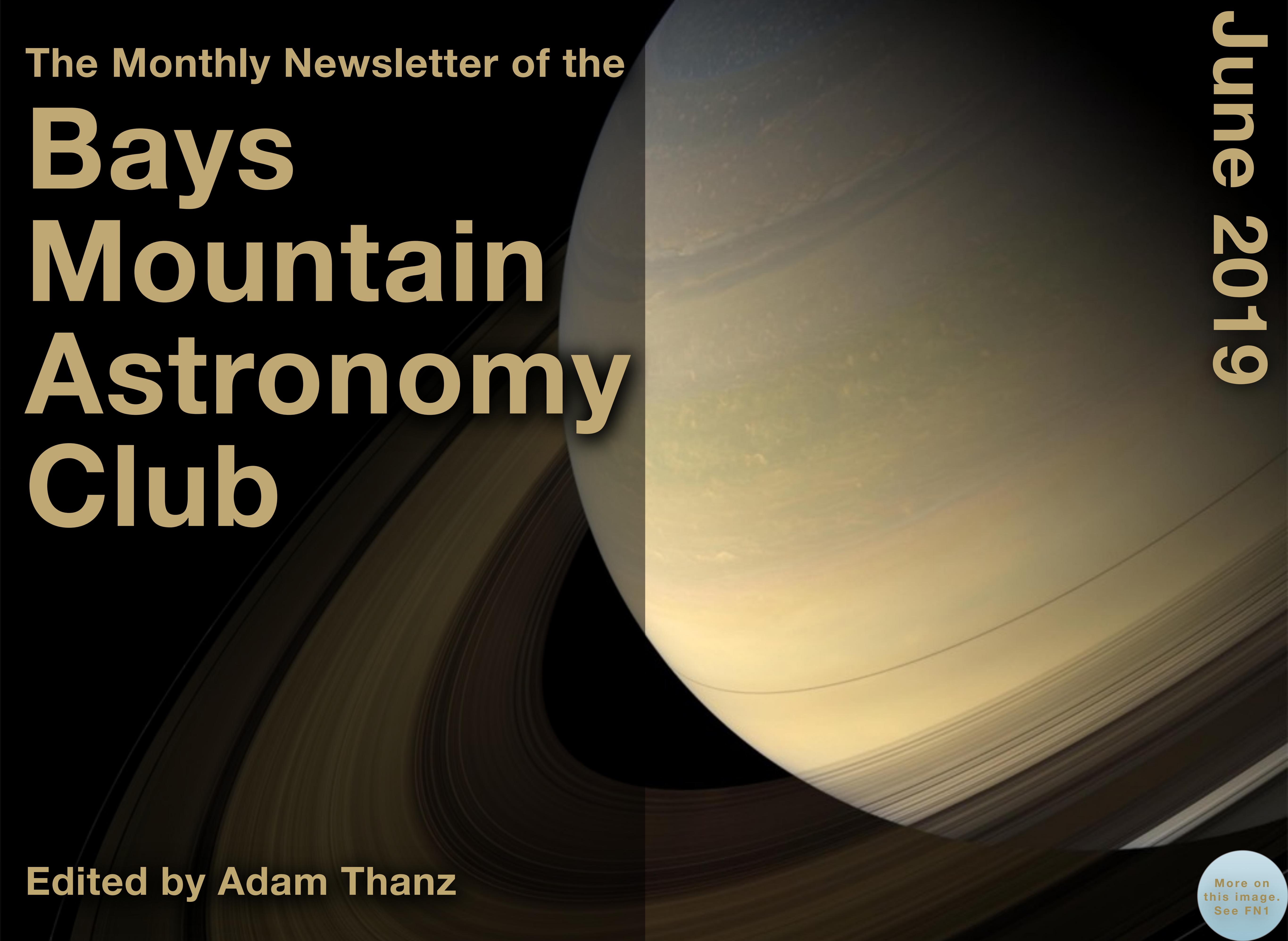
The Monthly Newsletter of the

Bays Mountain Astronomy Club

June 2019



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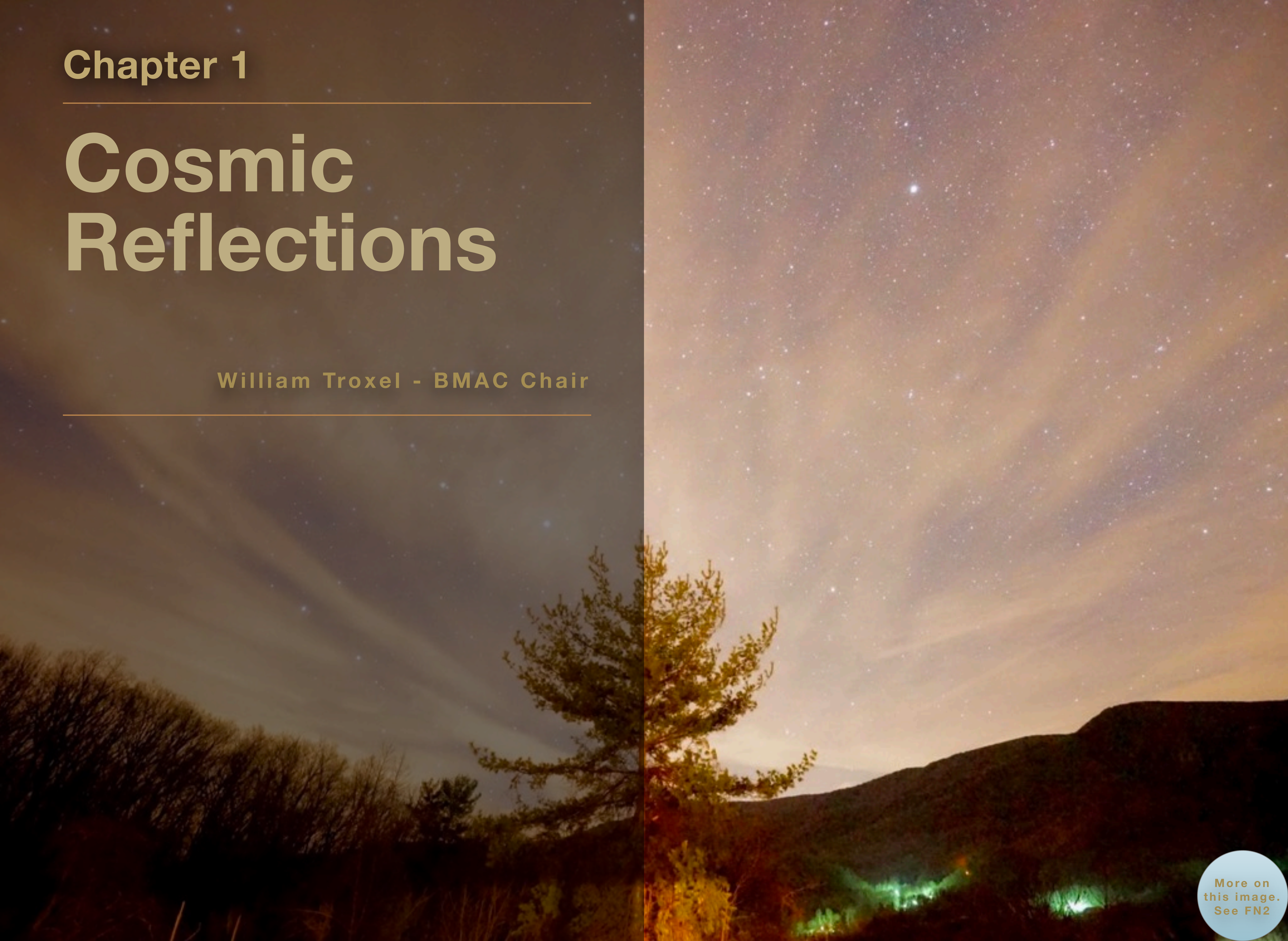
Edited by Adam Thanz

Chapter 1

Cosmic Reflections

William Troxel - BMAC Chair



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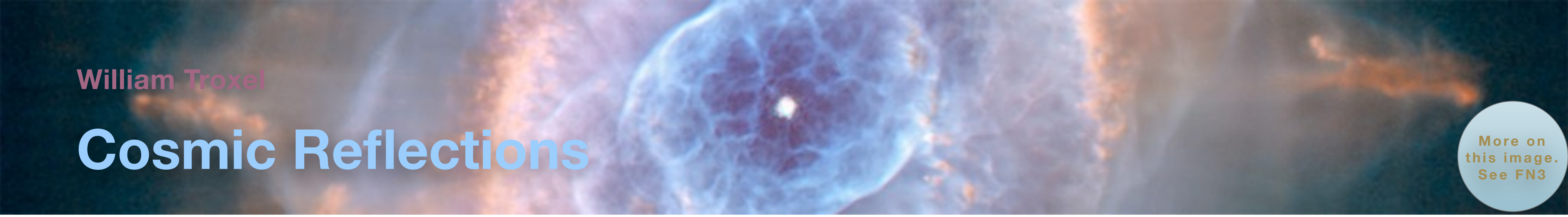


William Troxel

Cosmic Reflections

Greetings BMACer's. I wanted to recap the events of May. Those of you that were able to attend got to see and hear very wonderful science fair presentations from the young men and women from Sullivan South High School who are our future scientists and astronomers! Each presentation was well planned and presented. Each young person shared their goal, method and results. After each presentation, the students welcomed comments and questions from those present. I want to thank Tom Rutherford for bringing his students, it is always a wonderful meeting. Every May we invite Tom's young men and women to present their projects. It is one meeting that many of you have told me that you enjoy each year. I agree with you.

The second event this month was the annual Astronomy Day. Due to weather conditions, the event was moved indoors. However, we had some very good displays and many visitors asked questions about each of the displays. This year was the first time we had some information for those who have vision challenges. Due to the weather we did not offer the Sun nor outdoor StarWatch viewings of the annual event. This is the one event that any member is invited to attend and be a part. If you have not attended in the past I invite you to consider coming out in 2020!

This month I want to introduce 3 more terms for your working astronomy vocabulary.

Aurora - (noun) - An aurora is formed when charged particles emitted from the Sun during a solar flare penetrate the Earth's magnetic shield and collide with atoms and molecules in the atmosphere. These collisions results in countless little bursts of light called photons.

Eclipse - (noun) - the total or partial obscuring of one celestial body by another. Sentence use: The solar eclipse was viewed by many along its' path.

Parallax - (noun) - is the apparent displacement of an object because of a change in the observer's point of view.

For June, our constellation is Corona Borealis. I do not recall ever reading or studying this constellation. This constellation belongs to the Ursa Major family of constellations. Its name in Latin translates to "The Northern Crown." It is seen in the northern night sky. I found the information below in constellation-guide.com. While reading the information, I thought it was interesting to note four different visuals of four different groups of people. The Arabs saw it as “the poor peoples bowl,” the Cheyenne saw it as “a camp circle,” the Australians said it was a “Woomera” and the Welsh said it was the castle of the Lady Arianrhod. My personal thoughts are that looking at the star charts it looks like a big bowl. What do you think?

Corona Borealis is associated with the myth of Princess Ariadne of Crete. She was most famous for her part in helping the Greek hero Theseus defeat the Minotaur, the creature with a human body and head of a bull that lived in a labyrinth designed by Daedalus. In the myth, Ariadne married the god Dionysus. The circlet of stars in the constellation Corona Borealis represents the crown made by the god Hephaestus that she wore on her wedding day.

The Minotaur was in fact Ariadne’s half-brother. According to the legend, her mother Pasiphae gave birth to the creature after copulating with one of King Minos’ bulls. The king had the Minotaur locked inside the labyrinth to hide the family secret. The labyrinth was designed in such a way that no one, not even the Minotaur, could find a way out.

When Theseus came to Crete, he was chosen to be one of the people put into the labyrinth for the Minotaur to find and eat. Ariadne fell in love with Theseus and, following Daedalus’ advice, gave him a ball of thread to take with him into the labyrinth if he promised to take her with him once he escaped. Theseus agreed. Once he killed the Minotaur with his bare hands, the hero followed the trail of the thread and found his way out of the labyrinth.

Ariadne and Theseus sailed off together shortly thereafter, but he soon abandoned her on the island of Naxos. The god Dionysus found the princess weeping, fell in love, and the two were soon married. Ariadne wore a crown made by Hephaestus at the wedding and, once the ceremony was over, she tossed it into the sky, where the jewels turned into stars and the crown became the constellation Corona Borealis. The brightest star in the constellation, Gemma, got its name from the Latin word for “jewel.”

The Arabs know the constellation as “the poor people’s bowl” or Alphecca, which means “broken up.” The name Alphecca was later given to the constellation’s brightest star, Alpha Coronae Borealis.

The Cheyenne called the constellation the Camp Circle because its shape was similar to the way they arranged their camps, in a semi-circle.

In Australia, Corona Borealis is known as Woomera, the Boomerang, and the Welsh associate it with the castle of Lady

Arianrhod, the Welsh goddess who gave birth to two sons through magical means.

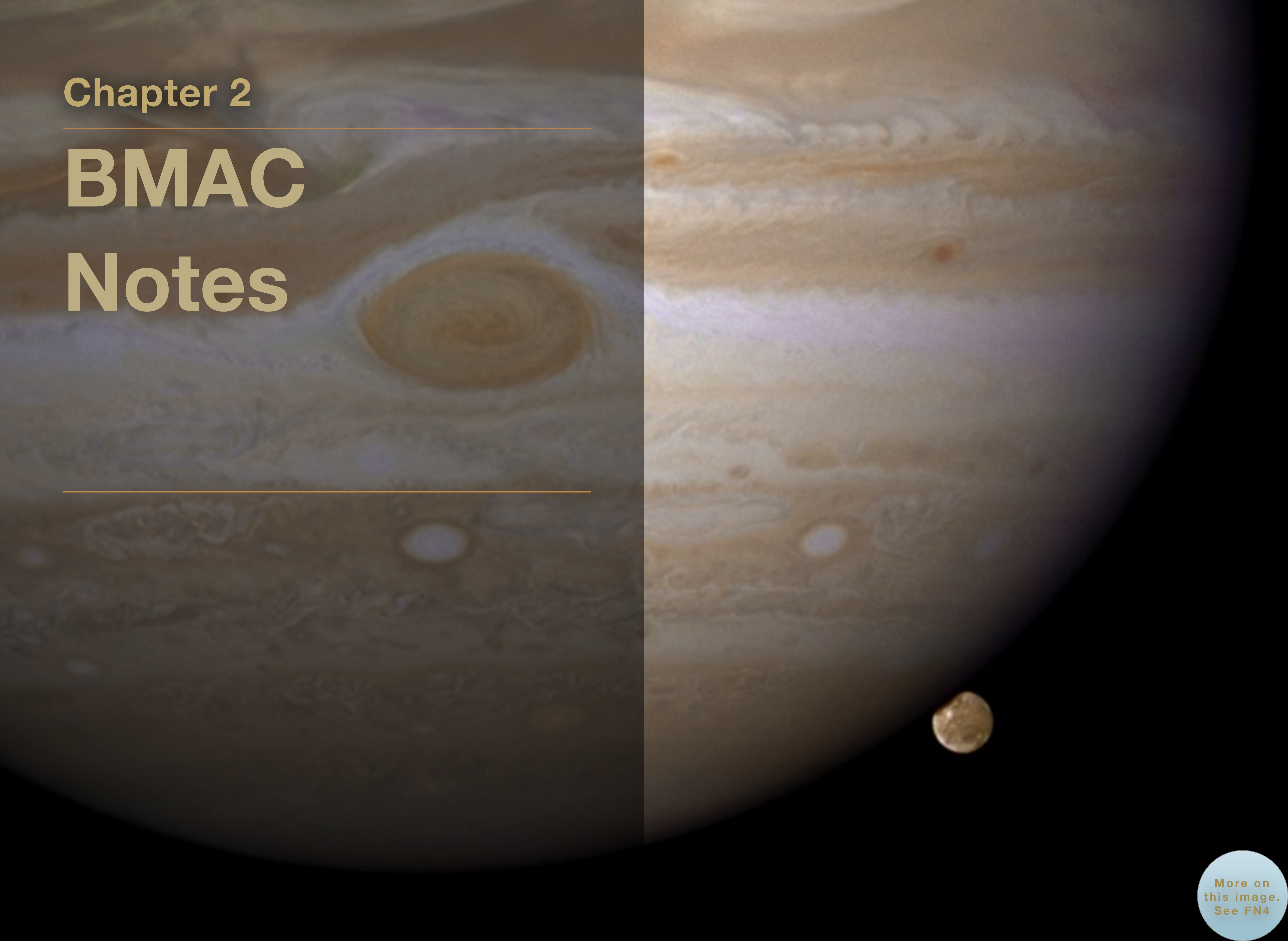
I invite you to check out Jason's Article to read about the details of this northern hemisphere constellation. Maybe you will find it interesting and want to add it your constellation watch list.

I want to remind everyone about the change of date for the June 2019 meeting. This is only for this month! We will be in the same place and same time only the meeting will be on the ***2nd*** second week of June. Our speaker will be BMAC's own Brandon Stroupe who will do a review of getting that perfect night sky picture. He will also talk a bit about ways to use your smart phone in this effort. We covered this topic at the very beginning of the series on tips for newbies. I think it is a great way to close this out. June is also the election of the chairman for the 2019-2020 year which be after the business meeting. Don't forget, mark your calendar for June 14, 2019 @ 7pm. Hope to see you then.

Until then, Clear Skies.

Chapter 2

BMAC Notes



More on this image. See FN4

BMAC May 2019 Meeting

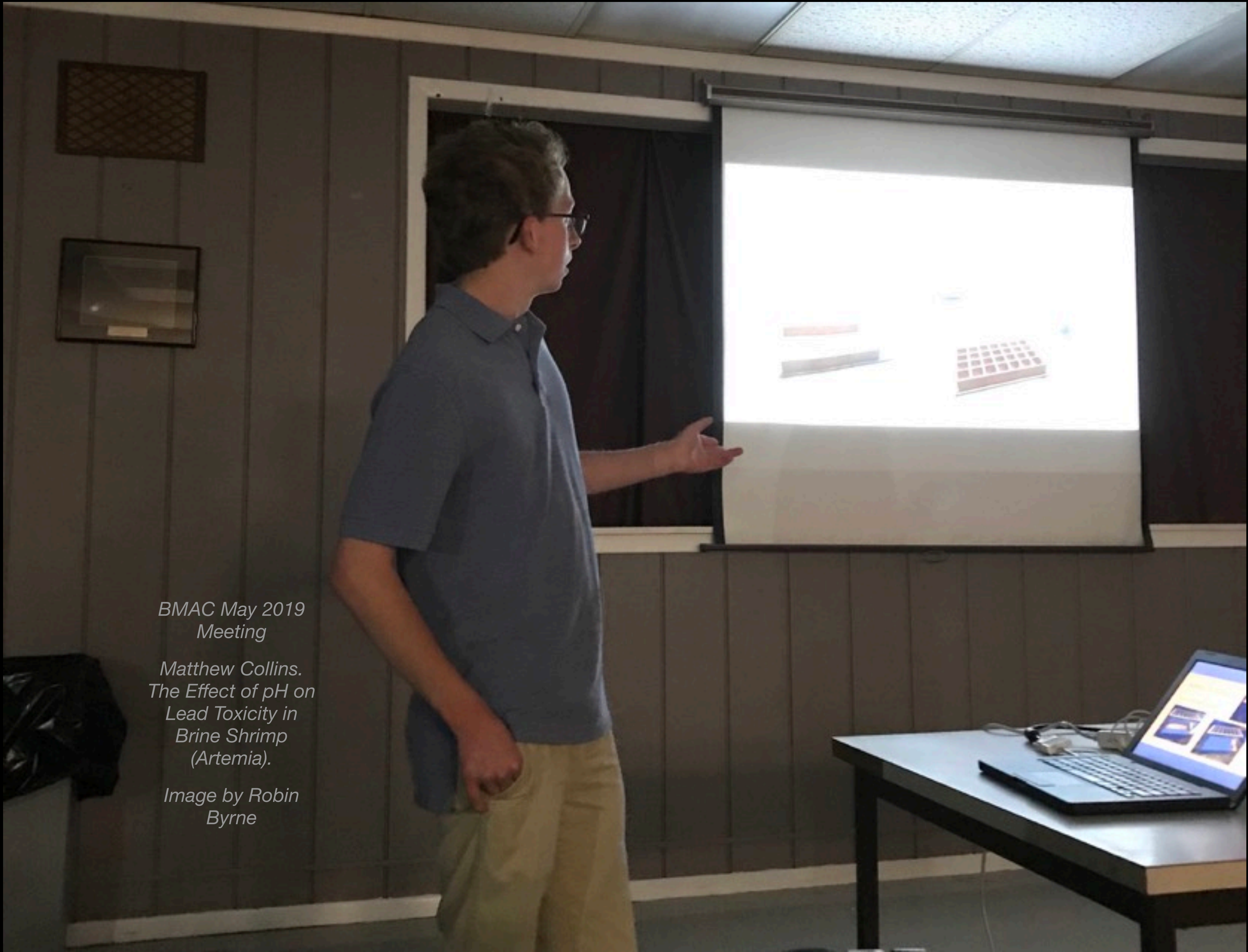
BMAC Chair William Troxel thanks Sullivan South educator and science project advisor, Tom Rutherford.

Image by Robin Byrne

BMAC May 2019 Meeting

Mackenzie Sanders (l) and Austin Monds (r). The Effects of Red Light on the Germination of Lettuce.

Image by Robin Byrne



BMAC May 2019 Meeting

Matthew Collins. The Effect of pH on Lead Toxicity in Brine Shrimp (Artemia).

Image by Robin Byrne

BMAC May 2019 Meeting

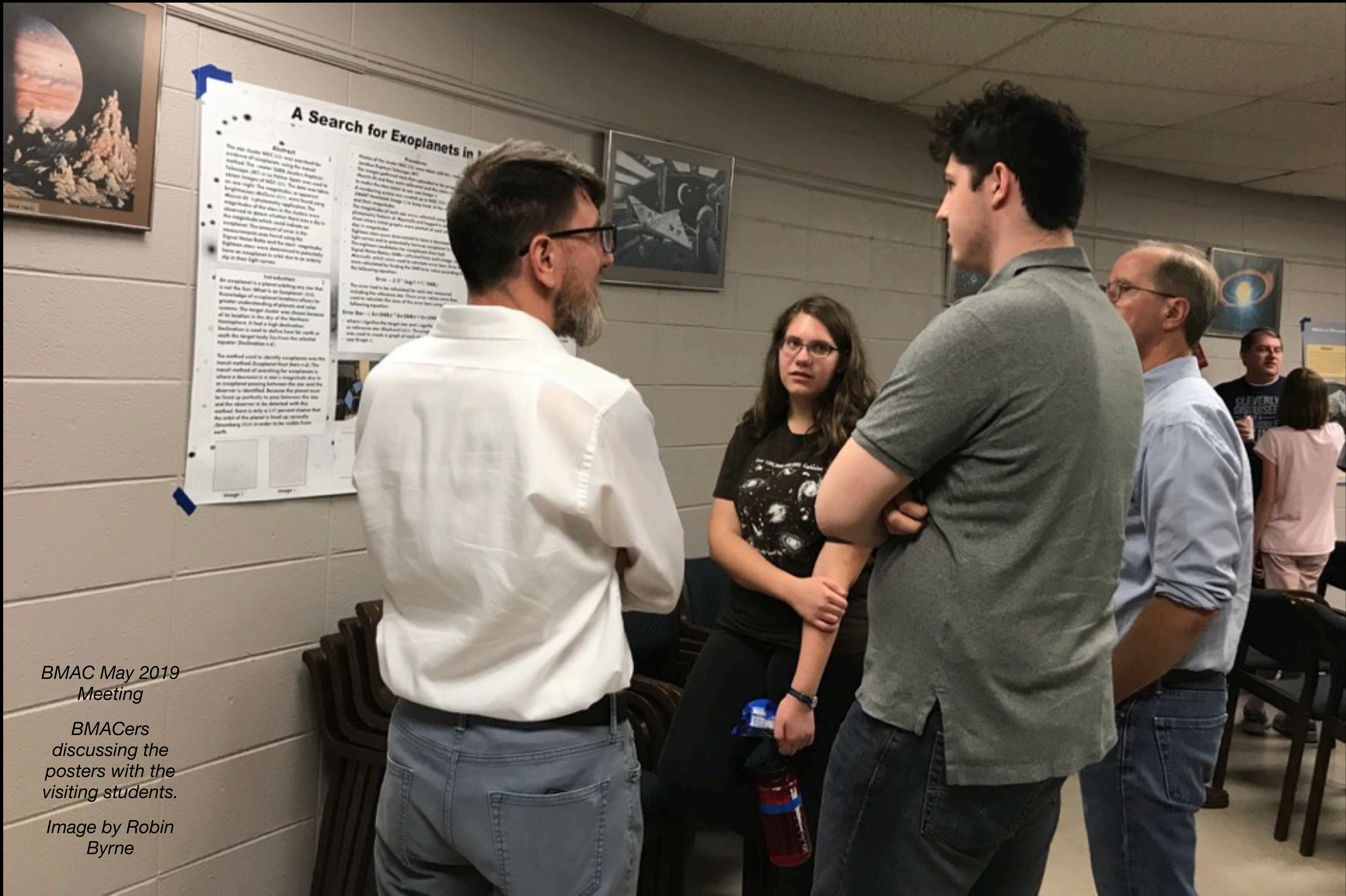
Aidan Henopp (l) and Rebecca Firth (r). A Search for Exoplanets in the Galactic Open Cluster NGC 2355.

Image by Robin Byrne

BMAC May 2019 Meeting

Mallory Muse. Using Gaia Data to Determine the Distance and Size of the Open Cluster NGC 2420.

Image by Robin Byrne



BMAC May 2019 Meeting

BMACers discussing the posters with the visiting students.

Image by Robin Byrne

Astronomy Day 2019

Making a constellation projector!

Image by Robin Byrne

Astronomy Day 2019

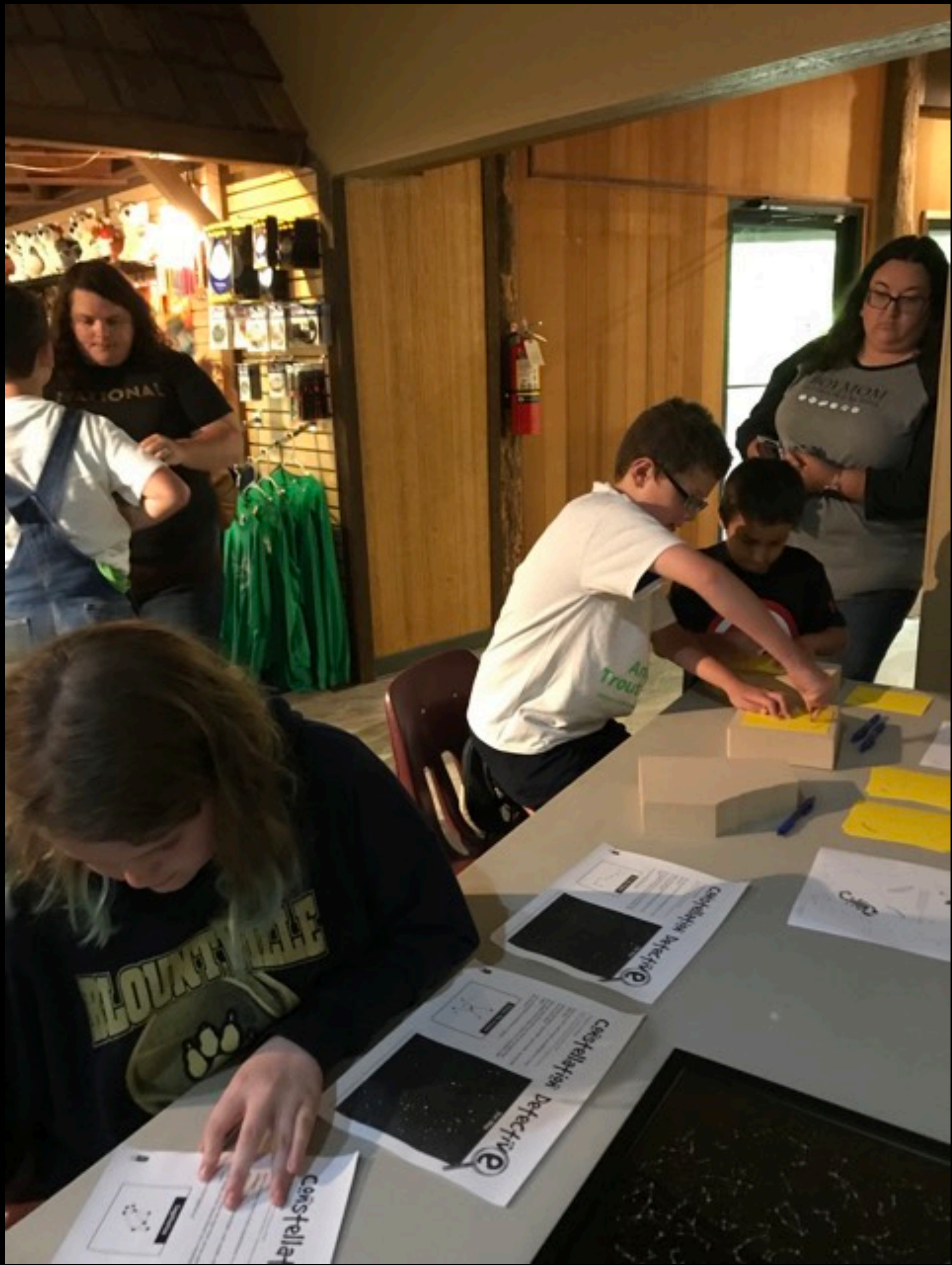
One of the constellation (asterism) projectors at work.

Image by Robin Byrne

Astronomy Day 2019

Visitors enjoying the Apollo and constellation display.

Image by Robin Byrne



Astronomy Day 2019

Making constellation projectors and finding the constellation in the starry sky image.

Image by Robin Byrne

Astronomy Day 2019

Visitors looking over the many giveaways offered at Astronomy Day.

Image by Robin Byrne

Chapter 3

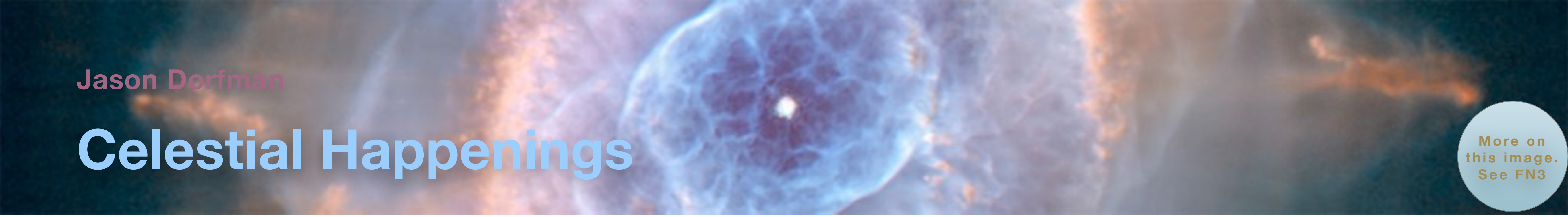
Celestial Happenings

Jason Dorfman

More on this image. See FN5

Jason Dorfman

Celestial Happenings



In the early hours of June 1, the first glint of morning twilight will begin to touch the sky at 4:26 a.m. This is the beginning of astronomical twilight, when the Sun is between 12° and 18° below the horizon. Over the next hour and 45 minutes, the sky will slowly brighten, ending with the Sun rising at 6:14 a.m. After a long and wonderful Saturday, the Sun will set at 8:42 p.m. with the fading glow of astronomical twilight ending at 10:30 p.m.

It is in June when we experience the longest days and shortest nights of the year as we transition from spring to summer. The Summer Solstice, when the Sun reaches its highest point in the northern hemisphere, officially occurs at 11:54 a.m. on the 21st. This marks the time when Earth's axis is seen tilting in the direction of the Sun. On this day, the Sun will rise at 6:12 a.m. and will set at 8:52 p.m.

Though the optimal conditions for observing occur later in the evening, the opportunity to enjoy some wonderful planetary views exists as we head into the summer months.

Planets

For your first planetary targets of the evening, look to the west where you'll find Mercury and Mars dancing together above the WNW horizon. Mercury will be the more challenging target at the start of the month. A half hour after sunset it will be about 6° high. At magnitude -1.0 with a clear view to the horizon, you should be able to catch a glimpse of this small world against the bright twilight sky. Wait a half hour to look for fainter Mars at magnitude +1.8. It will then be about 15° above the horizon.

Your chances of viewing Mercury will improve as the month progresses as Mercury is currently coming around from the far side of the Sun in its orbit and thus appears to be moving swiftly away from the Sun. It will catch up to Mars on the 17th when the two will appear side by side separated by only 30'. Look for the pair 10° above the horizon an hour after sunset. The two will appear even closer on the following night as Mercury moves above Mars. The separation between the two will be just 18', the closest that they have appeared to be in 13 years. Of course, this is just a conjunction where they appear to be together in the sky. They're actually still quite separated at this point with Mars on the far side of its orbit from Earth and Mercury swinging around closer to Earth in its orbit. A view through a telescope will highlight the truth of this. Mars is about 40% larger than Mercury, but will appear smaller than Mercury when viewed through a telescope. The disk of Mars will appear full but span a small 3.7" compared to Mercury's disk spanning 7.4" and appearing only half lit.

Mercury will slow its eastward motion as it reaches its Greatest Eastern Elongation on the 23rd. It will then be 25° east of the Sun. Look 11° up from the horizon a half hour after sunset to find the now magnitude +0.44 world. A telescope will reveal the planet as a thick crescent about 39% illuminated.

As twilight is fading out, turn your gaze to the southeast for mighty Jupiter. The king of the planets is still moving in slow retrograde in the southern part of Ophiuchus. Jupiter reaches opposition on the 10th, when it will be directly opposite the Sun and closest to Earth. It will be an easy target to find as its shining brilliantly at magnitude -2.6 against the backdrop of fainter stars in Ophiuchus. For better observing conditions, wait until 1:30 a.m. when it reaches its highest altitude of about 30° due south. The disk of the planet will span 46" making it very easy to see the colorful bands and circular storm systems in Jupiter's atmosphere. This month, try to become familiar with the four largest moons of Jupiter; Io, Europa, Ganymede and Callisto. Consult a chart or graph showing the positions of the moons and then watch as they dance around Jupiter from night to night.

Up next on the observing roster is the beautiful ringed world, Saturn. Saturn lies about 30° east of Jupiter and rises around 11 p.m. on the 1st, roughly 2 hrs after Jupiter. It will reach an altitude of about 32° due south just after 4 a.m. Saturn is still lingering next to the Teapot asterism in the eastern part of Sagittarius. Over the month, its magnitude will increase from +0.28 to +0.1 as Saturn heads towards its own opposition in early July. At mid-month, the planet will span 18" and the rings will span 41" with a 24° tilt.

For those who enjoy the early morning hours, you'll find Venus rising in the East as the morning twilight is blooming. On the 1st, look about 6° above the ENE horizon a half hour before sunup for dazzling Venus shining brilliantly at magnitude -3.8. Then, look about 6° to its right for a very thin crescent Moon. Over the month, Venus will appear at roughly the same altitude each morning, but it will move northward along the horizon as it progresses along in its orbit around the Sun. After mid-month, it will begin to descend into the brightening twilight glow.

Luna

The Moon begins the month, as we saw earlier, as a very thin waning crescent near Venus. It then disappears as it heads to New Moon on the 3rd. On the 5th, look for a very young waxing crescent about 5° east of Mars. In the early hours of the 17th, a Full Moon will be about 6° to the east of Jupiter. On the following night, the still nearly full Moon will pass less than half a degree below Saturn.

Constellation of the Month

Corona Borealis is our constellation for June. It is located at roughly 16 h in right ascension and +30° declination. On the 1st, as astronomical twilight is ending, look about 65° above the eastern horizon for the distinctive bowl-shaped curve of stars. Corona Borealis is bordered by Hercules to the east and Boötes to the west. Both of these constellations wrap around to create the northern border with Corona Borealis. Serpens Caput borders to the south.

Despite the brilliance of the stars that form the crown, this constellation is devoid of any interesting deep-sky objects, at least any observable ones. It lies outside of the band of our Milky Way, so it's not surprising that we find no nebula or star clusters. There is a very rich cluster of more than 400 distant galaxies concentrated in an area of sky about a half a degree wide, but the brightest members have apparent magnitudes of about 16.5 - well beyond the reach of most amateur telescopes.

Corona Borealis does have its share of variable stars, however, two of which are quite unique. One bright star that unpredictably turns faint and a fainter one that at times is seen to brighten. "R Coronae Borealis spends most of its time at magnitude 6.0, but every few years it suddenly drops to magnitude 14 or fainter. It gradually recovers in the following months, though often suffering relapses along the way. The fade-outs are believed to be caused by clouds of carbon particles — sooty smoke — condensing above the star's carbon-rich atmosphere." (MacRoberts, Alan. "R and T Coronae Borealis: Two Stellar Opposites." Sky & Telescope, July 17, 2006, www.skyandtelescope.com/observing/celestial-objects-to-watch/r-and-t-coronae-borealis-two-stellar-opposites/)

T Coronae Borealis is the other star and is a repeating nova. Most of the time, it would be a challenging star to find as it is normally a 10th magnitude star. But every several decades it brightens to 2nd or 3rd magnitude. "Its last eruptions came in 1866 and 1946. The next could happen any time." (ibid)

That's all for this month. Happy Observing!

Chapter 4

The Queen Speaks

Robin Byrne

Robin Byrne

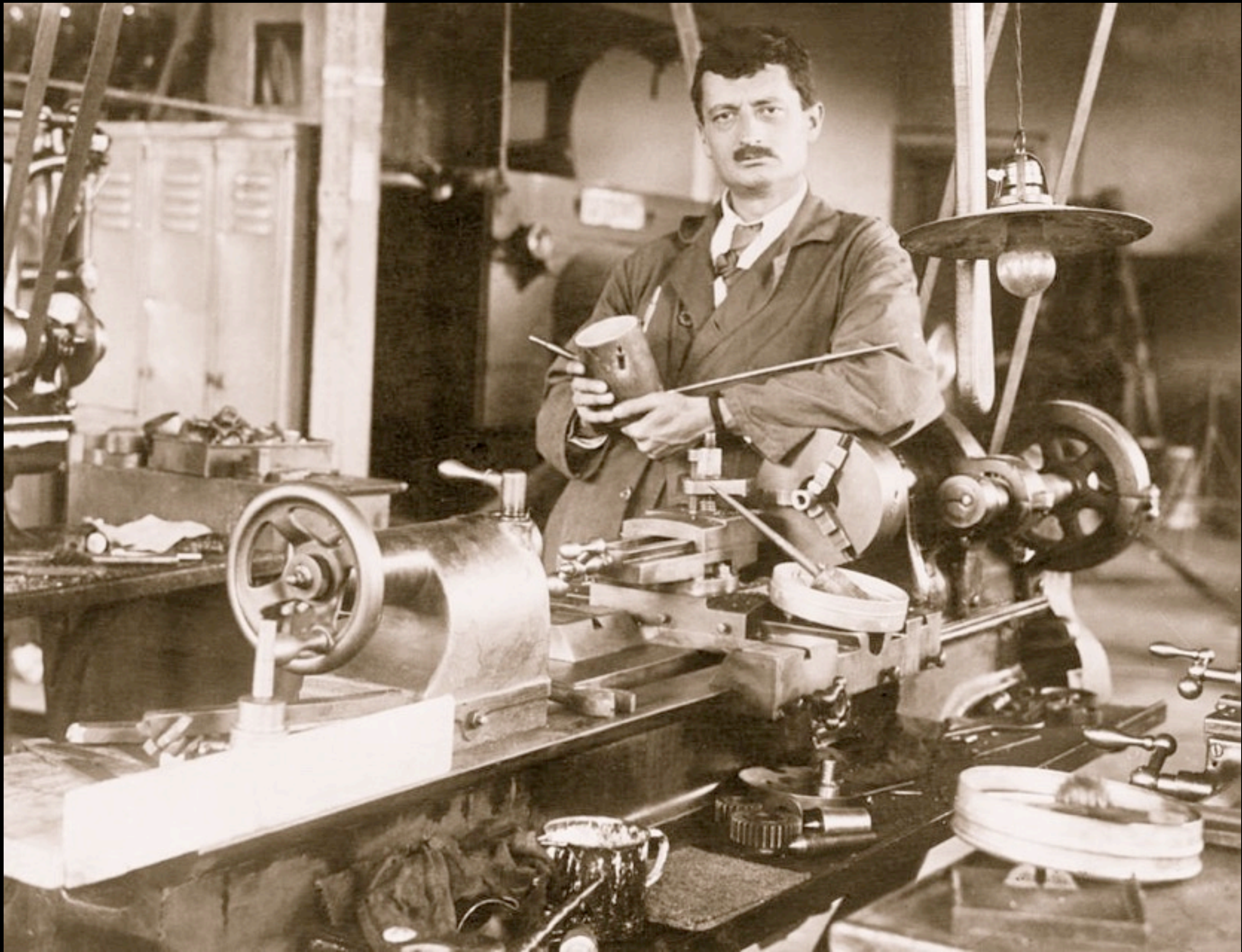
Happy Birthday Hermann Oberth

Continuing in the theme of honoring people and events leading up to the Moon landing anniversary, this month we celebrate the life of one of the three men considered the father of modern rocketry. Hermann Julius Oberth was born June 25, 1894 in what was then known as Hermannstadt, Transylvania, but is now Sibiu, Romania.

At the age of 11, Oberth contracted scarlet fever. He was sent to Italy to recover, and he took along with him two of Jules Verne's books: "From the Earth to the Moon" and "Around the Moon." He read both books so many times, it was said that he had memorized them. As his interest in rocketry grew, he studied the books in more depth and realized that Verne's stories weren't only fiction. Oberth found that the ideas were mathematically practical. By the age of 14, Oberth had built his first rocket. He was already thinking about space travel, envisioning a "recoil rocket" that could be propelled by the gasses pushed out of the exhaust. It was also at this time that he began thinking of liquid-fueled rockets.

With his ideas about rockets becoming more complex, Oberth had to teach himself the mathematics necessary to fulfill his dreams. His first discovery was that by increasing the ratio of fuel to rocket mass, you can increase the speed of the rocket. The problem was that as the fuel is used, the ratio will decrease. Oberth came up with the idea of a multi-stage rocket, jettisoning each section as the fuel is used to lighten the rocket's weight. Writing about this idea, Oberth said, "If there is a small rocket on top of a big one, and if the big one is jettisoned and the small one is ignited, then their speeds are added."

When it was time to enter college at the age of 18, Oberth's father, a doctor, wished for his son to follow in his footsteps. So, in 1912, Oberth traveled to Munich, Germany to study medicine at the University of Munich. However, shortly after starting college, World War I began, and Oberth was drafted into the Imperial German Army. Initially, he was assigned to an infantry battalion at the Eastern Front against Russia. In 1915, he was transferred to a medical unit in Romania. It was here that he discovered that he most definitely did not want to be a doctor. Instead, he used his spare time to conduct experiments with weightlessness. By 1917, he had complete designs for a rocket using liquid propellant that could travel up to 180 miles, which he



Hermann Oberth

showed to the Prussian Minister of War. After the war, Oberth returned to school to study physics and math.

On July 6, 1918, Oberth married Mathilde Hummel. Over the years, they would have four children. Two of his children died during World War II: a son while engaged in a battle, and a daughter in an industrial accident at the liquid oxygen plant where she worked.

For his PhD thesis in 1922, Oberth wrote about the future of rocket science. His dissertation committee rejected it as “utopian.” They wanted him to work on something more practical. Oberth refused, and later said, "I refrained from writing another one [thesis], thinking to myself: Never mind, I will prove that I am able to become a greater scientist than some of you, even without the title of Doctor.” Criticizing the German approach to education which led to the dismissal of his thesis, Oberth said, "Our educational system is like an automobile which has strong rear lights, brightly illuminating the past. But looking forward, things are barely discernible." So instead, in 1923, Oberth took his thesis and had it privately published as a book titled "The Rocket into Interplanetary Space.” In 1929, Oberth worked as a technical adviser to the director Fritz Lang while he was filming “Girl in the Moon.” During the filming, Oberth conducted an unsuccessful experiment, which resulted in the loss of sight in his left eye. Oberth designed the rocket shown in the film, and, as part of the publicity for the premier, built and launched a rocket. The film helped further popularize rocketry and space exploration. That same year, he expanded his thesis from the 92-page version, that had been published, to a whopping 429 pages. It was titled "Ways to Spaceflight,” which he dedicated to Fritz Lang. In the expanded version, he showed how a rocket could escape Earth’s gravity. This brought Oberth world-wide attention.

Oberth’s book inspired others to pursue amateur rocketry, which led to the creation of Verein für Raumschiffahrt (VfR) – the "Spaceflight Society.” Oberth joined the group, becoming a mentor to many of the members, including Wernher von Braun, who had become fascinated with rockets after reading Oberth’s book. Meanwhile, during the the 1920’s and 1930’s, the Depression years, Oberth faced the same problem as many, and couldn’t find much work, despite his accomplishments. He made do with a job teaching physics and math at a high school. In 1929, Oberth performed a static firing test of his first rocket motor that was liquid-fueled. Assisting him was 18-year old Wernher von Braun. Oberth received a patent for his design, and the first fully-functional rocket was successfully launched May 7, 1931, thanks to the help of many members of VfR, including von Braun.

During World War II, Wernher von Braun led the team developing rockets for warfare. In 1941, Oberth joined von Braun’s team in Peenemünde, Germany to help design and develop the V2 rocket. In August 1943, while working there, the facility was attacked by British air forces targeting German factories. Oberth survived the

Hermann Oberth in the 1950's.

attack and was awarded the War Merit Cross 1st Class for courageous behavior. Toward the end of the war, Oberth worked on solid-propellant anti-aircraft rockets in Wittenberg. Ultimately, he and his family moved to Nuremberg just in time for American forces to occupy it. In 1948, Oberth was allowed to leave, so he moved to Switzerland to work as a writer and consultant.

In 1950, Oberth moved to Italy to develop anti-aircraft rockets for the Italian Navy. In 1953, he returned to Germany and published another book: “Man into Space.” In this book, Oberth proposed ideas for placing telescopes in Earth orbit, building space stations, and designing spacesuits for working in the vacuum of space. During the 1950’s and 1960’s, Oberth proved that even the most intelligent of people can have wacky ideas. In his case, Oberth believed that UFO’s were alien spacecraft visiting Earth. Oberth wrote several articles for popular magazines promoting the reality of aliens and UFO’s. In 1958, Oberth returned to more realistic themes and published articles describing designs for a lunar rover vehicle, among other ideas.

In 1960, Oberth moved to the United States to work with his former protege, Wernher von Braun, in Huntsville, Alabama. Oberth assisted von Braun in the development of the Atlas rocket that was used during the Mercury missions to put men into orbit for the first time. Originally built as an ICBM, Atlas became the rocket of choice for launching various unmanned spacecraft for exploring the Solar System.

After three years of working in Huntsville, Oberth retired and returned to Germany. He made a trip back to the U.S. to witness the launch of Apollo 11 on its historic mission to the Moon. His last trip to America was in 1985 to watch the launch of the Space Shuttle Challenger on STS 61-A, which carried a Spacelab mission funded and supervised by West Germany. It was Challenger’s last successful launch. On December 29, 1989, Hermann Oberth died in a Nuremberg hospital at the age of 95.

When studying the history of rocketry, three names are always mentioned: Konstantin Tsiolkovsky (USSR), Robert Goddard (USA), and Hermann Oberth. All three men independently developed important ideas about rockets, so all three are considered fathers of modern rocketry, with each developing vital pieces of the puzzle that fit together to make the rockets we use today. Von Braun said of him: “Hermann Oberth was the first, who when thinking about the possibility of spaceships, grabbed a slide-rule and presented mathematically analyzed concepts and designs… I, myself, owe to him not only the guiding-star of my life, but also my first contact with the theoretical and practical aspects of rocketry and space travel. A place of honor should be reserved in the history of science and technology for his ground-breaking contributions in the field of astronautics.”

As we get closer to celebrating the Apollo Moon landing’s 50th anniversary, it is important to remember that we never would have gotten to the Moon without reliable rockets. The Saturn V that

Officials of the Army Ballistic Missile Agency

Hermann Oberth (forefront) with officials of the Army Ballistic Missile Agency at Huntsville, Alabama in 1956. Left to right around Oberth: 1) Dr. Ernst Stuhlinger (seated). 2) Major General H.N. Toftoy, Commanding Officer and person responsible for "Project Paperclip," which took scientists and engineers out of Germany after World War II to design rockets for American military use. Many of the scientists later helped to design the Saturn V rocket that took the Apollo 11 astronauts to the Moon. 3) Dr. Robert Lusser, a Project Paperclip engineer who returned to Germany in 1959. (Note: Lusser is incorrectly identified as Eberhard Rees in the standard NASA caption for this photo). 4) Dr. Wernher von Braun, Director, Development Operations Division.

Date: February 27, 1956

Image from NASA

carried men to the Moon was developed by Wernher von Braun. If von Braun hadn't been inspired by Hermann Oberth, how much longer would it have been before that milestone was reached? So many people played important roles in our trip to the Moon, and Hermann Oberth was definitely a major contributor to that historic flight.

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Hermann Oberth: Father of Space Travel by Christiaan Stange

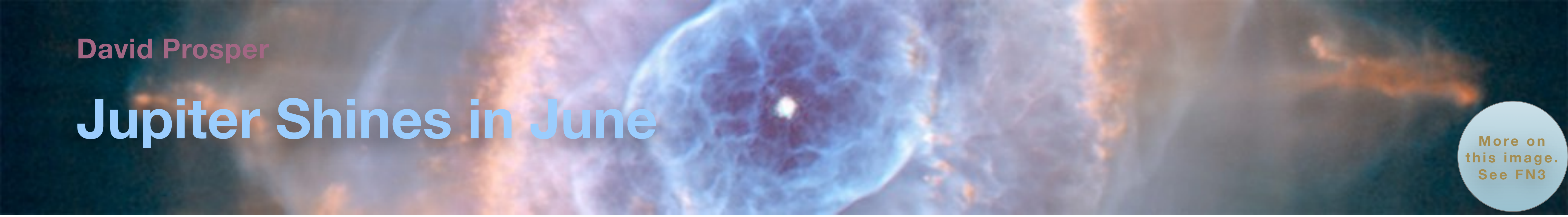
http://www.kiosek.com/oberth/

Hermann Oberth: Nazi germany

https://spartacus-educational.com/GERoberth.htm

Chapter 5

Space Place



David Prosper

Jupiter Shines in June

Jupiter stakes its claim as the "King of the Planets" in June, shining bright all night. Saturn trails behind Jupiter, and the Moon passes by both planets mid-month. Mercury puts on its best evening appearance in 2019 late in the month, outshining nearby Mars at sunset.

Jupiter is visible almost the entire evening this month. Earth will be between Jupiter and the Sun on June 10, meaning Jupiter is at opposition. On that date, Jupiter rises in the east as the Sun sets in the west, remaining visible the entire night. Jupiter will be one of the brightest objects in the night sky, shining at magnitude -2.6. Its four largest moons and cloud bands are easily spotted with even a small telescope.

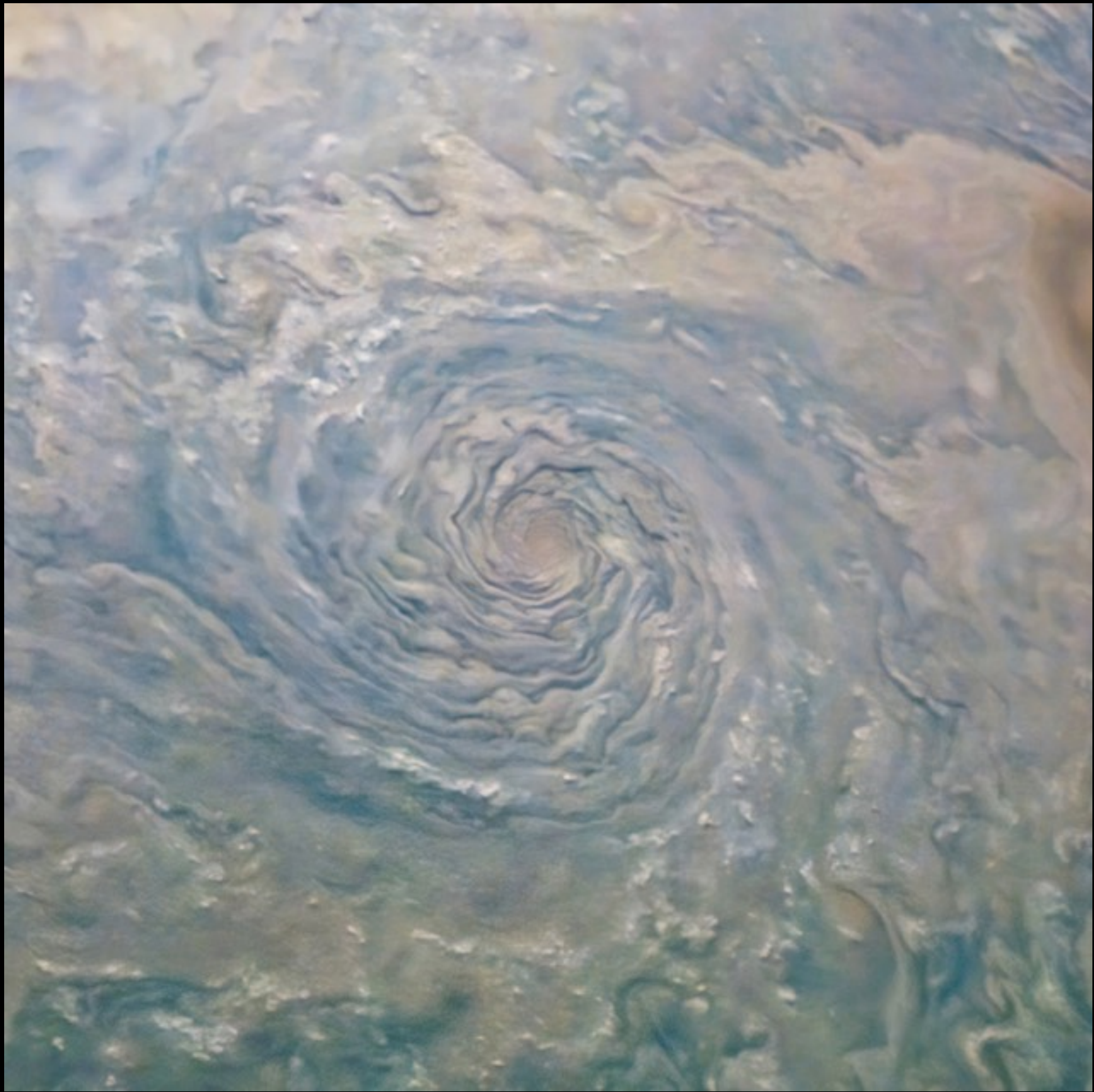
What if your sky is cloudy or you don't have a telescope? See far more of Jupiter than we can observe from Earth with NASA's Juno mission! Juno has been orbiting Jupiter since 2016, swooping mere thousands of miles above its cloud tops in its extremely elliptical polar orbits, which take the probe over 5 million miles away at its furthest point! These extreme orbits minimize Juno's exposure to Jupiter's powerful radiation as it studies the gas giant's internal structure, especially its intense magnetic fields. Juno's hardy JunoCam instrument takes incredible photos of Jupiter's raging storms during its flybys. All of the images are available to the public, and citizen scientists are doing amazing things with them. You can too! Find out more at bit.ly/JunoCam.

Saturn rises about two hours after Jupiter and is visible before midnight. The ringed planet rises earlier each evening as its own opposition approaches in July. The Moon appears near both gas giants mid-month. The Moon's tour begins on June 16 as it approaches Jupiter, and its visit ends on June 19 after swinging past Saturn.

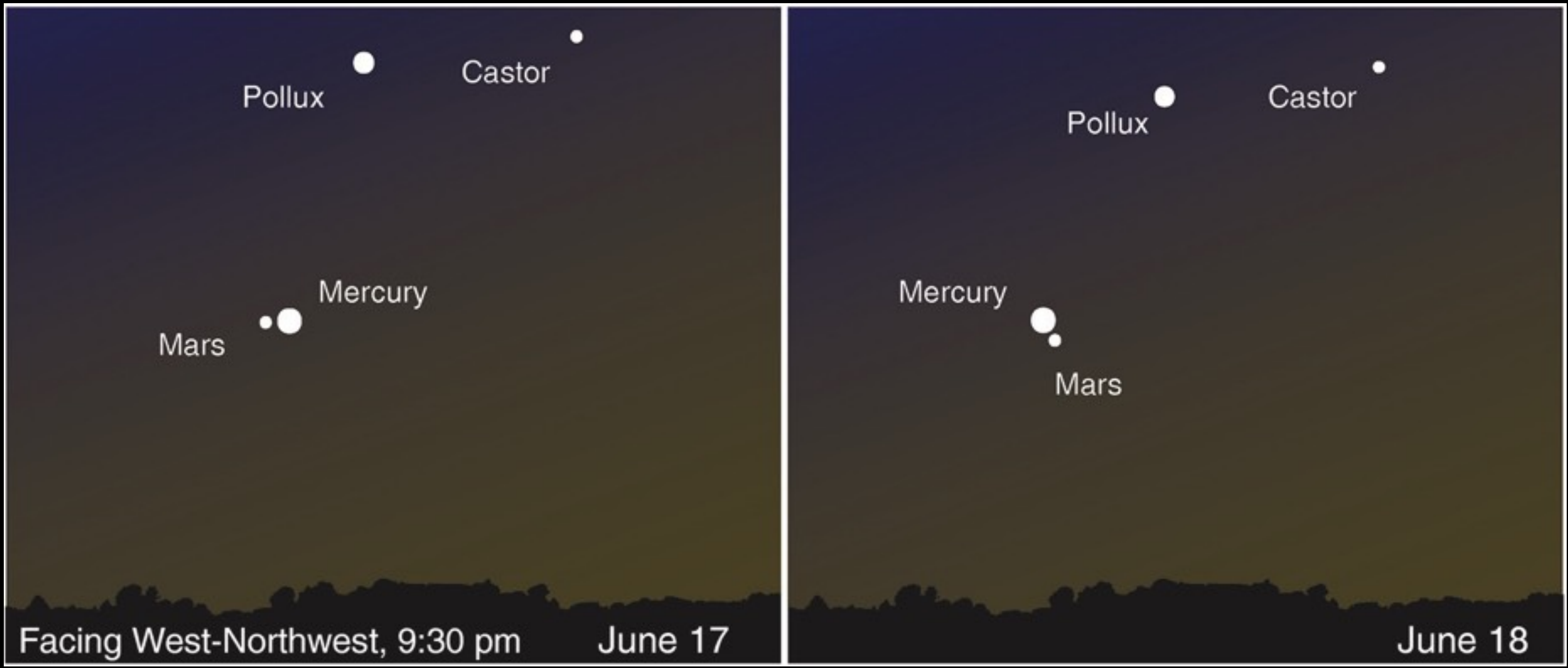
Mercury is back in evening skies and will be highest after sunset on June 23, just two days after the summer solstice! Spot it low in the western horizon, close to the much dimmer and redder Mars. This is your best chance this year to spot Mercury in the evening, and nearly your last chance to see Mars, too! The two smallest planets of our Solar System pass close to each other the evenings of June 17-18, coming within just 1⁄4 degree, or half the width of a full Moon, making for a potentially great landscape photo at twilight.

Discover more about NASA's current and future missions at nasa.gov.

More on this image. See FN8



More on this image. See FN9

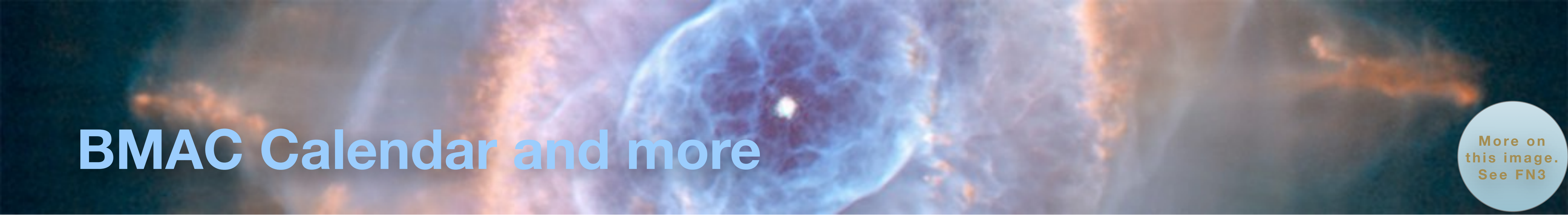


This article is distributed by NASA Night Sky Network. The Night Sky Network program supports astronomy clubs across the USA dedicated to astronomy outreach. Visit nightsky.jpl.nasa.org to find local clubs, events, and more!

Chapter 6

BMAC Calendar and more

More on this image. See FN7



BMAC Calendar and more

Date	Time	Location	Notes
BMAC Meetings			
Friday, June 14, 2019	7 p.m.	Nature Center Discovery Theater	Notice the date change to the 14th! Program: "Get That Perfect Night Sky Picture" with BMAC member Brandon Stroupe. Learn how to capture the night sky with your camera & how to set up your telescope so you can use your smart phone. This will close out the series on Newbies to Amateur Astronomy.; Free.
Friday, August 2, 2019	7 p.m.	Nature Center Discovery Theater	Program: Program TBA; Free.
Friday, September 6, 2019	7 p.m.	Nature Center Discovery Theater	Program: Program TBA; Free.
Friday, October 4, 2019	7 p.m.	Nature Center Discovery Theater	Program: Program TBA; Free.
SunWatch			
Every Saturday & Sunday March - October	3-3:30 p.m. if clear	At the dam	View the Sun safely with a white-light view if clear.; Free.
StarWatch			
Oct. 5, 12, 2019	7:30 p.m.	Observatory	View the night sky with large telescopes. If poor weather, an alternate live tour of the night sky will be held in the planetarium theater.; Free.
Oct. 19, 26, Nov. 2, 2019	7 p.m.		
Nov. 9, 16, 23, 30, 2019	6 p.m.		
Special Events			
Saturday, July 13, 2019	6 p.m.	To be sent directly to full BMAC members	Annual club picnic. BMACers and their families are most welcome to enjoy the evening of astronomy themed games and activities along with a potluck dinner and observing. Please bring a dish to share. Bring your own chair.
Oct. 18-20, 2019	-	Farmstead	StarFest 2019. Our 36th 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 Sept. 27, 2019 with full payment is mandatory for attendance. Sorry, no walk-ins nor "visits."*** Registration will open in August.

Bays Mountain Astronomy Club

853 Bays Mountain Park Road

Kingsport, TN 37650

1 (423) 229-9447

www.BaysMountain.com

AdamThanz@KingsportTN.gov

Annual Dues:

Dues are supplemented by the Bays Mountain Park Association and volunteerism by the club. As such, our dues can be kept at a very low cost.

$16 /person/year

$6 /additional family member

Note: if you are a Park Association member (which incurs an additional fee), then a 50% reduction in BMAC dues are applied.

The club's website can be found here:

https://www.baysmountain.com/astronomy/astronomy-club/#newsletters

Regular Contributors:

William Troxel

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

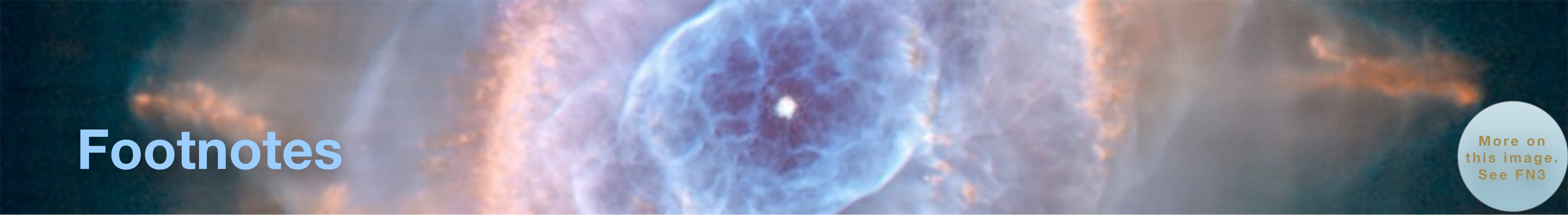
Robin has been writing the science history column since 1992 and was chair in 1997. She is an Associate Professor of Astronomy & Physics at Northeast State Community College (NSCC).

Jason Dorfman

Jason works as a planetarium creative and technical genius at Bays Mountain Park. He has been a member since 2006.

Adam Thanz

Adam has been the Editor for all but a number of months since 1992. He is the Planetarium Director at Bays Mountain Park as well as an astronomy adjunct for NSCC.



Footnotes

Footnotes:

1. The Rite of Spring

Of the countless equinoxes Saturn has seen since the birth of the solar system, this one, captured here in a mosaic of light and dark, is the first witnessed up close by an emissary from Earth … none other than our faithful robotic explorer, Cassini.

Seen from our planet, the view of Saturn's rings during equinox is extremely foreshortened and limited. But in orbit around Saturn, Cassini had no such problems. From 20 degrees above the ring plane, Cassini's wide angle camera shot 75 exposures in succession for this mosaic showing Saturn, its rings, and a few of its moons a day and a half after exact Saturn equinox, when the sun's disk was exactly overhead at the planet's equator.

The novel illumination geometry that accompanies equinox lowers the sun's angle to the ring plane, significantly darkens the rings, and causes out-of-plane structures to look anomalously bright and to cast shadows across the rings. These scenes are possible only during the few months before and after Saturn's equinox which occurs only once in about 15 Earth years. Before and after equinox, Cassini's cameras have spotted not only the predictable shadows of some of Saturn's moons (see PIA11657), but also the shadows of newly revealed vertical structures in the rings themselves (see PIA11665).

Also at equinox, the shadows of the planet's expansive rings are compressed into a single, narrow band cast onto the planet as seen in this mosaic. (For an earlier view of the rings' wide shadows draped high on the northern hemisphere, see PIA09793.)

The images comprising the mosaic, taken over about eight hours, were extensively processed before being joined together. First, each was re-projected into the same viewing geometry and then digitally processed to make the image "joints" seamless and to remove lens flares, radially extended bright artifacts resulting from light being scattered within the camera optics.

At this time so close to equinox, illumination of the rings by sunlight reflected off the planet vastly dominates any meager sunlight falling on the rings. Hence, the half of the rings on the left illuminated by planetshine is, before processing, much brighter than the half of the rings on the right. On the right, it is only the vertically extended parts of the rings that catch any substantial sunlight.

With no enhancement, the rings would be essentially invisible in this mosaic. To improve their visibility, the dark (right) half of the rings has been brightened relative to the brighter (left) half by a factor of three, and then the whole ring system has been brightened by a factor of 20 relative to the planet. So the dark half of the rings is 60 times brighter, and the bright half 20 times brighter, than they would have appeared if the entire system, planet included, could have been captured in a single image.

The moon Janus (179 kilometers, 111 miles across) is on the lower left of this image. Epimetheus (113 kilometers, 70 miles across) appears near the middle bottom. Pandora (81 kilometers, 50 miles across) orbits outside the rings on the right of the image. The small moon Atlas (30 kilometers, 19 miles across) orbits inside the thin F ring on the right of the image. The brightnesses of all the moons, relative to the planet, have been enhanced between 30 and 60 times to make them more easily visible. Other bright specks are background stars. Spokes -- ghostly radial markings on the B ring -- are visible on the right of the image.

This view looks toward the northern side of the rings from about 20 degrees above the ring plane.

The images were taken on Aug. 12, 2009, beginning about 1.25 days after exact equinox, using the red, green and blue spectral filters of the wide angle camera and were combined to create this natural color view. The images were obtained at a distance of approximately 847,000 kilometers (526,000 miles) from Saturn and at a Sun-Saturn-spacecraft, or phase, angle of 74 degrees. Image scale is 50 kilometers (31 miles) per pixel.

The Cassini-Huygens mission is a cooperative project of NASA, the European Space Agency and the Italian Space Agency. The Jet Propulsion Laboratory, a division of the California Institute of Technology in Pasadena, manages the mission for NASA's Science Mission Directorate, Washington, D.C. The Cassini orbiter and its two onboard cameras were designed, developed and assembled at JPL. The imaging operations center is based at the Space Science Institute in Boulder, Colo.

For more information about the Cassini-Huygens mission visit http://saturn.jpl.nasa.gov/. The Cassini imaging team homepage is at http://ciclops.org.

Image Credit: NASA/JPL/Space Science Institute

2. Leo Rising

A sky filled with stars and a thin veil of clouds.

Image by Adam Thanz

3. The Cat's Eye Nebula, one of the first planetary nebulae discovered, also has one of the most complex forms known to this kind of nebula. Eleven rings, or shells, of gas make up the Cat's Eye.

Credit: NASA, ESA, HEIC, and The Hubble Heritage Team (STScI/AURA)

Acknowledgment: R. Corradi (Isaac Newton Group of Telescopes, Spain) and Z. Tsvetanov (NASA)

4. Jupiter & Ganymede

NASA's Hubble Space Telescope has caught Jupiter's moon Ganymede playing a game of "peek-a-boo." In this crisp Hubble image, Ganymede is shown just before it ducks behind the giant planet.

Ganymede completes an orbit around Jupiter every seven days. Because Ganymede's orbit is tilted nearly edge-on to Earth, it routinely can be seen passing in front of and disappearing behind its giant host, only to reemerge later.

Composed of rock and ice, Ganymede is the largest moon in our solar system. It is even larger than the planet Mercury. But Ganymede looks like a dirty snowball next to Jupiter, the largest planet in our solar system. Jupiter is so big that only part of its Southern Hemisphere can be seen in this image.

Hubble's view is so sharp that astronomers can see features on Ganymede's surface, most notably the white impact crater, Tros, and its system of rays, bright streaks of material blasted from the crater. Tros and its ray system are roughly the width of Arizona.

The image also shows Jupiter's Great Red Spot, the large eye-shaped feature at upper left. A storm the size of two Earths, the Great Red Spot has been raging for more than 300 years. Hubble's sharp view of the gas giant planet also reveals the texture of the clouds in the Jovian atmosphere as well as various other storms and vortices.

Astronomers use these images to study Jupiter's upper atmosphere. As Ganymede passes behind the giant planet, it reflects sunlight, which then passes through Jupiter's atmosphere. Imprinted on that light is information about the gas giant's atmosphere, which yields clues about the properties of Jupiter's high-altitude haze above the cloud tops.

This color image was made from three images taken on April 9, 2007, with the Wide Field Planetary Camera 2 in red, green, and blue filters. The image shows Jupiter and Ganymede in close to natural colors.

Credit: NASA, ESA, and E. Karkoschka (University of Arizona)

5. 47 Tucanae

In the first attempt to systematically search for "extrasolar" planets far beyond our local stellar neighborhood, astronomers probed the heart of a distant globular star cluster and were surprised to come up with a score of "zero".

To the fascination and puzzlement of planet-searching astronomers, the results offer a sobering counterpoint to the flurry of planet discoveries announced over the previous months.

"This could be the first tantalizing evidence that conditions for planet formation and evolution may be fundamentally different elsewhere in the galaxy," says Mario Livio of the Space Telescope Science Institute (STScI) in Baltimore, MD.

The bold and innovative observation pushed NASA Hubble Space Telescope's capabilities to its limits, simultaneously scanning for small changes in the light from 35,000 stars in the globular star cluster 47 Tucanae, located 15,000 light-years (4 kiloparsecs) away in the southern constellation Tucana.

Hubble researchers caution that the finding must be tempered by the fact that some astronomers always considered the ancient globular cluster an unlikely abode for planets for a variety of reasons. Specifically, the cluster has a deficiency of heavier elements that may be needed for building planets. If this is the case, then planets may have formed later in the universe's evolution, when stars were richer in heavier elements. Correspondingly, life as we know it may have appeared later rather than sooner in the universe.

Another caveat is that Hubble searched for a specific type of planet called a "hot Jupiter," which is considered an oddball among some planet experts. The results do not rule out the possibility that 47 Tucanae could contain normal solar systems like ours, which Hubble could not have detected. But even if that's the case, the "null" result implies there is still something fundamentally different between the way planets are made in our own neighborhood and how they are made in the cluster.

Hubble couldn't directly view the planets, but instead employed a powerful search technique where the telescope measures the slight dimming of a star due to the passage of a planet in front of it, an event called a transit. The planet would have to be a bit larger than Jupiter to block enough light — about one percent — to be measurable by Hubble; Earth-like planets are too small.

However, an outside observer would have to watch our Sun for as long as 12 years before ever having a chance of seeing Jupiter briefly transit the Sun's face. The Hubble observation was capable of only catching those planetary transits that happen every few days. This would happen if the planet were in an orbit less than 1/20 Earth's distance from the Sun, placing it even closer to the star than the scorched planet Mercury — hence the name "hot Jupiter."

Why expect to find such a weird planet in the first place?

Based on radial-velocity surveys from ground-based telescopes, which measure the slight wobble in a star due to the small tug of an unseen companion, astronomers have found nine hot Jupiters in our local stellar neighborhood. Statistically this means one percent of all stars should have such planets. It's estimated that the orbits of 10 percent of these planets are tilted edge-on to Earth and so transit the face of their star.

In 1999, the first observation of a transiting planet was made by ground-based telescopes. The planet, with a 3.5-day period, had previously been detected by radial-velocity surveys, but this was a unique, independent confirmation. In a separate program to study a planet in these revealing circumstances, Ron Gilliland (STScI) and lead investigator Tim Brown (National Center for Atmospheric Research, Boulder, CO) demonstrated Hubble's exquisite ability to do precise photometry — the measurement of brightness and brightness changes in a star's light — by also looking at the planet. The Hubble data were so good they could look for evidence of rings or Earth-sized moons, if they existed.

But to discover new planets by transits, Gilliland had to crowd a lot of stars into Hubble's narrow field of view. The ideal target was the magnificent southern globular star cluster 47 Tucanae, one of the closest clusters to Earth. Within a single Hubble picture Gilliland could observe 35,000 stars at once. Like making a time-lapse movie, he had to take sequential snapshots of the cluster, looking for a telltale dimming of a star and recording any light curve that would be the true signature of a planet.

Based on statistics from a sampling of planets in our local stellar neighborhood, Gilliland and his co-investigators reasoned that 1 out of 1,000 stars in the globular cluster should have planets that transit once every few days. They predicted that Hubble should discover 17 hot Jupiter-class planets.

To catch a planet in a several-day orbit, Gilliland had Hubble's "eagle eye" trained on the cluster for eight consecutive days. The result was the most data-intensive observation ever done by Hubble. STScI archived over 1,300 exposures during the observation. Gilliland and Brown sifted through the results and came up with 100 variable stars, some of them eclipsing binaries where the companion is a star and not a planet. But none of them had the characteristic light curve that would be the signature of an extrasolar planet.

There are a variety of reasons the globular cluster environment may inhibit planet formation. 47 Tucanae is old and so is deficient in the heavier elements, which were formed later in the universe through the nucleosynthesis of heavier elements in the cores of first-generation stars. Planet surveys show that within 100 light-years of the Sun, heavy-element-rich stars are far more likely to harbor a hot Jupiter than heavy-element-poor stars. However, this is a chicken and egg puzzle because some theoreticians say that the heavy-element composition of a star may be enhanced after if it makes Jupiter-like planets and then swallows them as the planet orbit spirals into the star.

The stars are so tightly compacted in the core of the cluster – being separated by 1/100th the distance between our Sun and the next nearest star — that gravitational tidal effects may strip nascent planets from their parent stars. Also, the high stellar density could disturb the subsequent migration of the planet inward, which parks the hot Jupiters close to the star.

Another possibility is that a torrent of ultraviolet light from the earliest and biggest stars, which formed in the cluster billions of years ago may have boiled away fragile embryonic dust disks out of which planets would have formed.

These results will be published in The Astrophysical Journal Letters in December. Follow-up observations are needed to determine whether it is the initial conditions associated with planet birth or subsequent influences on evolution in this heavy-element-poor, crowded environment that led to an absence of planets.

Credits for Hubble image: NASA and Ron Gilliland (Space Telescope Science Institute)

6. Space Place is a fantastic source of scientific educational materials for children of all ages. Visit them at:

http://spaceplace.nasa.gov

7. NGC 3982

Though the universe is chock full of spiral-shaped galaxies, no two look exactly the same. This face-on spiral galaxy, called NGC 3982, is striking for its rich tapestry of star birth, along with its winding arms. The arms are lined with pink star-forming regions of glowing hydrogen, newborn blue star clusters, and obscuring dust lanes that provide the raw material for future generations of stars. The bright nucleus is home to an older population of stars, which grow ever more densely packed toward the center.

NGC 3982 is located about 68 million light-years away in the constellation Ursa Major. The galaxy spans about 30,000 light-years, one-third of the size of our Milky Way galaxy. This color image is composed of exposures taken by the Hubble Space Telescope's Wide Field Planetary Camera 2 (WFPC2), the Advanced Camera for Surveys (ACS), and the Wide Field Camera 3 (WFC3). The observations were taken between March 2000 and June 2009. The rich color range comes from the fact that the galaxy was photographed invisible and near-infrared light. Also used was a filter that isolates hydrogen emission that emanates from bright star-forming regions dotting the spiral arms.

Credit: NASA, ESA, and the Hubble Heritage Team (STScI/AURA)

Acknowledgment: A. Riess (STScI)

8. A giant storm in Jupiter’s north polar region, captured by JunoCam on February 4, 2019. Image processing performed by citizen scientists Gerald Eichstädt and Seán Doran. Source: bit.ly/JupiterSpiral.

9. Mars and Mercury after sunset the evenings of June 17-18, 2019. Image created with assistance from Stellarium.