The Bays Mountain Astronomy Club Newsletter

December 2022

Kingsport, TN

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Cosmic Reflections

William Troxel - BMAC Chair

Greetings and Happy Holidays fellow BMACers!

Thanksgiving is over and I hope you had a wonderful meal. Of course, November included StarFest 2022 and it was awesome. We had a great attendance and everyone enjoyed being back together. I have included a few pictures in this month's issue. If you didn't get a chance to come this year, maybe you will be able to attend next year.

December is here already. Time really flies. One of our very own members will be leading our December meeting. Milligan University assistant professor of physics Nate Wentzel will be sharing some "Fun with Physics" as our topic for the December meeting. He has an interactive exercise that we all can learn and have fun at the same time. Nate's program is entitled "Good Idea, Bad Idea: Crazy Ideas About the Universe That Were Right and Wrong."

Nate writes:

> History is full of outstanding ideas from thinkers like Johannes Kepler, Isaac Newton, and others who changed the way we understand the Universe. But not every idea these thinkers had turned out to be completely wrong! We will take a trip through history to look at a few ideas that seemed crazy but revolutionized our understanding of astronomy. Along the way, we will also talk about some of the ideas that turned out to be just crazy. The audience will get a chance to vote on how crazy they think each of those ideas were. Along the way we will hopefully learn some science, some history and even a little bit about ourselves.

I hope all will be able to come out and be a part of it.

I hope you have enjoyed the 2022 year of meetings. I am always open to ideas and topics, so please remember to share them with me. Please enjoy the Holidays and see you in December.

Until next time..., Clear Skies.

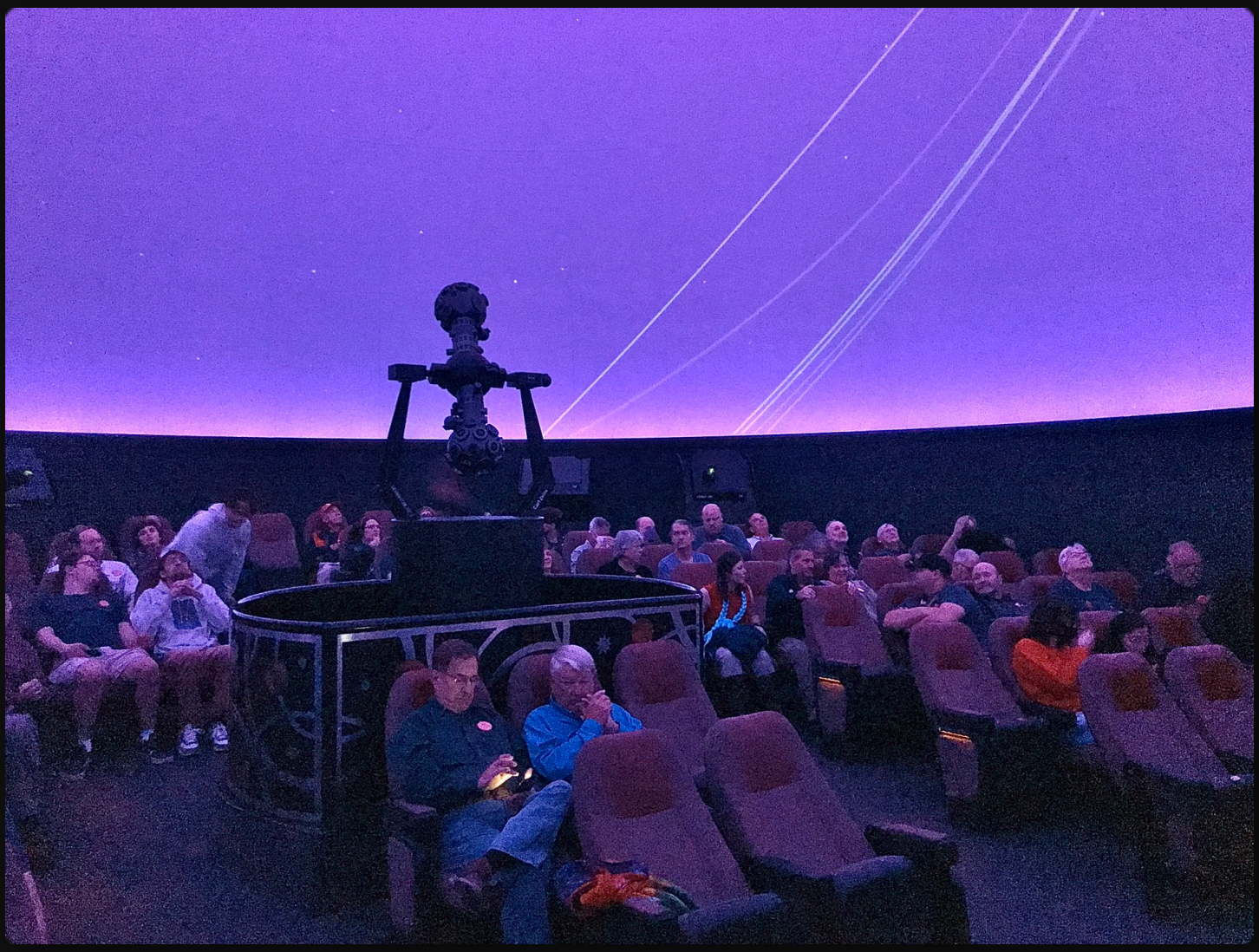
BMAC Notes

StarFest 2022 Photos

William Troxel & Robin Byrne have provided these images to share.

Meal time! Photo by William Troxel

Enjoying the outdoors. Photo by William Troxel



Awaiting one of the great presentations held in the planetarium. Photo by Robin Byrne

Our three great speakers. From L-R: Rico Ignace, Jana Ruth Ford and Theo Wellington. Photo by Robin Byrne

Attendee Bob Anderson brought his collection of shatter cones from Tennessee impact sites to share. Photo by Robin Byrne

Astro Items for Sale

MACer Jack Dison has a few items for sale. Please contact him if you have questions or are interested. Click here to e-mail.

- Explore Scientific 127 mm, f/7.5 triplet refractor with FCD 100 glass/ OTA
    - 3" ES field flattener 0.7x focal reducer
    - 2½" Moonlite focuser w/V2 stepper motor & 2"& 1¼" adapters
    - Rings & Vixen rail
    - soft case
    - Condition very good. Price $2,650.00
- Bresser refractor YARD CANNON OTA 152mm, 6" f/5, achromat with 2 additional lenses in rear - Petzval-type design
    - This gives good color correction for a short focal length refractor
    - Illuminated finder w/ polar reticle
    - 2" diagonal
    - Rings with vixen rail
    - JMI style hard case
    - Condition is very good. Price $650.00 w/case. $500.00 OTA alone
- Hotech SCT Laser collimator "complete & near new." $385.00

Stellar Observations

Greg Penner

Hello Mars and Bon Voyage Artemis!

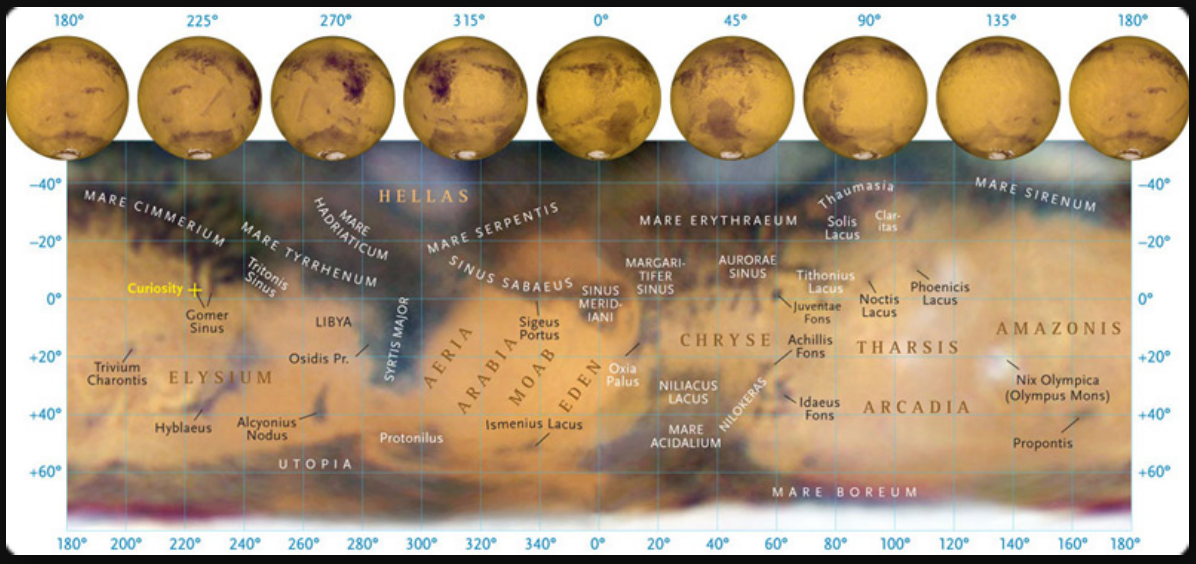
The month of December closes out 2022 with a bang as we get a close-up view of Mars, and NASA's Artemis 1 mission is finally on course to visit the Moon's neighborhood. In both our interaction with Mars and Artemis's visit to the Moon we will see the term "retrograde" used to describe the events. Let's first take a look at our close approach with Mars.

As Earth and Mars orbit the Sun, Earth is on the "inside track" so it goes around the Sun faster than Mars. Consequently, about every 26 months, Earth catches up to and passes Mars. When this happens, Earth and Mars are at their closest distance during that 26 month period. When Mars is most distant from Earth, it is about 140 million miles away. During the first week of December, Mars will be only about 50 million miles away. Most of the time you would notice that Mars is gradually moving eastward against the background stars in the night sky. However, for a few months as Earth catches up to and then

passes Mars, we see the red planet appear to move "backwards" toward the west in what we call retrograde motion. Using a lot of words to convey why this happens can be difficult. Watching this video will explain retrograde motion in a much more helpful way.

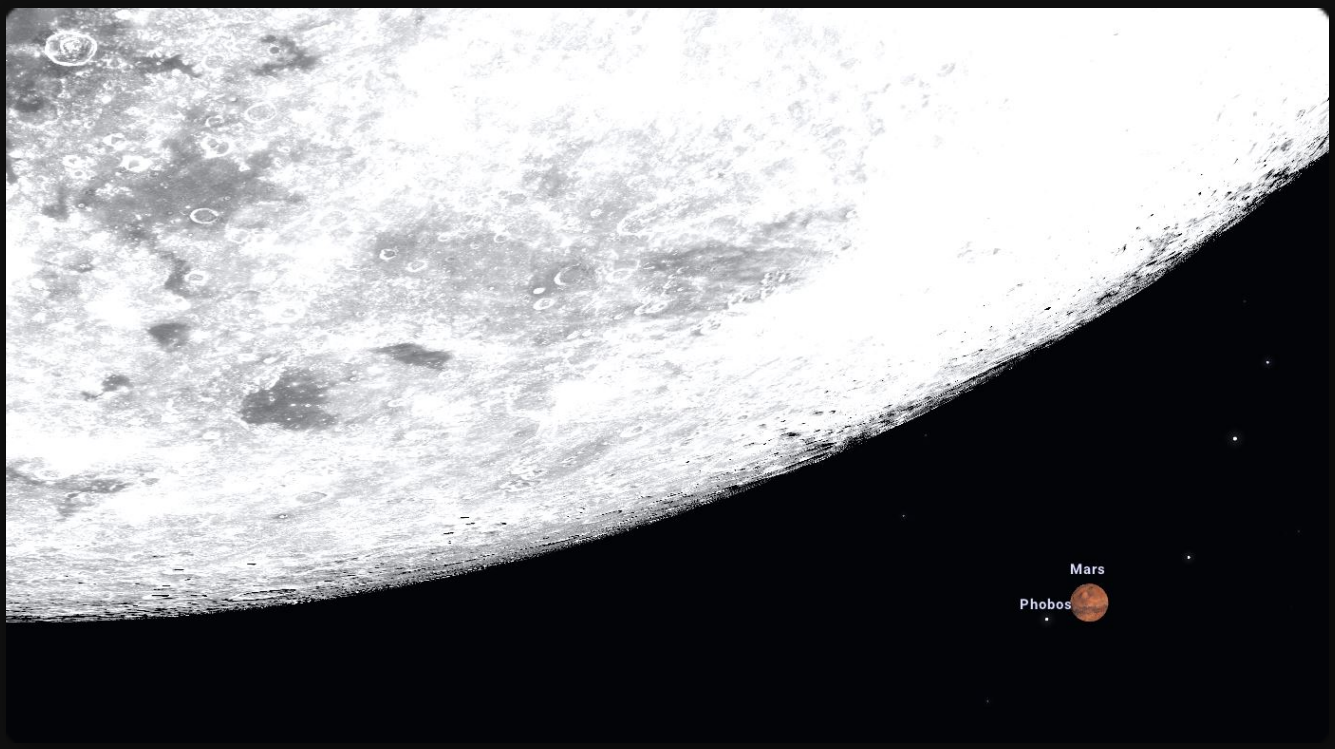
Now that we have caught up to Mars, it is time to take advantage of the proximity and point our telescopes at our neighbor to find out what we can see. At closest approach, the apparent diameter of Mars will be 17.2", which is 5.4" smaller than in 2020. The good news is that Mars will be much higher in the sky this time, which usually means better seeing conditions with less atmospheric interference. The accompanying map below from Sky & Telescope Magazine shows many of the major surface features that can be viewed on Mars depending on the aperture and magnification of your telescope/eyepiece configuration. The features that are visible are also dependent on your local seeing conditions as well as the weather on Mars itself. The red planet is known for dust storms that enshroud the entire planet obscuring all surface features. Most telescopes

should show one or both of the polar ice caps and various dark volcanic rock regions that contrast with the light reddish-orange dusty plains. The most prominent dark feature to look for is Syrtis Major, a dark "peninsula" that extends into the light orange plain. The view of the surface changes only slightly from night to night as Mars rotates in the same direction as Earth with a rotation period of about 24.5 hours. Observing early in the evening and then a few hours later, and repeating over a period of a few weeks, should allow you to see more of the planet's surface. To help you know which side of Mars you are looking at, Sky & Telescope has developed a tool called the Mars Profiler. Follow this **link** to use the tool.



Full Planet Mars Map - Credit: Sky & Telescope/Damian Peach

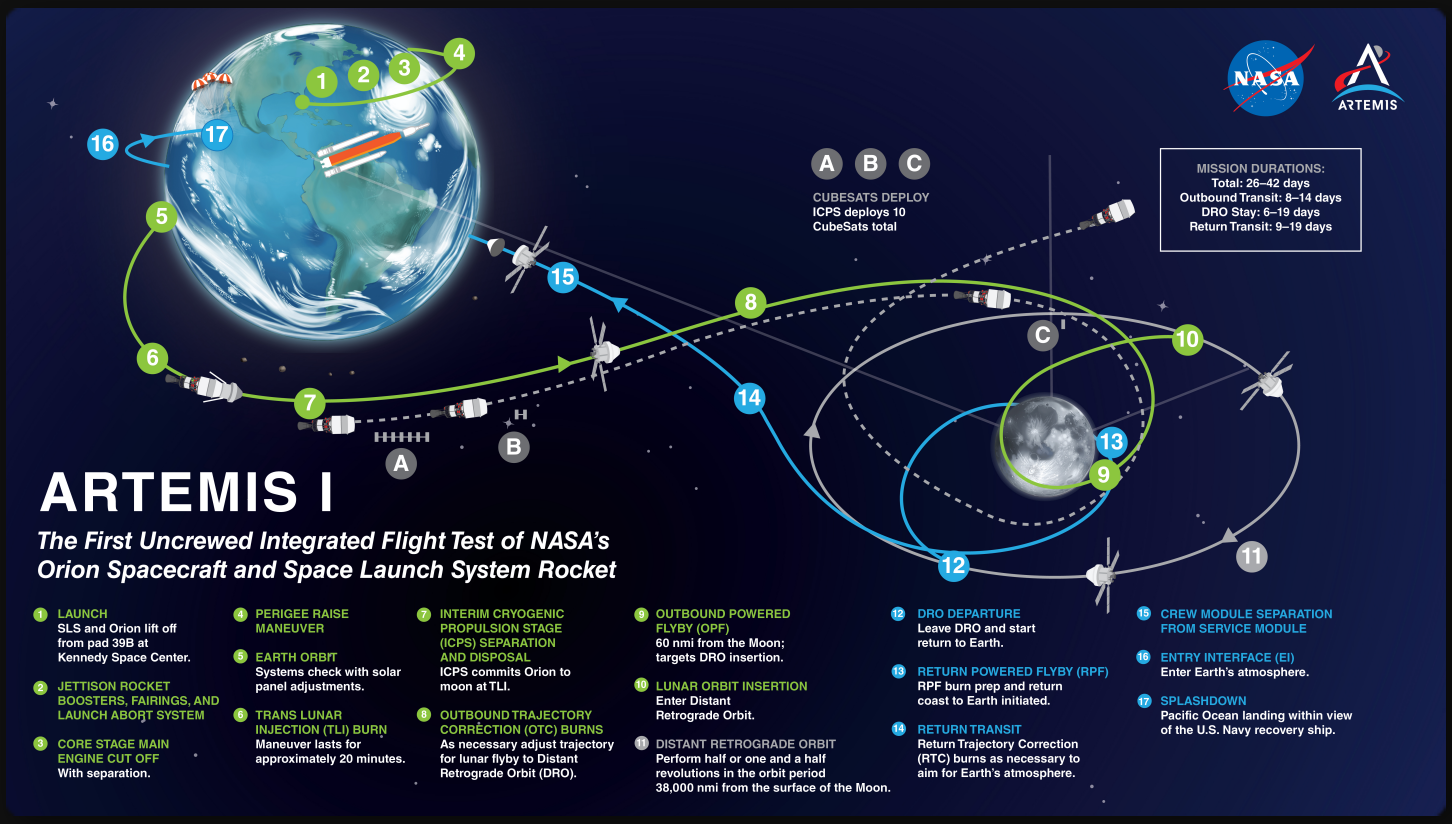
A bonus event taking place during this year's Mars opposition is a close encounter with Earth's Moon. On the night of December 7-8, much of North America will get to see the Moon occult (pass in front of) Mars. Those of us in East Tennessee will be treated to a view of Mars creeping ever so closely to the Moon as it gets as close as 1 arc-minute. At a fairly high magnification an observer should be able to see surface markings on Mars simultaneously with craters on the Moon in the same telescopic view! And speaking of the Moon, let's now take a look at the Artemis 1 mission.



Mars and Moon - Stellarium

As I am writing this article, Artemis 1 is on its way to the Moon after launching at 1:47am EST on November 16. The picture below is a screenshot from a NASA live feed from the Orion spacecraft as it was about 57,000 miles from Earth. This is a view we haven't seen of Earth since the Apollo 17 mission 50 years ago! As the Orion spacecraft approaches the Moon, it will get as close as 60 miles above the lunar surface at which time it will make a propulsive burn. This burn, along with a boost from the gravitational force of the Moon, will propel Orion to what is called a Distant Retrograde Orbit (DRO). The orbit is "distant" because it will be very high above the Moon, about 40,000 miles at its farthest. The orbit is "retrograde" because Orion will travel around the Moon opposite the direction the Moon travels around Earth. DRO is very stable because of the gravitational interaction between the Earth and Moon, which allows the spacecraft to use less fuel to remain in orbit around the Moon (see mission map). Orion will orbit the Moon for 6-19 days collecting data that will allow evaluation of its performance.

Earth from Orion Spacecraft - screenshot of NASA live feed



Artemis 1 Mission Map - NASA

Orion will then perform a departure burn, do another close fly-by of the lunar surface, and slingshot back to Earth at 25,000 mph. The speed of the spacecraft as it enters Earth atmosphere will generate temperatures up to 5,000 degrees Fahrenheit to test Orion's heat shield that will protect future astronauts and continue to a parachute-assisted splashdown in the Pacific Ocean.

What a fun way to end the year watching the continuing development of the Space Launch System that will hopefully one day carry people to Mars. At the same time, Mars is putting on a nice show for us in the night sky, and what perfect timing for it to nuzzle up close to the Moon as a reminder to us of the steps it will take to go back to the Moon and on to Mars!

The Queen Speaks

Robin Byrne

Happy Birthday Arthur Eddington

This month we celebrate the life of a man who revolutionized our understanding of the stars. Arthur Stanley Eddington was born December 18, 1882 in Kendal, England. His father, Arthur Henry, was the headmaster of a Quaker school, but died of typhoid when Arthur was only 2 years old. His mother, Sarah Ann, was left to raise Arthur and his sister with limited resources.

Arthur was home-schooled for many years. When he was quite young, his interest in astronomy was first awakened by the loan of a 3 inch telescope. At the age of 11, Arthur was sent to a preparatory school. While most of the students lived at the school, Arthur was among the few “day pupils,” due to the family being unable to afford to pay his boarding. It was here that his talent in mathematics was first discovered, but he quickly reached the limits of what the school could offer.

His talents were enough to earn a scholarship of 60 Pounds per year to attend Owens College in Manchester when Arthur was only 16. After a year, he decided to concentrate his studies in physics. Thanks to earning several scholarships, Arthur successfully completed his Bachelors of Science degree with First Class Honors in 1902.

After graduation, Eddington earned a scholarship to attend Trinity College, Cambridge to pursue his graduate degree. He was awarded a Masters in 1905, after which he spent a few years conducting various research projects that didn't excite him or make much progress.

In 1906, Eddington was recommended for a position at the Royal Observatory in Greenwich. He was hired to be the chief assistant to the Astronomer Royal. Eddington's first project was to analyze photographs of the asteroid 433 Eros to measure its parallax. Making use of a statistical method, Eddington's technique won him recognition that led to receiving the Smith's Prize in 1907, which resulted in a position at Trinity College.

Due to two unexpected deaths, Eddington quickly found himself rising through the ranks, and he became Director of Cambridge Observatory in 1914.

English astrophysicist Sir Arthur Stanley Eddington (1882–1944). From George Grantham Bain Collection, Library of Congress Prints and Photographs Division Washington, D.C.

Just as Eddington's career was beginning to take off, World War I began. Because of his Quaker upbringing, Eddington was a conscientious objector and did not enlist. During this time, Eddington became secretary of the Royal Astronomical Society, which put him in the position to receive letters from fellow scientists in other countries, including Germany. Because of this, he was among the first to hear about Einstein's theory of relativity. Due to his strong math skills, Eddington could actually understand it, and his pacifistic views allowed him to view the work of a German with an open mind.

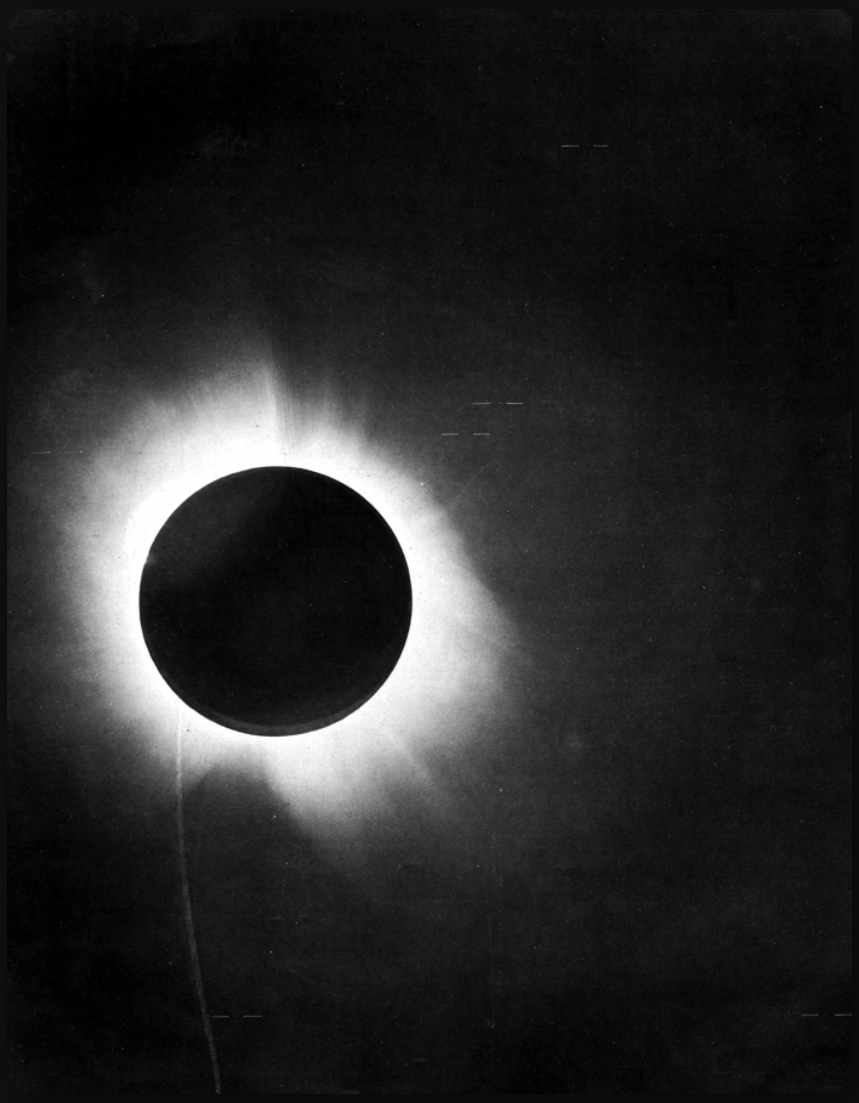
In March of 1916, England initiated conscription, requiring all eligible men to serve their country. Eddington planned to appeal on the grounds of his religious views, but the Astronomer Royal, Sir Frank Dyson, made an appeal in the name of science. Inspired by Einstein's predictions of gravitational lensing, Eddington and Dyson had made preparations to observe the total solar eclipse of 1919 to see if they could detect the apparent shift in position of stars seen near the eclipsed Sun. Science prevailed, and he was granted an

exemption, provided he follow through with the eclipse expedition.

Fortuitously, the war ended prior to the eclipse, making travel that much safer. In March of 1919, Eddington traveled to the island of Principe, off the coast of Africa, to photograph the Sun and the surrounding stars during totality, which would occur on the 29th of May. The Sun was near the Hyades, providing a rich field of stars to image. After much analysis, Eddington found that the stars shifted in position an amount consistent with the predictions made by relativity.

Due to this success, Eddington became a prolific popularizer of relativity. He was known for his clear explanations of such a difficult topic. According to one anecdote, he was approached by a fellow physicist, who considered himself among the experts on relativity. This physicist said that Eddington was one of only three people who understood relativity (the speaker clearly thought the three were Eddington, Einstein, and

himself). Eddington, after an awkward pause replied, "I was wondering who the third might be..."



Positive image of the solar eclipse in Sobral taken during Sir Arthur Eddington expedition to verify Albert Einstein's prediction of the bending of light with annotated positions of the stars.
From: F. W. Dyson, A. S. Eddington, and C. Davidson (1920). "A Determination of the Deflection of Light by the Sun's Gravitational Field, from Observations Made at the Total Eclipse of May 29, 1919".

In addition to relativity, Eddington also spent the World War I years trying to understand the interiors of stars. Treating stars as a ball of gas held in a balance between gravity pulling inwards and radiation pressure pushing outwards, Eddington was able to model the temperature, density, and pressure in the interior of a star, from the center to the surface. He also argued against the conventional wisdom of the time, which held that stars generated their energy purely from the heat released due to gravitational contraction. Eddington instead proposed that stars produced energy via the fusion of hydrogen into helium. It had been shown in laboratory experiments that helium has a mass that is fractionally lower than that of the four hydrogen atoms that would be needed to fuse into a helium atom. Making use of Einstein's famous equation, E = mc2, Eddington proposed that the mass that is lost in the process is converted into the energy that is ultimately radiated by the star. While not initially accepted by all of the scientific community, Eddington's ideas and models were eventually vindicated when observations confirmed his predictions for the diameters of stars.

Eddington’s book, "The Internal Constitution of Stars," published in 1926, became so well-established that it was still a required text book in the 1980’s, when I was in graduate school!

While clearly a master of understanding the structure of stars, Eddington was not always correct. Famously, he clashed with Subrahmanyan Chandrasekhar when "Chandra" was a graduate student at Cambridge. Chandrasekhar had work out mathematically that there was a limit to the mass of a white dwarf, beyond which it would collapse to a singularity. Eddington resoundingly dismissed this idea as preposterous and impossible. Of course, in retrospect, we now know that Chandra had just predicted the existence of black holes.

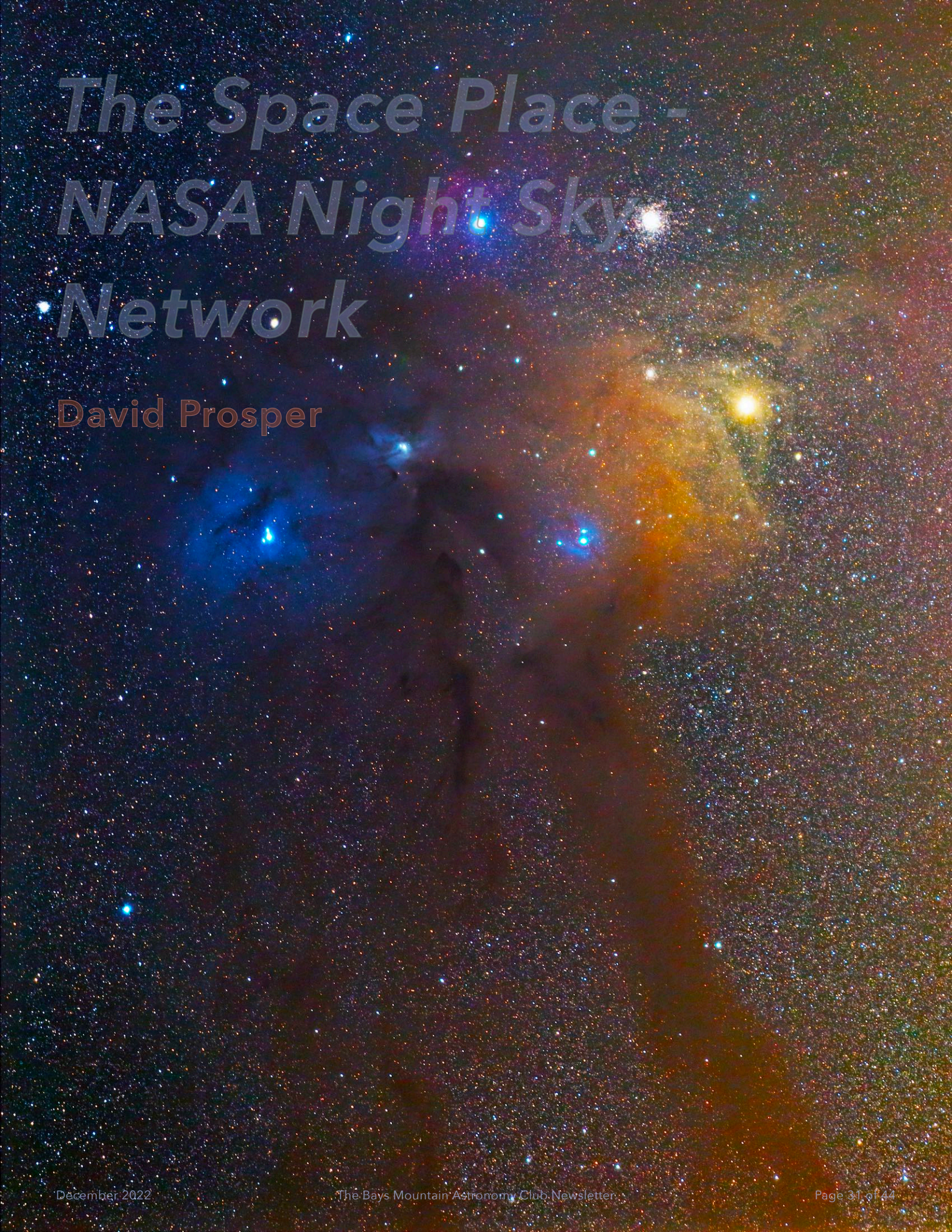
In 1930, Arthur Eddington was knighted, becoming Sir Arthur Eddington, one of a myriad of honors bestowed upon him during his lifetime. At the age of 62, after a battle with cancer, Arthur Eddington died on November 22, 1944.

Gazing at the night sky, enjoying the beauty of the stars, there's an overwhelming sense of awe. I feel that the more we understand about those stars, the deeper the feeling becomes. We have Arthur Eddington to thank for helping us to appreciate those spectacular specks of light we see each clear night.

References:

Arthur Eddington - **Wikipedia**

Arthur Stanley Eddington - **Math History**



The Space Place - NASA Night Sky Network

David Prosper

Binoculars: A Great First Telescope

Do you want to peer deeper into the night sky? Are you feeling the urge to buy a telescope? There are so many options for budding astronomers that choosing one can be overwhelming. A first telescope should be easy to use and provide good quality views while being affordable. As it turns out, those requirements make the first telescope of choice for many stargazers something unexpected: a good pair of binoculars!

Binoculars are an excellent first instrument because they are generally easy to use and more versatile than most telescopes. Binoculars can be used for activities like stargazing and birdwatching, and work great in the field at a star party, along the hiking trail and anywhere else where you can see the sky. Binoculars also travel well, since they easily fit into carry-on luggage – a difficult feat for most telescopes! A good pair of binoculars, ranging in specifications from 7x35 to 10x50, will give you great views of the Moon, large open star clusters like

the Pleiades (M45), and from dark skies, larger bright galaxies like the Andromeda Galaxy (M31) and large nebulae like the Orion Nebula (M42). While you likely won’t be able to see Saturn’s rings, as you practice your observing skills you may be able to spot Jupiter's moons, along with some globular clusters and fainter nebulae from dark sites, too.

What do the numbers on those binocular specs actually mean? The first number is the magnification, while the second number is the size in millimeters (mm) of the lenses. So, a 7x35 pair of binoculars means that they will magnify 7 times using lenses 35 mm in diameter. It can be tempting to get the biggest binoculars you can find, but try not to get anything much more powerful than a 10x50 pair at first. Larger binoculars with more power often have narrower fields of vision and are heavier; while technically more powerful, they are also more difficult to hold steadily in your hands and "jiggle" quite a bit unless you buy much more expensive binoculars with image stabilization, or mount them to a tripod.

The two most popular types of binocular designs are shown here: roof-prism binoculars (left) and porro-prism binoculars (right). Roof prisms tend to be more compact, lighter, and a bit more portable, while porro-prisms tend to be heavier but often offer wider views and greater magnification. Which should you choose? Many birders and frequent fliers often choose roof-prism models for their portability. Many observers who prefer to observe fainter deep-sky objects or who use a tripod with their observing choose larger porro-prism designs. There is no right answer, so if you can, try out both designs and see which works better for you.

Would it surprise you that amazing views of some astronomical objects can be found not just from giant telescopes, but also from seemingly humble binoculars? Binoculars are able to show a much larger field of view of the sky compared to most telescopes. For example, most telescopes are unable to keep the entirety of the Pleiades or Andromeda Galaxy entirely inside the view of most eyepieces. Binoculars are also a great investment for more advanced observing, as later on they are useful for hunting down objects to then observe in more detail with a telescope.

A pair of good binoculars can show craters on the Moon around 6 miles (10 km) across and larger. How large is that? It would take you about two hours to hike across a similar-sized crater on Earth. The "Can You See the Flag On the Moon?" handout showcases the levels of detail that different instruments can typically observe on the Moon, available ***here****. Moon image courtesy Jay Tanner.*

If you are able to do so, real-world advice and experience is still the best for something you will be spending a lot of time with! Going to an in-person star party hosted by a local club is a great way to get familiar with telescopes and binoculars of all kinds – just ask permission before taking a closer look! You can find clubs and star parties near you on the Night Sky Network's Clubs & Events **page** and inspire your binocular stargazing sessions with NASA's latest discoveries at **NASA**.

This article is distributed by NASA Night Sky Network

The Night Sky Network program supports astronomy clubs across the USA dedicated to astronomy outreach. Visit **nightsky** to find local clubs, events, and more!

BMAC Calendar & More

Calendar:

BMAC Meetings:

- Friday, December 2, 2022 - 7p - Planetarium Theater. Nate Wentzel, BMACer and Assistant Professor of Physics at Milligan University, will present “Good Idea, Bad Idea: Crazy Ideas About the Universe That Were Right and Wrong.”
- Friday, February 3, 2023 - 7p - Topic TBA.
- Friday, March 3, 2023 - 7p - Topic TBA.
- Friday, April 7, 2023 - 7p - Topic TBA.
- Friday, May 5, 2023 - 7p - Topic TBA.
- Friday, June 2, 2023 - 7p - Topic TBA.
- Friday, August 4, 2023 - 7p - Topic TBA.
- Friday, September 1, 2023 - 7p - Topic TBA.
- Friday, October 6, 2023 - 7p - Topic TBA.
- Friday, December 1, 2023 - 7p - Topic TBA.

SunWatch:

- Every clear Saturday & Sunday - 3p-3:30p - March-October - By the Dam
  - View the Sun safely with a white-light view if clear.; Free.
  - You must have completed the Park Volunteer Program in order to help with the public program. If you have, and have been trained, please show up at least 30 minutes prior to the official start time.

StarWatch:

- March 4 & 11, 2023 - 7p
- March 18 & 25, 2023 - 8p
- April 1, 8, 15, 22 & 29, 2023 - 8:30p
  - View the night sky with large telescopes at the observatories. If poor weather, an alternate live tour of the night sky will be held in the planetarium theater. Free.
  - You must have completed the Park Volunteer Program in order to help with the public program. If you have, and have been trained, please show up at least 30 minutes prior to the official start time.

pecial Events:

- **BMAC Dinner - January 2023 - Day & Time TBD**
  - Look for an e-mail with the latest information.
- **Astronomy Day - April 29, 2023 - 1p-4p; 8:30p-9:30p**
  - Come help share the fun of astronomy with the public. There will be tables with different themed topics plus solar and night viewing.
- **Annual Club Picnic - July 2023 - Day TBD - 6p?**
  - Site location will be sent directly to full BMAC members. BMACers and their families are welcome to enjoy an evening of astronomy-themed games and activities along with a potluck dinner and observing.
- **StarFest 2023 - November 3, 4 & 5, 2023**
  - Our 38th annual astronomy convention / star gathering for the Southeast United States. Three days of astronomy fun, 5 meals, 3 keynote speakers, unique T-shirt and more!
  - **Pre-registration by Oct. 13, 2023 with full payment is mandatory for attendance. Sorry, no walk-ins nor "visits."**
  - Link for all the StarFest info including registration and hotel reservation links.

Regular Contributors:

William Troxel

Robin Byrne

Greg Penner

Adam Thanz

William is the current chair of the club. He enjoys everything to do with astronomy, including sharing this exciting and interesting hobby with anyone that will listen! He has been a member since 2010.

Robin Byrne has been writing the science history column since 1992 and was chair in 1997. She is an Associate Professor of Astronomy & Physics at Northeast State Community College (NSCC).

Greg Penner is a semi-retired architect living in the Tri-Cities area since 2018. He has enjoyed astronomy since childhood when he received a “department store telescope” and viewed Saturn for the first time. He has been a member since 2018.

Adam Thanz has been the BMAC Newsletter Editor for all but a small number of issues since 1992. He is the Planetarium Director at Bays Mountain Park and an astronomy adjunct instructor at NSCC since 2000.

Connection:

Bays Mountain Astronomy Club:

- 853 Bays Mountain Park Road; Kingsport, TN 37650
- (423) 229-9447 - **Park Site** - **Club Site**
- Newsletter edited by **Adam Thanz**

Dues:

- Dues are highly supplemented by the Bays Mountain Park Association and volunteerism by the club. As such, our dues are kept at an extremely low cost.
- $16 / person / year
- $6 / each additional family member
- Note: if you are a Park Member (which incurs a separate, additional fee), then a 50% reduction in BMAC dues are applied.
- Dues can be paid in many ways. The easiest way is to pay via the CivicRec online portal. If you are a current member, please log in with your e-mail address and reset your password if you have not already done so. You can then update your membership. Here's the direct **link**. If you want to add family members, then add them via the internal link. You can also pay at the gift shop, by mail or over the phone.

Chapter Background Image Credits:

- **Cover image of Southern Milky Way by Adam Thanz.**
  - *Sony A7ii with Zeiss Batis 2.8/18 lens, f/2.8, 8 sec., ISO 6,400, August 9, 2020.*
- **Table of Contents image of Comet NEOWISE (C/2020 F3) by Adam Thanz**
  - *Sony A7ii with Sony FE 2.8/90 Macro G OSS lens, f/2.8, 8 sec., ISO 4,000, July 15, 2020.*
- **Cosmic Reflections image of the Summer Triangle area of the Milky Way by William Troxel.**
  - *Image captured July 23, 2016.*
- **BMAC Notes painting of the Moon with moon glow by Christa Cartwright.**
  - *Painting based on a photograph of the Moon Christa captured July 2020.*
- **Stellar Observations image of Crescent Nebula by David Reagan.**
  - *This image was taken with a 140mm refractor in his suburban backyard using an AstroPhysics 900 mount, 8.7 hours of 5 minute Ha and OIII subexposures, combined in AstroPixelProcessor as an HOO image and processed in Lightroom and Photoshop. Image captured in 2022.*
- **The Queen Speaks image of a solar halo by Robin Byrne.**
  - *iPhone 7, June 8, 2020.*
- **The Space Place - NASA Night Sky Network image of the Rho Ophiuchi cloud complex by Brandon Stroupe.**
  - *Canon 6D with Canon 2.8/70-200mm lens, f/2.8 @200mm, 20 x 120 sec. exposures, ISO 1,000, stacked in Deepsky Stacker, processed in Adobe Photoshop CC, Skywatcher Star Adventure mount, September 19, 2015.*
- **BMAC Calendar & More image of the Moon by Greg Penner.**
  - *iPhone shooting through a 9mm eyepiece and 12.5" Truss Tube Dobsonian @212x.*
- **All background images used with permission by their authors.**