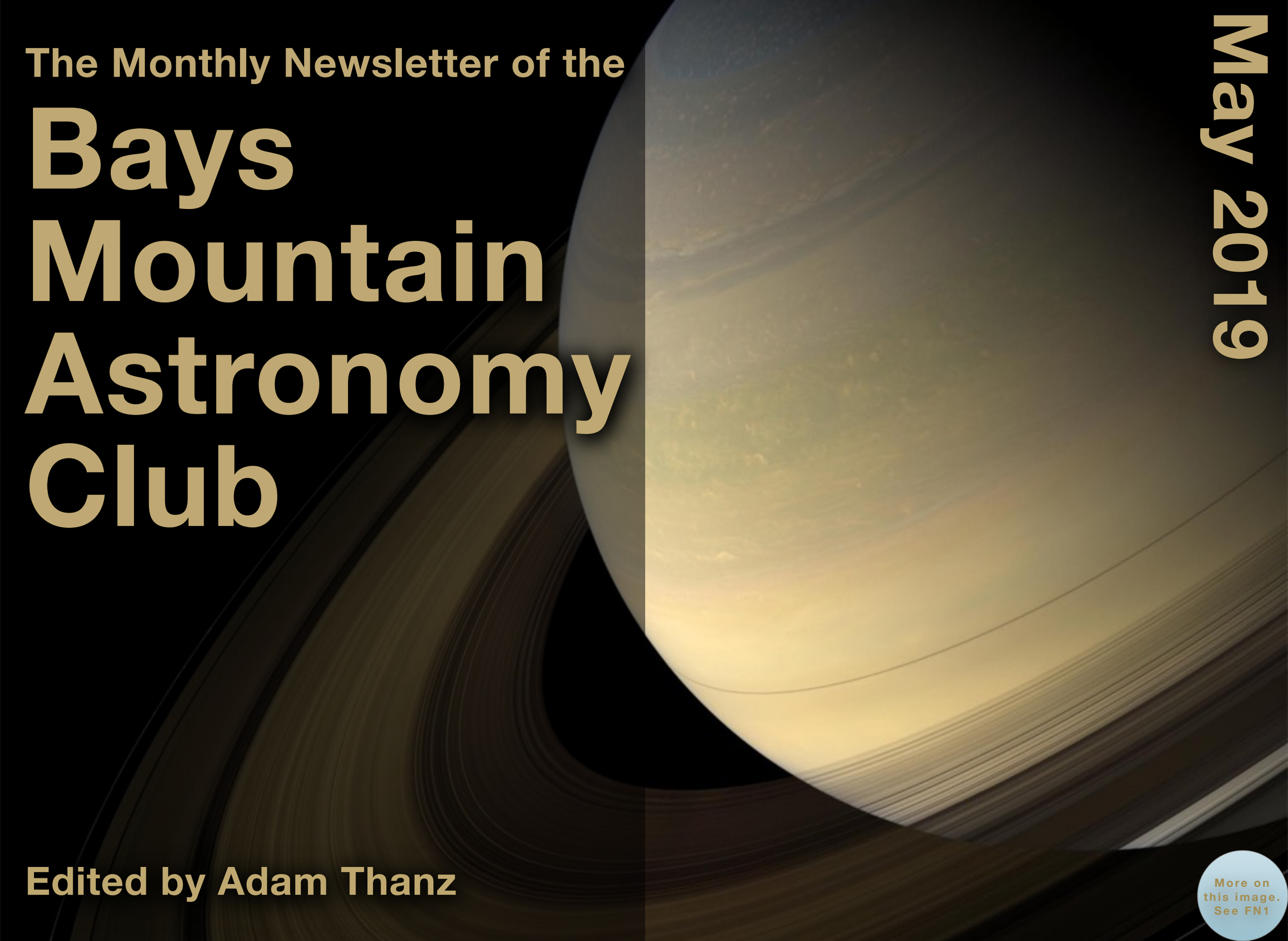
The Monthly Newsletter of the

Bays Mountain Astronomy Club

May 2019



Edited by Adam Thanz

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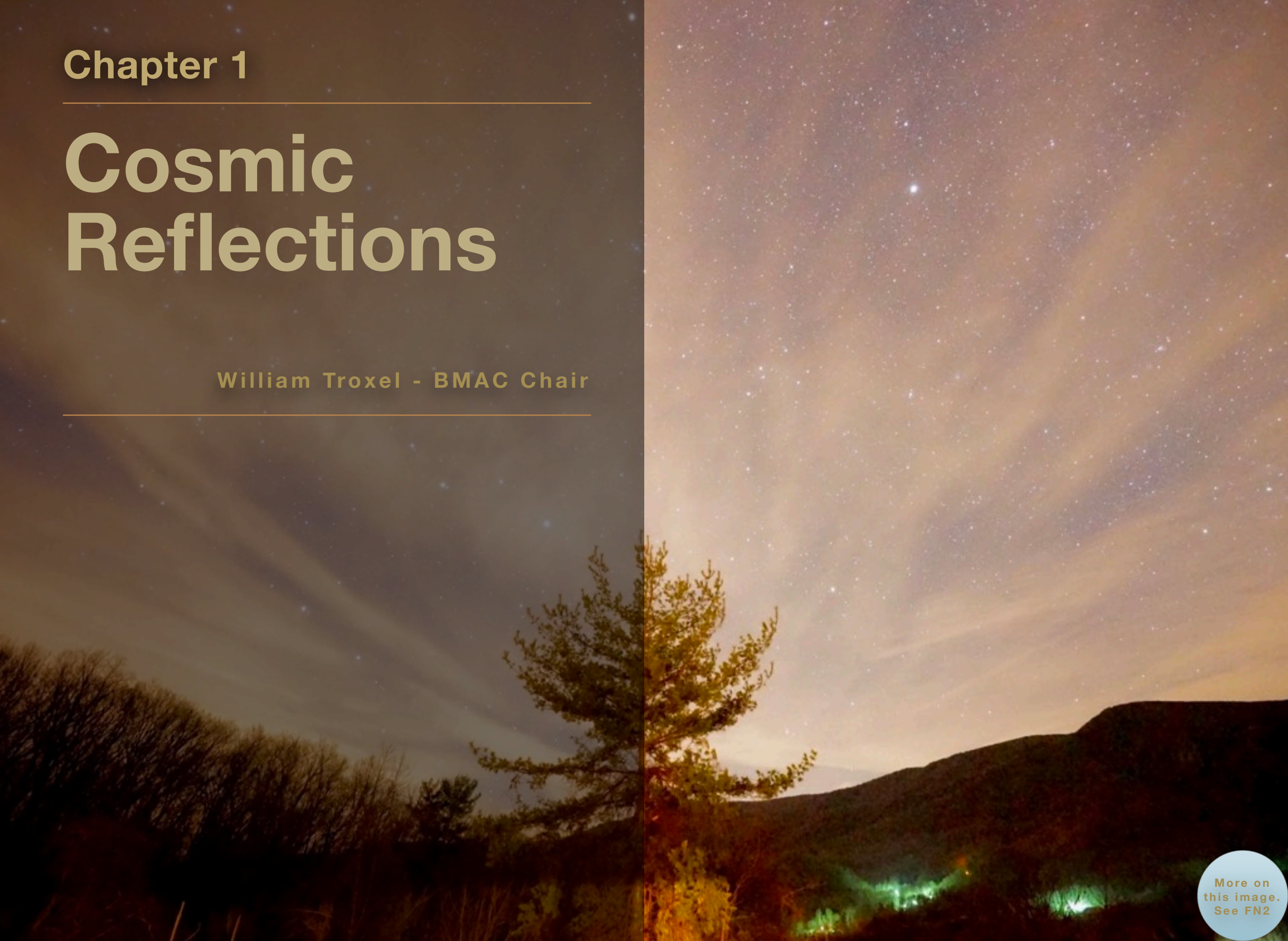
Chapter 1

Cosmic Reflections

William Troxel - BMAC Chair



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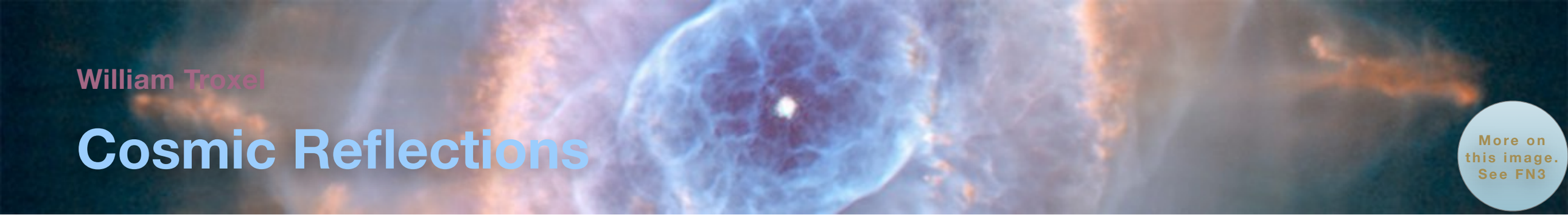


William Troxel

Cosmic Reflections

More on this image. See FN3

Greetings BMACer's. May is upon us. I hope you are having a good year so far. The work in the Park is still going on and moving forward, although it looks to my eyes as it is moving slowly. I am anxiously waiting to see the finished project. A few of you have been asking me if I know or have heard any updates. I will need to defer your questions to Adam or Jason. I still think it will be good for the Park and the club. StarWatch and SunWatch is being held at the dam for now. Until the projects are completed, this is where both events will be. I remind you, should you come up for either event you will need to park in the main parking lot. We have been having good attendance and I am hoping it will continue as the projects move forward. [Ed.: Observing from the dam for the StarWatches has not been much of a problem. When it is clear(ish), we've been seeing 30-70 people attend! The only real issue is elbow space. The parking lot is mostly done, but not finished. It will be by the end of the month. The repairs to fix dips in the entrance road is finished. Now they are installing a much needed sewage line to feed to the City line. That will run along the road. Then, they will pave the entire entrance road. The entire set of these projects will be done this summer.]

I want to thank everyone that participated in last month's meeting. Everyone did a great job and I think everyone enjoyed the meeting. We had a few visitors at the meeting last month. It is always encouraging to see visitors. Please help me welcome anyone that is visiting our meetings.

Astronomy Definitions:

This month I want to add the following to your list of definitions.

Asteroid - (noun) a small rocky body orbiting the Sun. Large numbers of these, ranging in size from nearly 600 miles (1,000 km) across (Ceres) to dust particles, are found (as the asteroid belt) especially between the orbits of Mars and Jupiter, though some have more eccentric orbits, and a few pass close to the Earth or enter the atmosphere as meteors.

Meteor- (noun) a small body of matter from outer space that enters the Earth's atmosphere, becoming incandescent as a result of friction and appearing as a streak of light.

Pulsar- (noun) a celestial object that is a rapidly rotating neutron star that emits regular pulses of radio waves and other

electromagnetic radiation when its magnetic pole sweeps over the Earth at rates of up to one thousand pulses per second.

May Constellation Conversation:

May's constellation is Crater and Corvus. These are 2 of the original 48 Greek constellations listed by Ptolemy in the Almagest. Below is the myth / story as written.

These two adjacent constellations are linked in a moral tale that goes back at least to the time of Eratosthenes in the third century BCE. As told by Ovid in his Fasti, Apollo was about to make a sacrifice to Zeus and sent the crow to fetch water from a running spring. The crow flew off with a bowl in its claws until it came to a fig tree laden with unripe fruit. Ignoring its orders, the crow waited several days for the fruit to ripen, by which time Apollo had been forced to find a source of water for himself.

After eating its fill of the delicious fruit, the crow looked around for an alibi. He picked up a water-snake in his claws and returned to Apollo, blaming the serpent for blocking the spring. But Apollo, one of whose skills was the art of prophecy, saw through the lie and condemned the crow to a life of thirst – which is perhaps one explanation for the rasping call of the crow. In memorial of this incident Apollo put the crow, the cup, and the water-snake together in the sky.

Additionally, Crater is know as “the cup,” and Corvus is know as “the Crow.” An additional tale about Corvus is that the Crow originally was totally white in color. This story was related by Ovid in his Metamorphoses, the crow was once snow-white like a dove, but the bird brought news to Apollo that his love, Coronis, had been unfaithful. Apollo in his anger cursed the crow, turning it forever black.

I encourage you to read Jason’s article as he will be talking more in detail about the technical aspects of these two constellations and their location in our night sky. Maybe you will want to add these two small constellations to your list of stars to keep track.

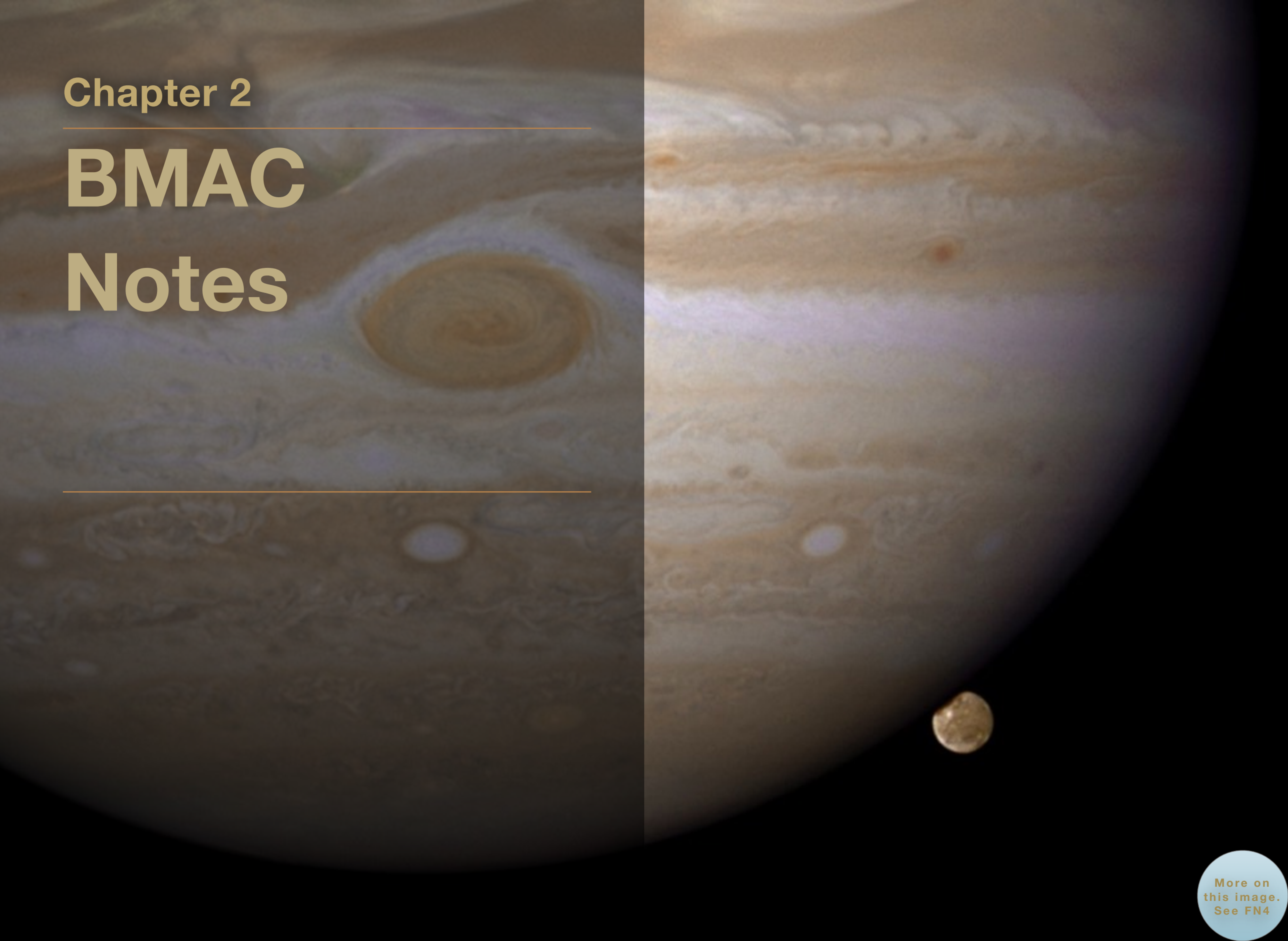
May's meeting on the 3rd will feature the young men and women students from Tom Rutherford’s Sullivan South High School astronomy class. His students always have some very interesting projects to share. Please try to make an effort to come out to show your support for these young future scientists. We will start our meeting at 7 p.m. in the Discovery Theater class room on the lower level of the Nature Center.

Just as a reminder to everyone that the June Meeting of the Club will be on the second Friday night (June 14, 2019), not the 1st Friday night as normal. This change is only for the June meeting. We will still have a presentation and one of the business items will be the election for the one office of the club. Please make sure to mark your calendar of the different date. Thanks again for reading my article. I am looking forward to seeing each of you.

Until Next time…. Clear Skies.

Chapter 2

BMAC Notes



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BMAC News

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Roy Morrow Passing

I am sad to say that long time StarFest attendee Roy Morrow from the ORION group had passed away earlier this month due to a large stroke. He was a great guy with a real interest in observing the night sky. He always had a smile and a kind word too.

Chapter 3

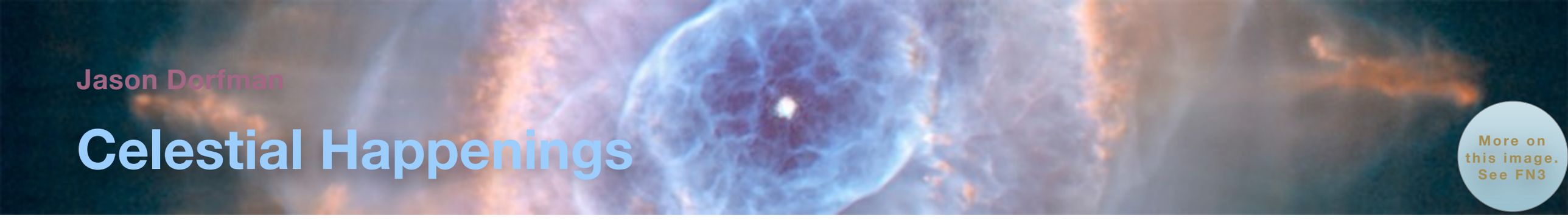
Celestial Happenings

Jason Dorfman

More on this image. See FN5

Jason Dorfman

Celestial Happenings



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Greetings to all my fellow stargazers. We have definitely been having some April showers this year, which are already resulting in some (early) May flowers, as the saying goes. The landscape is alive with color as the trees and plants are blossoming and the bleak winter terrain is transformed into a lush and green environment. The days are getting longer but, with the warming temperatures, the conditions for observing are quite wonderful.

Mars continues to be the prominent planet in the evening sky, though by month's end, we'll see Jupiter and Mercury joining the Red Planet. The Moon passing through the Beehive Cluster and a moonless peak night for the eta Aquariid meteor shower are a couple of the other highlights for the month.

For the beginning of the month, we'll see the early morning twilight begin to touch the sky at 5 a.m. with sunrise happening at 6:36 a.m. The Sun will set on the 1st at 8:19 p.m. with astronomical twilight ending at 9:55 p.m. When we reach the 31st, the twilight glow will begin at 4:25 a.m. with the Sun rising at 6:13 a.m. and sunset occurs at 8:43 p.m. with the last evening twilight fading away by 10:30 p.m.

Planets

As the month of May begins and the last embers of the setting Sun are dying out, you'll find Mars in the west floating amidst the horns of Taurus. An hour after sundown look a bit north of due west and up roughly 25° in altitude for the Red Planet. Mars begins the month at magnitude +1.6. On the 6th, Mars will lie on the line between the two horn stars in Taurus, Elnath and Tianguan.

Mars continues its swift easterly movement throughout May and crosses into Gemini on the 16th. By the 31st, Mars will reach a point just 1° south of Epsilon Geminorum. Look about 13° high an hour after sunset to find the now magnitude +1.8 world. Telescopic views will continue to be disappointing, however, with the disk of the Red Planet spanning only about 4" throughout the month.

The small and elusive world of Mercury will emerge from the twilight glow of the setting Sun as we approach the end of the month. On the 31st, a half hour after sunset, look about 5° high in the WNW for magnitude -1.1 Mercury. As long as you have a

clear view towards the horizon, you should be able to see it against the twilight sky.

As the evening turns to night, turn your gaze to the southeast for mighty Jupiter. The King of the Planets rises near 11:30 p.m. on the 1st, but it won't reach its highest altitude due south until closer to 4:30 a.m., when it will be 30° high. It will rise 2 hours earlier by month's end just as the sky is beginning to darken, climbing to an altitude of roughly 32° due south shortly after 2 a.m. The gas giant shines at magnitude -2.45 at the start of the month and will brighten slightly to magnitude -2.6 by month's end. Telescopes will reveal the brilliantly banded atmosphere of the planet growing slightly from 43" to 46" in diameter over the month. Jupiter lies in southern Ophiuchus about 15° east of Antares and is currently moving in a slow retrograde motion during May.

Next to rise is the beautiful ringed-world of Saturn appearing above the horizon two hours after Jupiter. Like Jupiter, Saturn will brighten slightly during May from magnitude +0.45 to +0.3. At mid-month a telescope will show the planet spanning 18" in diameter with the rings extending to 40" and tilted 24° to our line of sight.

Optimal observations will occur closer to dawn as Saturn reaches an altitude of 32° above the horizon due south just as the sky is beginning to lighten at the start of the month and closer to 4:30 a.m. as the month comes to a close.

Since Venus reached its greatest western elongation back in the first week of January, it has slowly been making its way back towards the Sun. This month our sister planet begins to descend into the growing morning twilight. However, at magnitude -3.8, Venus will still be easily visible despite the brightening sky. All month long, Venus will rise about an hour before the Sun and reach an altitude of 5° a half hour later. Look for it due east at the start of May. It will rise a little farther north each day reaching a position at month's end roughly 15° further north from where it began.

Luna

May begins with a thin crescent Moon in the early morning sky. On the 2nd, a very thin crescent Moon will be 4° to the south of Venus. Spotting it, however, will be quite a feat with the early glow of twilight as its backdrop. On the 6th when you are looking for Mars between the horn stars of Taurus, a two day old Moon will lie above the Hyades cluster that makes the face of the bull. It will be about 10° high in the WNW just as the last vestiges of twilight are fading away. On the next night, the waxing crescent Moon will have jumped up to a position just over 5' from the horn star, Tianguan, about a degree from the Crab Nebula and 3° south of Mars.

If you've ever wanted to catch a star being occulted by the Moon, then be sure to observe on the 10th as the crescent Moon passes through the Beehive cluster (M44) in Cancer. You're sure to see

lots of star occultations as the Moon crosses through this rich cluster of stars.

Full Moon occurs on the night of the 18th. A waning gibbous Moon will appear 7° west of Jupiter on the 19th and then about the same distance to the east of the gas giant on the following night.

Constellation of the Month

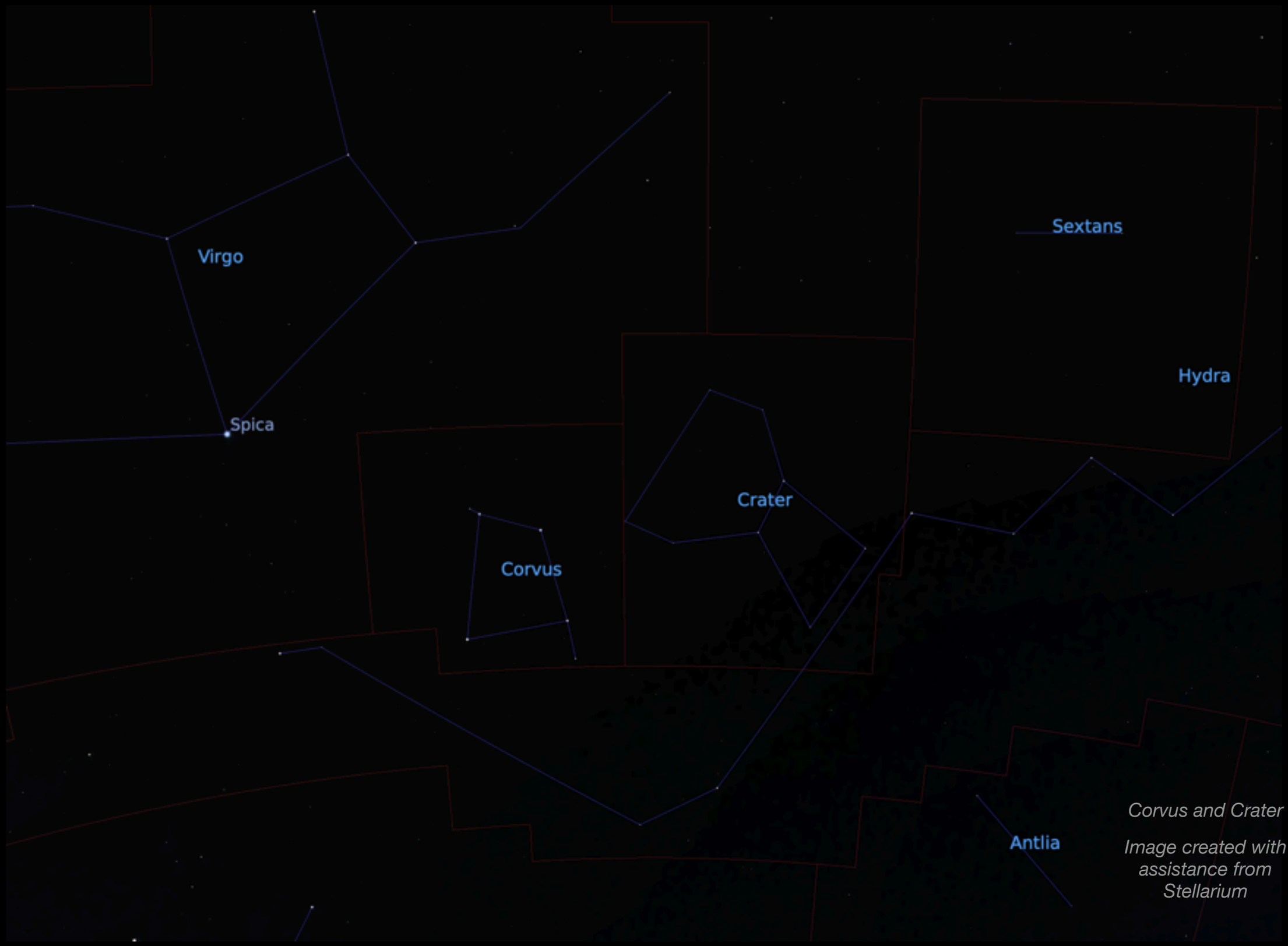
This month we decided to look at two less-prominent constellations, Crater and Corvus, which lie next to one another in the southern celestial hemisphere. They are located between 11 h and 13 h in right ascension and about -17° in declination. On the 1st, the pair will be about 35° high above the southern horizon around 11 p.m. Corvus, the raven, lies to the east of Crater, the cup. Virgo lies to the north and east of Corvus, while Hydra spans along the southern border of both and borders most of the western edge of Crater with Sextans completing the rest of the western border with Crater. While a little bit of Virgo is along the northern edge of Crater, the back leg of Leo juts down between Virgo and Sextans to form most of Crater's northern border.

Lying outside the band of our Milky Way, this region is somewhat devoid of interesting observational targets — no nebulae or Messier objects. Surprisingly, however, this area is also lacking in bright observable galaxies. The brightest at magnitude +10.9 is a pair of interacting galaxies in Corvus known as the Antennae (NGC 4038 and 4039), also known as the Ringtail Galaxy. These are two spiral galaxies that began colliding with one another a few hundred million years ago. In the included image, the yellow areas are the original cores of each galaxy. The gravitational interactions between the galaxies have resulted in increased star formation shown in red and blue. A wider field view reveals the tidal tails extending out in opposite directions from the interacting pair.

Eta Aquariid Meteor Shower

Though comet Halley will not make its return for some time to come, this month we can observe some of the debris left behind from this historic comet with the peak of the eta Aquariids meteor shower. This shower is active from April 19th to May 28th and peaks on the morning of May 5th. As fortune would have it, the New Moon occurs on the 4th, so you'll have a dark, moonless sky the morning of the peak. These are swift meteors associated with this shower that tend to produce a high percentage of persistent trains, but few fireballs. The ZHR (Zenithal Hourly Rate) is 40. [Ed.: Be aware that the ZHR is calculated for ideal observing conditions and the radiant is at the zenith.] Head outside about 2 hours prior to sunrise as Aquarius is rising in the East for the best opportunity to observe some of these events.

That's all for this month. Clear Skies!



Corvus and Crater

Image created with assistance from Stellarium

The NASA/ESA Hubble Space Telescope has snapped the best ever image of the Antennae Galaxies. Hubble has released images of these stunning galaxies twice before, once using observations from its Wide Field and Planetary Camera 2 (WFPC2) in 1997, and again in 2006 from the Advanced Camera for Surveys (ACS). Each of Hubble's images of the Antennae Galaxies has been better than the last, due to upgrades made during the famous servicing missions, the last of which took place in 2009.

The galaxies — also known as NGC 4038 and NGC 4039 — are locked in a deadly embrace. Once normal, sedate spiral galaxies like the Milky Way, the pair have spent the past few hundred million years sparring with one another. This clash is so violent that stars have been ripped from their host galaxies to form a streaming arc between the two. In wide-field images of the pair the reason for their name becomes clear — far-flung stars and streamers of gas stretch out into space, creating long tidal tails reminiscent of antennae.

This new image of the Antennae Galaxies shows obvious signs of chaos. Clouds of gas are seen in bright pink and red, surrounding the bright flashes of blue star-forming regions — some of which are partially obscured by dark patches of dust. The rate of star formation is so high that the Antennae Galaxies are said to be in a state of starburst, a period in which all of the gas within the galaxies is being used to form stars. This cannot last forever and neither can the separate galaxies; eventually the nuclei will coalesce, and the galaxies will begin their retirement together as one large elliptical galaxy.

This image uses visible and near-infrared observations from Hubble's Wide Field Camera 3 (WFC3), along with some of the previously-released observations from Hubble's Advanced Camera for Surveys (ACS).

Image from ESA/Hubble & NASA

Chapter 4

The Queen Speaks

Robin Byrne

Robin Byrne

Happy Birthday Alexei Leonov

More on this image. See FN3

Continuing in the theme of space firsts as we head toward the Apollo 11 anniversary, this month we celebrate the life and achievements of another pioneer in space. Alexei Leonov was born May 30, 1934 in the Soviet Union in Listvyanka, in Siberia. When Alexei was only 2 years old, his father was declared an “enemy of the people.” In Leonov’s autobiography, he downplays this designation, saying "He was not alone: many were being arrested. It was part of a conscientious drive by the authorities to eradicate anyone who showed too much independence or strength of character. These were the years of Stalin's purges." Alexei attended the Soviet Air Force Academy of Arts, as well as the Pilot prep school. Ultimately, he graduated with honors from the Chuguyev Higher Air Force School in 1957. Later, in 1968, Alexei graduated from the Zhukovskiy Air Force Engineering Academy. In 1981, he received a Candidate of Technical Sciences degree.

In 1960, Leonov was one of 20 Soviet Air Force pilots chosen to be the first cosmonauts. On March 18, 1965, Leonov flew with Pavel Belyayev aboard the Voskhod 2 flight. An hour and a half after launch, Alexei Leonov became the first person to walk in space. For twelve minutes, he floated in space while tethered to the spacecraft. Because of the secrecy surrounding the Soviet space program, no one knew ahead of time that he was going to do the spacewalk. Leonov’s father learned about it while watching it live on television. The elder Leonov’s reaction was disbelief, saying, “Why is he acting like a juvenile delinquent? Everyone else can complete their mission properly, inside the spacecraft. What is he doing clambering about outside? Somebody must tell him to get back inside immediately. He must be punished for this.” As the capsule approached the night side of Earth, it was time to reenter the spacecraft. However, due to the lack of atmospheric pressure in space, Leonov’s spacesuit had expanded and become stiff, which prevented him from maneuvering back into the capsule. Instead of entering feet-first, as had been the plan, Leonov had to enter head-first while opening a valve on his suit to let some of the air out. Inch by inch, he squeezed back into the spacecraft’s airlock. Once inside, Leonov had to awkwardly reach back around to close the hatch before Belyayev could pressurize the airlock and open the inner hatch. While his spacewalk had been televised live, as soon as it was obvious that Leonov was having trouble, the

"Soviet cosmonauts". Soviet cosmonauts (front row, from left): Vladimir Komarov (Voskhod 1), Yuri Gagarin (Vostok 1), Valentina Tereshkova (Vostok 6), Andriyan Nikolayev (Vostok 3), Konstantin Feoktistov (Voskhod 1), Pavel Belyayev (Voskhod 2), second row: Alexey Leonov (Voskhod 2), Gherman Titov (Vostok 2), Valery Bykovsky (Vostok 5), Boris Yegorov (Voskhod 1), and Pavel Popovich (Vostok 4). Star City. July 1, 1965.

From: RIA Novosti archive, image #888102 / Alexander Mokletsov / CC-BY-SA 3.0

transmission was abruptly stopped, replaced by classical music.

The end of the mission was just as, if not more, dramatic. Just minutes before their retro-rockets were set to fire for Earth reentry, Leonov discovered that the guidance computer was not working properly. That meant having to perform their reentry manually. As the mission Navigator, it was Leonov's job to work everything out. He chose a landing site near the city of Perm, figuring that even if they were very off course, they, at least, would still be within the Soviet Union. As they were slowly moving toward Earth, the crew heard a transmission from Yuri Gagarin asking them where they had landed. Mission control thought they had already landed. Belyayev calmly explained their situation, saying that they had to turn off the automatic landing program, and they were low on fuel for maneuvering into proper position for reentry.

After the final firing of the reentry engines, the orbital module and landing module were supposed to separate. However, that isn't what happened, and they remained connected via a communications cable. That caused the two components to spin around each other so rapidly that the crew experienced close to 10 G's of acceleration, causing some blood vessels in their eyes to rupture. Finally, the heat of re-entry caused the cable to burn through. Once they were free, the parachute opened, allowing them to float downward until the landing engines fired, and they were safely on the ground. However, they were in six feet of snow, and over 1000 miles away from their expected landing site. As night drew near, the two men, while ecstatic to be safely back on Earth, knew there was still danger. They had opened their hatch to see where they were (which disappeared in the snow), so they were exposed to the cold, not to mention potentially dangerous bears and wolves in the vicinity.

Mission control had not received their signal for where they landed, but various civilian aircraft in the area had. One helicopter tried to have them climb up a rope ladder, which was impossible in their bulky space suits. Another tossed them a bottle of cognac, which immediately broke when hitting the ground. Another plane tossed them boots and clothes. While the clothes got stuck in a tree, the boots were most welcome. Meanwhile, Leonov, who had worked up quite a sweat during his spacewalk, was getting very chilled from the moisture in his suit. The two men had to strip down, wring out the moisture from their underwear, and remove the outer layers from their spacesuits to wear only the more pliable inner layer. They spent a cold night in the capsule as temperatures dropped to -22 degrees Fahrenheit with no way to cover the hatch while snow fell. The next morning, a search crew found them, but it took another day before enough trees were cleared for a helicopter to land and retrieve the two men. In the meantime, a basic shelter, warm fire, hot bath, dry clothes, and food were provided for the crew. Ultimately, their 26-hour spaceflight turned into a 3-day ordeal. Leonov was given the Hero of the Soviet Union award for his spacewalk.

For the next ten years, Leonov would be assigned to various missions, with each one being cancelled, instead. Finally, in 1975, Leonov was named the Commander of another historic mission, Apollo-Soyuz, the first joint Soviet-US spaceflight. Flying with Leonov in the Soyuz capsule was Valerie Kubasov, while the American crew flying in the Apollo capsule were Tom Stafford, Vance Brand, and Deke Slayton. Despite being chosen as one of the original Mercury astronauts, this was Deke Slayton's first spaceflight after years of being grounded for an irregular heartbeat. The two crews trained together, both in the Soviet Union and America, while each learned the other's language. On July 15, 1975, both spacecraft launched, docking two days later. They spent about two days docked together, spending time on both spacecraft. A couple experiments were conducted together, and then they parted. On July 21, Leonov and Kubasov landed, ending Leonov's space career, but earning him a second Hero of the Soviet Union award.

After retiring from flying in space, for the next six years, Leonov worked as the Chief Cosmonaut and was also the deputy director of the Yuri Gagarin Cosmonaut Training Center. In 1991 Leonov officially retired from government service. Since then, he has filled many roles: chair of an investment corporation, artist, and author. Leonov's artwork has been published in several books. During Apollo-Soyuz, he had taken colored pencils and paper with him and sketched views of Earth, plus portraits of the American astronauts. In 1980, Leonov and Valentin Selivanov co-wrote the script for a movie titled The Orion Loop. In 2004, Leonov and US astronaut David Scott began co-writing a book titled Two Sides of the Moon: Our Story of the Cold War in Space, which was published in 2006.

Hardly one to rest on his laurels, Alexei Leonov is someone to be admired. From his pioneering spacewalk to his joint mission with the United States to his artwork and writing, Leonov seems to excel at everything he does. There's even a crater on the far side of the Moon named for him. As we get ready to celebrate the Moon landing anniversary, it is worth recalling that our space race with the Soviet Union was a driving force behind Kennedy's push to land on the Moon before the end of the decade. One of the people who helped nudge us closer to the Moon was Alexei Leonov.

References:

Alexei Leonov - Wikipedia

https://en.wikipedia.org/wiki/Alexei_Leonov

Alexei A.Leonov - International Space Hall of Fame

http://www.nmspacemuseum.org/halloffame/detail.php?id=17

The Nightmare of Voskhod 2 by Alexei Leonov Air & Space Magazine, January 2005

https://www.airspacemag.com/space/the-nightmare-of-voskhod-2-8655378/

S75-22410 (March 1975) --- These five men compose the two prime crews of the first-ever two-nation cooperative space mission, known in the US as the Apollo-Soyuz Test Project (ASTP) and in the Soviet Union as the Soyuz-Apollo Experimental Flight (Russian: Экспериментальный полёт Союз-Аполлон, Eksperimantalniy polyot Soyuz-Apollon). This was a docking mission in Earth orbit scheduled for July 1975. They are astronaut Thomas P. Stafford (standing on left), commander of the American crew; cosmonaut Aleksey A. Leonov (standing on right), commander of the Soviet crew; astronaut Donald K. Slayton (seated on left), docking module pilot of the American crew; astronaut Vance D. Brand (seated center), command module pilot of the American crew; and cosmonaut Valeriy N. Kubasov (seated on right), engineer on the Soviet crew. The crew members wear the same mission patch, but oriented to reflect "Soyuz-Apollo" or "Apollo-Soyuz", as the program was called in their respective countries.

From: NASA; Restoration by Adam Cuerden

This is the American crew insignia of the joint United States-USSR Apollo-Soyuz Test Project (ASTP). Of circular design, the insignia has a colorful border area, outlined in red, with the names of the five crew members and the words Apollo in English and Soyuz in Russian around an artist's concept of the Apollo and Soyuz spacecraft about to dock in Earth orbit. The bright sun and the blue and white Earth are in the background. The white stars on the blue background represent American astronauts Thomas P. Stafford, commander; Vance D. Brand, command module pilot; and Donald (Deke) K. Slayton, docking module pilot. The dark gold stars on the red background represent Soviet cosmonauts Aleksey A. Leonov, commander, and Valeriy N. Kubasov, engineer.

From: NASA

S74-20824 (April 1974) --- Cosmonaut Aleksey A. Leonov

From: NASA

Chapter 5

Space Place

More on this image. See FN6

David Prosper

Watching the Late Spring Skies

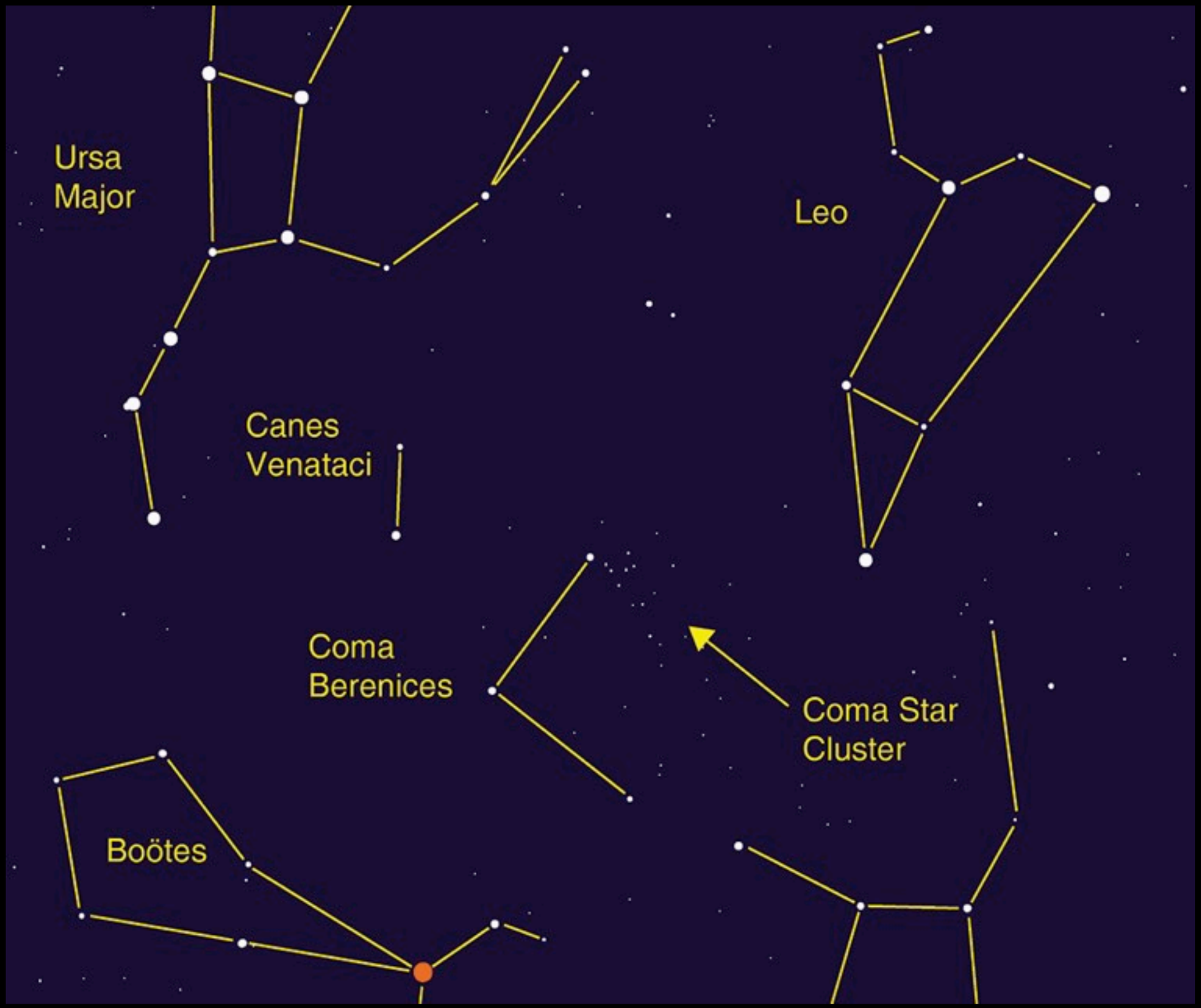
More on this image. See FN3

Late spring brings warmer nights, making it more comfortable to observe a good showing of the Eta Aquarids meteor shower. Skywatchers can also look for the delicate Coma Star Cluster, and spot the Moon on the anniversary of Apollo 10's "test run" prior to the Moon landing in 1969.

The Eta Aquarids meteor shower should make a good showing this year, peaking the morning of May 6. This meteor shower has an unusual "soft peak," meaning that many meteors can be spotted several days before and after the 6th; many may find it convenient to schedule meteor watching for the weekend, a night or two before the peak. You may be able to spot a couple dozen meteors an hour from areas with clear dark skies. Meteors can appear in any part of the sky and you don't need any special equipment to view them; just find an area away from lights, lie down on a comfy lawn chair or blanket, relax, and patiently look up. These brief bright streaks are caused by Earth moving through the stream of fine dust particles left by the passage of Comet Halley. While we have to wait another 43 years for the famous comet to grace our skies once more, we are treated to this beautiful cosmic postcard every year.

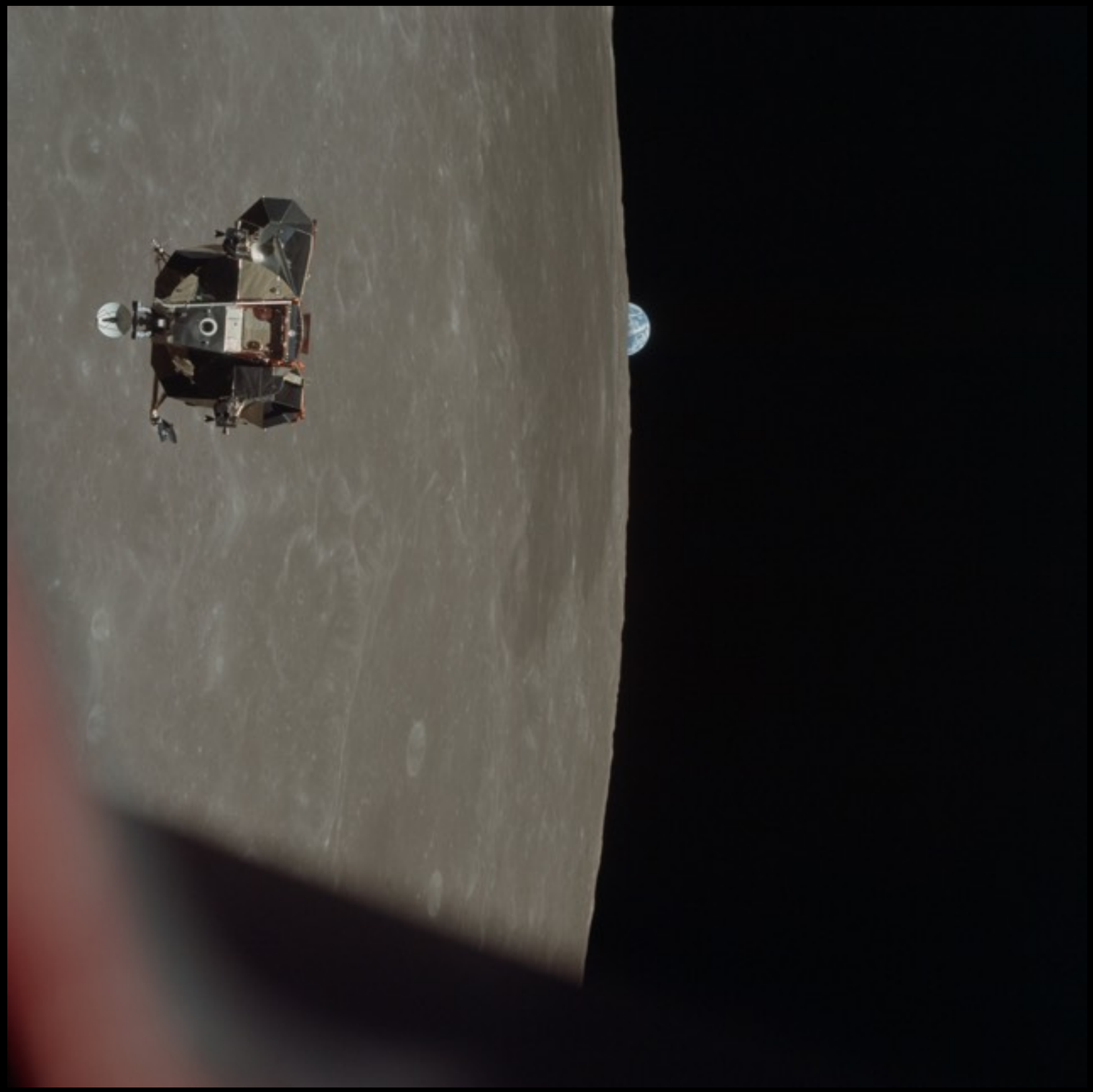
While you're up meteor watching, try to find a delightful naked eye star cluster: the Coma Star Cluster (aka Melotte 111) in the small constellation of Coma Berenices. It can be spotted after sunset in the east and for almost the entire night during the month of May. Look for it inside the area of the sky roughly framed between the constellations of Leo, Boötes, and Ursa Major. The cluster's sparkly members are also known as "Berenice's Hair" in honor of Egyptian Queen Berenices II's sacrifice of her lovely tresses. Binoculars will bring out even more stars in this large, young cluster.

May marks the 50th anniversary of the Lunar Module's test run by the Apollo 10 mission! On May 22, 1969, NASA astronauts Thomas Stafford and Eugene Cernan piloted the Lunar Module - nicknamed "Snoopy" - on a test descent towards the lunar surface. Undocking from "Charlie Brown" - the Command Module, piloted by John Young – they descended to 47,400 feet above the surface of the Moon before returning safely to the orbiting Command Module. Their success paved the way for the first humans to land on the Moon later that year with Apollo 11. Look for the Moon on the morning of May 22, before or after dawn, and contemplate what it must have felt like to hover mere miles above the lunar surface. You'll also see the bright, giant



Try to spot the Coma Star Cluster!

Image created with assistance from Stellarium



More on this image. See FN8

planets Saturn and Jupiter on either side of the Moon before sunrise. When will humans travel to those distant worlds?

You can catch up on all of NASA's current and future missions 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.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

More on this image. See FN3

Date	Time	Location	Notes
BMAC Meetings			
Friday, May 3, 2019	7 p.m.	Nature Center Discovery Theater	Program: Students from Sullivan South High School will present papers on their current scientific research. Lead educator, Thomas Rutherford. Titles: 1) Using Gaia Data to Determine the Distance and Size of the Open Cluster NGC 2420. 2) A Search for Exoplanets in the Galactic Open Cluster NGC 2355. 3) The Effects of Red Light on the Germination of Lettuce. 4) The Effect of pH on Lead Toxicity in Brine Shrimp (Artemia). 5) Microplastics in Bottled Water. 6) Terra-forming Mars.; Free.
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.
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			
Mar. 2, 9, 2019	7 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.
Mar. 16, 23, 30, 2019	8 p.m.		
Apr. 6, 13, 20, 27, 2019	8:30 p.m.		
Special Events			
Saturday, May 11, 2019	1-4:30 p.m. 8:30-9:30 p.m.	Nature Center & Observatory	Annual Astronomy Day - Displays et al. on the walkway leading to the Nature Center, 1-4:30 p.m.; Solar viewing 3-3:30 p.m. at the dam; Night viewing 8:30-9:30 p.m. at the observatory. All non-planetarium astronomy activities are free.
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.

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

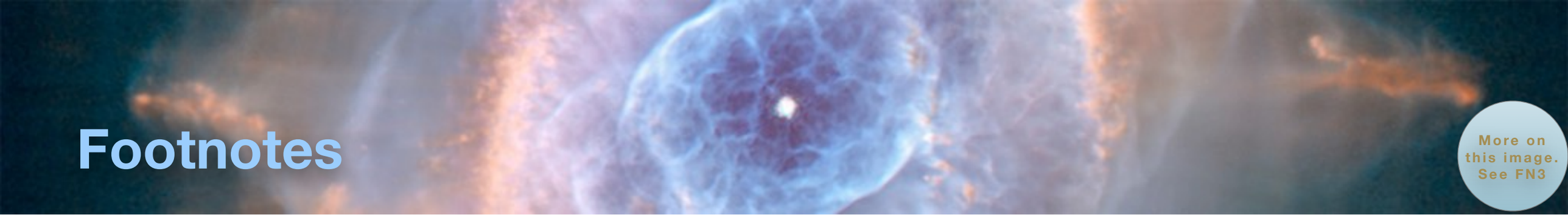
Robin has been writing the science history column since 1992 and was chair in 1997. She is an Associate Professor of Astronomy & Physics at Northeast State Community College (NSCC).

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

More on this image. See FN3

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 May 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 view of Apollo 10's Lunar Module from the Command Module as it returned from maneuvers above the lunar surface.

Photo Credit: NASA