Chapter 1

Looking Up

Brandon Stroupe - BMAC Chair
Hello BMACers,

March is now here and we are inching ever closer to spring. Warmer weather should be coming soon, but unfortunately that usually means rain as well. Of course, we really do not know what Mother Nature has in store for us. The weather around here has been crazy and you never know what we are going to get. I personally would love temperatures of 70 degrees during the day and about 40 degrees at night. Oh yeah, and clear skies 300 days out of the year. Does anyone know where I could find that? Needless to say, I am pretty picky about what kind of weather I like. I think we would all like to be out under the stars a little more often. I know I would.

Our meeting this month will feature Sabrina Hurlock. She is currently a teacher in Murfreesboro, Tennessee and she is a graduate of ETSU and she did graduate research work at the University of Tennessee Space Institute. Her presentation will be titled, “Women in Science: The Good, the Bad, and the Ugly.” Her talk will explore a range of topics from the history of women in the fields of physics, astronomy, and engineering, to current work being performed by leading local and global experts. A wrap-up discussion will address the struggles still faced by women in scientific fields on a daily basis and how we can encourage and affect positive change. Sabrina will be our 2nd speaker in our “Women in Astronomy” series. I hope everyone will be able to attend this meeting and I believe it will be a very informative and entertaining presentation.

At our February meeting, we welcomed Dr. Beverly Smith from ETSU. She is a professor in the Physics and Astronomy department at ETSU. Her presentation was titled, “Star Formation in Interacting Galaxies.” She spoke about the different types of galaxies and star clusters and then about the formation of stars. She also talked about the different ways to study star formation regions and the software that is used to study and analyze them. She also spoke about the two types of interacting galaxies modeling that is used to verify the data. Dr. Smith’s presentation came from her and her fellow colleagues’ own research. Her presentation was pretty detailed and informative. I hope all of you that attended really enjoyed the talk. After the talk, we had a brief business meeting where we began discussing the upcoming Astronomy Day. If you would like to
Cancer, the Crab

OJ287

M44

M67

Cancer the Crab
image from Stellarium
layout by Adam Thanz
help out or have some suggestions about what you think the public would like to see and learn, please contact me or William Troxel. William will be the planner and organizer for Astronomy Day. We also mentioned the upcoming Mercury Transit on May 9th. It will be held at The Yards. They are located on ETSU grounds in Johnson City, TN. It will probably draw some pretty big crowds so feel free to come out and help out and enjoy this awesome event. The public viewing is from 10 a.m. to 3 p.m. BMACers wanting to help need to show up by 9 a.m. If you bring a telescope, it MUST have a proper solar filter of at least neutral density 5. If the weather is poor, the viewing is cancelled. For more info, visit this web page: http://www.baysmountain.com/astronomy/observatory/?GTTabs=2

The constellation for this month is Cancer. It is translated to the Crab. Cancer plays a small role in the battle of Hercules and Hydra. While Hercules was busy fighting the multi-headed monster, Hera sent the Crab to distract him. Cancer grabbed onto the toes of Hercules with its claws but he was not distracted. Hercules crushed the crab with his foot. Hera, grateful for the brave but pitiful effort, gave it a place in the sky. Cancer is the dimmest of the zodiacal constellations. It has only two stars above 4th magnitude. A few of the notable objects in Cancer are M67, an open cluster, and the pretty well known open cluster of M44. Most of us know M44 as the Beehive Cluster. M44 is one of the nearest open clusters to our Solar System and it contains about 50 stars. One more notable feature of this constellation is OJ 287. It is an active galaxy with an active galactic nucleus located 3.5 billion light years away and an apparent magnitude of 14.83. Its central supermassive black hole is among the largest known, with a mass of 18 billion solar masses. That is more than six times the value calculated for the previous largest object. I found that fact pretty interesting myself. Next time you are out and the constellation is visible, take a look and remember all the things that are going on up there that we can’t even see.

That will be it for this month. I just wanted to remind everyone that the StarWatches and the SunWatches start back this month. The StarWatches will happen every Saturday night beginning at dusk, if it is clear. If cloudy, the event is moved into the planetarium. The SunWatches will happen every Saturday and Sunday, from 3-3:30 p.m. at the dam if it is clear. We are always happy to have volunteers from the club to help out. If you would like to help out, please arrive about 30 minutes early to help set up the equipment. If you want to start earlier or stay later, that is OK as well, but you’d need to have your own equipment. It’s important that at least the “official” 30 minute time window is covered. I hope to see everyone at the meeting this month to continue our “Women in Astronomy” series.

Until next month… Clear Skies.
Chapter 2

BMAC Notes
“BoBfest” 2016

by Greg Love, BMAC

Three Bays Mountain Astronomy Club (BMAC) members attended the Gardner-Webb University Astronomy Symposium this year. They included Jocelyn Guillard, William Troxel, and myself, Greg Love. If you have attended this meeting and are asking if this is a name change, yes it is. It is hosted by the Cleveland County Astronomy club (www.ccastro.org). But we usually refer to the meeting as BoBfest. The trek is about a 2.5 hour drive from Johnson City.

The meeting includes speakers, raffle prizes, and swap shop. There was also a meteorite exhibit with some of the meteorites for sale. Cost is whatever you spend on raffle tickets and lunch, so essentially very low. They have quite a few prizes for those who purchase the raffle tickets. William and I did very well with the prizes.

Meteorites: Pieces of the Night Sky - James Lamm is a member of the Charlotte Amateur Astronomers Club and collector of meteorites. James explained in simple language the types of meteorites and how to recognize them. He passed a few of his meteorites through the audience for closer inspection.

Geomagnetism and the GWU Geomagnetic Observatory - Dr. Don Olive, professor at Gardner-Webb University, introduced his project to build and install sensitive magnetic sensors to monitor the Earth’s magnetic field. His plan would be to link with a worldwide group of geomagnetic observatories (www.intermagnet.org). He explained that the primary source of Earth’s magnetic field is the rotation of a solid core at the center of Earth that is separated from the crust by a liquid layer. But, there are other sources, such as ionized particles in the atmosphere. This causes the map of Earth’s magnetic field to be more complex than a simple bar magnet.

So What Can You Do Without a Telescope? LOTS!!! - Joe Heafner is a dynamic speaker. He is an AAPT Fellow at Catawba Valley College in astronomy and physics. I was fooled by the title of his talk and expected a talk on what can be seen in the night sky. Instead, his talk encompassed personal scientific discovery on questions about the rotation of the Earth, the circumference of the Earth, your latitude, etc. His tool for these discoveries was a
"BoBfest" 2016 - photo by Greg Love
“Meteorites linked to asteroid”

Charlotte Observer – September 5, 2011

“In a wide-ranging analysis of tiny fragments collected from the asteroid Itokawa during a spacecraft visit in 2005, six studies by several teams of scientists piece together a detailed description, and history, of this particular space rock. Their findings were released last month by the Journal Science.

The more than 1,500 dust grains gathered by Japan’s Hayabusa spacecraft - which are uncontaminated by our atmosphere, unlike meteorites that fall to Earth - show that meteorites contain the primitive elements that formed the early solar system.

“These dust particles are the building blocks of the planets,” said Tomoki Nakamura, a planetary scientist at Tohoku University in Sendai, Japan, who is one of the studies’ lead authors.”

"These dust particles are the building blocks of the planets…”
Geomagnetism and the GWU Geomagnetic Observatory

The 24th Annual Regional Meeting of Amateur Astronomers: “BoBfest”

Don Olive
Gardner-Webb University
January 16, 2016

Image from Geomagnetism talk - photo by Greg Love
The Best Man
Unsung American Spectroscopist J. E. Keeler

Tom English
Cline Observatory/GTCC

GWUAS/BoBfest 2016

Keeler talk - photo by Greg Love
“stick.” A simple stick that you can find in your home could be used. Early scientific instruments were fancy sticks, such as the astrolabe and armillary.

The Best Man: America’s Pioneering Astrophysicist, J.E. Keeler - Tom English, professor of astronomy at Guilford Technical Community College, gave an in-depth biography of American astrophysicist James Edward Keeler. Among the positions held by Keeler was Director of Allegheny Observatory. But, he lived in the golden age of astronomy in America and observed at the Lick Observatory. His discoveries included the Encke Gap in the rings of Saturn and their rate of rotation. Indeed, some of his discoveries involved spectroscopy and the Doppler shifts. Along with George Hale, he founded the Astrophysical Journal.

ALERT!!! - “BoBfest” 2017 will be hosted by the Catawba Valley Astronomy Club (http://www.catawbasky.org/) and will be held at the Catawba Science Center in Hickory, NC.
A few interesting events occurred last month. The “alignment” of the visible planets with the culmination of the Moon, Mercury, and Venus in a nice triangle low to the horizon was very nice. Though, we had patchy clouds. I tried to get a good photo, but I couldn’t get all three together in one image.

Astronaut Dr. Mae Jamison was in the Tri-Cities on Feb. 4, 2016 at the Eastman Toy F. Reid Employee Center. She was the first African-American woman to fly in space on STS-47 which launched on Sept. 12, 1997.

Her presentation was mostly about the importance of education, the future of our society, and being part of a team when flying on the Space Shuttle Endeavor.

I’m also including an image of Leo with the planet Jupiter taken from my back deck on Feb. 11, 2016.
Dr. Mae Jemison taking questions.
Photo by Adam Thanz
Leo with Jupiter.
Photo by Adam Thanz
Leo with Jupiter. Lines have been added to show the constellation. Photo by Adam Thanz.
Chapter 3

Star Stuff

Terry Alford
Even though the Sun is still heading towards solar minimum, there are often opportunities to view sunspots and prominences through a properly filtered telescope. The days are getting warmer (usually!) and after Daylight Saving Time starts on the 13th, you will have one more hour of sunshine after getting home from work.

Mercury and Neptune are poorly placed for observation this month. Uranus is placed far into the southwest as the Sun sinks and will disappear completely around mid-month.

Venus rises in the east about an hour before sunrise. It reaches a magnitude of \(-3.8\) on March 5. By the end of the month it will go behind the Sun and be invisible from our view until later in the Spring.

Mars comes up around midnight. Its magnitude dramatically increases from \(+0.3\) at the start of the month to \(-0.5\) by month’s end. Its disk grows from 8.7” to 11.8”, wide so it should be a little easier to eek out a few details on the Red Planet with a quality telescope. It also moves out of Libra into Scorpius and on the morning of March 16, passes only 9’ from the lovely double star Beta Scorpii.

Jupiter is the “star” of the planet parade this month. It reaches opposition on March 8, rising at dusk, and will shine brightly at mag \(-2.5\). The planet is easy to find under the body of Leo. The disk is a generous 44” wide, so plenty of details should show even in a moderately sized telescope. Believe it or not, there will be eleven double shadow transits this month on Ol’ Jove. Three will occur that will be visible from East Tennessee. On the night of March 14 from 10:22 to 12:34 a.m., on the night of March 21 from 12:23 to 2:31 a.m. the next morning, and the third transit is on the morning of March 29 from 3:00 to 4:25 a.m. These transits are always fun and interesting to view, even with a relatively small scope. But, as usual, bigger is always better. Steady skies don’t hurt either.

Saturn goes from a mag of \(+0.5\) to a mag of \(+0.3\) by month’s end. Its equatorial diameter is 17”. The rings are still tilted favorably for observation at 26° and a pretty wide span of 38”. Unfortunately, Saturn is pretty low on the ecliptic in Ophiuchus so you will need a solid, steady night for good viewing. It will
begin retrograde motion on March 25. It will move westward and rapidly towards Mars. By the end of the month they will only be 9° apart, a pretty sight to be sure.

New Moon is on March 9 and Full Moon on March 23.
Chapter 4

The Queen Speaks

Robin Byrne
This month, we celebrate the birthday of a man whose career has spanned many areas, but who managed to, unintentionally, avoid being part of a harrowing experience. Thomas Kenneth Mattingly II was born March 17, 1936 in Chicago, Illinois. Known as “Ken,” Mattingly’s family moved to Hialeah, Florida when he was young. His early years were fairly typical, including joining the Boy Scouts, and achieving the rank of Life Scout. In 1954, Ken graduated from Miami Edison High School. From there, he went to Auburn University where he received a Bachelor of Science degree in Aeronautical Engineering in 1958.

After graduation, Mattingly joined the U. S. Navy as an ensign. Two years later, he had his aviator wings. With that achievement came a new assignment - Attack Squadron 53 in Virginia, where he flew the A-1H Skyraider aboard the USS Saratoga. Three years later, Mattingly transferred to Sanford, Florida, where he was assigned to the USS Franklin D. Roosevelt, flying the A-3B Skywarrior. During his many years of active duty in the Navy, Mattingly became quite proficient at landing a plane on an aircraft carrier. In 1966, he went to Edwards Air Force Base to attend the Air Force Aerospace Research Pilot School to become a test pilot. However, NASA had other plans for his career.

In April of 1966, Mattingly joined a new group of 18 other men chosen to join the astronaut ranks. While waiting his turn to fly, Mattingly acted as support crew for both the Apollo 8 and Apollo 11 missions. He also was part of the team that developed the Apollo spacesuit and the EMU (the backpack worn during spacewalks and used for maneuvering in a weightless environment). Finally, he was assigned his own mission. Originally, he and his fellow crew mates were to fly on Apollo 14, but due to Alan Shepard needing more training for his mission, the two crews were swapped, and Mattingly found himself slated to fly on Apollo 13 with Jim Lovell and Fred Haise. Mattingly was assigned to the Command Module Pilot position. However, three days before launch, he was pulled from the crew after discovering he had been exposed to the German measles from Charlie Duke. Mattingly found out about the change while listening to the radio, where he heard a special broadcast about it. His first thought was, “If this is a practical joke, it’s really well done, but I don’t think this is a joke.” He was replaced by Jack...
The original Apollo 13 prime crew. From left to right are: Commander, James A. Lovell; Command Module pilot, Thomas K. Mattingly; and Lunar Module pilot, Fred W. Haise. On the table in front of them are from left to right, a model of a sextant, the Apollo 13 insignia, and a model of an astrolabe. The sextant and astrolabe are two ancient forms of navigation. Command Module pilot Thomas "Ken" Mattingly was exposed to German measles prior to his mission and was replaced by his backup, Command Module pilot, John L. "Jack" Swigert Jr.
The Apollo 16 prime crew mission portrait. The astronauts are, from left to right, Thomas K. Mattingly II, command module pilot; John W. Young, commander; and Charles M. Duke Jr., lunar module pilot.
Swigert. Even though he never contracted the measles, the last minute swap saved Mattingly from being a part of the emergency that struck the Apollo 13 mission. However, the change allowed him to help address some of the issues faced by the crew in space, especially the power availability. Mattingly also knew that Jack Swigert was better suited to handle that particular emergency, because Mattingly can’t handle the cold. “I have a personal thermostat that’s set right around 70 degrees,” Mattingly said. “When my body gets below 60 degrees, it doesn’t function. If I had been stuck up there, I would have absolutely been a disaster.”

Because of the swap with Swigert, Mattingly was now poised to fly as the Command Module Pilot on the Apollo 16 mission from April 16 - 27, 1972. Flying with him were John Young and Charlie Duke. While Young and Duke worked on the lunar surface, Mattingly remained in orbit aboard Casper. His job was to perform observations of the moon’s equator, obtaining photographs and geochemical maps of the region. After leaving lunar orbit and while heading back to Earth, Mattingly performed an EVA (Extravehicular Activity) to retrieve film and data packages from the science bay located on the side of the service module.

After his stint with the Apollo program, Mattingly moved on to the Space Shuttle program. From 1973 to 1978, he worked as the head of the astronaut office for the program. He then briefly worked as a technical assistant for flight test to the Manager of the Orbital Flight Test Program. Starting in December 1979, Mattingly was head of the astronaut office ascent/entry group. Finally, in 1981, the first Shuttle launched. Mattingly served as back-up commander for both STS-2 and STS-3. He was then named Commander for the STS-4 mission, which was the last test flight of the Space Shuttle Columbia. Flying with him was Henry Hartsfield in the Pilot seat. Launching June 27, 1982, their seven days in space were used to evaluate the launch and entry performance of the space craft, the long-term thermal effects on the orbiter, plus some scientific experiments. They landed at Edwards Air Force Base on July 4, 1982. (A landing that I was SUPPOSED to see, but that’s another story.)

From June 1983 through May 1984, Mattingly served as Head of the Astronaut Office Department of Defense (DOD) Support Group. This may have played a role in his next assignment. On January 24, 1985, Mattingly was again the Commander of a shuttle mission, this time STS-51-C, which was the first DOD mission. The Space Shuttle Discovery landed on January 27, 1985. This was Mattingly’s last flight, garnering him a total of 504 hours in space, including 73 minutes of EVA.

After resigning from NASA in 1985, Mattingly was Chief of NAVSPACECOM for one year. He then retired from the Navy with the rank of Rear Admiral. From the Navy, Mattingly moved on to become the Director of Utilization and Operations at the Grumman Space Station Office. Later, he moved to Lockheed
S72-35901 (25 April 1972) --- Astronaut Thomas K. (Ken) Mattingly II, command module pilot of the Apollo 16 lunar landing mission, floats in space outside the spacecraft during his trans-Earth extravehicular activity (EVA), as seen in this reproduction taken from a color television transmission made by a color TV camera mounted on the Command Module (CM) hatch. Mattingly used hand-holds and a foot restraint to hold himself in position, and he was secured to the spacecraft by an umbilical tether line. During his EVA, Mattingly made an inspection of the Service Module’s (SM) Scientific Instrument Module (SIM) bay, and retrieved film cassettes from the Panoramic Camera and the Mapping Camera. The trans-Earth EVA occurred at ground elapsed time of 242:55, and 2:49 p.m. (CST), Tuesday, April 25, 1972.
CAPE CANAVERAL, Fla. - STS-4 thunders away from Launch Pad 39A at 10:59:59 a.m. EDT, bound for a seven-day Earth orbital mission and the final developmental flight for the Space Transportation System. The fourth Space Shuttle mission is piloted by Commander Ken Mattingly and Pilot Henry Hartsfield Jr.

Photo Credit: NASA
S82-33420 (4 July 1982) --- The aft wheels of the Space Shuttle Columbia ease down on the runway at Edwards Air Force Base (AFB) to successfully complete a week-long spaceflight for Astronauts Thomas K. Mattingly, II, and Henry W. Hartsfield, Jr. A T-38 aircraft serves as a chase plane (just above center of photo) in the background. Not long after this photograph was made and the crew had egressed their craft, President Ronald Reagan addressed a giant crowd on hand at Edwards AFB for a special kind of July 4 celebration.
Martin to be the Director of the X-33 Program, which was a proposed space plane that never reached fruition. After Lockheed Martin, Mattingly went to General Dynamics to head the Atlas booster program.

Whether flying in air or space, Ken Mattingly managed to live a charmed life while achieving goals most of us can only dream about. As NASA begins recruiting for the next round of astronauts to fly the Orion spacecraft, we can live vicariously through these individuals, who get to experience what only a select few ever will achieve. Ken Mattingly’s legacy lives on in all of them.

References

Ken Matting - Wikipedia

Astronaut Bio: Thomas K. Mattingly

Ken Matting: Apollo 16 Astronaut by Elizabeth Howell April 16, 2013
http://www.space.com/20689-ken-mattingly-astronaut-biography.html

International Space Hall of Fame:: New Mexico Museum of Space History
http://www.nmspacemuseum.org/halloffame/detail.php?id=80
Chapter 5

Space Place
When you think about the new stars forming in the Milky Way, you probably think of the giant star-forming regions like the Orion Nebula, containing thousands of new stars with light so bright it’s visible to the naked eye. At over 400 parsecs (1,300 light years) distant, it’s one of the most spectacular sights in the night sky, and the vast majority of the light from galaxies originates from nebulae like this one. But its great luminosity and relative proximity makes it easy to overlook the fact that there are a slew of much closer star-forming regions than the Orion Nebula; they’re just much, much fainter.

If you get a collapsing molecular cloud many hundreds of thousands (or more) times the mass of our sun, you’ll get a nebula like Orion. But if your cloud is only a few thousand times the sun’s mass, it’s going to be much fainter. In most instances, the clumps of matter within will grow slowly, the neutral matter will block more light than it reflects or emits, and only a tiny fraction of the stars that form—the most massive, brightest ones—will be visible at all. Between just 400 and 500 light years away are the closest such regions to Earth: the molecular clouds in the constellations of Chamaeleon and Corona Australis. Along with the Lupus molecular clouds (about 600 light years distant), these dark, light-blocking patches are virtually unknown to most sky watchers in the northern hemisphere, as they’re all southern hemisphere objects.

In visible light, these clouds appear predominantly as dark patches, obscuring and reddening the light of background stars. In the infrared, though, the gas glows brilliantly as it forms new stars inside. Combined near-infrared and visible light observations, such as those taken by the Hubble Space Telescope, can reveal the structure of the clouds as well as the young stars inside. In the Chameleon cloud, for example, there are between 200 and 300 new stars, including over 100 X-ray sources (between the Chamaeleon I and II clouds), approximately 50 T-Tauri stars and just a couple of massive, B-class stars. There’s a third dark, molecular cloud (Chamaeleon III) that has not yet formed any stars at all.

While the majority of new stars form in large molecular clouds, the closest new stars form in much smaller, more abundant ones. As we reach out to the most distant quasars and galaxies in the Universe, remember that there are still star-forming mysteries to be solved right here in our own backyard.

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.

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Chapter 6

BMAC
Calendar
and more
### 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, March 4, 2016</td>
<td>7 p.m.</td>
<td>Nature Center Discovery Theater</td>
<td>Program: Sabrina Hurlock; “Women in Science: The Good, the Bad, and the Ugly.” Ms. Hurlock is an educator in Murfreesboro, TN. Her talk will explore a range of topics from the history of women in the fields of physics, astronomy, and engineering, to current work being performed by leading local and global experts. A wrap-up discussion will address the struggles still faced by women in scientific fields on a daily basis and how we can encourage and affect positive change.; Free.</td>
</tr>
<tr>
<td>Friday, April 1, 2016</td>
<td>7 p.m.</td>
<td>Nature Center Discovery Theater</td>
<td>Program: Robin Byrne from Northeast State Community College. Topic TBA. Part of our 3-part series on “Women in Astronomy.” Free.</td>
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<tr>
<td>Friday, May 6, 2016</td>
<td>7 p.m.</td>
<td>Nature Center Discovery Theater</td>
<td>Program: TBA; Free.</td>
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<tr>
<td><strong>SunWatch</strong></td>
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<tr>
<td>Every Saturday &amp; Sunday March - October</td>
<td>3-3:30 p.m.</td>
<td>At the dam</td>
<td>View the Sun safely with a white-light view if clear.; Free.</td>
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<tr>
<td><strong>StarWatch</strong></td>
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<tr>
<td>Saturday, March 5, 12, 2016</td>
<td>7:00 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>Saturday, March 19, 26, 2016</td>
<td>8:00 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>
</tr>
<tr>
<td>Saturday, April 2, 9, 16, 23, 30, 2016</td>
<td>8:30 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><strong>Special Events</strong></td>
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<tr>
<td>Monday, May 9, 2016</td>
<td>10 a.m - 3 p.m.</td>
<td>ETSU CPA Front or Side Yard</td>
<td>Mercury Transit - Come help with this public viewing program. Please show up by 9 a.m. to set up. BMACers will need to bring a scope with proper solar filtration, plenty of water, a hat, a chair, and lunch. See the website for more details. <a href="http://www.baysmountain.com/astronomy/observatory/?GTTabs=2">http://www.baysmountain.com/astronomy/observatory/?GTTabs=2</a></td>
</tr>
<tr>
<td>Saturday, May 14, 2016</td>
<td>1-4:30 p.m.</td>
<td>Nature Center Observatory</td>
<td>Annual Astronomy Day - Displays et al. on the walkway leading to the Nature Center, 1-4:30 p.m.; Solar viewing 3-4 p.m. at the dam; Night viewing 8:30-10 p.m. at the observatory.</td>
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Annual Dues:

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

$16 /person/year

$6 /additional family member

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

The club’s website can be found here:

www.baysmountain.com/astronomy/astronomy-club/

Regular Contributors:

Brandon Stroupe

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

Terry Alford

Terry is a founding member since 1980 and has been chair many times. He has worked as an astronomy lab instructor at ETSU since 2001.

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).

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.


Creator/Photographer: NASA John W. Young

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 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 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. Image credit: NASA and ESA Hubble Space Telescope. Acknowledgements: Kevin Luhman (Pennsylvania State University), and Judy Schmidt, of the Chamaeleon cloud and a newly-forming star within it—HH 909A—emitting narrow streams of gas from its poles.