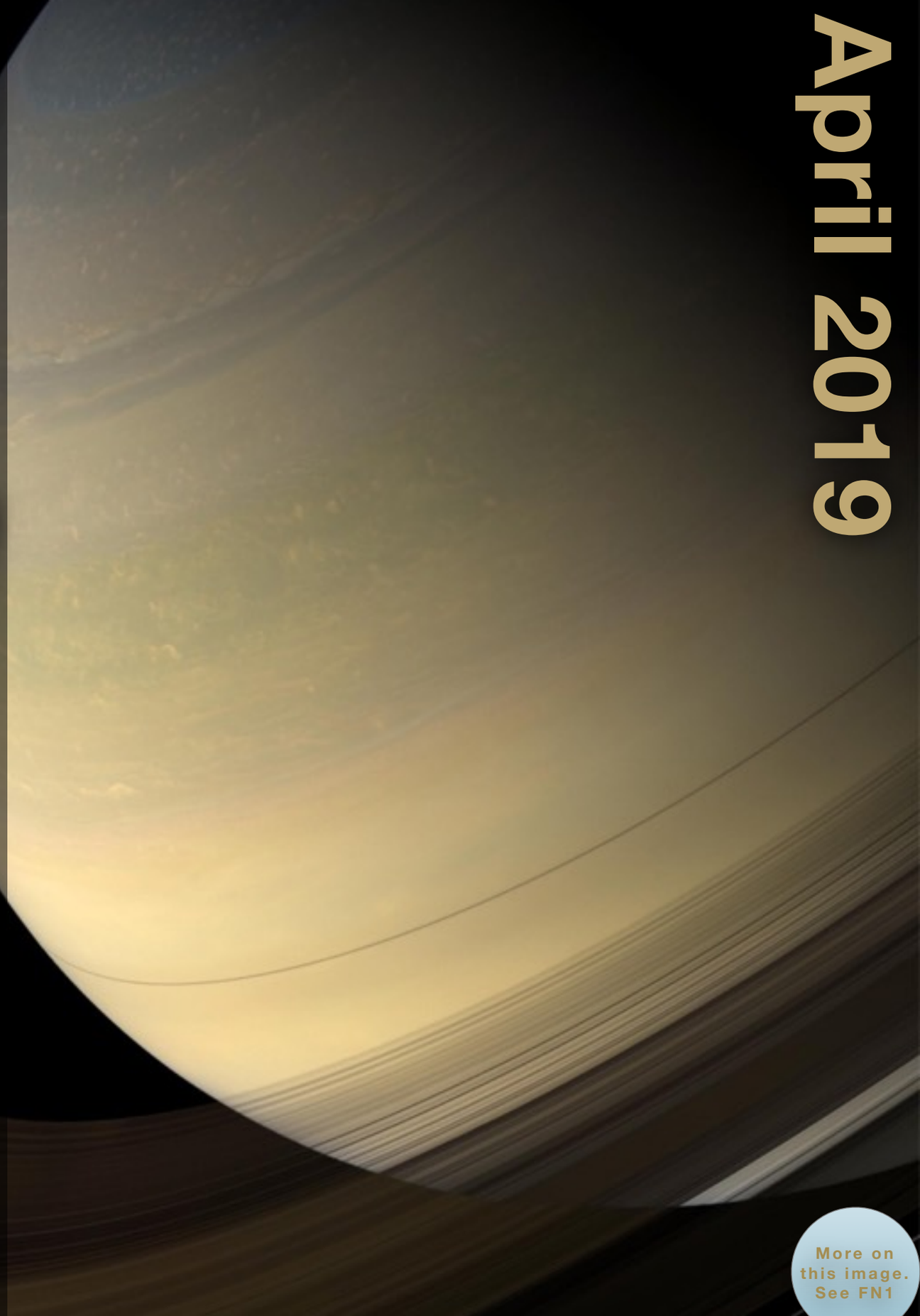
The Monthly Newsletter of the

Bays Mountain Astronomy Club

April 2019



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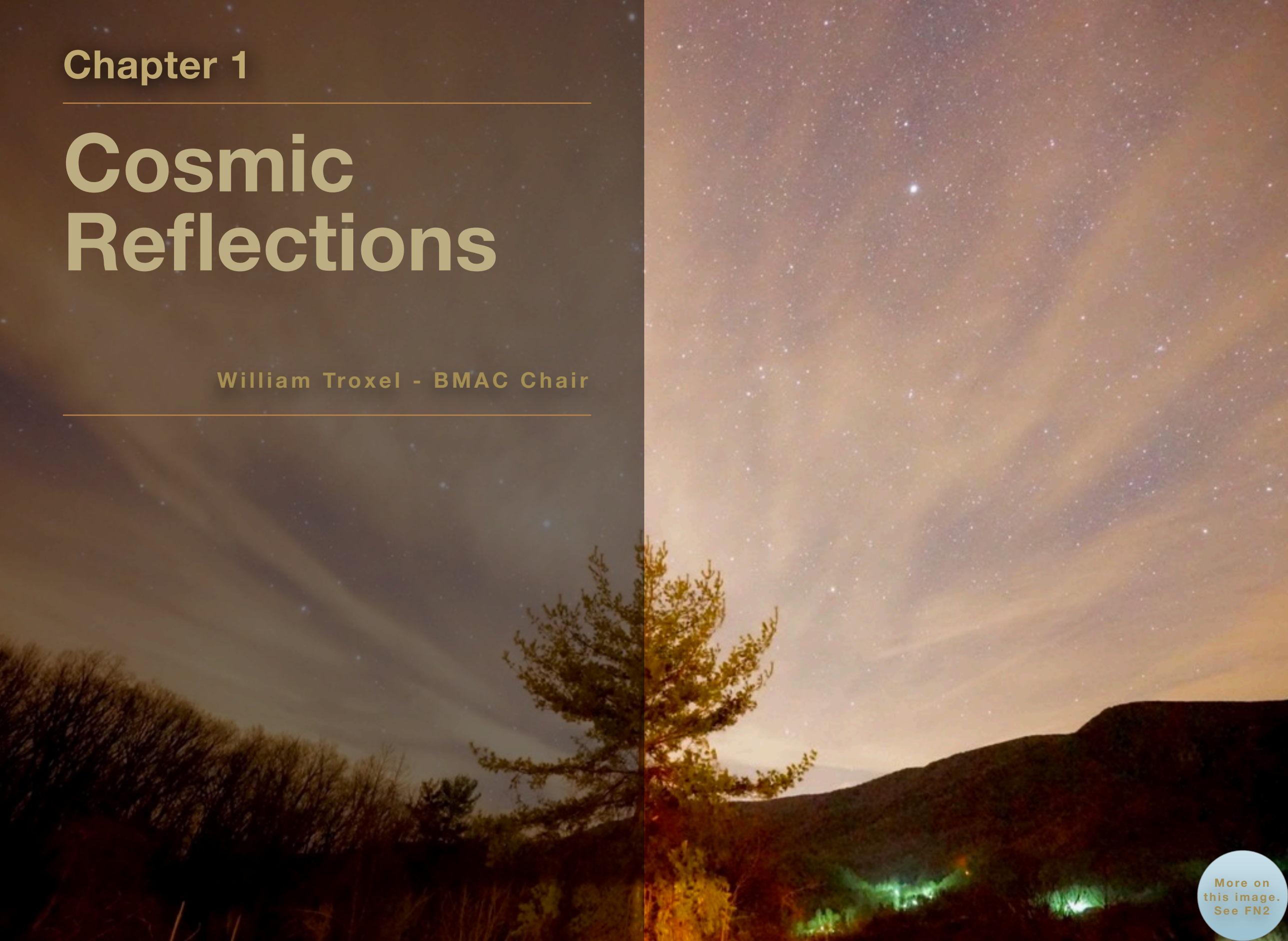
Edited by Adam Thanz

Chapter 1

Cosmic Reflections

William Troxel - BMAC Chair



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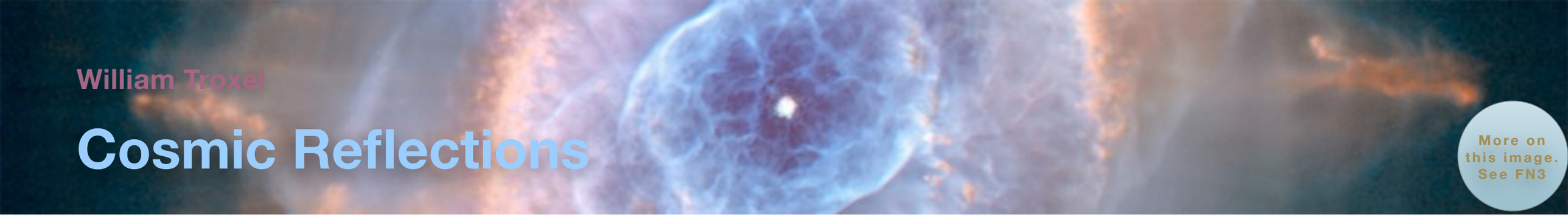


William Troxel

Cosmic Reflections

More on this image. See FN3

Greetings BMACers! April lets us know that the spring StarWatch is half over. It’s East Tennessee, so weather plays a major factor in this seasonal program. This year, the Park has also been experiencing a major addition to its parking so the March StarWatches have been affected. As of this writing, two have been in the planetarium due to weather and one has been at the dam. The one for March 23 looks like it will be at the dam as well. It currently looks like the observatory will still be off limits until mid April for the parking project to be complete. Whether it is completed then or later, we'll keep up the momentum and enthrall visitors at our alternative site. The viewing on March 16 was quite successful with 60 attending! I hope the park renovation will be completed very soon. Please keep watching the website for updates.

I want to thank Adam for the wonderful presentation at the March Meeting. The focus was on the stars and deep sky objects that we should be able to see hosting the StarWatches for March and April. The presentation showed us some interesting information that we can use to share with the public when we are outside. A hand out called "BMAC Meeting 20190301 Notes - Spring Sky" contained very interesting facts. To start the program, Adam showed us how to put our Smart Phone into night vision. This is one of those little things that are very important to know, because we all know that any bright light around the scope will distract, making it hard to see anything. Remember to remind your guests visiting your party, many will already know how to change the screen color. Review the notes and work the information into your fun. Everyone enjoyed the presentation. I know I learn a lot of new things. Again, thank you Adam and also Jason for helping out with the presentation.

Astronomy Definitions

From www.dictionary.com

This month I want to add 3 more words to your list. Here they are:

NEBULA - (Noun) A cloud of interstellar gas and dust. Any celestial object that appears nebulous, hazy, or fuzzy and extended in a telescope view.

Sentence Use: "We studied the nebula of Orion in depth, and depicted it in a large drawing."

LIGHT YEAR - (Noun) The distance traversed by light in one mean solar year, about 5.88 trillion mi. (9.46 trillion Km) : used as a unit in measuring stellar distances.

Sentence Use: "How many light years away is Sirius?"

BLACK HOLE - (Noun) A theoretical massive object, formed at the beginning of the Universe or by the gravitational collapse of a star exploding as a supernova, whose gravitational field is so intense that no electromagnetic radiation can escape.

Sentence Use: "Radio signals received from the galaxy's center back up the black hole theory."

April Constellation Conversation:

This month our constellation conversation is centered on Leo. We have archaeological evidence that the Mesopotamians had a similar constellation as early as 4000 BCE. The Persians called it Sir or Shir; the Turks, Artan; the Syrians, Aryo; the Jews, Arye; the Indians, Simha; which all mean Lion. In Greek mythology, the lion was conceded to be the Nemean Lion which was killed by Heracles (Hercules) during the first of his twelve labors. It was believed the Nemean lion would take women as hostages to its lair in a cave, this would then lure the village warriors out to fight for a damsel in distress, only to their misfortune. The lion was believed to be impervious to any weaponry used by the warriors. Thus enters the hero Hercules. Hercules knew that his weapons would not help him. His plan was to slip into the cave and attack the lion with his bare hands. Mythology states that Hercules lay in wait to catch the lion in close quarters. When the lion pounced, Hercules, it is said, caught the lion in mid air, with one hand grasping its fore legs and the other its hind legs, and bent it backward, breaking its back and freeing the trapped maidens.

Even though this is one constellation that we all know, it is still very interesting every time I read it. Please read Jason's article as he will be focusing on some of the different celestial objects that are located within this very large constellation. Either way, I think it will be a good one to add to your observation lists.

Upcoming Meetings

We have got a lot of things happening over the next few months for the club. Please check the website for the updates to programs and events.

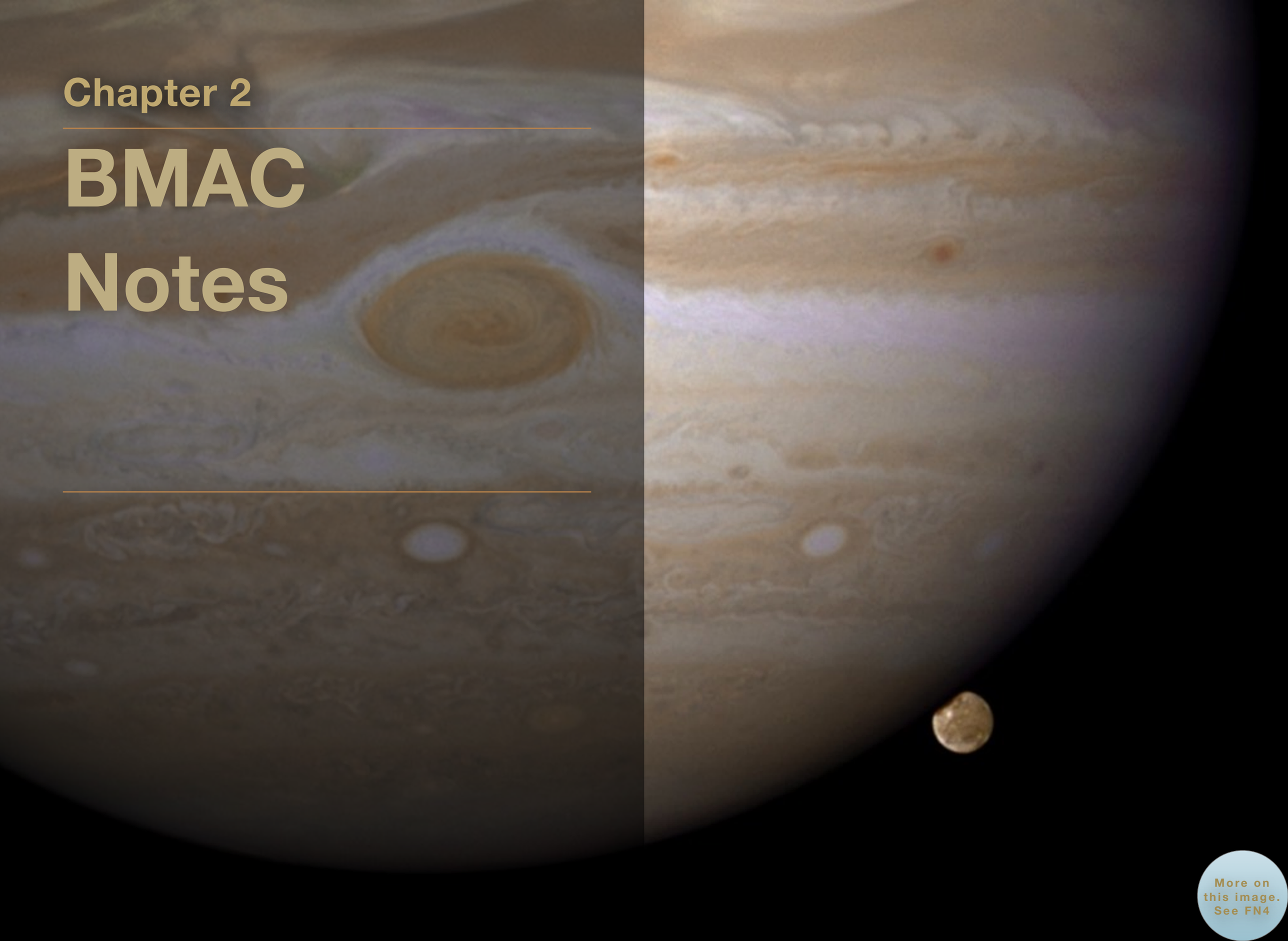
April's meeting will be an observing primer workshop. We'll start in the Discovery Theater at 7 p.m. with a short presentation of telescope types and mounts, how to use them, and how to find objects in the sky. This will be broken down into sections and each section will be led by a different club member to provide an impromptu presentation on each. The six major points to cover will be: Reflectors, Refractors, Dob Mount & pointing, Equatorial Mount & pointing, Using a Telrad and optical finders and using a star chart. There will be a 10" Dob and a 4" refractor on an equatorial mount to use as a prop. To keep on time, this should finish about 7:30 or so. Each section should take ~4 min. Snacks

will follow. Around 8 p.m., we will go out to the dam with the 10" Dob and give any new person to the hobby, whether a member or a visitor, the chance to point a scope for the first time with the assistance from a variety of BMAC members. I want to focus on easy objects for this exercise. This can include bright stars, double stars, the Pleiades, etc. Remember, since we are using the dam it will be cooler than at the observatory area. Please dress accordingly. The Park work is progressing, however it is slow. Thank you for your understanding while this work is going forward. I feel very sure that the end result will be worth all the adjustments now.

I want to start taking about our May Meeting. Our speakers will be the students from Sullivan South High school. They will be presenting their astronomy and other science projects. They always have some very interesting projects and I hope that you will come out and show your support for their efforts. Hope to see you. Until Next time…. Clear Skies.

Chapter 2

BMAC Notes



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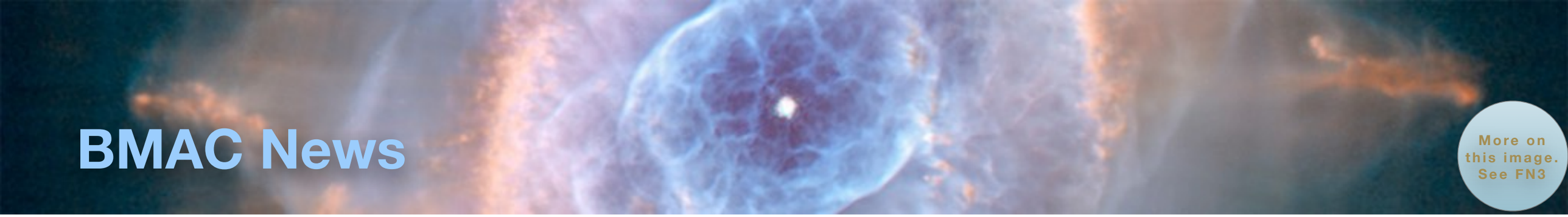


Apollo 11 Landing Web Interface

Here's a cool website to visit to relive those exciting minutes when the Apollo 11 LEM approached and landed on the Moon for the first time.

https://www.firstmenonthemoon.com/?fbclid=IwAR2kJzXdoQd9hwi2scEa4qqrQHZcbwOQefuzqIqH11V1aqe3FsWqE_H-O5Y

Of course, you should realize that this summer is the 50th anniversary of the first landing on the Moon.

Apollo 11 Documentary

If you haven't made a trek to see it, Apollo 11 is out in theaters. It is truly a first-rate documentary. The footage is all or mostly from NASA from the original 16mm, 35mm, 65mm and 70mm film used to document the historic event. There's also thousands of hours of audio that was processed. The image clarity is so great, you truly feel like you are there. The film covers the mission from suiting up to release from quarantine in 93 minutes. Here's a link to the trailer:

https://www.youtube.com/watch?v=tpLrp0SW8yg

Here's a link to another trailer, but also discusses how they digitized such a treasure trove of content to 16K!

https://youtu.be/S6tVRTz_FIg

Apollo Planetarium Show Coming in May

Bays Mountain Planetarium will be showing "First & Farthest" in the planetarium theater starting in May and will run through the summer. It looks back at the start of the Space Race and its culmination in the US landing on the Moon. The show is followed by a quick update on the NASA Space Program and a brief tour of the current night sky. Click the link for more information on our current and future planetarium shows.

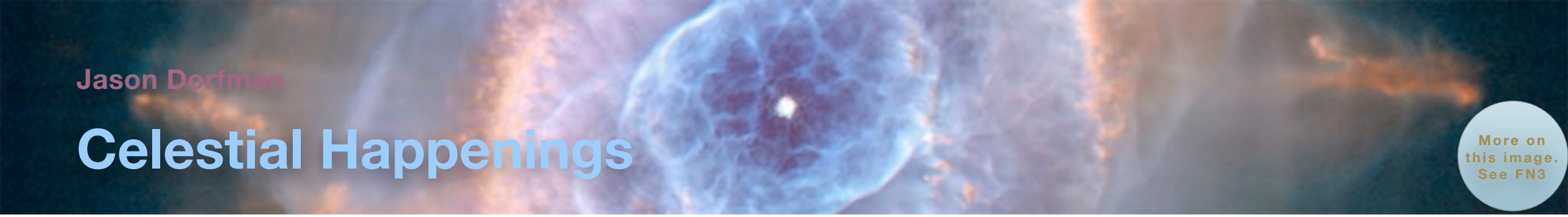
https://baysmountainpa.wpengine.com/planetarium/planetarium-show-times/

Chapter 3

Celestial Happenings

Jason Dorfman

More on this image. See FN5



Jason Dorfman

Celestial Happenings

More on this image. See FN3

April is here and that means spring is upon us. The world around us is about to explode with colorful blossoms and greener trees and lawns. With it comes longer days and, for some of us, seasonal allergies!

The Sun will rise at 7:17 a.m. EDT and set at 7:51 p.m. EDT on the 1st of April. By the end of the month, the Sun will rise earlier, 6:39 a.m., and set a little later, 8:16 p.m., as the days begin to lengthen.

This month, Mars remains as the solitary planet in our evening skies while the morning presents the best opportunity for planetary observations with Venus, Saturn and Jupiter. The asteroid 2 Pallas reaches a prime observing point this month and the Lyrids occur as the third week begins.

Planets

Mars continues to be the planetary focus for evening sky watchers. As April begins, we find Mars hanging about 35° above the western horizon an hour after sunset. Mars is moving through Taurus, the Bull, this month and begins its eastward trek through the constellation just 3° southeast of the brilliant Pleiades star cluster. As it moves between the Pleiades and Hyades star clusters, the Red Planet will gain a companion on the 8th when the Crescent Moon appears 6° south of Mars and 8° west of Aldebaran. The magnitude of Mars will dim slightly over the month from +1.45 to +1.6. By month's end, you'll find Mars about 25° above the horizon between the horns of the bull. With the two horn stars, Elnath and Tianguan, the trio will form an isosceles triangle. Mars will set between midnight and 11:30 p.m. during April.

After observing Mars, take the opportunity to explore some deep-sky objects (see the constellation of the month) or maybe take a break for a warm beverage as you wait for the king of the planets to appear. Jupiter rises in the southeast just after 1:30 a.m. on the 1st. An hour later, it will be 10° high making it easier to observe. The best observations, however, will be a bit later when Jupiter climbs to 30° above the southern horizon an hour before sunrise. This magnificent gas giant will rise earlier each evening, rising just before midnight as we reach the 30th with best observing occurring around 4:30 a.m.

At magnitude -2.3, Jupiter shines like a bright beacon in the bottom east corner of Ophiuchus. Its eastern movement appears to slow and stop in the second week of April. It will then begin to move in retrograde near the end of the month. Telescopic views will show the disk growing slightly over the month from 40" to 43".

Next to appear above the eastern horizon is our Solar System's other gas giant planet, Saturn. Saturn rises just before 3:30 a.m. on the 1st, but wait an hour as it will then reach about 10° high in the southeast. And, an hour before sunrise on the 1st, Saturn will climb to an altitude of 25° above the horizon. Saturn will rise about two hours earlier by the end of the month and will reach an altitude of 30° above the southern horizon an hour before sunrise.

Saturn remains in Sagittarius, just east of the Teapot asterism and will not appear to change its position by much this month. The ringed world at magnitude +0.5 is a bit dimmer than Jupiter. The most amazing views are through a telescope which reveals the unique ring-plane tilted 24° to us and spanning 38". The immense planet itself spans a good 17".

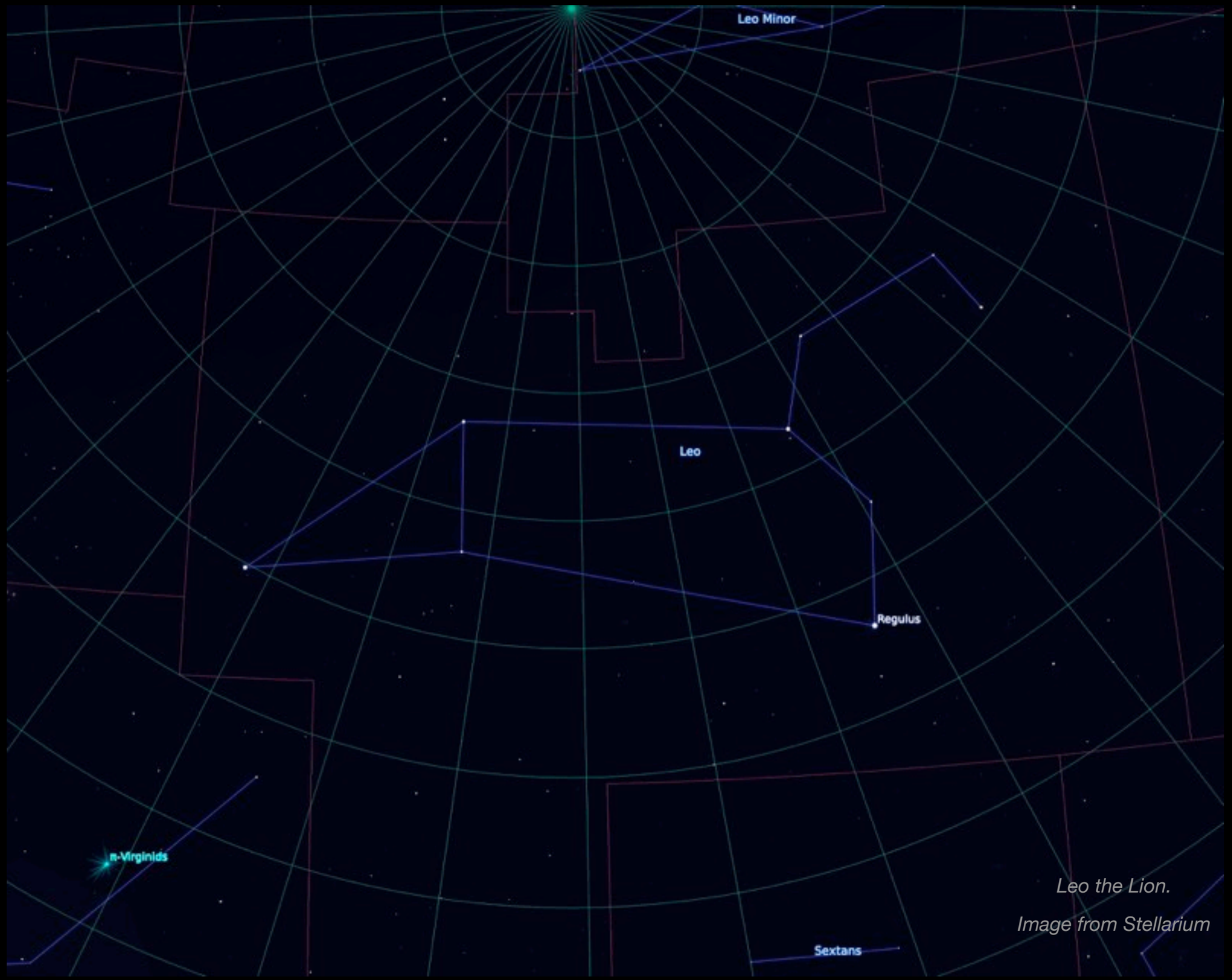
As the night reaches its end and twilight approaches, a bright morning star emerges from the depths of the eastern horizon - our sister planet, Venus. Look for it rising around 6 a.m. on the 1st with a thin crescent Moon about 8° to its right. Venus will dominate the early morning sky shining brilliantly at magnitude -3.9. Telescopes will reveal a gibbous planet at 80% illumination.

For a challenging conjunction observation, take your scope out on the morning of the 10th about 45 minutes prior to sunup. You'll need a somewhat clear view towards the eastern horizon as you'll need to look about 6° in altitude for Venus. Now for the challenging part, 8th magnitude Neptune will be just 0.3° above Venus. The pair will fit into a telescope view at lower power. You'll need clear skies to spot Neptune with the coming twilight. With a 12 magnitude difference, Venus is roughly 60,000 times brighter than Neptune. This month, Venus is moving eastward back towards the Sun in the sky and the bright twilight glow. By the end of the month, Venus will rise a half hour earlier.

The inner-most world, Mercury, rises an hour before the Sun on the 1st. Mercury will reach its greatest western elongation on the 11th. Look about 5° above the eastern horizon a half hour before sunrise to find +0.3 magnitude Mercury amongst the brightening morning twilight. Venus can help as Mercury is positioned just 5° to the west.

Luna

April begins with a very thin crescent Moon in the early morning skies. As the first week comes to a conclusion, the Moon will have swung around to our early evening skies passing near Mars and the Hyades cluster on the 8th/9th. Full Moon will occur on the 19th. On the 23rd, a waning gibbous Moon can be seen within 2° of Jupiter and two nights later a nearly 3rd quarter Moon will then be within 3° and to the west of Saturn.



Leo the Lion.

Image from Stellarium

Asteroid 2 Pallas

The second asteroid discovered in our Solar System will be moving through the constellation of Boötes, the herdsman, this month. It will reach opposition on the 9th and thus be in optimal observing position. Its magnitude is +7.9. Consult a finder chart to know exactly where to look. On the 10th, Pallas passes just 2' east of magnitude 2.7 Eta Boötis, which is located down in the left knee of the herdsman.

Meteor Showers

This month the Lyrids will peak on the night of the 21st/22nd. The Lyrids are a medium strength shower with a ZHR of about 18. Meteors of this shower usually lack persistent trains but can produce some fireballs. As with most showers, the best time to view is in the pre-dawn hours around 2 a.m. Unfortunately, this year's event occurs 3 days after the full Moon, so only the very brightest meteors will be visible.

Constellation of the Month

This month we decided to take a look at one of the more prominent and easier to find constellations in the sky - Leo, the Lion. Surprisingly, looking back at previous newsletters, it looks like Leo has never been the constellation of the month. To find the mighty lion, go out at 10 p.m. and look between 50° and 80° above the southeastern horizon. On the right side of the constellation is the brightest star in Leo, Regulus, "The Little King;" sometimes called Cor Leonis, "The Lion's Heart," which marks the chest of the Lion. Extending up from Regulus, look for an asterism known as "the Sickle" or "the Backwards Question Mark" which outlines the head and flowing mane of Leo. The body of the lion extends a little more than an hour in right ascension eastward to a triangle of stars that mark his back legs and tail. Leo is bound by Cancer to the west, Leo Minor and Ursa Major to the North, Coma Berenices to the east, and Sextans and Crater to the south.

As we heard in Adam's presentation at last months meeting, there are quite a few galaxies worthy of observation in Leo. In fact, when it comes to deep-sky objects, galaxies are what we find in this constellation. There are no observable nebulae or clusters within Leo. Below the triangle of stars in the hindquarters of the lion, we find the Leo Triplet - M65, M66 and NGC 3628. All three are spiral type galaxies with differing orientation angles to us. M65 and M66 are about 2.1' apart and can be observed together with lower power. M66 is to the east of M65 and is about magnitude +9.7. M65 is a bit fainter at magnitude +10.3 and a bit more elongated. NGC 3628 is located just over 0.5° north of this pair. It is a spiral galaxy seen edge-on and is slightly fainter than the other two.

Below the center of the body of Leo, we find several other galaxies of note. M95 and M96 are a pair of spirals separated by about 42' with M95 to the west of M96. About 48' to the NNE from M96 is another triplet of galaxies - M105 (NGC 3379), NGC

3384 and 3389. The three form a small triangle about 8' on a side.
M105 is a 10th magnitude elliptical galaxy.

That’s all for this month. Wishing you all clear spring skies!

Chapter 4

The Queen Speaks

Robin Byrne

Robin Byrne

Happy Birthday Apollo 13

More on this image. See FN3

With the 50th anniversary of the first Moon landing coming up this summer, it seems appropriate to recall other Apollo missions. This month we look at one of the most harrowing space missions to date.

Apollo 13 was the third mission to land on the Moon. Interest was low and there was very little news coverage. Other stories that got more news coverage included the introduction of L'Eggs [Ed.: pantyhose in a plastic egg-shaped container], the break-up of the Beatles [a musical quartet], and the opening of baseball season. The only true interest concerned the number 13. People looked for various numerological omens: The launch date was 4/11/70, which, if you add the digits 4+1+1+7 = 13; lift-off was at 13:13 Houston time; and they would enter the Moon's gravitational field on April 13.

During the first 2 days, the crew ran into a couple minor surprises, but generally, it was one of the smoothest flights so far. At 46 hours 43 minutes Joe Kerwin, the CapCom on duty said, "The spacecraft is in real good shape as far as we are concerned. We're bored to tears down here." They wouldn't be bored again for a while.

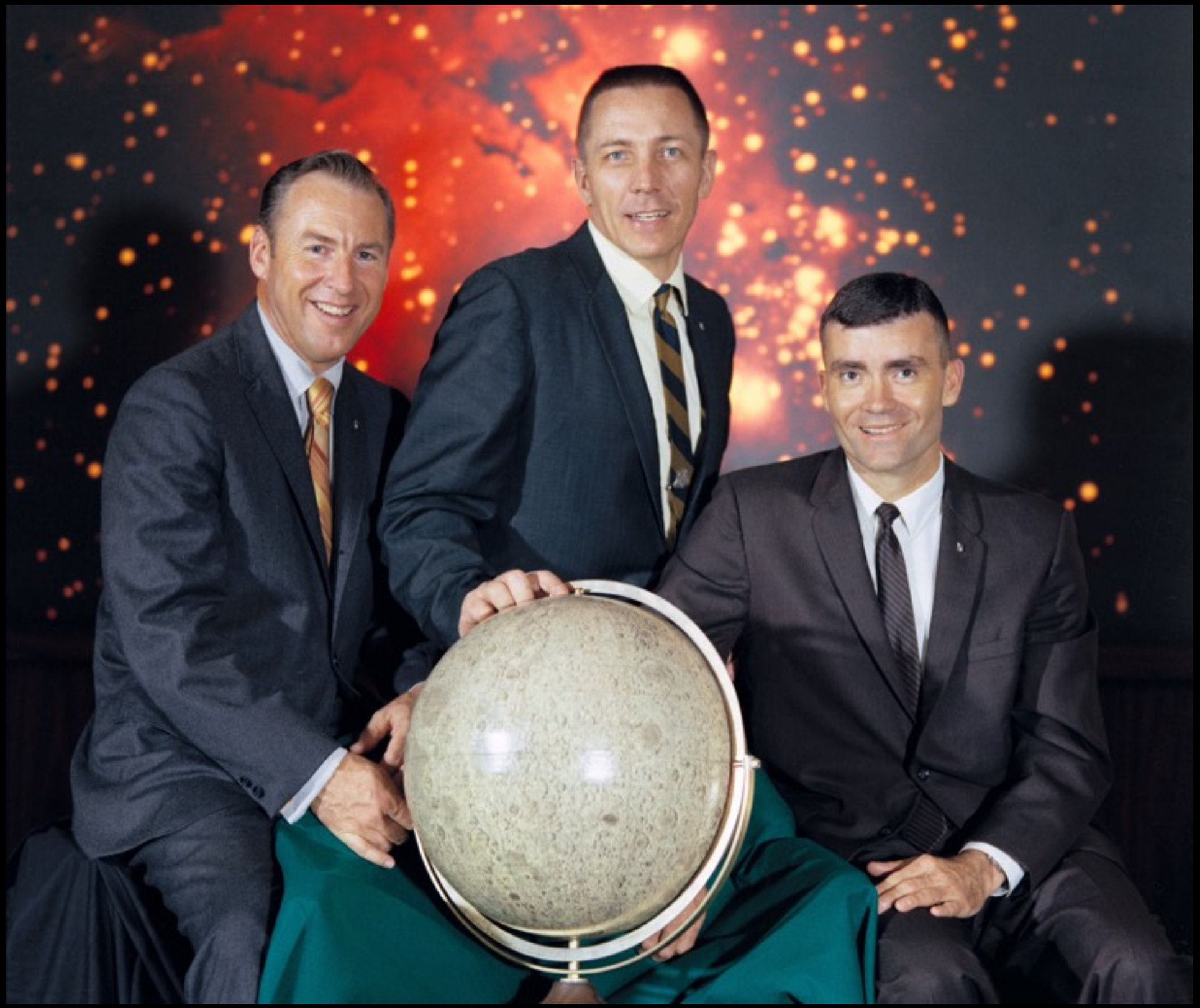
At 55 hours 46 minutes, the crew had finished a TV broadcast. Nine minutes later, at 21:08 hours on April 13, Oxygen Tank No. 2, while being stirred, exploded. They were about 200,000 miles from Earth. Thirteen minutes after the explosion, Lovell looked out the left-hand window and saw that they were venting a gas.

One hour after the explosion, Jack Lousma, the CapCom on duty called up and said, "…we are starting to think about the LM (as a) lifeboat." Using the Lunar Module as a lifeboat had been done in a simulation a few weeks before the launch.

To conserve their minimal resources, they had to cut back on water consumption, and they had to power down all unnecessary systems, including the heat. Discomfort is an understatement for what the crew felt during the mission. Sleep was almost impossible due to the cold. They discovered that if they remained perfectly still, then they would become surrounded by a blanket of air warmed by their body heat. In the absence of gravity, the hot air would not rise. As long as they didn't move, the warm air would stay right next to their body.

Apollo 13 Insignia - Logo Apollo 13 This is the insignia of the Apollo 13 lunar landing mission. The Apollo 13 prime crew will be astronauts James A. Lovell Jr., commander; Thomas K. Mattingly II, command module pilot; and Fred W. Haise Jr., lunar module pilot. Represented in the Apollo 13 emblem is Apollo, the sun god of Greek mythology, symbolizing how the Apollo flights have extended the light of knowledge to all mankind. The Latin phrase Ex Luna, Scientia means "From the Moon, Knowledge." Apollo 13 will be the National Aeronautics and Space Administration's (NASA) third lunar landing mission.

Image from NASA.



The actual Apollo 13 lunar landing mission prime crew from left to right are: Commander, James A. Lovell Jr., Command Module pilot, John L. Swigert Jr.and Lunar Module pilot, Fred W. Haise Jr.The original Command Module pilot for this mission was Thomas "Ken" Mattingly Jr. but due to exposure to German measles he was replaced by his backup, Command Module pilot, John L. "Jack" Swigert Jr.

Image from NASA.

Fred Haise became sick near the end of the mission with a kidney infection. It was due to having to conserve water. Besides the rationing that had already been devised, the men had voluntarily cut back their water consumption even more, but due to a different reason. Shortly after the explosion, they were told to no longer dump their waste overboard for fear of it shifting their course. They had to store all waste. Bags of urine quickly filled the cabin, even with the reduced water consumption. All three men stopped drinking much at all.

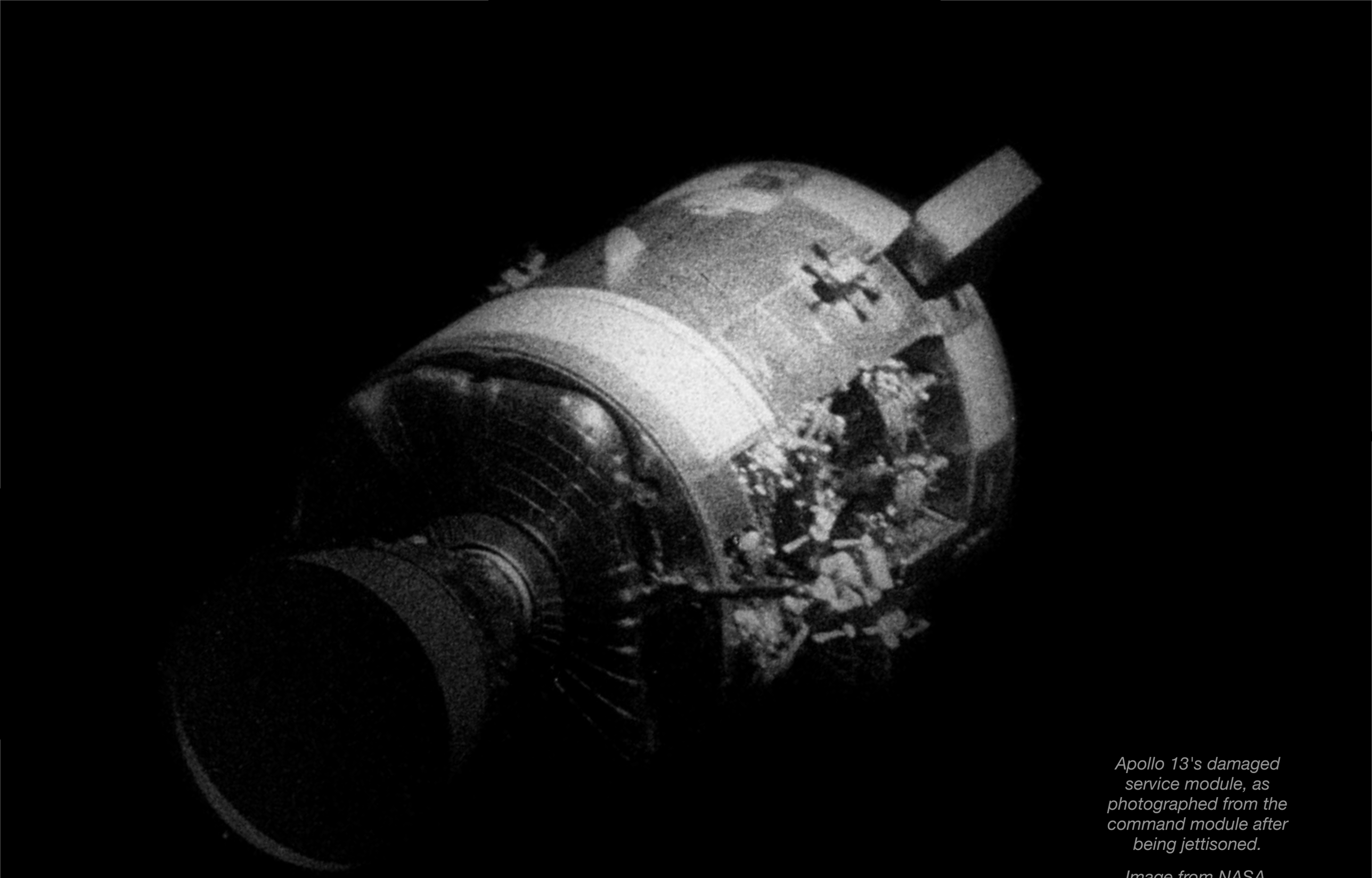
Four hours before landing, the damaged Service Module was released and gave the crew their first chance to see what had gone wrong. Photos showed one whole panel missing, and wreckage hanging out. Where the oxygen tank should have been, there was a large charred space with nothing there. One hour later, the crew left the Lunar Module, and moved back into the Command Module. During reentry, they started to feel Earth's gravity. With gravity now present, all the condensation on the walls started to fall. Lovell described it as being like rain. Splashdown took place in the Pacific Ocean, near Samoa.

The Apollo 13 Review Board conducted an exhaustive investigation. They discovered that in 1965 the Service Module had undergone many improvements, including raising the allowable voltage to the heaters in the Oxygen tanks from 28 to 65 volts. However, the thermostat switches on the heaters were not modified to tolerate the higher voltage. The thermostat on the heater was designed to prevent it from going above 80 ˚F. Originally, the No. 2 oxygen tank had been installed in the Service Module of Apollo 10, but was removed for modifications. During removal, it was dropped a small amount. It was examined, upgraded, and OK'd for flight on Apollo 13. During a test on the launch pad, the tanks were to be emptied to half capacity. The No. 2 tank only emptied to 92% of capacity. Apparently, when it was dropped, it put one of the drain tubes out of alignment. It was decided to "boil off" the remaining oxygen by using the heater in the tank. The thermostat, which couldn't handle the higher voltage, most likely fused shut, so the heat would not turn off. The readout for the tank temperature didn't go above 80 (since the tanks weren't supposed to get any hotter than that), so no one realized how hot it was getting. The wires were heated to 1000 ˚F for 8 hours, which melted the Teflon insulation. During the normal tank stir, the exposed wires arced, causing the explosion. It could have occurred at any point in the mission.

It is absolutely amazing that those three men made it home safely. This mission is a testament to the skill and abilities of not only the crew, but everyone at Mission Control who worked out how to get them back. So far, no one has lost their life while in space. However, it is not a matter of "if" it will ever happen, but "when" it will happen. Inevitably, the more we explore space, the more likely someone will lose their life in that exploration. That is the price for exploration. With plans to return to the Moon, or even travel to Mars, we need to be prepared for a disaster that doesn't

Astronaut John L. Swigert, at right, with the "mailbox" rig improvised to adapt the command module's square carbon dioxide scrubber cartridges to fit the lunar module, which took a round cartridge.

Image from NASA.



Apollo 13's damaged service module, as photographed from the command module after being jettisoned.

Image from NASA.

end happily. Remembering what happened on Apollo 13 should remind us how lucky we have been so far.

References:

NASA Apollo Mission Apollo-13 Web Page:

https://science.ksc.nasa.gov/history/apollo/apollo-13/apollo-13.html

“Lost Moon” by James Lovell and Jeffrey Kluger

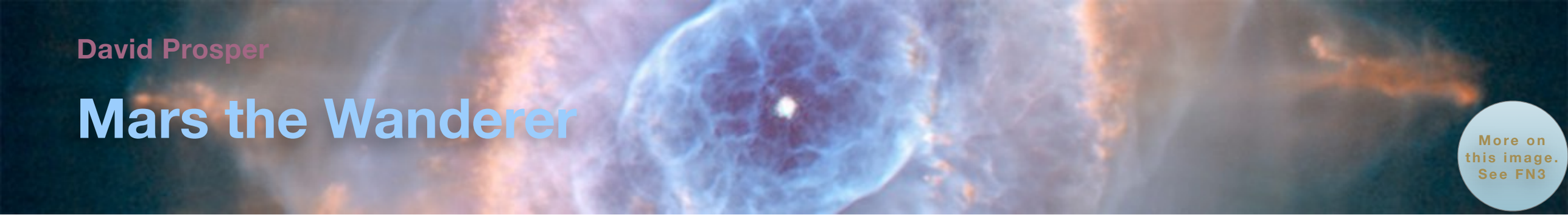
The crew of Apollo 13 on board the USS Iwo Jima following splashdown.

Image from NASA.

Chapter 5

Space Place

More on this image. See FN6



David Prosper

Mars the Wanderer

More on this image. See FN3

April's skies find Mars traveling between star clusters after sunset, and a great gathering of planets just before sunrise.

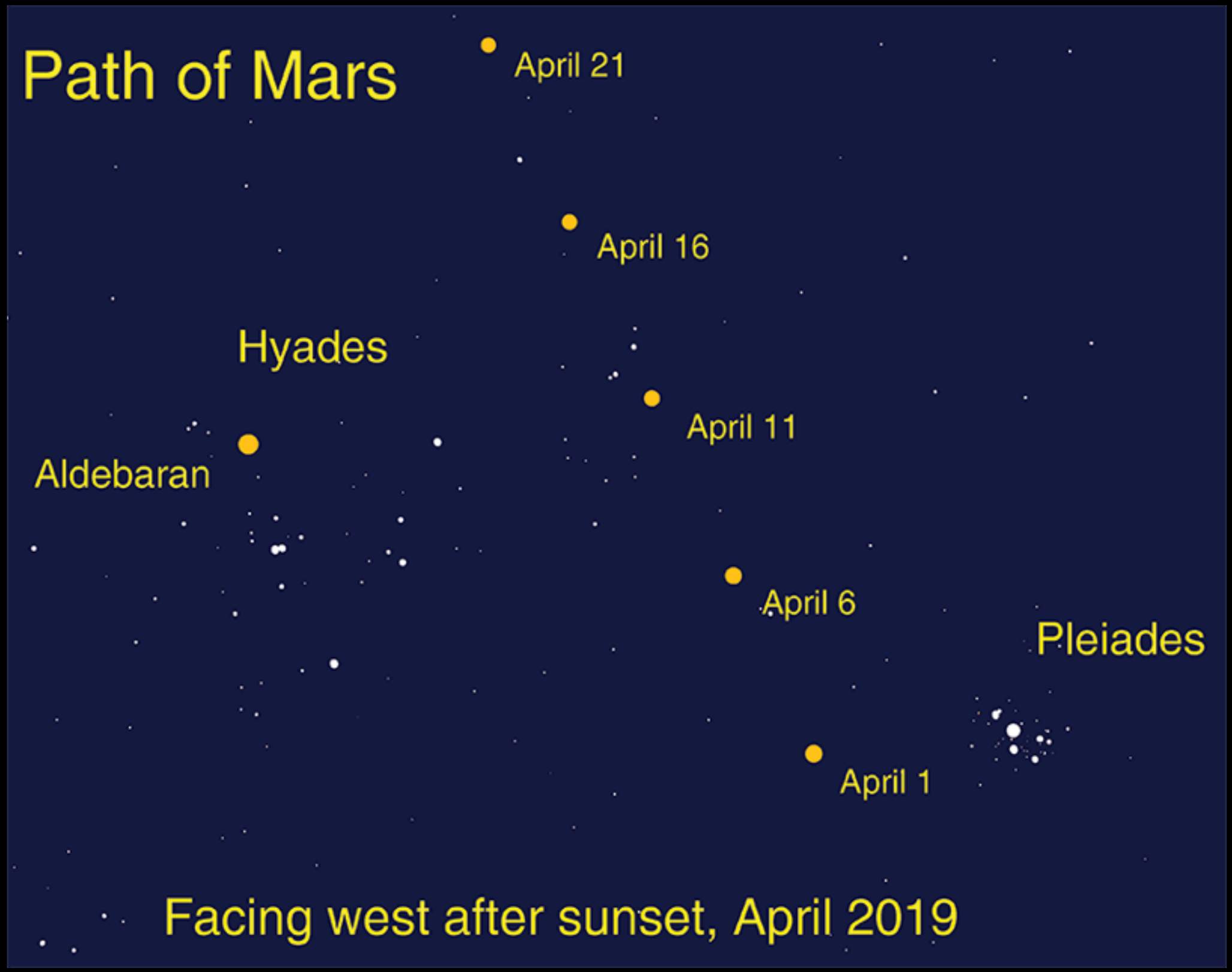
Mars shows stargazers exactly what the term "planet" originally meant with its rapid movement across the evening sky this month. The ancient Greeks used the term planete, meaning wanderer, to label the bright star-like objects that traveled between the constellations of the zodiac year after year.

You can watch Mars as it wanders through the sky throughout April, visible in the west for several hours after sunset. Mars travels past two of the most famous star clusters in our night sky: the Pleiades and Hyades. Look for the red planet next to the tiny but bright Pleiades on April 1st. By the second week in April, it has moved eastward in Taurus towards the larger V-shaped Hyades. Red Mars appears to the right of the slightly brighter red-orange star Aldebaran on April 11th. We see only the brightest stars in these clusters with our unaided eyes; how many additional stars can you observe through binoculars?

Open clusters are made up of young stars born from the same "star nursery" of gas and dust. These two open clusters are roughly similar in size. The Pleiades appears much smaller as they are 444 light years away, roughly 3 times the distance of the Hyades, at 151 light years distant. Aldebaran is in the same line of sight as the Hyades, but is actually not a member of the cluster; it actually shines just 65 light years away! By comparison, Mars is practically next door to us, this month just a mere 18 light minutes from Earth - that's about almost 200 million miles. Think of the difference between how long it takes the light to travel from these bodies: 18 minutes vs. 65 years!

The rest of the bright planets rise before dawn, in a loose lineup starting from just above the eastern horizon to high above the south: Mercury, Venus, Saturn, and Jupiter. Watch this month as the apparent gap widens considerably between the gas giants and terrestrial planets. Mercury hugs the horizon all month, with Venus racing down morning after morning to join its dimmer inner Solar System companion right before sunrise. In contrast, the giants Jupiter and Saturn move away from the horizon and rise earlier all month long, with Jupiter rising before midnight by the end of April.

The Lyrids meteor shower peaks on April 22nd, but sadly all but the brightest meteors will be washed out by the light of a bright gibbous Moon.



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, April 5, 2019	7 p.m.	Nature Center Discovery Theater	Program: April's meeting will be an observing primer workshop. We'll start in the Discovery Theater at 7 p.m. with a short presentation of telescope types and mounts, how to use them, and how to find objects in the sky. This will be followed by going out to the dam with a 10" Dob and give any new person to the hobby the chance to point a scope for the first time. Remember, since we are using the dam it will be cooler than at the observatory area. Please dress accordingly.; Free.
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.
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

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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

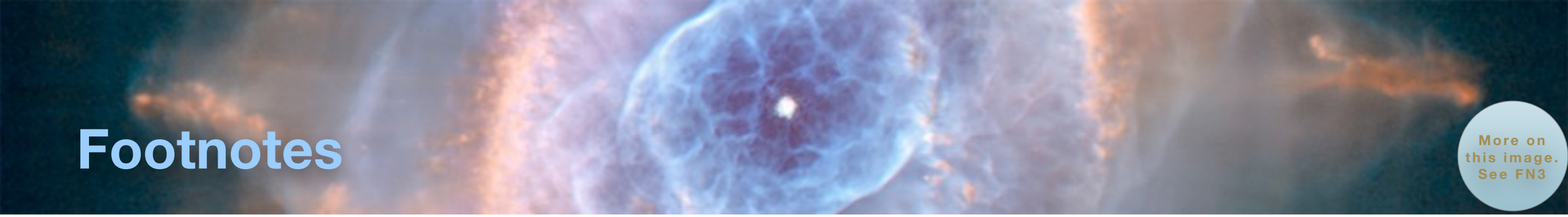
Robin has been writing the science history column since 1992 and was chair in 1997. She is an Associate Professor of Astronomy & Physics at Northeast State Community College (NSCC).

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 April 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. The path of Mars between the Pleiades and Hyades in April.

Image created with assistance from Stellarium.