Chapter 1

Looking Up

Brandon Stroupe - BMAC Chair
Hello BMACers,

With June upon us, we are officially at the half way point of this year. This year just seems to be flying by. Before we know it, it will be time for StarFest 2017. You all know that is your favorite time of the year. We have a lot of stuff coming up in the next couple of months that I want to briefly talk about. First, I want to remind everyone that our annual picnic is coming up in July. It will be on July 15 at Natural Tunnel State Park in Duffield, VA. I will be talking about that more in the coming weeks. Second, I want to remind everyone that the club chairman election will be held this month at our meeting. If you would like to lead our club and take over the reins, please put your name in the running for the club chair. You can do that by either posting it on our club Yahoo group, BMASTRO or you can put your name in at our June meeting. The club will vote that night at our meeting. The last thing that I want to mention, you all already know about. It is the upcoming Total Solar Eclipse. Most of you probably know that it is occurring on August 21, 2017. Hopefully the weather will cooperate with us on that day. There is not any specific event that the club itself is holding for this upcoming eclipse, but some of us club members will be at Cades Cove campground in the Smoky Mountain National Park in Townsend, TN. If that sounds interesting to you and would maybe like to join, please message me on BMASTRO. Regardless of what event you are attending for the eclipse, please remember to be safe when looking at the Sun. [Ed.: Shameless plug here - the BMP gift shop has high-quality solar glasses for sale, only $2 each. All funds support the Park!]

For our meeting this month, we will be welcoming a club member that you all already know. It will be William Troxel. He is one of our past club chairs. His presentation will be entitled, “What Type of ‘Scope is Best for You.” He will be discussing his specific type of telescope to everyone. He will be focusing on the Celestron brand of scopes for his presentation.

He will also speak about the benefits and uses of this type of telescope. He will be covering the different steps a person should take in picking out the correct type of scope for them. I hope everyone will be able to come out and see Will’s presentation. Please invite any people you know to the meeting, especially if
they have just purchased a scope or are thinking about getting a scope.

At our May meeting, we once again welcomed Tom Rutherford and some of his students for some very entertaining presentations. We always reserve the month of May for Tom to bring a few of his students to give their research presentations in astronomy and other science topics as well. Tom is a member of our Astronomy Club, the Bristol Astronomy Club, and a science teacher at Sullivan South High School in Kingsport. As I mentioned in last month’s article, some of his students are chosen to give their presentations at local and regional science fairs. Some even make it to the national level. I think it is awesome that that is happening in Kingsport’s own school system. There were multiple presentations given at our meeting. One was about the effects of X-ray radiation on plant growth and development. The students got to use a dentist’s office x-ray machine to conduct their experiment. That is pretty neat. Another presentation was about bacterial growth on makeup. Yes, I said makeup. Anyone who uses makeup would have enjoyed that one. One presentation was about the Asteroid 6729 Emiko, and another was about a possible transiting star system called KOI 1065. One of the last presentations was about the effects of global warming on atmospheric temperature and pressure. This was an interesting experiment that did not go at all as expected for the students. They had one obstacle after another when trying to complete this experiment. Even though nothing went as planned, they still collected some good data. All of these presentations were very good. I hope you all were able to be in attendance. Thank you, Tom and your students for your hard work and coming out to share your research.

This month’s article will not include a constellation of the month. Instead, I would like to talk about the future of our club. I would like to see the club highlight the basic needs of astronomy. Instead of a long presentation, maybe have a short talk followed by observing. Or, the talk is about learning how to use a type of piece of equipment like William’s talk for the next meeting. We as an astronomy club are here to enjoy astronomy and teach others about it as well. When the public comes to one of our meetings or to a StarWatch, many times it is because they want to learn how to use their new telescope or to learn about the night sky. If they are not getting information about any of these things, they may never come back. I would like to see our astronomy club grow tremendously. I would like to start having more hands-on, informative presentations. We will still be having special speakers come and speak to the club, but I would like the teaching/hands-on presentations take the front seat. For now, this will begin with William’s presentation this month. If I continue to be your club chair, we will be having a broad presentation/workshop on the different types of telescopes in August. The members and the public will be able to learn about and use the different types of telescopes that are out there. I hope everyone will find these types of presentations very informative and enjoyable. I am really
trying to do the best I can for our club and help it grow as much as possible.

That will be it for this month. I want to thank the members that came out and helped with Astronomy Day last month. We had a really good turnout of the public that came by the tables. The weather even cooperated with us this year. I also wanted to remind everyone, as usual, that the SunWatches are continuing as usual. If you would like to volunteer to help with the SunWatches, please arrive a little before 3:00 p.m. to help with setup at the dam. Until next month… Clear Skies.

[Ed. Addenda: I would like to stress that what Brandon is proposing is good. Establish a ground base of education for new members and build upon that. I would also like to state that the observing after a short presentation be one that uses club members’ (or a visitor’s) telescopes, not a Park telescope. The reason being is that the meetings should be member-focused, not Park-focused. The club members need to learn to use their own equipment and help others with their equipment. If we keep using Park equipment, then it turns into Park staff running the show. But, it would be great for more members to learn and use the Park’s equipment for public viewings. Training of Park equipment must be led by Park staff, i.e. Jason or myself. Mainly because it is the property of the City of Kingsport. If you want to learn to use this equipment, then contact Jason or myself earlier in the week of a public StarWatch to set up a training session. Come at least 45 minutes early on a clear StarWatch Saturday and be trained to use one of the Park scopes and to learn how to serve the public in educational outreach. Ask not what the club can do for you, but what you can do for the club...]
Chapter 2

BMAC Notes
The BMAC has a YouTube channel. Click here to see what's on!

(https://www.youtube.com/channel/UCwIQM6nUs9qxJtDQe4AaAWQ)

There are now four entries in our channel. Check them out!

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Total Solar Eclipse 2017 Exhibit Now Open for Viewing

Bays Mountain Park & Planetarium is happy to announce their latest exhibit creation for the public. The display highlights the major points regarding total solar eclipses, especially the one coming up on August 21, 2017.

The exhibit itself is simple, but features wonderful design elements that greatly enhance its presentation. Within its nine panels, one can learn about eclipses, how to view them safely, what phenomena to experience, some insightful quotes, and a large map of the eclipse shadow path as it crosses the United States. It's important to show just how close the path of totality is to the Tri-Cities area. Only about three hours away!

The exhibit was a joint effort of the exhibits and planetarium departments. The principle players were Cassy Rose and Jason Dorfman, respectfully. The exhibit was developed to be shown in conjunction with the Park's main planetarium show, “Totality,” which was also produced in-house by the planetarium and exhibits departments.

The new exhibit is on display adjacent to the main lobby of the Nature Center. The planetarium show is offered most days up through August 20. Please see the Park’s website at baysmountain.com for show times.
Cassy Rose and Jason Dorfman present their new exhibit about the 2017 total solar eclipse.

Photo by Adam Thanz
Chapter 3

Celestial Happenings

Jason Dorfman
This month we transition from spring to summer. We are already seeing some typical late spring weather with more showers and higher humidity. The summer solstice occurs on the 21st at 12:24 a.m. On the summer solstice, the axis of the Earth is tilted so that the northern hemisphere is pointed towards the Sun which allows a larger area of the northern hemisphere to receive sunlight. Of course, this means short nights and long days, not the best for observing unless your willing to stay up late.

Despite the later hour of sunset and the typical hazy conditions and thunderstorms this time of year, there are still some great things going on in the skies above that are worth the effort when the conditions are favorable. The Summer Triangle is just rising in the east, Ursa Major and Ursa Minor are easy to spot this time of year, the constellation of Virgo and its cluster of galaxies is visible for most of the evening and, as the evening progresses, the brighter portion of the Milky Way is appearing in the southeast with its many deep-sky objects. Also this month, Saturn reaches opposition creating optimal observing conditions, Jupiter is still prominent in the evening sky with more double shadow crossings and Venus is putting on a wonderful show in the early dawn hours. The Moon will pair nicely with all three of these planets during the month, as well. And, finally, there is a new comet to observe.

Planets

As June begins, Mars is exiting our evening skies. If you really want to get one more glimpse, the first week of June is your chance. You’ll probably need to use binoculars to pull out magnitude 1.7 Mars from the twilight glow of the setting Sun. Look for it in the west-northwest below and a little right of the twin stars of Gemini, Castor and Pollux. By the second week of June, the Red Planet will be lost in the glare of the Sun until it re-emerges in our morning skies in September.

Jupiter is still shining brightly in Virgo at magnitude -2.2. As the month opens, Jupiter will appear to stand still amongst the stars as it completes its westward retrograde motion coming to a halt on the 9th/10th. It will then begin its trek eastward back towards Spica. Jupiter is two months past opposition and its size in the sky is now decreasing. At mid-month it will span about 39".
There are a few more double shadow crossings this month cast by the four largest moons of Jupiter. On the morning of the 2nd from 3:42-5:52 a.m., look for the shadows of Io and Europa. Europa will begin its transit first at 1:18 a.m. with Io transiting later at 2:28 a.m. Europa’s shadow will appear at 3:31 a.m. with Io’s shadow close behind at 3:42 a.m. Io, being closer to Jupiter, has the faster motion, so watch Io’s shadow move past Europa’s and exit at 5:52 a.m. Europa’s shadow will then disappear 4 minutes later. On the 3rd/4th, look for the shadows of Io and Ganymede, the largest moon of Jupiter, starting at 10:21 p.m. and lasting until 12:21 a.m. And again on the evening of the 19th, the shadows of Io and Europa can be seen from 10:04 p.m. until 10:38 p.m. This month’s edition of Sky & Telescope has a useful table on page 51 listing the transits, eclipses, occultations, and shadow crossings for these moons of Jupiter.

The planetary highlight for the month is the beautiful ringed world of Saturn. Look for it in Ophiuchus between the teapot in Sagittarius and Antares in Scorpius. It is moving retrograde and will be at or very near magnitude 0.0 for the month. Saturn reaches opposition on the night of the 14th/15th. This means that it will rise around sunset and set close to sunrise for the month providing a full night of being able to observe this fascinating world. Unfortunately, due to the low altitude of the ecliptic around the solstice, Saturn will remain low in the south, reaching a maximum altitude of about 32° for the Tri-Cities region. At mid-month the planet will span 18” and the ring plane will appear 42” across the sky. Also, the ring plane is tilted quite a bit at 27°, the greatest since 2003.

As mentioned in last month’s article, the Cassini spacecraft has begun a series of 22 close flyby’s between the planet Saturn and its rings. It has successfully completed its first pass. Check out the Cassini mission webpage for a good video showing the cloud tops of Saturn taken during this pass.

Look to the morning skies for the planet Venus. Venus reaches its greatest western elongation on the 3rd when it will be 46° from the Sun. It is about magnitude -4.4 this month. In early June, it rises 2 hours before sunup and will be about 15° above the eastern horizon an hour before sunrise. However, as we approach the end of the month, even though it will be moving back towards the Sun, Venus will rise 2.5 hours before the Sun and get about 5° higher due to the steepening angle of the ecliptic. We’ll see Venus move quite a bit against the background stars in June. Starting at the bottom of the V-shape in Pisces, Venus will move into Aries spending just one day in Cetus. It will move through the southern part of Aries and just scoot into Taurus at month’s end.

Grab a pair of binoculars to catch Venus sliding about 2° just south of the ice giant Uranus from the 1st through the 4th.

Luna

The month of June begins and ends with a first quarter Moon. On the 3rd, a waxing gibbous Moon will lie just 2° from Jupiter. Full
Moon occurs on the 9th and will appear about 3° north of Saturn. For the early risers, look to the east on the 20th and 21st to see a waning crescent near Venus. It will be 2° south on the 20th and a little more than that to the east-northeast on the 21st. The Moon will be at apogee (farthest distance from Earth) on the 8th.

Comets

Comet 41P/Tuttle-Giacobini-Kresak which I’ve mentioned in the last two articles is still observable all night this month. Currently in Lyra, it’s now a 10th magnitude object so look for it once the Moon has exited the sky.

A more prominent comet this month is Comet Johnson (C/2015 V2). This is a new comet making its first trip through the inner Solar System. It will make its closest approach to Earth on the 5th and then the Sun a week later as it takes a dive across the plane of the Solar System just beyond the orbit of Mars. It is currently at magnitude 7.3, but should continue to brighten a bit as it gets closer to the Sun. During June, it will travel from Boötes into Virgo, passing east of Arcturus on the 3rd/4th.

That’s all for this month. Clear Skies!
Chapter 4

The Queen Speaks

Robin Byrne
This month, we honor the life of a man who knew the Moon better than just about any other person... ever. Ewan Adair Whitaker was born June 22, 1922 in London, England. The son of a typesetter, George Whitaker, and housewife, Gladys. Ewen attended the John Roan School in Greenwich. This is a pricey, private boarding school, but Ewen received a scholarship to cover his expenses. When he left school, Ewen’s first job was as a lab assistant, working for the Siemens Brothers electrical engineering company.

During World War II, Ewen worked for Project PLUTO (Pipe Line Under the Ocean), which was built under the English Channel to provide fuel to allied forces in France. Whitaker’s job was to use UV spectral analysis to monitor the quality of the lead that surrounded the hollow cables which carried the fuel. He became quite adept at spectroscopy, which would have an influence on his later career. It was during this time that Whitaker earned a certificate in mechanical engineering from a local trade school. In 1946, Ewen married Beryl Hornswell. They had three children: Fiona, Graham, and Malcolm.

Despite having no formal training as an astronomer, in 1949, Whitaker found himself working at the Royal Greenwich Observatory. His experience with spectroscopy got Whitaker a job working on UV spectra of stars. However, it wasn’t long before Ewen found his true calling, the Moon. A hand-drawn lunar map published in 1935 was the primary resource for all studies of the Moon. Whitaker spent his spare time updating the map with the use of information from photographs of the Moon. He was not only a member of the Lunar Section of the British Astronomical Association, but Whitaker soon took on a leadership role. In 1954, Whitaker published the first accurate chart of the Moon’s South Polar region. Working with D. W. Arthur, they created names for various craters near the Moon’s limb. All the names they suggested were adopted by the International Astronomical Union (IAU).

In 1955, Whitaker attended the IAU meeting held in Dublin, Ireland. It was here that he met Gerard Kuiper, who was the Director of Yerkes Observatory at the time. He must have made a good impression on Kuiper, because in 1958, Kuiper invited Whitaker to join the Lunar Project at Yerkes. Whitaker accepted.
Their primary project was to create a high-quality photographic atlas of the Moon. Whitaker took images of the Moon with both the 40-inch telescope at Yerkes, and the 82-inch telescope at McDonald Observatory. After taking hundreds of images over a couple years, the Photographic Lunar Atlas was published in 1960.

That same year, Kuiper moved to the University of Arizona to establish the Lunar and Planetary Laboratory (LPL). Whitaker, along with over 300 others, joined the staff. Whitaker’s first task was to use the facility’s new 61-inch telescope to photograph the Moon. Meanwhile, a combination of the images from Yerkes and the new images were compiled into the Orthographic Atlas of the Moon (1961) and the Rectified Lunar Atlas (1963). Those images ultimately were published all together in the Consolidated Lunar Atlas (1967), which is still available for use through the Lunar and Planetary Institute’s web page.

With the Moon being the ultimate goal of the space race, it was natural for the LPL to be at the forefront of information used by the space program. In 1964, Whitaker, along with Kuiper, Urey, Shoemaker, and Heacock, worked on the Lunar Ranger Project. Whitaker chose impact locations on the Moon for both Rangers 6 and 7. Ranger 7 provided the first up-close images of the Moon’s surface. As the missions became more complex, Whitaker began using a technique developed by Fritz Zwicky, that looked at features in both UV and infrared light. By “subtracting” one image from the other, you could get information about the chemical composition of the features. Whitaker used this technique to choose landing sites for the Surveyor spacecraft, and later for Apollo landing sites. This project culminated in 1967 with the Lunar Orbiter 5 Scientific Site Selection Team, of which Whitaker was a member. The Lunar Orbiter 5 provided the most detailed images yet for choosing Apollo landing sites, as well as images of the Moon’s far side that had never been photographed before.

Whitaker was a member of the Lunar Surveyor TV Investigator Team. Using images taken by the Surveyor landers of the area around the landing sites, Whitaker compared them to other images of the Moon, in an attempt to pinpoint where the landers were located. One of the goals of the Apollo 12 mission was to land near Surveyor 3 and retrieve some of the parts. Whitaker used Surveyor 3’s images and saw two unique-looking rocks. After scanning through images of over 1000 craters, he found the rocks. Whitaker made the bold prediction that the astronauts would only have to walk a few hundred feet to the Surveyor 3 spacecraft. “If they don’t, boy, I’m dead,” Whitaker told The New York Times. They did. In 1969, Whitaker received a letter of commendation from President Nixon for this achievement.

While Whitaker retired from LPL in 1978, he certainly didn’t stop working. One project he worked on was to try to determined
when Galileo made his famous sketches of the Moon that were published in Sidereus Nuncius in 1610. Whitaker used tables of solar data, along with his own photographs of the Moon, to prove that Galileo made 10 of his sketches on Nov. 30 - Dec. 18, 1609. Identifying a star in the last sketch as Theta Librae, Whitaker established that date as Jan. 19, 1610. Another project involved studying photographs of Uranus and its moon, Miranda. Using a plate-measuring technique that he devised, Whitaker determined the moon's orbital eccentricity and inclination.

Still, our Moon continued to be his passion. Whitaker remained active in the IAU’s Task Group for Lunar Nomenclature. In 1999, Whitaker published “Mapping and Naming the Moon,” on the history of lunar maps and nomenclature. In 2006, the IAU adopted a lettering system that Whitaker developed for designating unnamed craters on the Moon’s far side. Whitaker also chose the craters on the far side of the Moon that were named for the astronauts who died in both the Challenger and Columbia tragedies. And, in 2007, Whitaker built a telescope based on a 16th century design created by Leonard Digges, which provided magnified wide-field views.

After all his years of work, and in recognition of his many contributions to astronomy, the University of Arizona awarded Ewen Whitaker an Honorary doctorate in 2011.

Ewen Whitaker died in Tucson, Arizona on October 11, 2016, at the age of 94. What an amazing life this man led, and what important contributions he made to the world of astronomy and space exploration. The next time you have a chance to gaze at the Moon, pause a moment and remember the man who knew that celestial body better than anyone else: Ewen Whitaker.

References:

Ewen Whitaker - Wikipedia


Ewen Whitaker, Who Guided NASA to the Moon, Dies at 94

By William Grimes, Oct 27, 2016


Remembering Ewen A. Whitaker, 1922-2016


Lunar Orbiter 5 - Wikipedia

https://en.wikipedia.org/wiki/Lunar_Orbiter_5
Chapter 5

Space Place

See FN6
With clouds, rain, seas, lakes and a nitrogen-filled atmosphere, Saturn’s moon Titan appears to be one of the worlds most similar to Earth in the Solar System. But it’s still alien; its seas and lakes are full, not of water, but liquid methane and ethane.

At the temperatures and pressures found on Titan’s surface, methane can evaporate and fall back down as rain, just like water on Earth. The methane rain flows into rivers and channels, filling lakes and seas.

Nitrogen makes up a larger portion of the atmosphere on Titan than on Earth. The gas also dissolves in methane, just like carbon dioxide in soda. And similar to when you shake an open soda bottle, disturbing a Titan lake can make the nitrogen bubble out!

But now it turns out the seas and lakes might be fizzier than previously thought. Researchers at NASA’s Jet Propulsion Laboratory recently experimented with dissolved nitrogen in mixtures of liquid methane and ethane under a variety of temperatures and pressures that would exist on Titan. They measured how different conditions would trigger nitrogen bubbles. A fizzy lake, they found, would be a common sight.

On Titan, the liquid methane always contains dissolved nitrogen. So when it rains, a methane-nitrogen solution pours into the seas and lakes, either directly from rain or via stream runoff. But if the lake also contains some ethane—which doesn’t dissolve nitrogen as well as methane does—mixing the liquids will force some of the nitrogen out of solution, and the lake will effervesce.

“It will be a big, frothy mess,” says Michael Malaska of JPL. “It’s neat because it makes Earth look really boring by comparison.”

Bubbles could also arise from a lake that contains more ethane than methane. The two will normally mix, but a less-dense layer of methane with dissolved nitrogen—from a gentle rain, for example--could settle on top of an ethane layer.

In this case, any disturbance—even a breeze—could mix the methane with dissolved nitrogen and the ethane below. The nitrogen would become less soluble and bubbles of gas would fizz out.

Heat, the researchers found, can also cause nitrogen to bubble out of solution while cold will coax more nitrogen to dissolve. As the seasons and climate change on Titan, the seas and lakes will inhale and exhale nitrogen.
But such warmth-induced bubbles could pose a challenge for future sea-faring spacecraft, which will have an energy source, and thus heat. “You may have this spacecraft sitting there, and it’s just going to be fizzing the whole time,” Malaska says. “That may actually be a problem for stability control or sampling.”

Bubbles might also explain the so-called magic islands discovered by NASA’s Cassini spacecraft in the last few years. Radar images revealed island-like features that appear and disappear over time. Scientists still aren’t sure what the islands are, but nitrogen bubbles seem increasingly likely.

To know for sure, though, there will have to be a new mission. Cassini is entering its final phase, having finished its last flyby of Titan on April 21. Scientists are already sketching out potential spacecraft—maybe a buoy or even a submarine—to explore Titan’s seas, bubbles and all.

To teach kids about the extreme conditions on Titan and other planets and moons, visit the NASA Space Place: https://spaceplace.nasa.gov/planet-weather/.

This article is provided by NASA Space Place. With articles, activities, crafts, games, and lesson plans, NASA Space Place encourages everyone to get excited about science and technology. Visit spaceplace.nasa.gov to explore space and Earth science!
Chapter 6

BMAC
Calendar and more

See FN7
### BMAC Calendar and more

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Location</th>
<th>Notes</th>
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<tbody>
<tr>
<td><strong>BMAC Meetings</strong></td>
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<tr>
<td>Friday, June 2, 2017</td>
<td>7 p.m.</td>
<td>Nature Center</td>
<td>Program: BMACer William Troxel; “What Type of ‘Scope is Best for You;” Free.</td>
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<td>Discovery Theater</td>
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<td>Friday, August 4, 2017</td>
<td>7 p.m.</td>
<td>Nature Center</td>
<td>Program: Topic TBA; Free.</td>
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<td>Discovery Theater</td>
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<tr>
<td>Friday, September 1, 2017</td>
<td>7 p.m.</td>
<td>Nature Center</td>
<td>Program: Topic TBA; Free.</td>
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<td>Discovery Theater</td>
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<tr>
<td>Friday, October 6, 2017</td>
<td>6 p.m.</td>
<td>Observatory</td>
<td>Program: Observatory cleaning and topic TBA; Free.</td>
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<tr>
<td><strong>SunWatch</strong></td>
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<td>Every Saturday &amp; Sunday</td>
<td>3-3:30</td>
<td>At the dam</td>
<td>View the Sun safely with a white-light view if clear.; Free.</td>
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<td>March - October</td>
<td>p.m.</td>
<td>if clear</td>
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<tr>
<td><strong>StarWatch</strong></td>
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<tr>
<td>Oct. 7 &amp; 14, 2017</td>
<td>7:30 p.m.</td>
<td>Observatory</td>
<td>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.</td>
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<tr>
<td>Oct. 21 &amp; 28 &amp; Nov. 4, 2017</td>
<td>7:00</td>
<td>Observatory</td>
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<tr>
<td>November 11, 18, &amp; 25, 2017</td>
<td>6:00</td>
<td>Observatory</td>
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<td><strong>Special Events</strong></td>
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<td>Saturday, July 15, 2017</td>
<td>6 p.m.</td>
<td>Gazebo, Natural Tunnel State Park</td>
<td>Annual club picnic. BMACers and their families are most welcome to enjoy the evening along with a potluck dinner. Please bring a dish to share. You’ll need to bring your own chair and telescope to share the night sky.</td>
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<tr>
<td>Oct. 27-29, 2017</td>
<td>-</td>
<td>Farmstead</td>
<td>StarFest 2017. Our annual astronomy convention/star gathering for the Southeast United States. Three days of astronomy fun, 5 meals, 4 keynote speakers, unique T-shirt, and more. <strong>Pre-registration by Oct. 6, 2017 with full payment is mandatory for attendance. Sorry, no walk-ins nor “visits.”</strong> Registration opens in August.</td>
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</table>
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:
www.baysmountain.com/astronomy/astronomy-club/

Regular Contributors:

Brandon Stroupe
Brandon is the current chair of the club. He is a photographer for his home business, Broader Horizons Photography and an avid astrophotographer. He has been a member since 2007.

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 vasty dominates any meager sunlight falling on the rings. Hence, the half of the rings on the left dominated 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.


Image Credit: NASA/JPL/Space Science Institute

2. Duke on the Craters Edge

Astronaut Charles M. Duke Jr., Lunar Module pilot of the Apollo 16 mission, is photographed collecting lunar samples at Station no. 1 during the first Apollo 16 extravehicular activity at the Descartes landing site. This picture, looking eastward, was taken by Astronaut John W. Young, commander. Duke is standing at the rim of Plum crater, which is 40 meters in diameter and 10 meters deep. The parked Lunar Roving Vehicle can be seen in the left background.

Image AS16-114-18423

Creator/Photographer: NASA John W. Young

3. The Cat's Eye Nebula, one of the first planetary nebula 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

Footnotes:
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 counterpart 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 Tucanae.

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 theorists 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 August 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. Radar images from Cassini showed a strange island-like feature in one of Titan’s hydrocarbon seas that appeared to change over time. One possible explanation for this “magic island” is bubbles. Image credits: NASA/JPL-Caltech/ASI/Cornell