the club forward as we celebrate our 85th year.

Get in touch by emailing me at levesque5562@att.net. I'm looking forward to hearing from you.

Paul Levesque

## 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 SPRING Seasonal Messier List

NCRAL SUMMER Seasonal Messier List

NCRAL AUTUMN Seasonal Messier List

NCRAL WINTER Seasonal Messier List

# HOW'S THE WEATHER?



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## President's Corner: Carbon stars

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which you can read about further on in this used without significant error within a couple of years. But by now, we are now more than 21 years beyond the epoch 2000.0 table values. I was curious to know how much the coordinates of La Superba have changed during the last 21+ years.

Consulting "Practical Astronomy With Your Calculator", second edition by Peter Duffett-Smith, and after following the method described on page 59, I sought to convert La Superba's coordinates from epoch 2000.0 to the current epoch. The math is a little involved, but if you are interested, I am including the calculations as a separate attachment for those of you who are inclined to go the extra mile. For those of you not so inclined, here is what I found:

Epoch 2000.0	Epoch (now: July 15)
RA 12h45m06s	12h46m07s
DEC +45°26′00″	+45°18′54″

The other possibility is to consult one of the various planetarium programs such as Stellarium which gives both Epoch 2000.0 and Epoch (now) values. Using the Epoch (now) values yields excellent targeting of La Superba using the club's CPC 1100.

Still I find it interesting the so-called "fixed" objects have actually moved in our sky far enough to nearly throw them out of a scope's field of view in the course of 21 years! Interesting. Keep looking up!



Alan Sheidler captured this image of the carbon star 'La Superba' after performing some calculations (shown below) to allow for precession.

For La Superba, the coordinates from "The Night Sky Observer's Guide", Volume 2 is RA/DEC (2000.0) = 12h 45"065/+45°26'00" For the observing date 15 July 2021:  $N = \left(2021 + \frac{7}{12} + \frac{15}{365}\right) - 2000.0$ N = 2021,624 - 2000.0 = 21.6 number of years from table value for La Superba For La Superba (2000.0): RAD = 12 + 45 + 6 = 12.7517 hours RAD = 191.275 deg (15 deg per haur) DECa = +45 + 26 = +45.438 deg For La Superba (2021.6): RA, = RA, + [3.0742 + 1.33589 in (RA) tan (DEC) RA,h = 12.7517h + 0.01685h = = 12.7686h RA, = 12h46m07s  $DEC_{1}^{4} = DEC_{0}^{4} + [20.0388 cor (RA_{0}^{4})] + N$ 3600 = 45.433 + (-0.1179) DEC. = 45.3/51 deg = 45° 18'54" DEC.

## Astronomical League Observing Programs

The Carbon Star, Globular Cluster and Planetary Nebula observing programs cited in the "Presidents Corner" are among the more than 70 different observing programs offered by the Astronomical League. 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, including a special program in celebration of the Astronomical League's 75th anniversary.

## Putnam visitors enter 'Gateway to Space'

The Popular Astronomy Club joined with the Quad Cities Astronomical Society at the Putnam Museum's "Gateway to Space" weekend, held June 12 and 13. The event was organized to coincide with Quad Cities Museum Week, and also officially launched the Putnam's new Space Gallery.

Throughout the event, the PACMO was parked in front of the museum to offer solar observing; a sunspotter scope and other telescopes for safe viewing of the sun were also set up.

Inside the museum, the "Cosmic Chefs" did hourly comet making demonstrations in an area which one housed the Putnam gift shop – since relocated – and that now serves as a classroom. Roy Gustafson did the "Magnetic Sun" Night Sky Network talk in the same room after each comet-making demo.

Dino Milani brought samples of meteorites and set up display boards, and did a talk on "Asteroids and Comets: Old and New Discoveries" on Sunday. Robert Mitchell and Sam Santiago represented QCAS on Saturday and brought three telescopes for an inside display.

Byron Davies brought his Explore Scientific scope on Sunday and set it up in the lobby. He talked about how it works and also showed visitors some of his astrophotog-



raphy from the previous night at Menke.

Dr. Paul Sipiera of the Planetary Studies Foundation also made a presentation during the event, and the foundation set up a display featuring meteorite fragments. Iowa State University had a table where they demonstrated robotics and virtual reality.

PAC had craft, temporary tattoo, and literature tables set up and provided handouts from NASA.

The Putnam Museum reported that over 400 people attended "Gateway to Space," some from as far away from Florida. Overall it was a great event with great support from the club; thanks to all members who participated for your time and hard work.

#### Sara Sheidler

Cosmic chefs Alan Sheidler and Alex Holt (above) cook up some comets; Sam Santiago (standing) and Dale Hachtel do some solar observing; Dino Milani staffs an information table on asteroids and comets. Turn to pages 5 and 6 for more on 'Gateway to Space.'





## Local family has a blast at PAC-supported event

Every parent knows that finding something to keep the kids entertained on the weekend isn't always easy, but Linda Lambiotte found that taking her two youngsters to "Gateway to Space" was just the ticket.

Linda – who, full disclosure, is a friend and coworker of the editor – brought husband Kirk, 12-year-old son Riley, and seven-year-old daughter Alayna to the Putnam on June 12, and reported that it was fun for the whole family.

"I personally enjoyed having something on this topic in the Quad Cities," Linda said. "My son is really into 'anything space' and we try to foster his interest whenever we can.

"I really liked the 'cooking' demonstration on how to make a comet – I thought it was an amazing way to teach kids, and adults, how they form in space," Linda said. "I also loved how they integrated the robotics / engineering stand from Iowa State University into the event – we were able to learn about the Iowa State Engineering Kids program and STEM camps and activities available this summer."

Riley, who hopes someday to design and build robots that will explore Mars and other planets, said that he enjoyed the hands-on learning available at "Gateway to Space."

"I learned the history of 'space rocks' while holding them," he said. "I also loved the VR flying simulation; I was never able to experience before!"

"I liked being able to hold a piece of a meteorite, knowing it came from space; it was really cool!" Alayna said. "I also had fun moving the bee robot around," referring to a mini-robot set up by Iowa State that children could program to move to diffeent spaces.

Thanks to the Lambiottes for attending and for letting us know what they thought. Their experience shows that PAC's participation in public events really does make a positive difference in the community.

Paul Levesque





The Lambiottes (from left) - Kirk, Riley, Linda and Alayna (in eclipse glasses) had fun at 'Gateway to Space." Alayna enjoyed the bee robot and found out what she would weigh on the moon.



# **MORE 'GATEWAY TO SPACE' PHOTOS**





Rusty Case greets some visitors at the PACMO; Roy Gustafson presents the 'Magnetic Sun'; a young man takes a virtual reality ride; Dr. Robert Mitchell from the Quad Cities Astronomical Society talks telescopes; Dr. Paul Sipiera discusses meteorites with young visitors; meteorite fragments are on display.

## Middle school students enjoy PAC viewing event

The first observing session held under a community partnership between the Popular Astronomy Club and the Moline School District took place at John Deere Middle School on June 15.

About 10 students and their families turned out for the session, which was facilitated by four PAC members operating three telescopes. Objects observed during the session included the Moon, Venus and Mars, as well as the Sombrero Galaxy, Ring Nebula, and the double star Cor Caroli.

Four PAC members – Rusty Case, Roy Gustafson, Dale Hachtel and Alan Sheidler – were present for about three hours, explaining the objects being observed, interacting with students, parents and guests, and answering their questions.

Chad Potter, a science teacher at John Deere Middle School who is the district's primary point of contact for the partnership with PAC, helped schedule and set up the observing session. Mr. Potter hopes to form an astronomy club at the school.

Under the partnership, PAC will hold four events a year at John Deere Middle School. The events will fall under the Lights On for Learning program, which provides education enrichment opportunities on evenings, weekends and other times when school is not in session.





A John Deere Middle School student does some observing, assisted by science teacher Chad Potter.

sometime in the fall, after the start of the 2021-22 school year.

Thanks to all the PAC members who made the observing session possible and are supporting a program that will spark interest in astronomy in local students.

## PAC performs public outreach at Giant Goose

The Popular Astronomy Club held a public outreach event at Giant Goose Conservation Area in Atkinson, Illinois, on June 5.

Fortunately, this was a sunny Saturday, because the event focused on solar observing. The PACMO and five other telescopes



Telescopes are set up for solar viewing at Giant Goose Conservation Area.

were set up for viewing the sun. Included in hydrogen-alpha scope, which showed solar prominences and interesting granulation effects in the turbulent solar atmosphere. Also

available was a Sun-

projects an image of the sun on a white background; this allows several visitors at a time to view sunspots on the sun's disk.

All other telescopes were equipped with white light filters to assure safe solar observing. Live video images of the sun were projected onto the PACMO's flatscreen throughout the event. Some astrophotographs taken those instruments was a by PAC members during night observing sessions were displayed.

Organizers from Giant Goose estimate that the event attracted more than 150 visitors, making it another successful observing session. Thanks to the PAC members who came out that day, including Alan, Sara and Eric Sheidler; Roy and Jan Gustafson; and Rusty spotter telescope, which Case, Dale Hachtel and Wayland Bauer.

## Astrophotos by Byron Davies featured on local news

On the evening of June 12, Byron Davies joined other members of the Popular Astronomy Club and the Quad Cities Astronomical Society at Menke Observatory for an observing and photography session.

Some of his photos came out so well that Byron decided to send them into KWQC / Channel 6, as a means of publicizing the clubs and making the public aware of amateur astronomy in the Quad Cities area.

Three of the photos were shown during a 4 p.m. news broadcast on June 17. The photos were of the Eastern Veil Nebula, the Western Veil Nebula – also known as the "Witch's Broom" – and the North American Nebula.

As they showed the photos, newscaster Sharon DeRycke and meteorologist Erik Maitland praised them effusively, remarking on the detail and calling them "absolutely gorgeous." They compared them to images provided by NASA, and remarked how these were produced locally.

A copy of the broadcast can be viewed on PAC's YouTube page, via the following link: <u>https://youtu.be/C6nyXULAvTg</u>. It can also be downloaded from the "Information and Presentations" page on the PAC website, here:

https://www.popularastronomyclub.org/infoand-presentations

Kudos to Byron for sharing his excellent work and for facilitating some great public outreach!



These photos taken by Byron Davies (from top) of the Western Veil Nebula, Eastern Veil Nebula and North American Nebula were featured on the Channel 6 news broadcast on June 17.

## Registration open for Astronomical League convention

There's still time to register for the annual Astronomical League convention, which will be held August 19-21 in virtual space.

The event is free, and you need not be a member of the Astronomical League or any other astronomy organization to attend. Awards for both 2020 and 2021 will be presented, and over \$3,000 worth of door prizes will be handed out.

Keynote speaker at the convention will be Dr. Jocelyn Bell Burnell, an astrophysicist who is credited with discovering the first radio pulsars.

Click on this link to register for the convention: <u>https://www.astroleague.org/content/register-</u> <u>alcon-21-virtual</u>

## Scorpius shines in the summer night sky

Throughout the summer, the constellation Scorpius is at its best when high in the sky during the evenings of June, July and August.

In Greek mythology, Scorpius is the scorpion that killed Orion, the hunter. That is why these constellations are set at opposite sides of the sky. Scorpius rises in the east as Orion sets in the west. Scorpius has many bright stars and deep sky objects spread throughout a rich part of the Milky Way.

Scorpius resembles a scorpion, with a head and stinger. It is one of the few constellations that resembles the creature after which it is named. The northeastern end is a line of three bright stars.

At the center of the scorpion lies the red star Antares (Greek for rival to Mars). Romans called it Cor Scorpionis: Heart of the Scorpion. The Persians thought of Antares as one of the Royal Stars, guardian of heaven.

The ancient Chinese called Antares's glow the "Great Fire" at the heart of the Dragon of the East. It is a red supergiant star at a very late stage of its evolution. It is immense, with a diameter close to 300 times that of our sun.

M4 is a globular cluster due east of Antares. A globular cluster is a large compact spherical mass of stars, typically old stars in the outer regions of a galaxy. M4 is nearly one-half degree in diameter, approximately the size of the full moon. Its stars are loosely concentrated.

Binoculars trained on M4 show a fuzzy patch of light. A small telescope reveals a mottled patch of haze. A larger telescope shows individual stars. M4 is considered one of the best globulars for telescope viewing, and is the first cluster in which individual stars were resolved.

M80 is a small bright cluster northeast of Antares. It can be spotted with binoculars, but needs a large telescope to resolve stars. It contains several hundred thousand stars, and ranks among the densest clusters in the Milky Way.

M80 hosts relatively many "blue stragglers," stars that appear to be much younger than the



# This map of Scorpius shows the location of the globular clusters found in this constellation.

cluster. It is thought these have lost part of their outer layers due to close encounters with other cluster members, or perhaps from collisions between stars in the dense cluster.

There are three open clusters in Scorpius: M6, M7 and NGC 6231. M6 and M7 are located to the north of the scorpion's stinger. M6, which can be glimpsed with the naked eye, is also referred to as the butterfly cluster. Viewed at higher powers in a telescope, the bright stars resemble the wings and body of a butterfly.

M7, which lies to the southeast of M6, is another cluster of bright stars. The cluster is about one-quarter degree in diameter. It contains a number of blue supergiant stars, clustered in a compact group. This cluster is visible to the naked eye as a bright spot. It is best viewed through binoculars.

NGC 6231 is another bright cluster, one-half degree north of Zeta Scorpii. It lies is the rich star fields of the Milky Way, and is best viewed through binoculars.

#### **Bryan Raser**

# The Planets in July 2021

## Mercury and Venus

**Mercury** starts off on July 1 in the northeastern sky 6° off the horizon at 5 am. It is magnitude .79. It is at greatest western elongation on the 4th. The 28day old Moon passes 3 ° 37' to the south of Mercury on the 8th, as seen in the diagram on the left. Mercury continues to decline in altitude until it is at superior conjunction on August 1st.

**Venus** on July 1 shines brightly in the western sky at magnitude -3.85. It is at an altitude of  $12^{\circ}$  41' off the horizon at 9 pm. The two-day old Moon passes  $3.3^{\circ}$  north of the planet on the 12th. Venus passes  $1^{\circ}$  North of Regulus on the 21st.





# The Planets in July 2021 Mars, Jupiter, Saturn, Uranus and Neptune

**Mars** starts off July 1 just above Venus low on the western horizon at 9 pm. It is magnitude 1.82. It slowly draws close to Venus on July 13 to pass  $1/2^{\circ}$  north. The rest of the month, Mars continues to sink into the twilight.

**Jupiter** is high in the south at 5 am on July 1. It is magnitude -2.43 and 36 ° 35.29' off the southern horizon. On the 26th, Jupiter is 4.2 ° north of the moon.

Saturn on July 1 is just 19° 18' southwest of Jupiter at 5 a.m. It shines at magnitude 0. It will be 3.8° north of the Moon on the 24th. Uranus at magnitude 5.8 is 30° 51' above the southeastern horizon at 5 am on July 1. The Moon passes 8° 30' south on the 5th.

**Neptune** on July 1st is magnitude 8.8 and  $21^{\circ}$  54' east of Jupiter. The Moon is 5° 48' to the southeast.



Neptune is 42° above the southern horizon.





# Spotlight Galaxy: NGC 7023

**NGC 7023** (also known as the **Iris Nebula** and **Caldwell 4**) is a bright reflection nebula in the constellation Cepheus. The designation NGC 7023 refers to the open cluster within the larger reflection nebula designated LBN 487. The nebula, which shines at magnitude +6.8, is illuminated by a magnitude +7.4 star designated SAO 19158. It is located near the Mira-type variable star T Cephei, and near the bright magnitude +3.23 variable star Beta Cephei (Alfirk). It lies 1,300 light-years away and is six light-years across.



## **ASTRONOMY AND SPACE HISTORY – IT HAPPENED IN JULY**

July 4, 1997: The Mars Pathfinder spacecraft makes a soft landing on the red planet; the spacecraft carries Sojourner, the first rover to successfully traverse the Martian sur-



face. Sojourner exited the spacecraft soon after and approached some rocks which scientists on Earth nicknamed "Barnacle Bill," "Yogi," and "Scooby-Doo," apparently due to their resemwas expected to last about a month, Sojourner continued to analyze Martian rocks and soil for nearly three months before its battery failed and communication was lost.

July 5, 1687: The first edition of Isaac Newton's Philosophiæ Naturalis Principia Mathematica (Mathematical Principles of Natural Philosophy) - commonly known as the Prinicipia - is published. The book outlines Newton's laws of motion and gravitational attraction, and provides further confirmation of Johannes Kepler's law of planetary motion. Newton would later update the work of the Principia in two subsequent editions, published in 1713 and 1726. The Principia was a quantum leap in science, mathematics and astronomy, even though some of its theories were overturned when Albert Einstein formulated his theory of general relativity.

July 16, 1994: Fragments of Comet Shoemaker-Levy, which had been discovered two years earlier by astronomers Carolyn and Eugene Shoemaker and amateur astronomer David Levy, begin colliding with Jupiter, a process that would continue for over a week. It's estimated that the comet fragments entered Jupiter's atmosphere at speeds of over 134,000 miles per hour. PAC members set up telescopes on the grounds of Coal Valley Baptist Church and also supported public observing sessions held at Gamble Memorial Observatory at Augustana College. Even the smallest telescopes showed

the scars on Jupiter caused by the collisions. Data collected by professional astronomers during the event added to our understanding of the Solar System's largest planet.

July 17, 1953: The Popular Astronomy Club hosts the annual convention of North Central Region of the Astronomical League. The event is held at Sky Ridge Observatory in Moline and includes a picnic supper on the grounds, a lecture, and an observing session. Later that year, PAC president Dr. Carl Gamble would preside at blance to cartoon characters. Though its mission the league's national convention in Washington, D.C.

> July 17, 1975: American astronaut Thomas Stafford and Soviet cosmonaut Alexei Leonov shake hands in orbit, three hours after the docking of their Apollo and Soyuz spacecraft.



Stafford is joined on the mission by astronauts Deke Slayton – an original member of the "Mercury 7" making his only spaceflight – and Vance Brand, while cosmonaut Valeri Kubosov joins Leonov. The spacecraft remained docked for about four days, during which time the astronauts and cosmonauts conducted scientific experiments and exchanged gifts.

July 24, 2009: King Juan Carlos II of Spain presides at an inauguration ceremony held at Gran Telescopio Canarias on the Canary Islands. More than 500 astronomers, government officials and journalists attend the ceremony. Preliminary observations through the telescope had actually

begun about two years earlier, but scientific observations did not begin until 2009. GTC's reflecting telescope measures more than 35 feet, making it the world's largest singleaperture optical telescope.



# **MEMBER OBSERVATIONS**









This group (from left: Rusty Case, Byron Davies, Chad Potter from John Deere Middle School, Ally Nordick and Alan Sheidler) took advantage of a cloudless night on June 4 to do some observing and test the school's new CPC 1100 HD telescope, shown in the left foreground of the photo. The new scope passed its test with flying colors. Here are some of the images taken that night (from top right): M27 Dumbbell Nebula; Venus. shown with and without atmospheric dispersion; M104 Sombrero Galaxy; the NGC4631 Whale Galaxy; the NGC4244 Silver Needle Galaxy; (from top left) M57 Ring Nebula; M99 Pinwheel Galaxy (other galaxies seen at left); and NGC4565 Needle Galaxy.

# MEMBER OBSERVATIONS





NIABI PUBLIC VIEWING JUNE 19

PAC held a public viewing night June 19 (now also known as 'Juneteeth' at Niabi Zoo. About 20 visitors showed up, along with PAC members Wayland Bauer, Rusty Case, Byron and Sharon Davies, Terry Dufek, Dale Hachtel, and Alan and Eric Sheidler. Shown are some of the images taken that night; the object observed included the Moon, Venus and Mars, M13, M92, the Needle Galaxy, the Ring Nebula, Cor Caroli, and a number of double stars.





When Alan and Sara Sheidler headed west for a summer vacation, they packed the telescope and cameras. They are shown on a chilly night at Mesa Verde in Colorado, where they used the telephoto lens to capture this image of the full 'strawberry' moon rising over a ridge. The image of the Milky Way was taken at Zion National Park in Utah, where the sky was, in Alan's words, 'incredibly dark and indescribably beautiful'; the image is a composite of two shots taken with a 10mm wide angle lens at F3.5, 25 second exposure time at ISO 6400 using a Nikon D7500 camera.



## June 2021

## Gravity

Gravity is one of the most fundamental things in physics. Everything and everyone has gravity. The more massive something is, the more gravity it has. When you jump into the air, Earth's gravity brings you back down. What you cannot see while you are in the air is that your gravity brings Earth towards you just a wee little bit, off-setting the extra push away from you that your feet gave Earth when you jumped.

Isaac Newton presented the first ever mathematical description of gravity in 1687. I admit that I know nothing about gravitation, except that it is all around me. I do recall the myth that Newton was sitting under a tree when an apple fell on his head. Supposedly, he then formulated his law of gravity. Did the apple actually fall on his head? I doubt it. But at his childhood home in the village of Woolsthorpe, England, he probably did witness an apple fall from a tree.

During the last half of the nineteenth century, physicists realized that Newton's theory of gravity did not accurately describe the orbit of Mercury, the planet closest to the Sun. Mercury's elongated orbit precesses slightly faster than Newton's theory predicts. Several unsuccessful attempts were made to account for this discrepancy.

Newton's theory, which assumes that gravity is a force, held sway for more than two centuries, until superseded by Albert Einstein's General Theory of Relativity in 1915. A decade earlier, Einstein realized that mass and energy are two aspects of one thing, and that space and time are interrelated, a blended spacetime. With General Relativity, Einstein treated gravity not as a force, but as the geometry of spacetime. The geometry of spacetime is curved by the mass-energy of matter, and the curvature instructs matter how to move.

Now comes the hard part. When Roy Bishop, emeritus professor of Physics at Acadia University, pointed out to me that gravitation is geometry, and not a force at all, I didn't believe him at first. But Dr. Bishop is the most brilliant person I have even had the privilege of knowing. Recently he described gravity this way, and he is right:

"Einstein spent several years in an eventual successful attempt to include gravity in a modified description of spacetime. Early in his progress toward that goal Einstein had what he called the happiest thought of his life — that if a person were to fall off the roof of a house, while falling she would not feel a force of gravity. Before she falls, she feels the force of the roof supporting her. When her fall comes to its abrupt halt she feels the ground pushing against her. If she cannot feel a force of gravity while she is falling, why pretend that she felt a force of gravity when the roof supported her before she fell, or that she feels a force of gravity when she is lying on the ground?

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## How to observe the Milky War and the Great Rift

Summer skies bring glorious views of our own Milky Way galaxy to observers blessed with dark skies. For many city dwellers, their first sight of the Milky Way comes during trips to rural areas so if you are traveling away from city lights, do yourself a favor and look up!

To observe the Milky Way, you need clear, dark skies, and enough time to adapt your eyes to the dark. Photos of the Milky Way are breathtaking, but they usually show far more detail and color than the human eye can see – that's the beauty and quietly deceptive nature of long exposure photography.

For Northern Hemisphere observers, the most prominent portion of the Milky Way rises in the southeast as marked by the constellations Scorpius and Sagittarius. Take note that, even in dark skies, the Milky Way isn't easily visible until it rises a bit above the horizon and the thick, turbulent air which obscures the view.

The Milky Way is huge, but is also rather faint, and our eyes need time to truly adjust to the dark and see it in any detail. Try not to check your phone while you wait, as its light will reset your night vision. It's best to attempt to view the Milky Way when the Moon is at a new or crescent phase; you don't want the Moon's brilliant light washing out any potential views, especially since a full Moon is up all night.



If the Milky Way was shrunk down to the size of North America, our entire Solar System would be about the size of a quarter. At that scale, the North Star, Polaris - which is about 433 light years distant from us - would be 11 miles away!

Keeping your eyes dark adapted is especially important if you want to not only see the haze of the Milky Way, but also the dark lane cutting into that haze, stretching from the Summer Triangle to Sagittarius. This dark detail is known as the Great Rift, and is seen more readily in very dark skies, especially dark, dry skies found in high desert regions.

What exactly is the Great Rift? You are looking Continued on Page 18



The Milky Way's Great Rift can be seen with the naked eye in very dark conditions, but not in the detail possible in long exposure photos such as this one. As seen in the photo, the Great Rift - also know as the 'Dark Rift' - can be found stretching from the Summer Triangle to Sagittarius.

# Skyward: General relativity and gravity

## Continued from Page 15

"When thinking about the falling lady, Einstein had the fantastic insight that perhaps gravity never was a force. By late in 1915 he had that insight in elegant mathematical form such that the resulting theory, General Relativity, can be used to make precise predictions concerning gravitation."

Einstein was elated when, on November 18, 1915, he found that his General Theory of Relativity predicted the measured precession of Mercury's orbit. According to his friend and biographer Abraham Pais: "This discovery was, I believe, by far the strongest emotional experience in Einstein's scientific life, perhaps in all his life." Pais then continues with five words that crystallize that profound experience: "Nature had spoken to him." After several years of work, on that day Einstein knew that he was the only person on Earth who understood gravity!

Today, there are thousands of people who understand gravity. Roy is one of them. Most of us, including me, are not one of them. But reading it described so well is one of the pleasures we can feel as we try to appreciate the wonderful cosmos in which we live. Not only does General Relativity correctly predict the precession of Mercury's orbit, but it is essential to the programs used in the GPS navigation system, and it describes the gravitational waves (ripples in the geometry of spacetime) generated by two coalescing black holes, directly detected 100 years after 1915 by LIGO, the Laser Interferometer Gravitational-Wave Observatory.

# Observing the Milky Way: The darker, the better

#### Continued from Page 15

at massive clouds of galactic dust lying between Earth and the interior of the Milky Way. Other "dark nebulae" of cosmic clouds pepper the Milky Way, including the famed Coalsack, found in the Southern Hemisphere constellation of Crux. Many cultures celebrate these dark clouds in their traditional stories along with the constellations and Milky Way.

Where exactly is our solar system within the Milky Way? Is there a way to get a sense of scale? The "Our Place in Our Galaxy" activity can help you do just that, with only birdseed, a coin, and your imagination:

bit.ly/galaxyplace.

You can also discover the amazing science NASA is doing to understand our galaxy – and our place in it - 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.



## July meeting will feature virtual observatory tour

The next general membership meeting of the Popular Astronomy Club, scheduled for July 12 at 7 p.m. at Moline's Butterworth Center, will feature a virtual tour of the Green Bank Observatory in West Virginia.

For more than 60 years, the Green Bank Observatory has served as a center for radio astronomy and related research. It is home to the 100meter Robert C. Byrd Green Bank Telescope, the world's largest steerable radio telescope, and seven other radio telescopes. To facilitate its operations, the observatory is in a remote location in the midst of the National Radio Quiet Zone.

The tour of the observatory will be led by Luci Finucan, an educator at the observatory's science center. Finucan, who has worked at the observatory since January 2019, teaches thousands of students a year about radio telescopes and their operations, hosts weekly multicultural planetarium shows, and directs the Pocahontas County (W.Va.) Science and Engineering Fair.

Finucan is currently pursuing a master's degree in education, with a focus on science literacy, at Marshall University in Huntington, West Virginia, with the goal of applying what she learns to increase public trust in science and scientists.

While pursuing a degree in physics at Virginia Tech University, Finucan did research at the school's Center for Communicating Science. She also volunteered at the Smithsonian Air and Space Museum in Washington, D.C., and completed an education outreach internship with the



Luci Finucan is an educator at Green Bank Observatory in West Virginia, home of the world's largest steerable radio telescope.



Center of Science and Industry in Columbus, Ohio. Finucan's interest in science began when she practiced reading with her father from what she described as an "admittedly outdated" astronomy encyclopedia. When they got to the chapter about the "big crunch" theory, six-year-old Luci began sobbing at the thought of everything imploding on itself. Her father comforted her by saying, "Don't worry, we'll all be long dead by the time the universe collapses."

She is relieved to know that new data suggests that the universe may not collapse after all.

## Dates are set for annual PAC picnic and banquet



Mark your calendars: The dates have been set for the annual picnic and the banquet held by the Popular Astronomy Club.

The picnic will take place on Saturday, August 14, beginning at 6:30 p.m. at Paul Castle Observatory. The grille will be set up and picnic goers are asked to bring a dish to pass and maybe dessert. Wayland Bauer is organizing this year's picnic.

The annual banquet, which will celebrate PAC's 85th anniversary, will take place on Saturday, October 23, beginning at 5:30 p.m. at the Riverfront Grille in Rock Island.

The guest speaker will be Dr. Russet McMillan of the Apache Point Observatory in New Mexico, who will discuss the observatory's lunar laser ranging project.

Watch this newsletter and other information sources for more on these events.

# **SUMMARY OF JUNE MEETING**

The Popular Astronomy Club held a "hybrid" membership meeting on June 14 at Moline's Butterworth Center. Six PAC members attended in person, and 18 others signed on to attend virtually via Zoom; some virtual attendees were guests from other astronomy clubs in the region, in response an invitation sent to those clubs.

The meeting featured a virtual presentation by Matthew Will, secretary-treasurer of the Association of Lunar and Planetary Observers. Mr. Will discussed ALPO's history and mission, as well as the cost and benefits of membership and the organization's long-established newsletter. He also showed how ALPO members and other amateur astronomers had advanced the science of astronomy through their observations.

A business meeting was then held. At the start of that meeting, Paul Levesque was nominated to serve as secretary and newsletter editor in lieu of Terry Dufek, who is unable to continue due to health reasons. Wayland Bauer made the nomination, which was seconded by Rusty Case; the motion passed unanimously.

Alan Sheidler then reminded PAC members that all officers will see their terms expire later this year, and encouraged members to consider serving as club officers.

A treasurer's report was presented by Dale Hachtel, who later reminded members that the deadline to donating to PAC through Birdies For Charities was approaching. Such donations receive a bonus of five percent or more through the Birdies For Charities Foundation.

Wayland Bauer stated that the PAC picnic was scheduled for August 14 at Paul Castle Observatory, with more to follow. Rusty Case reported that the PACMO had been out and was working well.

The meeting concluded with a display of some astrophotographs that had been taken recently and a discussion of the technical specifications of the photos.

A video recording of the meeting is available via this link: https://youtu.be/1wXkVjlKaFA



#### 6/2021 TREASURER'S REPORT

from 3/1/2021 to 5/31/2021

description	current period detail	current	YTD
Receipts:		00000	1.00000000
memberships	1 new, 3 renewals	135.00	322.50
member donations			30.00
program donations	Moline-CV School Dist.	200.00	200.00
misc donations			
interest		0.14	0.23
banquets			
birdies			
special			
sales			
other			
Total Receipts		335.14	552.73

Expenditures:			
programs	Ancient N America Skywatchers	50.00	50.00
speakers			20.00
PACMO operation	storage rental, maintenance	295.26	295.26
observatory			301.00
equipment			
maintenance			
Astronomical League	1		
insurance			162.00
operating supplies			
newsletter			
web page			
banquet			
donations			
miscellaneous			
legal			
observatory upgrade			
other			
adjustments			
Total Expenditures		345.26	828.26

Balances	as of	5/31/2021		
previous balance			7844.86	8110.27
net change			-10.12	-275.53
ending balance			7834.74	7834.74
check account				2164.15
money market account				5414.92
savings account				10.23
business special				45.44
cash				0.00
undeposited checks				200.00
Total Cash Assets				7834.74

## Popular Astronomy Club of the Quad Cities, Inc.

http://www.popularastronomyclub.org/





The July 12 meeting will once again be a 'hybrid' meeting, with limited in-person attendance at the Butterworth Center and all others welcome to attend virtually via Zoom. Contact Alan Sheidler if you plan to attend in person. MORE UPCOMING EVENTS:

- July 17: Outreach at Niabi Zoo; sunset
- July 31: Outreach at Silver Bell Hollow Alpaca Farm, Illinois City, 8 p.m.
- August 14: Annual PAC Picnic at Castle Observatory; NO REGULAR MONTHLY MEMBERSHIP MEETING at Butterworth Center

MONTH	NEWSPAPER ARTICLES	CONSTELLATION REPORT	PROGRAM
JUL 2021	Bryan Raser	AVAILABLE	Green Bank Observatory. Green Bank, West Virginia - Virtual Tour and Current Projects
AUG 2021	Matt Neilssen	AVAILABLE	Annual PAC Picnic
SEPT 2021	Jim Rutenbeck	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
JAN 2022	AVAILABLE	AVAILABLE	Presentation: "Curiosity Paving the Way for Perseverance" by Dr. Rebecca M E. Williams, Planetary Science Institute
FEB 2022	AVAILABLE	AVAILABLE	Presentation: "Seeing Stars: How Birds Use the Night Sky During Migration" by Dr. Jennifer C. Owen, Corey Marsh Ecological Research Center, Michigan State University
MAR 2022	AVAILABLE	AVAILABLE	Business Meeting; Smorgasbord of Member Presentations

## 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. Photos and other images should be sent as separate files rather than embedded in emails. Send to levesque5562@att.net Thank you!