The Bays Mountain Astronomy Club Newsletter

June 2022

Kingsport, TN

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Cosmic Reflections

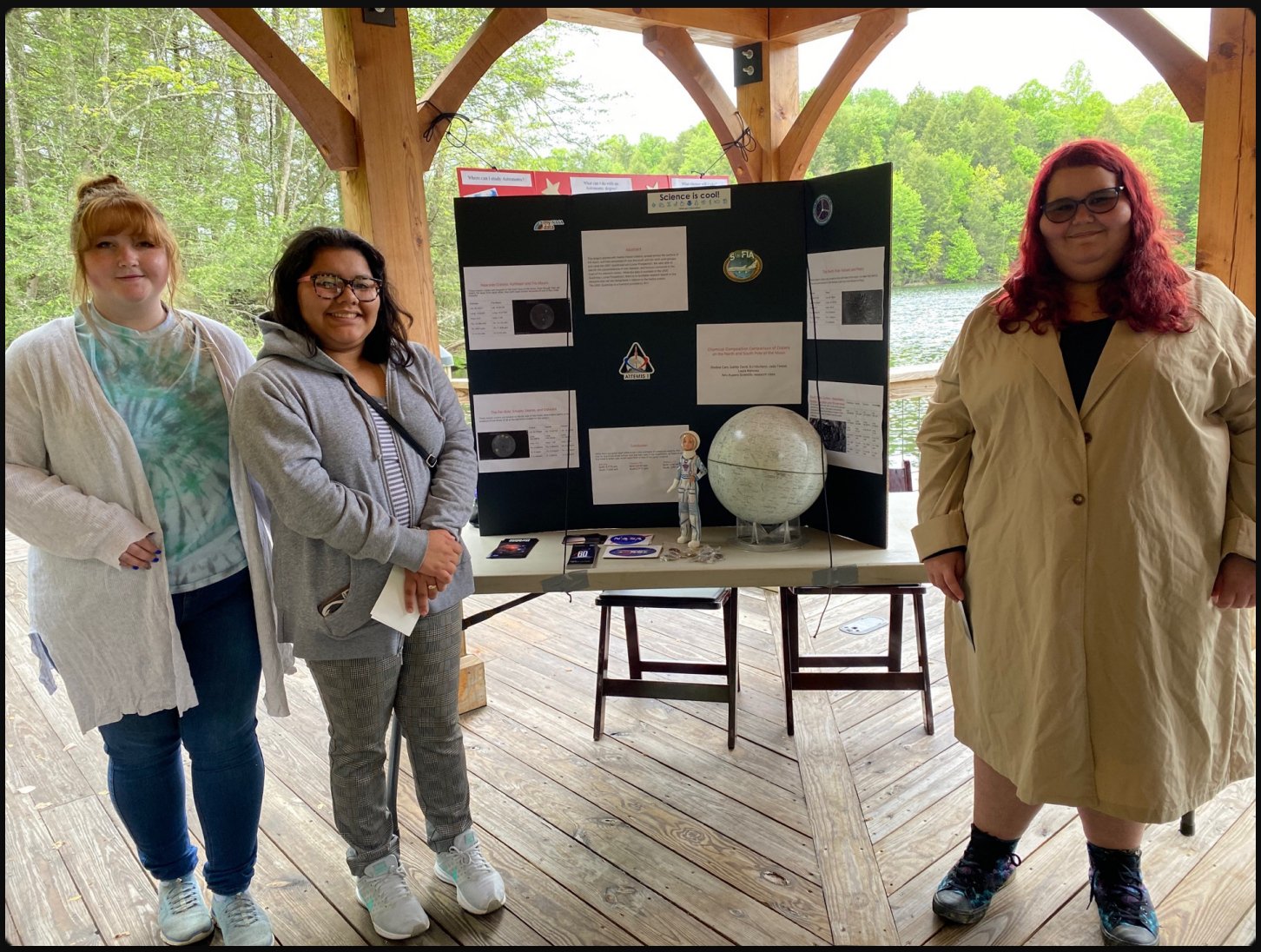
William Troxel - BMAC Chair

Greetings fellow BMACers. June is here, we are almost half way finished with 2022. I can't believe I am writing that so soon. It was so wonderful to see the public and be able to interact with them and share the joys of the our hobby. I have included a few pictures of the Astronomy Day Event, so take a look at them.

We held the event at the Park Pavilion by the lake. Even through mother nature provided us a bit of rain & cold, I think it was a great day. I want to share with you some very special guests that provided a display table this year.

We welcomed three young ladies from North Greene High School, Gabby Davis, Laura Ramirez & Shelbie Cain. They shared their project which was a study of the craters of the Moon. The ladies' presentation was very interesting and presented at a level that everyone was able to understand. They shared that their mentor left during the middle of the project so it forced them to continue on their own, which as you can see from the pictures, continued on and the end result was very impressive.

Congratulations and well done! Thank you for taking your Saturday to come be a part of our annual event.



The students from North Greene High School. Image by William Troxel.

BMACer Robin had a very fun project that was for the kids, but I'll tell you a secret, I think it was so cool and fun. Yes, I tried it and loved it. She called it "Make a Crater." The Ladies from North Greene High School and Robin stole the show. I also want

to thank all the BMAC members for coming out and helping with sharing with the public!

Smooth out the sand and then drop the heavy metal ball to make a crater! Image by William Troxel.

I was very happy with the public turnout for over two years of not being able to have this event. Again, thank you to everyone.

Michael Hopkins is setting up his scope to show off to the public. Image by William Troxel

Our next meeting is on Friday, June 3, 2022, 7p. It will be held in the Discovery Theater at the park. We have some astro games planned as well as our annual voting for club chair. To run for chair, you need to be in the club for at least a few years and part of the Park's volunteer program.

Until next time... clear skies!

Greg Penner and Olivia Kuper standing by one of the display tables. Image by William Troxel

BMAC Notes

Lunar Eclipse

BMACer Dale Wentzel submitted this very nice lunar eclipse photo to share.
The image was taken on May 16, 2022 with a Canon T6 DSLR, 2 second exposures at f/11, ISO 1600.

The Planets

I [the editor] was fortunate to present visuals that went along a performance of Gustav Holst's "The Planets" on the evening of Astronomy Day at the Eastman Employee Center. Music was performed live from the Symphony of the Mountains. The visuals were created by Jason Dorfman and myself and were presented live along with the accompanying movement. Each movement was based on a different known planet, prior to 1930, when Pluto was discovered.

The auditorium during intermission. Image by Adam Thanz

Stellar Observations

Greg Penner

Celestial Drifting

William Herschel is one of the great pioneering legends of astronomy and telescope making. Due to the size and mount design of his giant reflecting telescopes, one observing method he employed is known as the "drift method." The idea is to fix the telescope on a particular point in the sky and let celestial objects drift by due to the natural rotation of the Earth. Instead of trying to track the apparent motion of the stars, the observer just watches the objects go by through the eyepiece view. This method was necessary for some of his telescopes due to their inability to track. Today we have made it easy to track the motion of stars with modern equipment, but we can utilize this drift technique for another good purpose.

If an observer is using a telescope that doesn't have a computerized mount to help you locate and point at objects, then finding some faint objects can be a challenge. Walter Scott Houston, a modern observer of renown who wrote a column for

Sky & Telescope for many years, advocated using the drift technique to find these faint objects. He described the procedure as follows: set a telescope on a star lying west of the desired faint object (galaxy or star cluster), but having nearly the same declination. The telescope is then left stationary, allowing the diurnal motion to carry the object into the center of field. The drift time required is the same as the difference in right ascension between the star and the faint object. The example he gives is an area of the sky that is currently nicely placed for viewing.

Begin by inserting an eyepiece that will produce a field of view approximately 1 degree. Using a star chart, find 109 Virginis, a 4th magnitude star in the constellation Virgo located at approximately +2 degrees declination. Only 1/3 degree to the west of that star is the galaxy NGC 5746, an edge-on spiral galaxy. Fix the telescope at this point and relax and watch the stars drift by. After about 13 minutes, a group of galaxies near 110 Virginis will appear at the edge of the field of view. The "drift time" is equal to the difference in right ascension, which is

13 minutes. If your telescope is 6 inches in diameter or more, you should be able to make out at least NGC 5846, the brightest of the group. After another 10 minutes of drifting (10 minutes of R.A. along the +2 degree declination line), the globular cluster M5 comes into view, one of the best globulars for small telescopes according to Houston who says "it actually gives the impression of being a cluster rather than an amorphous glow."

This image from Stellarium shows the path from 109 Virginis to M5.

As we move further into summer, this technique can be used to explore the area of the Milky Way that is so full of celestial gems that it can sometimes be difficult to find your intended target. I'd like to explore two good areas to use this technique in the Scorpius/Ophiuchus region of the sky. The easily located very bright star Antares is our first starting point. Less than two degrees west of Antares is the globular cluster M4. After enjoying the glittering stars of this cluster, we will be drifting along between declination -26 to -27 degrees. Let Antares drift back into view and see if you can spot its elusive 6.5 magnitude companion. Then, for the next 30 minutes or so enjoy watching the densely packed stars of the Milky Way drift by until +5.5 magnitude globular cluster M19 comes into view. M19 is unique in that it appears more oblate than any other globular cluster. This may be caused by intervening dust or gas clouds. After another 7 minutes, NGC 6293 comes into view. This globular cluster is a fainter +9 magnitude object and may be difficult to pick out from the myriad stars of the Milky Way. Finally just 5 minutes later, a nice double star, 36 Ophiuchi, drifts into view.

The primary and secondary are nearly identical 5th magnitude orange main-sequence dwarfs separated by only 5 arcseconds.

This image from Stellarium shows the path from M4/Antares to 36 Ophiuchi.

From where you left off at 36 Ophiuchi you can nudge your telescope northeast a couple of degrees to the bright 3rd magnitude star Theta Ophiuchi. Center this star in your field of view and then for the next 30-40 minutes watch an incredibly dense section of the Milky Way drift by (along -25 degrees declination) until the real summer showstopper appears, the

Lagoon Nebula (M8). You will likely want to spend plenty of time exploring this magnificent part of the sky, but if you want to continue observing after the Lagoon, let the drift continue and in about 20 minutes you will find the globular cluster M28 followed in just another 15 minutes by the very large globular cluster M22 (you might need to nudge your scope a bit north).

This image from Stellarium shows the path from Theta Ophiuchus (upper right) to M22 (lower left).

Viewing the stars using this drift method can really give the impression of being a spaceship tourist looking out the porthole window watching the stars go by. Instead of constantly hunting for faint objects, perhaps trying this method will provide an alternate way to enjoy the night sky in a more relaxed way.

The Queen Speaks

Robin Byrne

Happy Discovery Anniversary Quaoar

This month, we celebrate the anniversary of the first discovery that put into question Pluto's planetary status. Chad Trujillo and Michael Brown were working at the Mount Palomar Observatory as part of the Caltech Wide Area Sky Survey. Their objective was to find brighter objects in the Kuiper Belt, a region just past the orbit of Neptune. On June 4, 2002, Trujillo imaged an area near the constellation Ophiuchus. Looking at the pictures the next day, he noticed a very faint object that changed position relative to the stars. Based on its brightness, at magnitude 18.6, and estimated distance based on the rate of motion, this object could end up being as large as Pluto.

The first step was to establish the orbit of this new Solar System body. Brown and Trujillo began by searching archival photographs to see if it had been imaged before. Looking through the Near-Earth Asteroid Tracking Survey photographic plates taken between 1996 and 2002 revealed several pictures

of the object. Two other images were found from 1983 that were part of a search for a planet beyond Pluto, plus one plate from the Palomar Sky Survey that was taken in 1954. The combination of all of these observations allowed Brown and Trujillo to determine that the new object is located an average of 43.7 Astronomical Units (AU) from the Sun, just a little more distant than Pluto. At that distance, it takes almost 289 years to complete one orbit. The orbit is very close to being circular in shape, but is tilted almost 8˚ to the plane of the Solar System, which is more similar to how smaller bodies in the Kuiper Belt orbit the Sun (larger Kuiper Belt Objects, like Pluto, have orbits that are more elongated and more tilted).

Before going public, Brown wanted to confirm the discovery with some more observations. However, because he wanted the announcement to be a surprise, he had to be very secretive about what he was doing. In order to get data using the Hubble Space Telescope, instead of making a formal proposal, he went directly to one of the telescope operators and requested observing time. The operator complied, giving him a brief

window to use the Hubble. Brown had already been given observing time to study a few of the moons of Uranus using one of the Keck telescopes. However, instead, he used the allocated time to observe the new Kuiper Belt Object.

Hubble Space Telescope image of Quaoar and its moon Weywot, taken on 14 February 2006. Image by Hubble Space Telescope/Michael E. Brown.

So, it wasn't until October 7, 2002 that a public announcement was made in the Minor Planet Electronic Circular. The object was given a provisional name of 2002 LM60. That same day, at the American Astronomical Society's Division for Planetary Sciences, Brown and Trujillo reported their discovery and subsequent findings to their colleagues and the press. In addition to the orbital parameters, they had an initial estimate of its size as being the largest Kuiper Belt Object yet found, other than Pluto. (Since then, even larger objects have been found, including: Eris, Haumea, Makemake and Gonggong.)

Although it had not been formally approved, it was during the announcement of its discovery that Brown first referred to this new body as "Quaoar." The International Astronomical Union (IAU) has rules for naming new discoveries. In this case, non-resonant Kuiper Belt Objects are named after creation deities. Brown and Trujillo wanted to honor the Tongva peoples, who were the first inhabitants of the region where Mount Palomar is located. Through their research, they discovered the story of "Kwawar," the creation force of the Universe, who sang into

existence the sky, Earth, and Sun deities. Brown and Trujillo then met with a tribal historian to request permission to use the name. The historian approved of the name, but suggested the preferred spelling of “Quaoar.” Despite their breach of procedure, by announcing a name before it had been approved by the appropriate IAU committee, the name of Quaoar did become the official designation the following month.

On February 14, 2006, Michael Brown and T.A. Suer discovered, using the Hubble Space Telescope, that Quaoar has a moon that orbits 14,500 kilometers (km) from Quaoar. Estimates for its size range from 74 to 170 km in diameter. It most likely is the result of a large object colliding with Quaoar. The Tongva people were given the opportunity to name the moon. They chose the name Weywot, who is the son of Quaoar in their mythology.

As astronomers continue to study Quaoar, more is learned about its nature. Its surface may be similar to the moons of Uranus and Neptune, with a very low reflectivity, indicating that there is no fresh ice on the surface. Like other Kuiper Belt

Objects, its surface seems to have a reddish-color. Spectroscopic studies reveal the presence of methane, which imply a possible atmosphere. However, observations of Quaoar as it occulted stars indicate that if it has an atmosphere, it is not very substantial at all, with a pressure about one-billionth of Earth's atmospheric pressure.

Thanks to Weywot, it was relatively easy to determine Quaoar's mass of 1.6×10^{21} kilograms, which is similar to the mass of Pluto's moon Charon. The occultations of stars helped determine Quaoar's diameter to be approximately 1,100 kilometers, making it half as big as Pluto and similar in size to Charon. The occultations also confirmed that Quaoar is very close to being spherical in shape, with just a slight flattening. Although not yet officially designated as a dwarf planet, Quaoar appears to have all of the qualifications to eventually be added to their ranks.

In 2004, David Jewitt and Jane Luu discovered possible evidence for some form of geologic activity on Quaoar. At a

distance of almost 44 AU, Quaoar would not be expected to get much warmer than -223˚C (-369˚F). At such a cold temperature, ice crystals should not have any structure. Using infrared imaging, Jewitt and Luu found that the ice has a crystalline pattern. For that pattern to occur in ice, the temperature at some point had to be warmer than -163˚C (-261˚F). So, how did it get so warm? With an almost circular orbit, the distance to the Sun doesn't change enough to account for such a large temperature difference. The current thought is that radioactive decay of elements, such as uranium, in Quaoar's interior generated the heat. And if that much heat is present, then there's also the possibility that Quaoar could have cryogenic volcanoes, causing gas, liquid, and ice to erupt from Quaoar's interior onto the surface.

While Quaoar was the first of the larger Kuiper Belt Objects discovered since Pluto, it wasn't the last. Those discoveries began the discussion of whether they should be called planets or not. Ultimately, the decision was made that since they are in a belt of objects, they would fall into the new category of

“Dwarf Planets.” However, this new definition also meant that Pluto would fall into the dwarf planet category, since it, too, orbits in the Kuiper Belt.

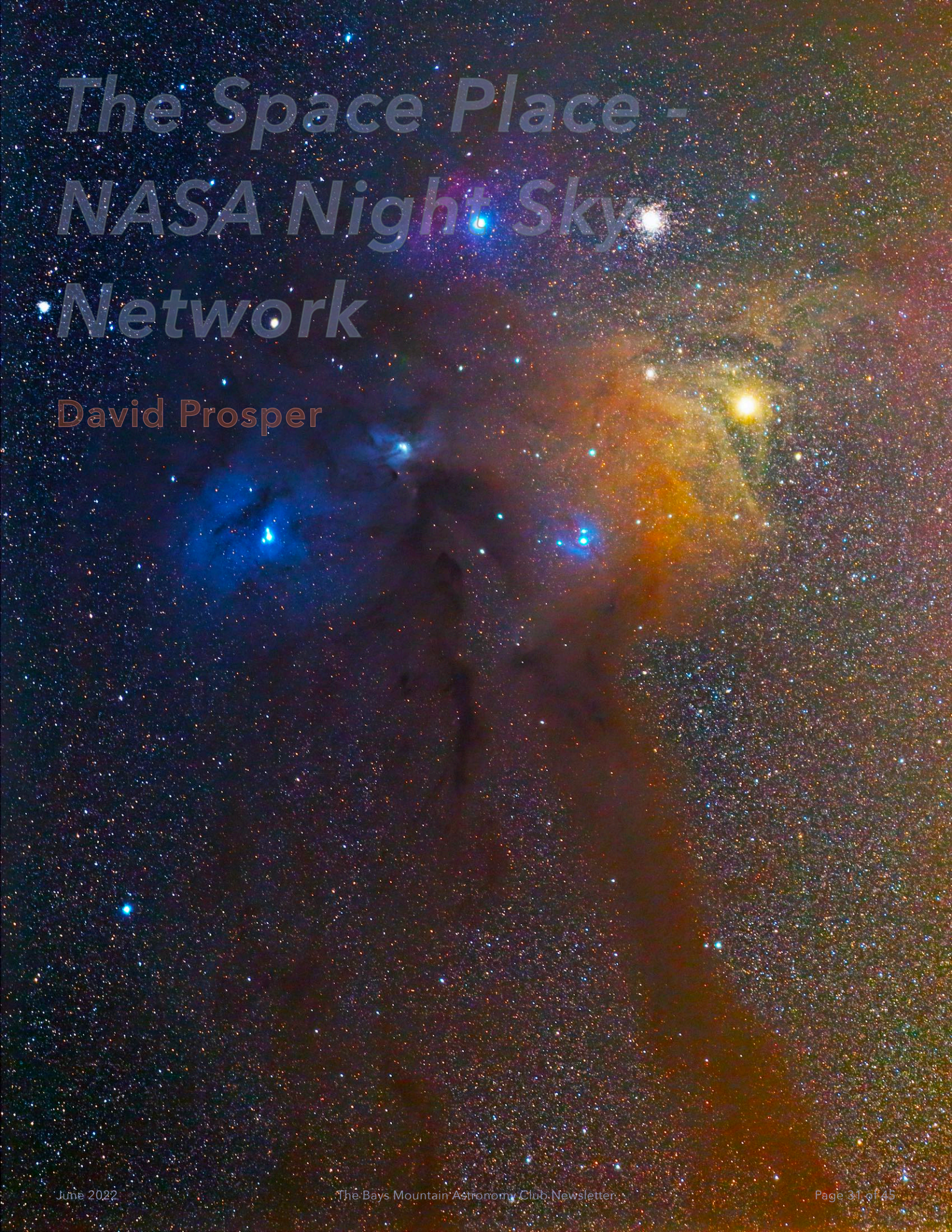
While the dwarf planets in the Kuiper Belt have fairly stable orbits around the Sun, objects that are smaller can easily get redirected onto paths that bring them into the inner Solar System. When that happens, we get the opportunity to observe a short-period comet, which are comets that orbit the Sun every 200 years or less. With as many as 70,000 objects with diameters of 100 kilometers (60 miles) or more, the Kuiper Belt has the potential to treat us to many great comets in the years to come. When the next short-period comet comes around, take a moment to think about the fact that it originated in the Kuiper Belt and was a neighbor to a variety of dwarf planets, including this month’s honoree, Quaoar.

References:

50000 Quaoar - Wikipedia

The Dwarf Planet Quaoar - Universe Today

Chilly Quaoar had a warmer past by Mark Peplow - Nature, 12/8/04



The Space Place - NASA Night Sky Network

David Prosper

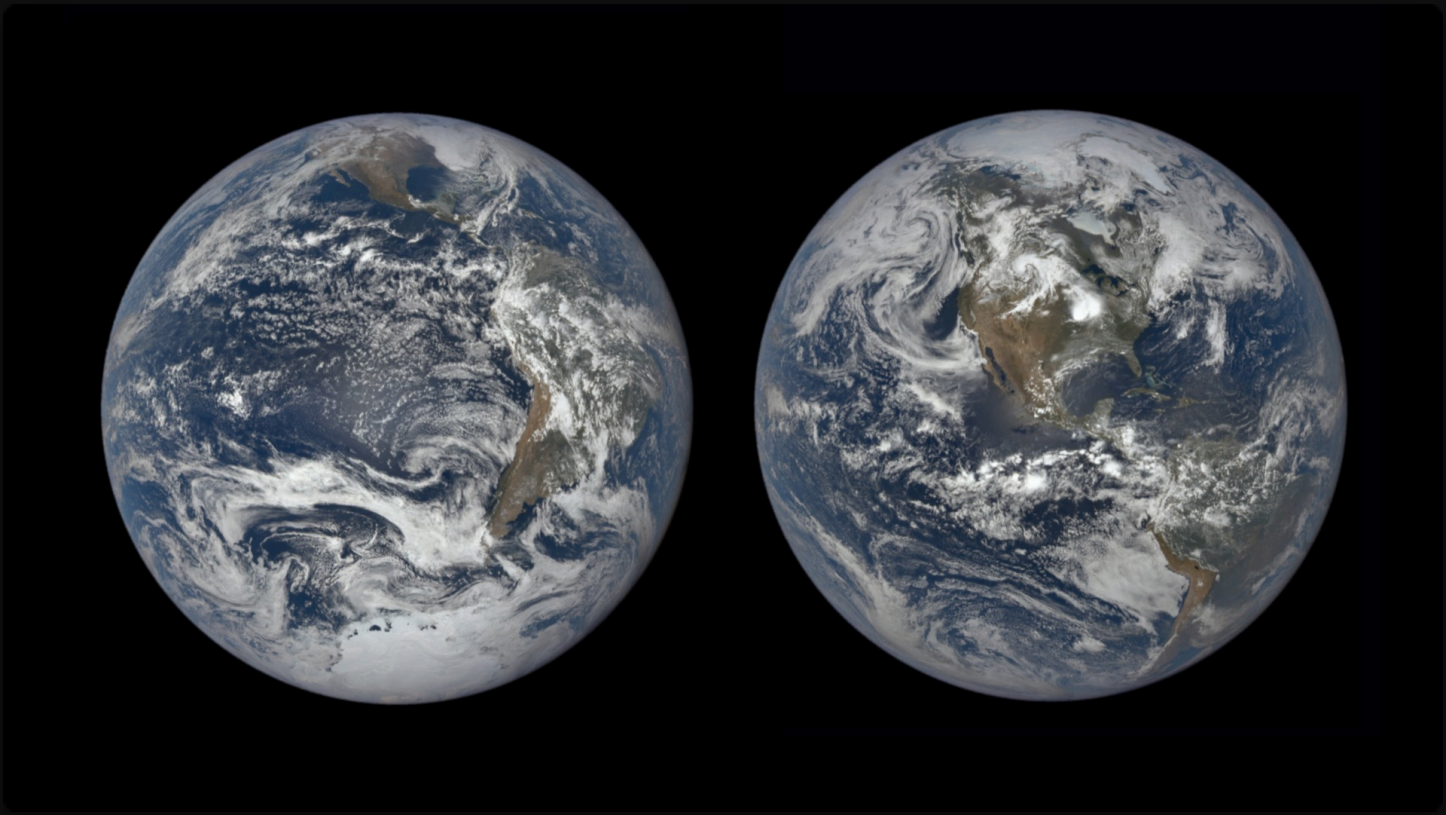
Solstice Shadows

Solstices mark the changing of seasons, occur twice a year, and feature the year's shortest and longest daylight hours - depending on your hemisphere. These extremes in the length of day and night make solstice days more noticeable to many observers than the subtle equality of day and night experienced during equinoxes. Solstices were some of our earliest astronomical observations, celebrated throughout history via many summer and winter celebrations.

Solstices occur twice yearly, and in 2022 they arrive on June 21 at 5:13 a.m. EDT (9:13 UTC) and December 21 at 4:48 p.m. EST (21:48 UTC). The June solstice marks the moment when the Sun is at its northernmost position in relation to Earth's equator and the December solstice marks its southernmost position. The summer solstice occurs on the day when the Sun reaches its highest point at solar noon for regions outside of the tropics, and those observers experience the longest amount of daylight

for the year. Conversely, during the winter solstice, the Sun is at its lowest point at solar noon for the year and observers outside of the tropics experience the least amount of daylight - and the longest night – of the year. The June solstice marks the beginning of summer for folks in the Northern Hemisphere and winter for Southern Hemisphere folks, and in December the opposite is true, as a result of the tilt of Earth's axis of rotation. For example, this means that the Northern Hemisphere receives more direct light from the Sun than the Southern Hemisphere during the June solstice. Earth's tilt is enough that northern polar regions experience 24-hour sunlight during the June solstice, while southern polar regions experience 24-hour night, deep in Earth's shadow. That same tilt means that the Earth's polar regions also experience a reversal of light and shadow half a year later in December, with 24 hours of night in the north and 24 hours of daylight in the south. Depending on how close you are to the poles, these extreme lighting conditions can last for many months, their duration deepening the closer you are to the poles.

Solstice from Space



These images from NASA's DSCOVR mission shows the Sun-facing side of Earth during the December 2018 solstice (left) and June 2019 solstice (right). Notice how much of each hemisphere is visible in each photo; December's solstice heavily favors the Southern Hemisphere and shows all of South America and much of Antarctica and the South Pole, but only some of North America. June's solstice, in contrast, heavily favors the Northern Hemisphere and shows the North Pole and the entirety of North America, but only some of South America. Credit: ***NASA/DSCOVR EPIC***

While solstice days are very noticeable to observers in mid to high latitudes, that's not the case for observers in the tropics - areas of Earth found between the Tropic of Cancer and the Tropic of Capricorn. Instead, individuals experience two "zero shadow" days per year. On these days, with the sun directly overhead at solar noon, objects cast a minimal shadow compared to the rest of the year. If you want to see your own shadow at that moment, you have to jump! The exact date for zero shadow days depends on latitude; observers on the Tropic of Cancer (23.5° north of the equator) experience a zero shadow day on the June solstice, and observers on the Tropic of Capricorn (23.5° south of the equator) get their zero shadow day on December's solstice. Observers on the equator experience two zero shadow days, being exactly in between these two lines of latitude; equatorial zero shadow days fall on the March and September equinoxes.

Zero Shadow Day Demonstration

A presenter from the San Antonio Astronomy Club in Puerto Rico demonstrating some Earth-Sun geometry to a group during a "Zero Shadow Day" event. As Puerto Rico lies a few degrees south of the Tropic of Cancer, their two zero shadow days arrive just a few weeks before and after the June solstice. Globes are a handy and practical way to help visualize solstices and equinoxes for large outdoor groups, especially outdoors during sunny days! Credit & Source: Juan Velázquez / San Antonio Astronomy Club

There is some serious science that can be done by carefully observing solstice shadows. In approximately 200 BC, Eratosthenes is said to have observed sunlight shining straight down the shaft of a well during high noon on the solstice, near the modern-day Egyptian city of Aswan. Inspired, he compared measurements of solstice shadows between that location and measurements taken north, in the city of Alexandria. By calculating the difference in the lengths of these shadows, along with the distance between the two cities, Eratosthenes calculated a rough early estimate for the circumference of Earth – and also provided further evidence that the Earth is a sphere!

Are you having difficulty visualizing solstice lighting and geometry? You can build a “Suntrack” model that helps demonstrate the path the Sun takes through the sky during the seasons; find instructions **here**. You can find more fun activities and resources like this model on NASA Wavelength: science.nasa.gov/learners/wavelength. And of course, discover the latest NASA science at nasa.gov.

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:

MAC Meetings:

- Friday, June 3, 2022 - 7p - Discovery Theater - Astro fun & games.
- Friday, August 5, 2022 - 7p - Discovery Theater - Topic TBA.
- Friday, September 2, 2022 - 7p - Discovery Theater - Topic TBA.
- Friday, October 7, 2022 - 7p - Discovery Theater - Topic TBA.
- Friday, December 2, 2022 - 7p - Discovery Theater - Topic TBA.

SunWatch:

- **Cancelled until further notice. Soon to return.**
- Every clear Saturday & Sunday - 3p-3:30p - March-October - On the Dam
  - View the Sun safely with a white-light & Hα 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:

- October 1 & 8, 2022 - 7:30p
- October 15, 22, 29 & November 5, 2022 - 7p
- November 12, 19 & 26, 2022 - 6p
  - 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:

- **Annual Club Picnic - July 2022 - 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.
  - **Please bring a dish to share and bring your own chair.**
- **StarFest 2022 - November 4, 5 & 6, 2022**
  - Our 37th annual astronomy convention / star gathering for the Southeast United States. Three days of astronomy fun, 5 meals, 4 keynote speakers, unique T-shirt, and more!
  - **Pre-registration by Oct. 14, 2022 with full payment is mandatory for attendance. Sorry, no walk-ins nor "visits."**
  - MeadowView Marriott special hotel rate.
  - StarFest Link

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 Association 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 by mail, over the phone or in person at the gift shop.

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.**