

The Monthly Newsletter of the

# Bays Mountain Astronomy Club

February 2019

Edited by Adam Thanz

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See FN1

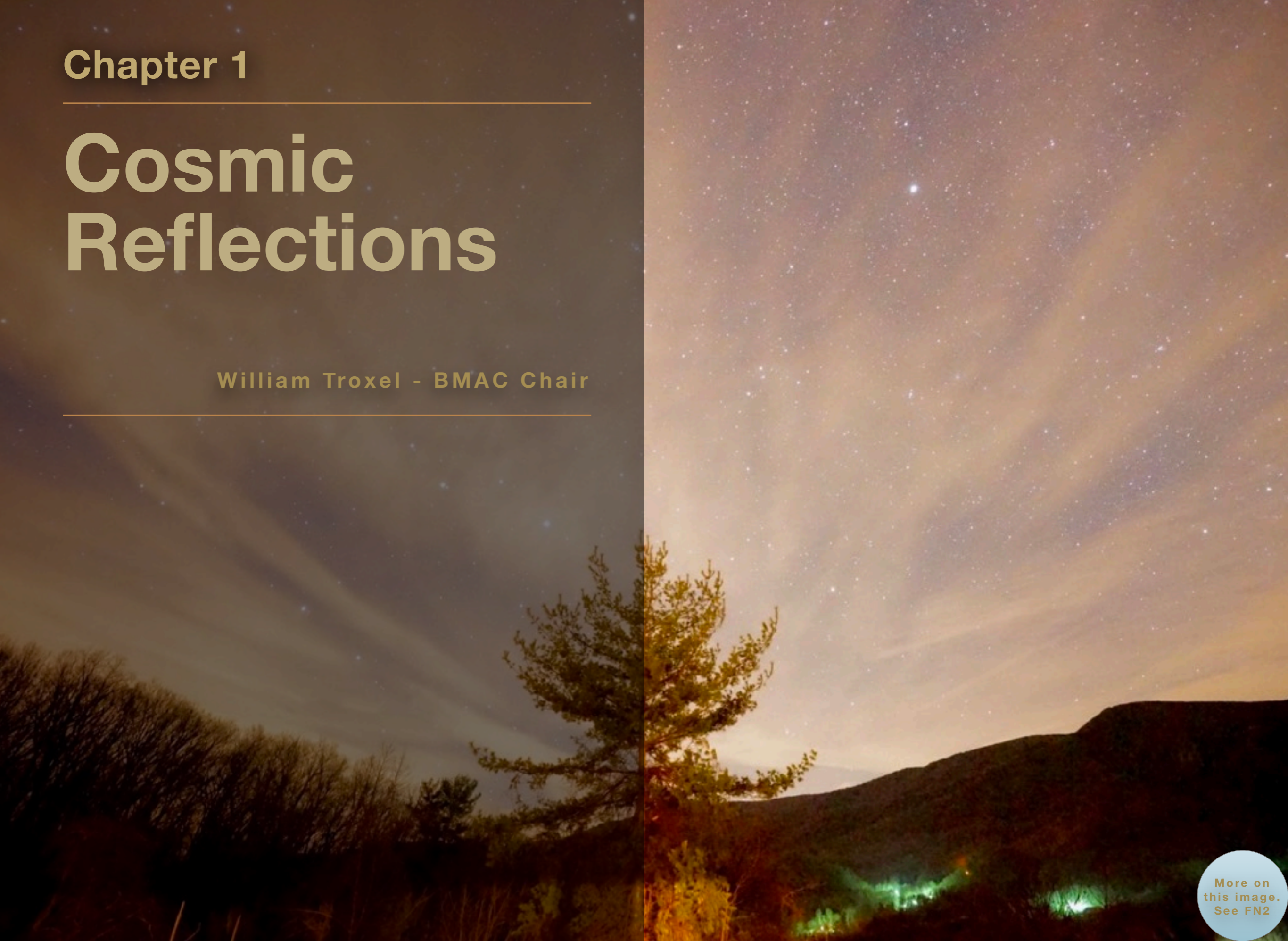
## Chapter 1

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# Cosmic Reflections

William Troxel - BMAC Chair

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See FN2

# Cosmic Reflections

Greetings BMACers! Here we are in February of 2019, I can not believe I am writing the 2nd chairman's article of the year already. We have had a wonderful annual dinner at The Meadows Restaurant inside of the MeadowView Resort. The dinner was Saturday night, the 12th of January. The event started with drinks in the lobby bar. We then went down to the restaurant for our meeting time of 6 p.m. Everyone that shared with me their impressions of the event were positive. We had 19 attend which I felt that was a great turnout. This year I tried a little different program. I found a word search puzzle that we all enjoyed. We also shared the one astronomy-related event we attended in 2018 that we thought was the best. It was very interesting to hear what each person chose to share. I was able to get a little better understanding of the members and their interests. Thank you again to the Meadows Restaurant for allowing us to come and a big thank you to all the members who attended. The annual dinner was a very nice event to start 2019.

The word search puzzle I used at the dinner was a kickoff for the vocabulary section of my article each month. During the StarWatches that I attended in the Fall, a few of the public would

ask if we had an astronomy dictionary. That got me thinking about my own lack of knowledge when it came to definitions of common terms we use in astronomy. I want to offer each month a few words to help you to increase your vocabulary. I will list the dictionary I found the clearest definition. However, if you find one that is clearer, please let me know so I can add it to reference list. This month I wanted to share the following:

Oort Cloud - (Noun) a hypothetical huge collection of comets orbiting the Sun far beyond the orbit of Pluto [Ed.: Pluto's orbit is ~40AU, the Oort Cloud's radius is about 50,000 AU]; perturbations (as by other stars) can upset a comet's orbit and may send it tumbling toward the Sun. Sentence Use: The Oort cloud is estimated to have up to a trillion comets.

Zenith - (Noun) the point above the observer that is directly opposite the nadir on the imaginary sphere against which celestial bodies appear to be projected. Sentence Use: The star hit its zenith at 23:30 hours. [Ed.: There is a difference in the English language use of zenith and its use in astronomy. In astronomy, zenith is the point directly over an observer, i.e. 90° altitude. A celestial object's zenith is the same as an observer's

zenith. Ex: In the Tri-Cities, the Sun never reaches zenith as we are too far north. If we lived on the Tropic of Cancer (~23.5° latitude) and it was the summer solstice, then we would experience the Sun overhead.]

Redshift - (Noun) (astronomy) a shift in the spectra of very distant galaxies [or any fast, receding object] toward longer wavelengths (toward the red end of the spectrum); generally interpreted as evidence that the Universe is expanding. Sentence Use: Redshift is one of the tools used to support the theory connected to the expansion of the Universe.

#### February Constellation Conversation:

This month I want to share the story of Lepus, the Hare. A hare is a rabbit. Jason will cover the celestial information so I hope you will continue to his article and read all about this very small constellation.

The story goes that at one time a very long time ago, Lepus was a very sleek and powerful bird that was very fast. The bird could fly across the night sky 3 times before the Sun would rise in the morning. The goddess Ostara, (Ēostre, the god of Spring) changed Lepus into a hare. The hare was allowed to keep its speed so that it would escape from those that would try to hunt it. The myth says that once each year the hare is allowed to lay eggs as it did as a bird. Here is where the myth gets interesting. The one time each year falls on what we call EASTER. That is how the

Easter bunny, which is Lepus, is able to bring Easter eggs to the ancient festival, according to the myth.

The location of this very small constellation is below the Feet of Orion, the Hunter.

February's meeting will be a little bit different. I have listed the title of the meeting as "Math for Amateur Astronomers." That was a working title, the actual title is "Navigating Celestial Spheres: Using Simple Math to Find Objects in Your Sky." Dr. Nathaniel Wentzel, Assistant Professor of Physics at Milligan College will be the speaker. He has asked that that you bring with you the following items: Your favorite pencil and eraser, a calculator (you can bring your smart phone if it has that app). If you have any of the following you can bring these as well, however they are not required. Planispheres, Atlases, printed Star Maps, DeepMap 600's, Norton's, or a Tirion Atlas. This is really an 1980's night, so no electronic guides and maps because they were not around in the 80's! Dr. Wentzel will have handouts, cool teaching tools and a presentation so mark your calendar for this every interesting look at the past of our hobby. Hope to see everyone. Remember we will meet in the Discovery Theater in the Nature Center at 7 p.m. Hope to see you there.

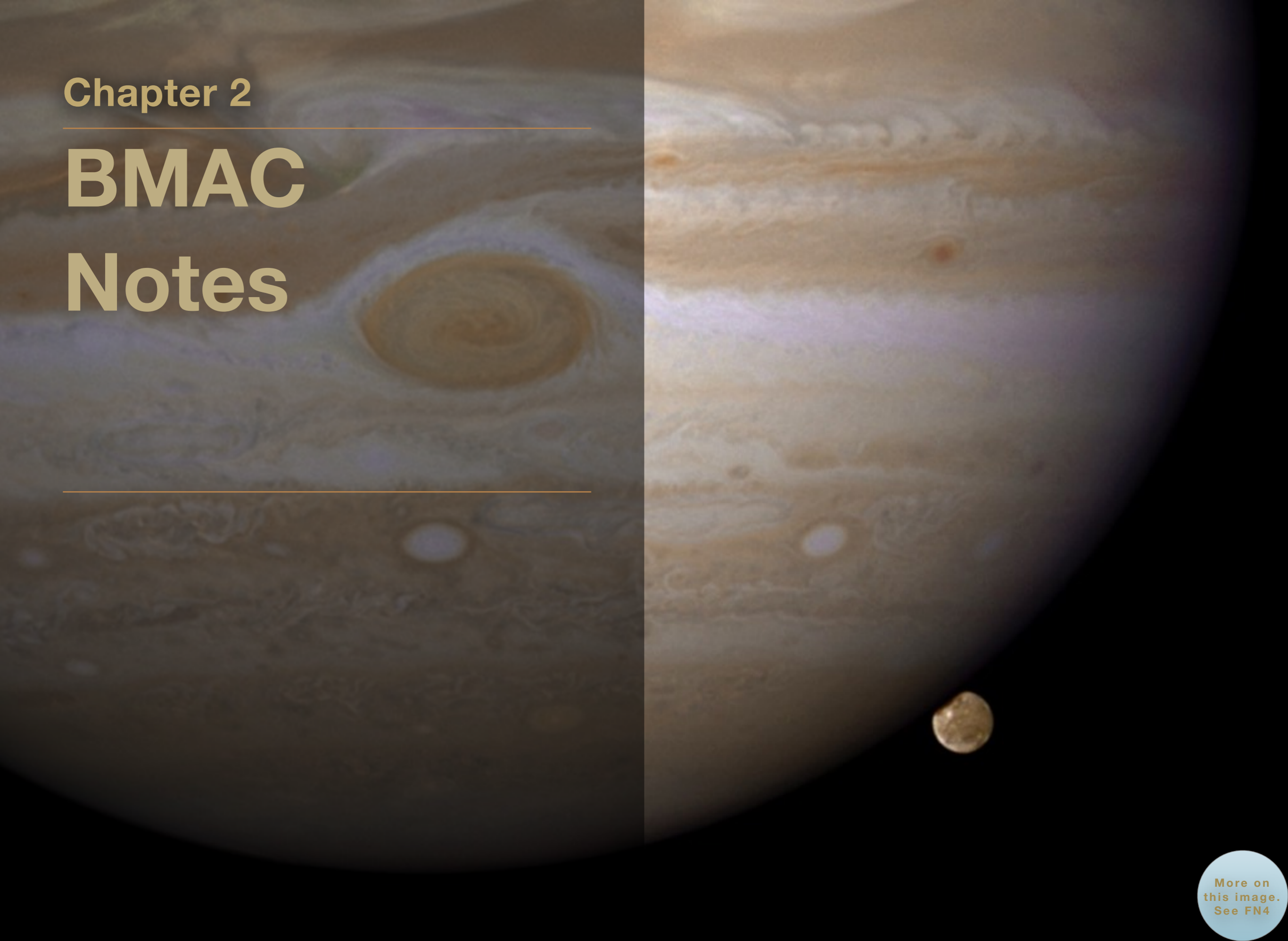
Until next time.... Clear skies.

Chapter 2

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# BMAC Notes

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More on  
this image.  
See FN4

# BMAC News

More on  
this image.  
See FN3



*The 2019 Annual  
BMAC Dinner at the  
Meadows Restaurant.*

*Image from William  
Troxel.*



*The Moon in partial  
eclipse, 1/20/19.*

*Image by Greg Penner.*



*The Moon in eclipse,  
1/20/19.*

*Image by Greg Penner.*



# Total Lunar Eclipse January 20-21, 2019



*Lunar eclipse montage.*

*Images by Adam  
Thanz.*

Images © Layout by Adam Thanz

## BoBfest - Regional Gathering of Amateur Astronomers

The 27th Annual Regional Gathering of Amateur Astronomers 2019, aka BoBfest, will occur on February 2, 2019 in the west wing of the Catawba Science Center, Hickory.

There is an update to the Table Top Talks as well as new lunch format and T-shirts available for sale on site this year.

### Itinerary:

- 8:30 Doors Open - Registration and Door Prize ticket sales begins
- 9:30 Welcome and Frank Westmoreland display opens
- 9:45 Bob Moore - Northeast Astro-imaging Conference (NEAC), Northeast Astronomy Forum (NEAF), National Star Gaze - The importance of public outreach by amateur astronomers in younger student education
- 10:30 Club Announcements
- 10:45 Anthony Love - Laboratories Manager, Appalachian State University Department of Geology - Identification and classification of meteorites
- 11:30 LUNCH - Groucho's Deli will be on site with sandwiches, sides, etc.
- 11:30 Solar Observing begins
- 12:45 Club Announcements & Orientation to Afternoon Schedule
- 1:00 Table Top Talks - round 1

- 2:00 Table Top Talks - round 2
- 3:00 Table Top Talks - round 3
- 4:00 Door Prizes and The Golden Dumbbell Award
- 4:30 Closing Remarks - BoB
- 7:00 Observing at Lucile Miller Observatory, Maiden, NC

### Table Top Talks include:

- Alan Mason - Remote astro-imaging and use of 3D printed gear
  - Sam Choate - Developing The Choate 2000 Observing List - Everything visible with a 10" SCT
  - Anthony Love - Determining sample meteorite composition
  - Ronnie Sherrill - Observing and photographing comets
  - John O'Neal - Smartphone astrophotography
  - Joe Heafner - Using almanacs in astronomy
  - Chris Waldrup - Capturing your images with sketching
  - Stormy Boreman - Getting started in astronomy
  - Robert Jones - What are dwarf planets and why are they called that?
  - Jeff Whisenant - Astronomy club outreach without telescopes - The NASA Night Sky Network Kits
  - Corrie Ann Delgado - A brief tour of the universe
- NEW ASTRO-FUN:

The Golden Dumbbell (M-27) Award - The Catawba Valley Astronomy Club (CVAC) has been recognizing astro-errors in popular media (movies, TV shows, news, internet) via our club's M-27 award each month. We thought it would be fun and educational for clubs in attendance at BoBfest to nominate a media error and provide the correct explanation at the 27th annual (get it?) BoBfest! The winner will be judged by crowd applause and a valuable prize awarded to the winning club! Feel free to submit your nominations via email or come prepared to nominate, describe and correct the error in person. Either way, have somebody there who will describe your entry.

BoBfest T-Shirts for sale - \$15. Bring your money and shirt size. Also, when you register, look for a place to indicate that you are interested in a shirt. This will help with our ordering.

#### NEW ASTRO-IMPROVEMENTS:

We are placing more and darker light shades on the windows in the Kiser Room, where we start the event with our Keynotes, as well as Table Top Rooms

Lunch Cafe by Groucho's Deli - Groucho's will be on hand with sandwiches and fixings in the Community Room across from the Millholland Planetarium at the Science Center.

#### BoBFEST ASTRO-TRADITIONS:

As usual for BoBfest, we will have door prizes on hand!! Your ticket purchase for a chance on a door prize helps keep BoBfest funded. Tickets are \$1 each or 6 for \$5, 12 for \$10, 25 for \$20, etc.

Of course, we will have commercial vendors and room for swap tables in our BoBfest Marketplace rooms, as well as display tables for your club and other astro-related organizations.

Also, bring your astro-artwork for display - photos, drawings, sculptures, quilts, etc.

Although there is not a fee for BoBfest, please register here: <http://www.catawbasky.org/cgi-bin/addbfreg.php> This helps us plan for attendance, vendor, swap table and display space, door prize donations, and club announcement times. Pre-registration also helps us plan our gastronomical goodies for the event!

For updated info, click here <http://www.catawbasky.org/bobfest/> and share with your club.

Make plans to come early, stay late and have a great time at BoBfest 2019 on February 2.

Brian Hissom, BoBfest Committee - Catawba Valley Astronomy Club



Charlotte Amateur  
Astronomers Club

# Southern Star 2019 ASTRONOMY CONVENTION

## APRIL 4 – 7



### Dr. Dan Durda

Southwest Research Institute

- *The History of the Astronomical Art: From the Renaissance to the Space Age*
- *The Science and Exploration of Little Rocky Worlds*



### Dr. Paul Byrne

North Carolina State University

- *Does Venus Show Us What Ancient – and Future – Earth Looks Like?*
- *Is There Life Inside the Icy Moons of Jupiter and Saturn?*



### Dr. Sheila Kannappan

University of North Carolina – Chapel Hill

- *The Visible and Invisible Cosmic Web*
- *Truth and Awe in Astronomy*



### Ken Launie

Antique Telescope Society

- *Early Telescopes in America and Their Makers*
- *Russell Porter and the Garden Telescope*

## Come to the Wildacres Retreat in the Blue Ridge Mountains

- **Great accommodations and meals**
- **Night-time observing under DARK skies!**
- **Wine and Cheese Reception**
- **Ice Cream Social !**
- **Nature hike and visits to local artisans**
- **Door Prizes!**
- **Swap tables! Trade and sell - Trash to Treasures !!**

Adults 18+ : \$290      College Student ID: \$180  
 Child 6 – 17: \$115      Child 3 – 6: \$80      Under 3: Free  
 Day Attendee: \$60 (each day, meals available separately)

**REGISTRATION form (February)**  
[www.CharlotteAstronomers.org](http://www.CharlotteAstronomers.org)

## Chapter 3

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# Celestial Happenings

Jason Dorfman

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More on  
this image.  
See FN5

# Celestial Happenings

I hope that everyone had a safe and enjoyable transition into the New Year. The new year began with a bit of excitement as the New Horizons spacecraft made the most distant flyby of a Solar System object ever achieved. All went according to plan and we now know a bit more about this Kuiper Belt Object, Ultima Thule. It turns out that it is a contact binary, two once distinct objects that are now attached. From the included image, you can see that it looks a little like a snow-person or BB-8 from Star Wars [Ed.: or a shmoo from Li'l Abner]. At the planetarium, we'll be giving updates from the mission over the next few months in our alternate program, currently Appalachian Skies-Winter and Exploring New Horizons in March and April - shameless plug. ; )

## Planets

During the first half of February, Mars shines brightly against the dimmer background stars of Pisces as the only visible naked-eye planet in the evening sky. On the 1st, look about  $45^\circ$  above the SW horizon an hour and a half after sunset and you should easily identify the Red Planet by its orangish-red hue. Mars begins the month at a magnitude of +0.9. The wonderful telescopic views of Mars when it was near opposition are now far behind us.

Through a scope you'll see a small orange blob of light spanning just 6.1" in diameter. If the seeing is good enough, you might notice that it's not a full circle but gibbous being 89% illuminated.

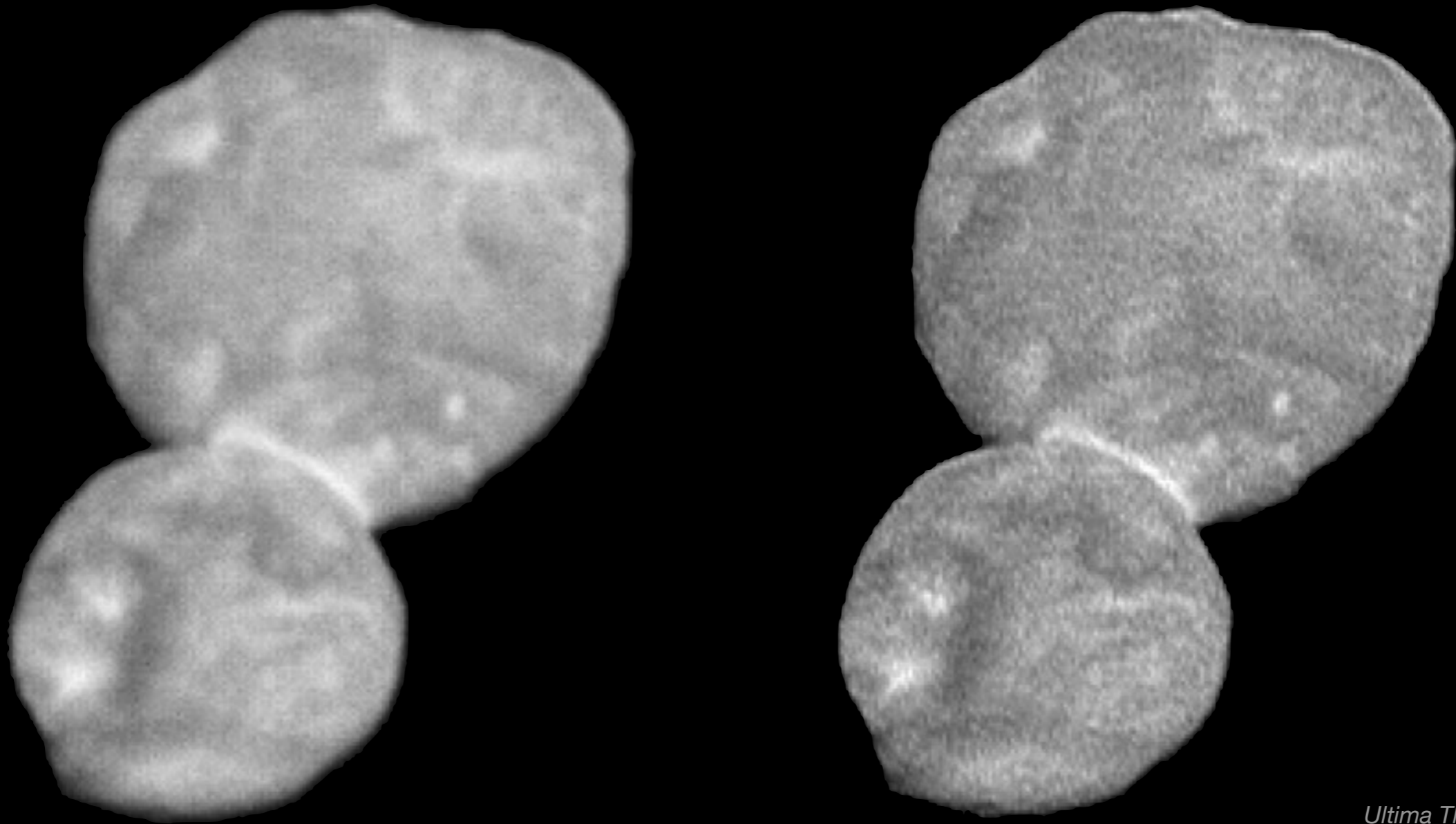
Mars crosses into Aries on the 12th and, as it does, it will be in conjunction with a much more distant world in our Solar System, the planet Uranus. This distant ice giant also started out the month in Pisces, but crossed into Aries on the 5th. The two worlds will appear to be just  $1^\circ$  apart on the 12th. Locate Mars first in your binoculars or telescope, then look for a smaller, fainter dot to the SE with a slightly bluish-green tint. The magnitude of Uranus will be +5.8 and the disk spans a mere 3.5". On the next evening, the separation will be  $1.1^\circ$  with Mars north of Uranus.

The swift eastward motion of Mars will keep it relatively high in the sky over the month. As the month ends, you'll find Mars about  $40^\circ$  high in the west an hour and a half after sunset. It will have dimmed slightly to magnitude +1.2. It will then be 91.4% lit and span a diameter of 5.3".



*Lepus and surrounding constellations*

*Image from Stellarium.*



*Ultima Thule*

*Image from NASA/Johns  
Hopkins University Applied  
Physics Laboratory/Southwest  
Research Institute.*



As the second week of February comes to an end, Mercury emerges from the bright twilight glow of the setting Sun. On the 15th, it will be just  $5^\circ$  above the horizon in the WSW a half hour after sunset. If you have a clear view towards the horizon, you should be able to distinguish it amongst the twilight sky glimmering at magnitude -1.1. With some visual aid, you'll see a nearly full disk spanning 5.6" in diameter. Your chances to observe this elusive inner world will increase as the week goes on. As Mercury heads towards its greatest eastern elongation on the 26th, it will rise a little higher each night. At greatest elongation, Mercury will be  $18^\circ$  east of the Sun and will be about  $11^\circ$  above the western horizon a half hour after sundown. Having moved closer to Earth, the diameter will have increased to 7.2", but the illuminated portion will have been reduced to just 50% resulting in a slightly dimmer magnitude of -0.5.

To view the other visible planets in our Solar System, you'll need to wait until well after midnight. Jupiter will be the first to appear, rising at about 4 a.m. on the 1st and about an hour and a half earlier on the 28th. Jupiter is currently in the constellation of Ophiuchus shining at magnitude +2.0. Rising about 30 minutes after Jupiter on the 1st, is our sister world Venus. Shining brightly at magnitude -4.3, Venus begins the month at the western edge of Sagittarius above the Teapot having just crossed the border from Ophiuchus. Over the month, it will move swiftly eastward over the Teapot reaching the eastern edge of the constellation by month's end.

Telescopic views on the 1st will reveal Venus at 62% illumination and a diameter of 19.1". As it makes its way towards the far side of the Sun, the appearance of Venus will change. By the 28th, you'll see a more gibbous but slightly smaller world at 72% lit and 15.7" diameter.

Last to rise is the beautiful ringed world of Saturn. On the 1st, Saturn rises about 5:30 a.m. or an hour and a half after Jupiter. Saturn currently lies just NE of the handle of the Teapot asterism in Sagittarius and will move only slightly eastward over the month. Its magnitude is about +0.6 and the planet spans roughly 16" while the rings span 35". As Saturn moves along in its orbit, the orientation of the planet shifts with respect to the Earth's orbit resulting in a change in the tilt of the ring-plane from our perspective. The ring-plane has been quite open to us over the last year, but the tilt is beginning to lessen a bit as we see the slow seasonal change of Saturn. The rings are currently tilted  $24^\circ$  to us.

For the astrophotographers or those who just enjoy an interesting view, Venus will pair up with some wonderful deep-sky objects, as well as Saturn. On the 4th, the Trifid Nebula (M20) will lie  $2^\circ$  due south of Venus with the Lagoon Nebula (M8)  $1.5^\circ$  south of that. Then, on the 10th, Venus will pass  $2^\circ$  south of open cluster M25 and on the next night the planet will appear  $3^\circ$  north of globular cluster M22. From the 16th to the 20th, Venus and Saturn will be within  $2.5^\circ$  of each other. The closest that the two

will appear will occur on the 18th when Venus will be only  $1.1^\circ$  north of Saturn.

## Luna

I hope that most of you were able to view the Lunar eclipse last month. I got caught up with weekend projects and almost completely forgot about it. Luckily, I remembered about 8 minutes before the Moon would begin to cross into the Earth's umbral shadow. Fortunately, the weather cooperated and the clouds cleared enough to see the event. Unfortunately, the temperature was very cold! I alternated between going outside for a few minutes to look through binoculars and staying inside to keep warm.

February begins with a very thin, waning crescent visible in the early morning hour between Venus and Saturn. Once the Moon swings around through New Moon, look on the 10th for a waxing crescent in the evening sky, roughly  $5^\circ$  SE of Mars. Full Moon occurs on the 19th. As the shortest month comes to a close, look again to the morning skies. On the 27th, the waxing crescent Moon will lie  $2^\circ$  north of Jupiter. Then, on the last day of February, it will be between Jupiter and Saturn with Venus to the east of Saturn. Look to the East an hour before sunup to see the quartet align for a spectacular view starting with Venus about  $10^\circ$  above the SE horizon and about  $10^\circ$  separating each one.

## Constellation of the Month

Once again, we continue our focus on some of the smaller, less well-known constellations of the sky. Lepus, the hare, is the constellation for February. It ranks 51st in size among the 88 constellations in the night sky. It is bordered by Orion to the north, Eridanus to the west, Columba to the south and Canis Major to the east. Monoceros also butts up to it in the northeast and Caelum sneaks in a bit to the southwest. If you trace a line down through the middle of Orion, you will find the alpha and beta stars of Lepus, Arneb and Nihal. The two are separated by about  $3^\circ$  and lie at the center of the constellation.

There is one deep-sky object of note, globular cluster M79. Its magnitude is +8.5. To locate it, draw a straight line through Arneb and Nihal and head south along this line just a little more than the separation between the two stars, about  $3.5^\circ$ . M79 is then about 2' to the east of this. This is not one of the more spectacular globular clusters, and really only becomes impressive in rather large telescopes.

Bundle up to stay warm and get out there and enjoy the clear winter skies!

## Chapter 4

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# The Queen Speaks

Robin Byrne

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Robin Byrne

# Happy Birthday Scott Kelly

More on  
this image.  
See FN3

This month we celebrate the achievements of a man who pushed the envelope of space exploration. Scott Joseph Kelly, and his identical twin brother, Mark, were born February 21, 1964 in Orange, New Jersey. His father, Richard, was a police officer in West Orange. Scott and Mark attended Mountain High School in West Orange. While in high school, Scott worked as an emergency medical technician. After his graduation in 1982, Scott attended the University of Maryland in Baltimore. During his freshman year, Scott read “The Right Stuff,” which inspired him to pursue a career in naval aviation. First he tried to transfer to the United States Merchant Marine Academy, where his brother was in school, but his poor grades prevented that plan from coming true. So, instead, Scott transferred to the State University of New York Maritime College (SUNY Maritime) at the start of his sophomore year, where he received a NAVY ROTC scholarship. As part of the Navy ROTC, Scott sailed aboard different training ships each summer, visiting various places around the world. In 1987, Scott graduated with a Bachelor of Science degree in Electrical Engineering.

After graduation, Kelly was commissioned in the U.S. Navy as an ensign. He had flight training at NAS Pensacola, and then jet training at the NAVAL Air Station Chase Field in Beeville, Texas. Kelly officially became a Naval Aviator in 1989. His first assignment was at the Naval Air Station Oceana, Virginia. Once all training was complete, Kelly was deployed in 1990 to the North Atlantic and Persian Gulf. While stationed in Virginia Beach, Kelly met Leslie Yandell. They married April 25, 1992, and would go on to have two children: Samantha and Charlotte. In 1993, Kelly was chosen to attend test pilot school, where his brother would be a fellow classmate. After completion of that program, in 1994, Kelly worked as a test pilot. He logged more than 8000 hours in over 40 different aircraft, with 250+ carrier landings.

In 1995, both Scott and Mark applied to NASA’s astronaut program. Both were selected as astronaut candidates in April, 1996. This was the first time that two relatives were selected for the program, and they would eventually become the only two siblings to have both travelled in space. After completion of training, Scott was assigned to the caution and warning system



*NASA astronaut Scott Kelly, wearing an Extravehicular Mobility Unit (EMU) spacesuit.*

*Image from NASA/  
Robert Markowitz.*



*NASA Expedition 45/46 Commander, Astronaut Scott Kelly along with his brother, former Astronaut Mark Kelly at the Johnson Space Center, Houston Texas speak to news media outlets on Jan. 19, 2015. The subject is Scott Kelly's upcoming 1-year mission aboard the International Space Station.*

*Image from NASA/  
Robert Markowitz.*

of the International Space Station (ISS). At the same time, Scott also completed a Master of Science degree in Aviation Systems from the University of Tennessee.

In December of 1999, Scott flew his first Space Shuttle mission as the pilot of STS-103. The primary goal was a servicing mission to the Hubble Space Telescope. Following this successful flight, Scott was assigned to the role of NASA's Director of Operations in Star City, Russia.

In 2002, Scott served on the NEEMO 4 mission as the commander. This involved working in the Aquarius underwater laboratory near Key Largo, Florida. The underwater component of the mission lasted five days, cut short by a hurricane. The experience was meant to simulate working under the kinds of extreme conditions that would be encountered on extended space flights. Later, in 2005, Kelly served on another NEEMO mission for three days that worked on the difficulties of construction under those conditions.

After the Space Shuttle Columbia disaster in February of 2003, Kelly served as the coordinator of the searches for debris by airplanes and helicopters. In 2007, both Scott and Mark, at different times, were diagnosed and treated for prostate cancer. Both treatments were successful.

Due to delays as a result of the Columbia disaster, it wasn't until August 2007 that Scott would fly again, this time as the

commander of his second spaceflight aboard Space Shuttle Endeavour on STS-118. This would be a 12-day mission to the International Space Station, delivering a truss system and other new components, along with supplies, to the growing space station. Another hurricane cut another of Scott's missions short, this time returning a day earlier than planned.

Two years later, Scott and his wife would get a divorce. The following year, Scott would get to spend a much longer time in space. In October of 2010, Scott would begin his 159-day stay aboard ISS as part of Expedition 26 in the role of commander. During his time there, they conducted 115 scientific experiments, including testing vegetable growth in a weightless environment and the dynamics of heat transfer in weightlessness. While in orbit, Scott's sister-in-law and wife of Mark, Congresswoman Gabrielle "Gabby" Giffords was shot. It wasn't until his return two months later that Scott could visit both Mark and Gabby.

In November of 2012, it was announced that Scott and cosmonaut Mikhail Korniyenko would fly aboard ISS for a one-year mission. From March 27, 2015 to March 1, 2016, Scott and Mikhail lived in space. The purpose was to study the effects of such an extended stay in space on the human body, in particular, with a journey to Mars in mind. Among the tests conducted were: analyzing how the shifting of fluid in the body affects vision, plus repeated chemical analysis of blood and urine samples. NASA wanted to see how the body reacted to weightlessness for such a

long period of time and exposure to radiation, as well as the mental health issues of isolation and stress. More than once during their year-long stay, there were problems with resupply ship failures. Scott also performed three EVA's during his time there, either performing repairs or installations of equipment. Over the course of the year, Scott and Mikhail flew with a total of 13 other astronauts and cosmonauts from not only the United States and Russia, but also Italy, Japan, Denmark, and Kazakhstan. At the end of the flight, Scott had spent, over the course of his four flights, a total of 520 days in space. That was the record for the most days in space by an American until Jeff Williams reached 534 days, and, later, Peggy Whitson passed them both with 665 days.

Due to the unique opportunity of having identical twins in the space program, NASA studied both Scott and Mark before, during, and after his flight. This allowed them to see what differences appeared during Scott's time in space. One of the more publicized changes was in Scott's gene expression, erroneously reported as a change in his genetic code. Gene expression has to do with how the instructions from a gene are converted into a product. Changes in gene expression also occur after living at very high altitudes. In both cases, it is related to adapting to a different environment.

Scott retired from NASA April 1, 2016. In November of that year, he was appointed the United Nations Champion for Space by the

United Nations Office for Outer Space Affairs (UNOOSA). His role is to raise awareness for the outreach activities made by UNOOSA. In 2017, Scott published a book chronicling his year in space, titled, "Endurance: A Year in Space, a Lifetime of Discovery." This past July, Scott married Amiko Kauderer, who is a Public Affairs Officer for NASA.

From his exemplary military career, to his many accomplishments with NASA, to being a social media darling during his year in space, Scott Kelly has much to be remembered for. And at age 55, he has plenty of time to impress us with more. Happy Birthday, Scott! Go get 'em!

### **References:**

Wikipedia Scott Kelly (astronaut)

[https://en.wikipedia.org/wiki/Scott\\_Kelly\\_\(astronaut\)](https://en.wikipedia.org/wiki/Scott_Kelly_(astronaut))

Biographical Data Scott J. Kelly

<https://www.jsc.nasa.gov/Bios/htmlbios/kellysj.html>

NASA Astronaut Scott Kelly Returns Safely to Earth after One-Year Mission, NASA Press Release, Mar. 2, 2016

<https://www.nasa.gov/press-release/nasa-astronaut-scott-kelly-returns-safely-to-earth-after-one-year-mission>



Chapter 5

# Space Place

the  
Space Place



More on  
this image.  
See FN6

# Hexagon at Night, Quartet in the Morning

More on  
this image.  
See FN3

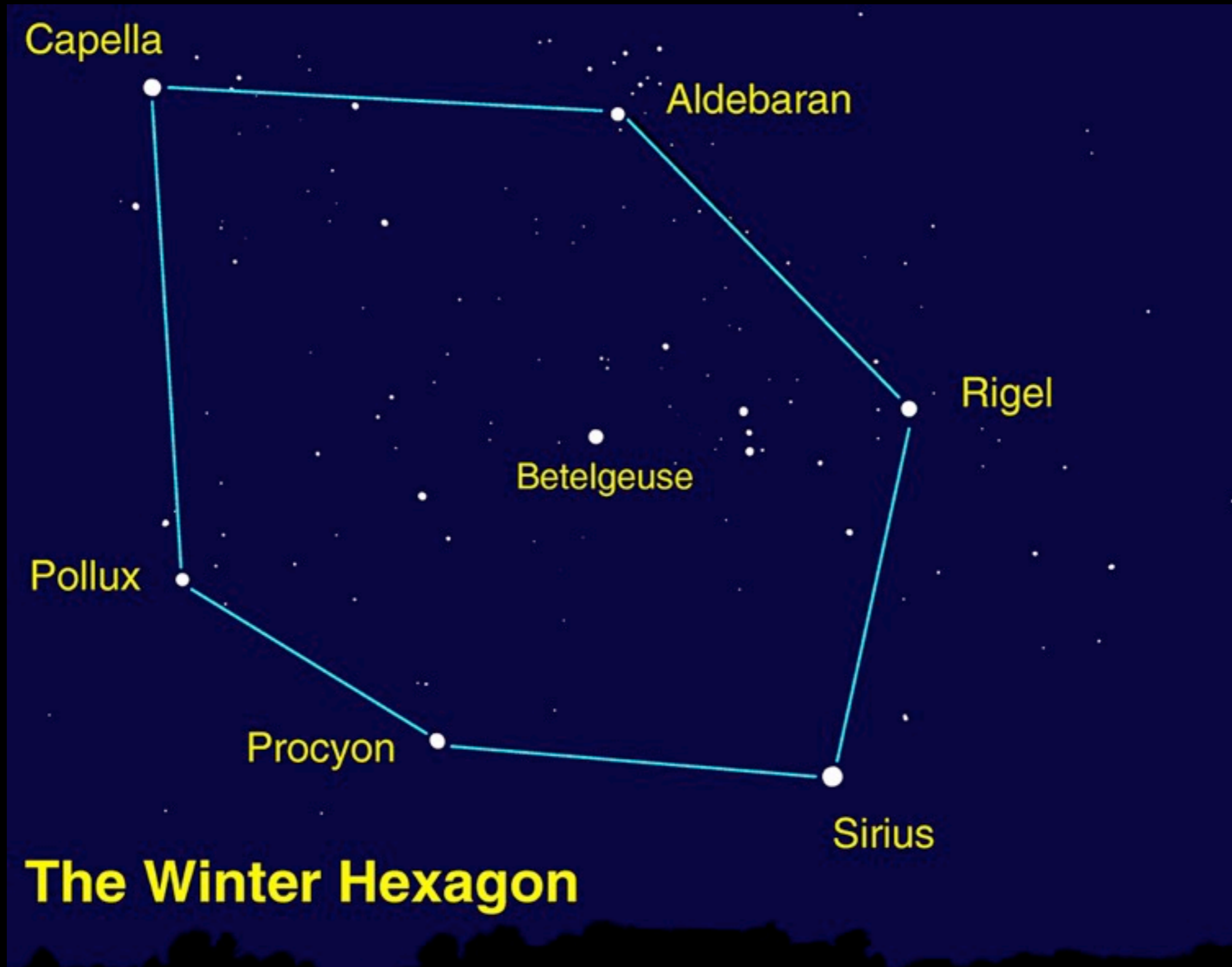
The stars that make up the Winter Hexagon asterism are some of the brightest in the night sky and February evenings are a great time to enjoy their sparkly splendor. The Winter Hexagon is so large in size that the six stars that make up its points are also the brightest members of six different constellations, making the Hexagon a great starting point for learning the winter sky. Find the Hexagon by looking southeast after sunset and finding the bright red star that forms the “left shoulder” of the constellation Orion: Betelgeuse. You can think of Betelgeuse as the center of a large irregular clock, with the Winter Hexagon stars as the clock’s hour numbers. Move diagonally across Orion to spot its “right foot,” the bright star Rigel. Now move clockwise from Rigel to the brightest star in the night sky: Sirius in Canis Major. Continue ticking along clockwise to Procyon in Canis Minor and then towards Pollux, the brighter of the Gemini twins. Keep moving around the circuit to find Capella in Auriga, and finish at orange Aldebaran, the “eye” of the V-shaped face of Taurus the Bull.

Two naked-eye planets are visible in the evening sky this month. As red Mars moves across Pisces, NASA’s InSight Mission is readying its suite of geological instruments designed to study the Martian interior. InSight and the rest of humanity’s robotic

Martian emissaries will soon be joined by the Mars 2020 rover. The SUV-sized robot is slated to launch next year on a mission to study the possibility of past life on the red planet. A conjunction between Mars and Uranus on February 13 will be a treat for telescopic observers. Mars will pass a little over a degree away from Uranus and larger magnifications will allow comparisons between the small red disk of dusty Mars with the smaller and much more distant blue-green disk of ice giant Uranus.

Speedy Mercury has a good showing this month and makes its highest appearance in the evening on February 27; spot it above the western horizon at sunset. An unobstructed western view and binoculars will greatly help in catching Mercury against the glow of evening twilight.

The morning planets put on quite a show in February. Look for the bright planets Venus, Jupiter, and Saturn above the eastern horizon all month, at times forming a neat lineup. A crescent Moon makes a stunning addition on the mornings of February 1-2, and again on the 28th. Watch over the course of the month as Venus travels from its position above Jupiter to below dimmer Saturn. Venus and Saturn will be in close conjunction on the 18th; see if you can fit both planets into the same telescopic field



## The Winter Hexagon

Southeast After Sunset, February Evenings

of view. A telescope reveals the brilliant thin crescent phase of Venus waxing into a wide gibbous phase as the planet passes around the other side of our Sun. The Night Sky Network has a simple activity that helps explain the nature of both Venus and Mercury's phases at [bit.ly/venusphases](https://bit.ly/venusphases).

You can catch up on all of NASA's current and future missions at [nasa.gov](https://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](https://nightsky.jpl.nasa.org) to find local clubs, events, and more!

***BMAC***  
***Calendar***  
***and more***

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# BMAC Calendar and more

More on  
this image.  
See FN3

Date	Time	Location	Notes
<b>BMAC Meetings</b>			
Friday, February 1, 2019	7 p.m.	Nature Center Discovery Theater	<p>Program: Dr. Nathaniel Wentzel, Assistant Professor of Physics at Milligan College will be leading a workshop entitled: "Navigating Celestial Spheres: Using Simple Math to Find Objects in Your Sky."</p> <p>Attendees are asked to bring: Your favorite pencil and eraser, a calculator (you can bring your smart phone if it has that app). If you have any of the following you can bring these as well, however they are not required. Planispheres, Atlases, printed Star Maps, DeepMap 600's, Norton's, or a Tirion Atlas. This is really an 1980's night, so no electronic guides and maps because they were not around in the 80's! Dr. Wentzel will have handouts, cool teaching tools and a presentation so mark your calendar for this every interesting look at the past of our hobby. Free.</p>
Friday, March 1, 2019	7 p.m.	Nature Center Discovery Theater	Program: Program TBA; Free.
Friday, April 5, 2019	7 p.m.	Nature Center Discovery Theater	Program: Program TBA; Free.
<b>SunWatch</b>			
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.
<b>StarWatch</b>			
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.		
<b>Special Events</b>			
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.

## Bays Mountain Astronomy Club

853 Bays Mountain Park Road

Kingsport, TN 37650

1 (423) 229-9447

[www.BaysMountain.com](http://www.BaysMountain.com)

[AdamThanz@KingsportTN.gov](mailto: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>

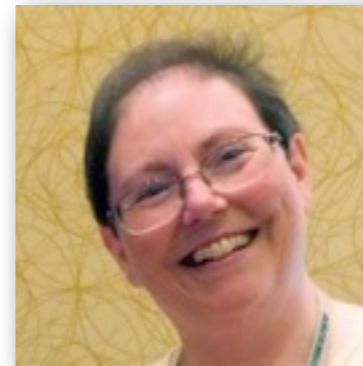
## Regular Contributors:

### *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:

### 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 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 February 2009. The rich color range comes from the fact that the galaxy was photographed in visible 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 stars of the Winter Hexagon. Image created with help from Stellarium