

# The ECLIPSE

July  
2019

*The Newsletter of the Barnard-Seyfert Astronomical Society*

## Next Membership Meeting:

July 19, 2019, 7:30 pm

Cumberland Valley  
Girl Scout Council Building  
4522 Granny White Pike

Topic:  
*Apollo 11 and the  
Return to the Moon*

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## From the President

This month, let's take a look at the Moon. As I read that sentence, I am reminded that the word "month" is derived from the word "moon". Then I chuckled because I realized that I am writing this on a Monday, also named after our Moon. The Moon certainly has had a lot of influence on all cultures and languages.

A lot of things happen around the moon this month starting on the 2nd with a total eclipse of the sun. Unfortunately, we won't be able to witness it here in Nashville, but we do have members down in Chile to witness this spectacular event. Let's hope they come back with some great stories and maybe some pictures. This will get us ready for the next North American total eclipse in 2024.

On Independence Day, the Moon will swing by Mars for a conjunction visible to us just after sunset on the 3rd. On the 13th, the Moon will pass by Jupiter for a great conjunction. On the 16th, the Moon and Saturn have a conjunction just a week after Saturn's opposition. Let's hope we have some clear skies so that we can take a few moments and watch our satellite dance with the planets.

Then on the 20th we celebrate the 50th anniversary of the Apollo 11 Moon landing. This marks a tremendous achievement in human history culminating from years of engineering and science breakthroughs. Although the space race with the Soviets played a tremendous part of the motivation to get to the moon, the actual landing was an experience shared with the entire world. For one brief moment, the world was united while waiting to see humans walk on the surface of another world. Let's hope that we can make it back and unite the world again.

There certainly is a lot happening with the Moon this month.

Clear skies and have a great month!

Keith Rainey



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**Eta Carinae, Hubble Space Telescope**

**Credit:** NASA, ESA, N. Smith (University of Arizona), and J. Morse (BoldlyGo Institute)

## Upcoming Star Parties

Friday July 5 9:00 to 11:00 pm	BSAS Public Star Party <b>Bells Bend Outdoor Center</b>
Saturday August 3	BSAS Private Star Party <b>Natchez Trace Parkway mile marker 435.3</b>
Friday August 9 9:00 to 11:00 pm	BSAS Public Star Party <b>Bowie Nature Park (Fairview)</b>
Saturday August 31	BSAS Private Star Party <b>Natchez Trace Parkway mile marker 412 (Water Valley Overlook)</b>



July 2, 31  
Aug 30



July 9  
Aug 7



July 16  
Aug 15



July 24  
Aug 23

## Happy 50th Birthday Apollo 11 by Robin Byrne

This is the anniversary we've been waiting for. Fifty years ago, men first set foot on the Moon. The story of how we got there is fascinating.

It all began in 1957, when the Soviet Union put the first manmade object in Earth orbit, Sputnik. The United States didn't get a satellite in orbit until 3 months later. Four years later, the USSR put the first man in orbit, Yuri Gagarin, with the US once again lagging behind, finally launching Al Shepard into space (but not orbit) a month later. The Space Race had begun, and America was bringing up the rear, largely due to the Soviets already having more powerful rockets built to propel ballistic missiles. President John Kennedy wanted to set a goal that would require technology that neither the US nor the USSR had, giving us an equal starting point. So, one month after Al Shepard's 15 minute trip into space, Kennedy made the announcement, "I believe that this nation should commit itself to achieving the goal, before this decade is out, of landing a man on the moon and returning him safely to the Earth." Over the intervening years, the Gemini program tested all the components necessary during a lunar mission, except actually going to the Moon. At the same time, all the hardware needed for the mission was developed and built. Despite the horrific setback experienced by the Apollo 1 fire that killed the crew, the program moved forward. Apollo's 7, 8, 9, and 10 all tested various components of the Command Module (CM) where the astronauts were housed; the Lunar Module (LM) that would land them on the Moon; the Service Module (SM) which provided the electrical power, life support, and propulsion for the trip; and the Saturn V rocket that would launch everything into space and to the Moon.

The crew for this historic mission were Neil Armstrong (Commander), Michael Collins (Command Module Pilot), and Buzz Aldrin (Lunar Module Pilot). For all three men, this would be their second trip into space, and their last. In the fledgling space program, that was unusual, with Apollo 10 being the only other mission with all crew members having been in space on a previous mission. It wouldn't happen again until 1988 on the Space Shuttle mission STS-26.

Long before going into space, it was traditional for the crew to design an insignia for the mission patch. Michael Collins wanted the insignia to include a symbol of peace to represent the idea of "coming in peace." Jim Lovell, the backup Commander, suggested a bald eagle to also symbolize the United States. One of the simulation instructors, Tom Wilson, thought they should include an olive branch as a symbol of peace. He originally proposed the eagle could carry the branch in its beak, but the images created looked aggressive with the eagle's talons extended. The director of the Manned Spacecraft Center (MSC), Bob Gilruth, had the idea of moving the olive branch so that the eagle was carrying it in his talons. Collins wanted the background to be the Moon's surface with the Earth above it. All three crew members thought the Moon and Earth should be in realistic colors, with the border being in gold and blue. They chose not to have their names on the patch, emphasizing that the mission was the work of everyone who had contributed to the program.

## Apollo 11, continued

On missions that included both the CM and LM flying separately, each vehicle needed its own call sign. Since an eagle was included in the insignia, it was decided to name the LM “Eagle.” For the CM, a name was chosen that had several references associated with it, “Columbia.” In the Jules Verne book, “From the Earth to the Moon,” the rocket was launched by a giant cannon, named Columbiad. It is also a reference to Christopher Columbus, and several ships that have been dubbed Columbia.

Before traveling to the Moon, a location for landing needed to be decided. The criteria for the landing sites included: being near the Moon’s equator, relatively free of craters, no large hills or other obstacles along the approach path, the Sun located between

7 and 20 degrees behind the LM for visibility, and terrain that is not too steeply angled. Notice that scientific interest was not a consideration. Five possible sites had been chosen based on pictures taken by various unmanned probes. The Sun angle, in particular, really limited their options, with launches being restricted to a few days per month. The time of landing needed to be when the Sun was still low in the sky to minimize the temperature extremes. Of the original five sites suggested, the Sea of Tranquility was chosen as the top candidate, with Sinus Medii and Ocean of Storms as the backups, in case of a launch delay. During the Apollo 10 mission, they flew over the Sea of Tranquility, and confirmed that it would be an acceptable landing site.

Before leaving Earth, another decision had to be made: who would walk first on the Moon? In all the earlier missions that involved an EVA (Extravehicular Activity or spacewalk), it never was the Commander, but the Pilot. This was done in case a problem arose, and the person performing the EVA had to be abandoned in space, so that the Commander could continue the mission. Because of this precedent, many people assumed that Buzz Aldrin would be the first to leave the LM and walk on the Moon. Aldrin, naturally, was all for going first, but NASA officials had a different plan. On April 14, 1969, it was officially announced that Armstrong would be first. There were two reasons for this decision. First, the way the LM was designed, and where each man was located, it would have been more difficult to maneuver into position if Aldrin were to exit first. The second reason, which was based on the private views of the NASA brass, was that they wanted the first man on the Moon to be



## Apollo 11, continued

more like Charles Lindbergh, calm and quiet. Those two criteria could not be applied to Buzz.

After all of the preparations were complete, it was time to launch. The day before, the fuel tanks of the Saturn V were filled. That night, flood lights lit the spacecraft for all to see. On the morning of July 16, 1969, Deke Slayton, head of the Astronaut Office, woke up the crew at 4:00 am for their tradition breakfast of steak and eggs. The crew suited up and were taken to the spacecraft. Fred Haise, the backup Lunar Module Pilot, and one of the pad technicians helped get the three men strapped into their seats. Once everyone was set, the support team left, and the hatch was sealed. At that point, the cabin was pressurized. The countdown began.

It is estimated that around one million people packed into coastal Florida to watch the launch from beaches and roadsides. At the VIP section of the Kennedy Space Center, attendees included hundreds of politicians from all over the US, including Vice President Agnew and former President Johnson, and thousands of media representatives from all over the world, with a third of the people present coming from 55 different countries. The launch was shown live on television, and estimates say that 25 million people watched in just the US, with millions more watching all over the world. At 9:32 am EDT, on July 16, 1969, Apollo 11 launched for the Moon.



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**Next BSAS meeting  
July 17, 2019, 7:30 pm**

Cumberland Valley  
Girl Scout Council Building  
4522 Granny White Pike

Topic:  
*Chuck Schlemm: Apollo 11 and the  
Return to the Moon*

## Apollo 11, continued

The first step was to get into Earth orbit. This required using the first two stages of the Saturn V rocket. The crew completed about one and a half orbits of Earth, taking a little over two hours, when the third stage was fired to initiate TLI, Trans-Lunar Injection, to leave Earth's orbit and head to the Moon. Once the fuel was completely used, the CM and SM separated from the third stage, turned around, and docked with the LM, which was stored inside the top of the third stage. Once they were docked, the LM was extracted from the rocket. Now it was time to head for the Moon.

During the three day journey, the crew prepared for their historic encounter with Earth's satellite. Along the way, they aired two TV broadcasts. The first was from the CM, while the second, on July 18, was from the LM, with Armstrong and Aldrin suited up to check out the Lunar Module's systems. The next day, they were in orbit around the Moon. During each of the 2 hour trips around the Moon, they photographed the lunar surface to be used in studies of lunar geology. They also looked at their landing site in great detail.

On July 20, it was time for Neil and Buzz to suit up and enter the LM. After five hours of getting everything ready, the lunar module separated from the command module, with Armstrong saying, "The Eagle has wings!" As Armstrong and Aldrin flew down to the surface, they realized that they were passing landmarks earlier than they should, and they concluded that they would be "long," meaning that they would fly miles past their landing site before they were on the surface. Meanwhile, the guidance computer started showing program alarms. These turned out to be due to the computer being inundated with so much data, it couldn't process it all in real time, so non-critical data was being stored for later processing. Margaret Hamilton, the Director of Apollo Flight Computer Programming, described the situation this way: "The software's action, in this case, was to eliminate lower priority tasks and re-establish the more important ones. The computer, rather than almost forcing an abort, prevented an abort. If the computer hadn't recognized this problem and taken recovery action, I doubt if Apollo 11 would have been the successful Moon landing it was." It was eventually determined that both the landing radar and the rendezvous radar (to be used when docking back with the CM) were on. Turning off the rendezvous radar eliminated the information overload on future missions.

Now that they knew for sure it would be safe to land, the crew had more troubles arise. Armstrong saw that where they were headed to land would be an area filled with large boulders. The only thing to do was to take manual control and try to find a more suitable site. As Aldrin kept Armstrong appraised of the navigational data, and Mission Control notified them of their rapidly declining fuel levels, Armstrong concentrated on flying the craft to a safe location. He spotted a level area, but discovered a crater in the middle of it, however past the crater was a perfect place to land. At 100 feet above the surface, and 90 seconds of fuel remaining, Armstrong began his descent. The closer he got to the surface, the more the LM's engines kicked up dust, making his ability to see what he was doing more difficult. Armstrong used two boulders jutting above the dust as his reference points to gauge how fast he was moving as he descended. With 25 seconds of fuel remaining, one of the probes hanging down

## Apollo 11, continued

from the landing pads touched the surface, prompting Aldrin to announce, “Contact light!” Armstrong was supposed to cut the engines at this point and let the spacecraft drop the remaining 5 feet, but he forgot and turned off the engines after they had landed. With 650 million people worldwide watching (20% of the world’s population), Armstrong radioed, “Houston, Tranquility Base here. The Eagle has landed.” Calling their location “Tranquility Base” was a spur of the moment decision by Armstrong, which caught his CAPCOM, Charlie Duke off guard, who replied, “Roger, Twan— Tranquility, we copy you on the ground. You got a bunch of guys about to turn blue. We’re breathing again. Thanks a lot.”

The schedule had been set for the astronauts to sleep for five hours after the landing. The crew didn’t think they’d be able to sleep, so they began preparations to perform their EVA after eating a small meal. Two hours after landing, Aldrin radioed, “This is the LM pilot. I’d like to take this opportunity to ask every person listening in, whoever and wherever they may be, to pause for a moment and contemplate the events of the past few hours and to give thanks in his or her own way.” Aldrin was an elder in the Presbyterian Church and had brought with him a communion kit to commemorate the achievement. He intentionally left out any specific religious reference in his transmission due to complaints that had been made after the Apollo 8 mission had read from Genesis on their Christmas Eve broadcast.

Just landing had accomplished half of their primary goal: land on the Moon and return safely to Earth. Other objectives included: send TV broadcasts of the Moon; photograph the moon, the lander, and themselves; deploy experiment packages to measure the solar wind and seismic activity; set up the Laser Ranging Retroreflector, and gather samples from the Moon’s surface. To accomplish those goals, they had to leave the spacecraft. In training, it had taken two hours to get ready to perform the EVA, but that was in ideal conditions and with everything laid out nicely. In reality, it took over three hours. Once they were set, the cabin was depressurized and the hatch was opened. Armstrong squeezed out of the hatch, his Portable Life Support System proving to be more awkward to maneuver with than expected. As Armstrong climbed down the ladder, he pulled a cord to open up the compartment on the side of the lander and activate the TV camera inside. At least 600 million people around the world watched Armstrong climb down onto the Moon.

Before stepping on the Moon, Armstrong uncovered the plaque attached to the part of the lander that would remain on the Moon, with images of the Earth, signatures of the crew members and President Nixon, and the caption, “Here men from the planet Earth first set foot upon the Moon, July 1969 A.D. We came in peace for all mankind.” Armstrong described the powdery texture of the lunar surface and noted how far the landing pads had sunk into the dust. And then he stepped off the lander onto the Moon’s surface, uttering the now famous declaration, “That’s one small step for [a] man, one giant leap for mankind.”

One of Armstrong’s first tasks was to collect a sample of the soil and stow it in his spacesuit. This was a contingency plan, in case they had to leave quickly without any other samples. He then used

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## Apollo 11, continued

the camera on the lander to film a panorama, and then the camera was mounted on a tripod for the remainder of the mission. Armstrong also carried with himself a camera for still images. Most of the photographs from this mission were taken by Armstrong with this camera. Twenty minutes after Armstrong stepped on the Moon, Aldrin joined him, describing the Moon as, “Magnificent desolation.”

After testing out different ways of moving in the lower gravity, the astronauts settled on loping as the best method. The soil proved to be slicker than expected, so they had to think about what they were doing before actually moving. Aldrin noted that their spacesuit maintained temperature evenly from sunlight to shadow, but the helmet got warm in the sunlight.

Before conducting any science, the crew set up the American flag. The hard ground prevented them from planting it as deeply as they wanted, and they were afraid it would fall over on live TV. President Nixon then spoke to the crew from the Oval Office to express his pride and thanks. Then they got to work taking care of all of the mission objectives. They accomplished them all, though it took longer than planned, so they stopped documenting things as thoroughly as they would like, and the crew was granted a 15 minute extension. All the experiment packages they left on the Moon worked, and they brought 47 pounds of lunar rocks and soil back home. The rocks were basalt and breccia. Three new minerals were found, which were dubbed armalcolite (named by combining Armstrong, Aldrin, and Collins), tranquillityite (named for the Sea of Tranquility), and pyroxferroite (named for the elements in the mineral). Later, all three types of minerals were found on Earth.



Unbeknownst to the crew, they almost weren't the first ones to return pieces of the Moon to Earth. Three days before the launch of Apollo 11, the Soviet Union launched Luna 15, which arrived at the Moon before the Americans. It was supposed to land on the Moon, retrieve a sample, and return to Earth. However, while Neil and Buzz were two hours away from leaving the Moon's surface, Luna 15 suffered a malfunction and crashed in Mare Crisium.

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## **Apollo 11, continued**

After two and a half hours of exploring the region within 300 feet of the lander, it was time to reenter Eagle. Aldrin went in first. Loading all of the sample boxes was a challenge, with the pulley system not working very well. It was ultimately decided that it would be easier to just carry the boxes up by hand. A bag of memorial items was left on the Moon, which included: medallions with the names of the three astronauts killed in the Apollo 1 fire and two cosmonauts who had died in accidents; a gold replica of an olive branch; a silicon message disk carrying messages from Presidents Eisenhower, Kennedy, Johnson, and Nixon, and from leaders of 73 other countries; plus names of various congressmen and NASA officials. Once this was placed on the surface, Armstrong entered the LM. The next task was to toss out anything not needed for the return trip in order to lighten the weight of the spacecraft. Then the hatch was closed and the ship was pressurized.

During all of this activity, Aldrin bumped into a circuit breaker and broke part of the switch needed to activate the engine for take-off. Fortunately, they discovered that they could use a felt-tip pen to hit the switch.

NOW they could sleep. However, the LM, being designed to be as light as possible, didn't even have seats, let alone a place to sleep, so Neil Armstrong slept on the floor, while Buzz Aldrin rigged up a sort of hammock in one corner. After sleeping for seven hours, it was time to wake up and leave the Moon. Two and a half hours later, they lifted off. Film footage showed the flag being whipped around violently from the exhaust. Although not filmed, Aldrin saw it fall over. On future missions, they made sure to plant the flag further away from the LM.

During the 21 hours that Neil and Buzz were on the Moon, Michael Collins was alone in the Command Module, but he didn't mind, later saying, "this venture has been structured for three men, and I consider my third to be as necessary as either of the other two." Out of each 2 hour orbit, 48 minutes were spent behind the Moon, where he had no radio contact with Earth or the crew on the Moon. Collins was not distressed by the isolation, describing his feelings as, "awareness, anticipation, satisfaction, confidence, almost exultation." And he didn't have a lack of things to do, either. He was supposed to find the LM on the surface, but despite several attempts, he never could find it, since they had landed four miles away from the expected spot. He also had various maintenance tasks to take care of, such as dumping excess water from the fuel cells and preparing the cabin for the crew's return. He experienced a problem with the coolant, with the possible result of part of the CM freezing up. Collins was instructed to control it manually. Instead, he just turned the system off and then back on, which seemed to fix it. (Isn't that always the case?) Once Neil and Buzz had settled in for sleep, Mike did, too.

On July 21, Eagle and Columbia docked back together. After transferring their samples into the CM, Eagle was jettisoned and left in orbit around the Moon. It would eventually crash into the Moon's surface. Then they fired the engines to leave lunar orbit and head home. Once they were headed back to Earth, the astronauts slept for another 10 hours.

## Apollo 11, continued

On July 23, the crew made their last TV broadcast before splashing down. Collins said, “All you see is the three of us, but beneath the surface are thousands and thousands of others, and to all of those, I would like to say, “Thank you very much.” Aldrin’s statement included, “This has been far more than three men on a mission to the Moon; more, still, than the efforts of a government and industry team; more, even, than the efforts of one nation. We feel that this stands as a symbol of the insatiable curiosity of all mankind to explore the unknown.” Armstrong closed the broadcast with, “We would like to give special thanks to all those Americans who built the spacecraft; who did the construction, design, the tests, and put their hearts and all their abilities into those craft. To those people tonight, we give a special thank you, and to all the other people that are listening and watching tonight, God bless you. Good night from Apollo 11.”

Prior to splashdown, it was found that the weather at their target zone would have poor visibility, which would prevent the helicopters from finding the capsule. So it was decided to change the landing location to a spot about 200 miles away. This changed the flight plan, so new instructions were sent up to the crew. On the morning of July 24, four helicopters and three escort planes were launched from the USS Hornet, carrying divers, recovery equipment,



cameras, and the decontamination team. After 8 days, 3 hours, and 18 minutes in space, Columbia splashed down in the Pacific Ocean, 13 miles from the aircraft carrier. Despite landing upside down, the flotation bags inflated and righted the spacecraft. The recovery helicopters arrived and stabilized the capsule. Divers brought the crew their Biological Isolation Garments, which the crew put on before leaving the capsule to prevent bringing back anything lethal from the Moon. After lifting the crew members into a helicopter, the life raft they were on was sunk to avoid any contamination. The capsule was wiped down with chemicals to kill anything that might be on its surface. On the Hornet, the crew entered the Mobile Quarantine Facility (MQF), which was a modified Airstream trailer. With them would be a physician and MQF project engineer, who would join them in the larger isolation facility in Houston two days later. They would remain in isolation for a total of 21 days (including their 8 days in space), to make sure they weren’t carrying anything infectious. The Columbia capsule was placed next to the MQF and attached by a flexible tunnel. This allowed the crew to bring the lunar samples, film, data tapes, and other items into the MQF. On August 10, 1969, the Apollo 11 crew were set free.

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## **Apollo 11, continued**

But they weren't done! Three days later, they were in not one, but two, ticker-tape parades: one in New York City, and the other in Chicago. Roughly 6 million people attended the parades. Then that evening, they were flown to Los Angeles for a state dinner with members of Congress, 44 governors, 83 ambassadors, the Chief Justice, Vice President Agnew, and President Nixon, who awarded each crew member with the Presidential Medal of Freedom. In September, the crew spoke to a joint session of Congress. Then they set off on a 38-day world tour to 22 countries. They weren't the only ones on tour. The Columbia spacecraft visited every state and Washington, DC, before becoming part of the collection of the Smithsonian National Air and Space Museum. In anticipation of the 50th anniversary, Columbia has been on tour again, visiting Houston, Saint Louis, Pittsburgh, and Seattle. Neil and Buzz's spacesuits had been on display at the Smithsonian up to this last December, when the Moon exhibit was closed, though there will be a special display this July. The Moon rocks are kept at Houston and White Sands, New Mexico. Over 100 labs have studied the samples, with roughly 500 samples sent out each year. The seismic experiment left on the Moon lasted for about a month, but the retroreflectors are still being used.

Landing on the Moon was one of the most spectacular human accomplishments, ever. NASA is now planning to return to the Moon in 2024. Will it spark people's imaginations the same way Apollo 11 did? I hope so, but the cynic in me says that it won't. The Apollo era was a magical time that we will never be able to recreate. Maybe when we have people landing on Mars we will see the same enthusiasm return. Meanwhile, we can celebrate 50 years since we first landed on the Moon and relive a little of the excitement that the world felt in 1969.

### **References:**

[Apollo 11 - Wikipedia](#)

[Apollo 11 Mission Overview](#)

[Apollo 11 \(AS-506\) Air and Space Museum](#)

## Observe the Moon and Beyond: Apollo 11 at 50 by David Prosper

Saturn is at opposition this month, beckoning to future explorers with its beautiful rings and varied, mysterious moons. The Moon prominently passes Saturn mid-month, just in time for the 50th anniversary of Apollo 11!

Saturn is in opposition on July 9, rising in the east as the Sun sets in the west. It is visible all night, hovering right above the teapot of Sagittarius. Saturn is not nearly as bright as Jupiter, nearby and close to Scorpius, but both giant planets are easily the brightest objects in their constellations, making them easy to identify. A full Moon scrapes by the ringed planet late in the evening of the 15th through the early morning of the 16th. Some observers in South America will even see the Moon occult, or pass in front of, Saturn. Observe how fast the Moon moves in relation to Saturn throughout the night by recording their positions every half hour or so via sketches or photos.

While observing the Saturn-Moon celestial dance the early morning of the 16th, you can also contemplate the 50th anniversary of the launch of the Apollo 11 mission! On June 16, 1969, Apollo 11 blasted off from Cape Canaveral in Florida on a journey of almost a quarter million miles to our nearest celestial neighbor, a mission made possible by the tremendous power of the Saturn V rocket – still the most powerful rocket ever launched. Just a few days later, on July 20, 1969 at 10:56 pm EDT, Neil Armstrong and Buzz Aldrin set foot on the lunar surface and became the first people in history to walk on another world. The astronauts set up equipment including a solar wind sampler, laser ranging retroreflector, and seismometer, and gathered up almost 22 kilograms (48 pounds) of precious lunar rocks and soil samples. After spending less than a day on the Moon's surface, the duo blasted off and returned to the orbiting Columbia Command Module, piloted by Michael Collins. Just a few days later, on July 24, all three astronauts splashed down safely in the Pacific Ocean. You can follow the timeline of the Apollo 11 mission in greater detail at [bit.ly/TimelineApollo11](http://bit.ly/TimelineApollo11) and dig deep into mission history and science on NASA's Apollo History Site: [bit.ly/ApolloNASA](http://bit.ly/ApolloNASA).

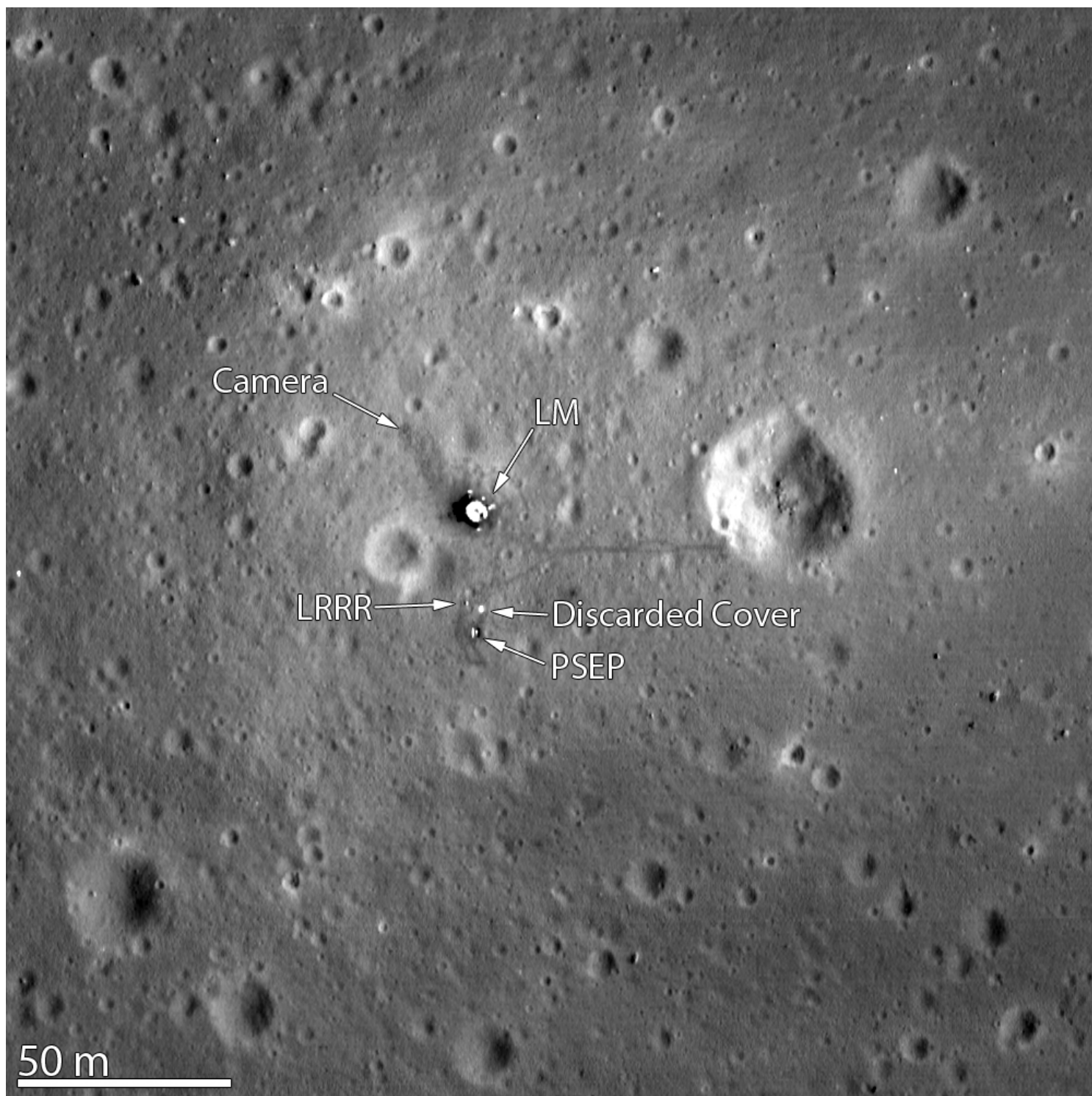
Have you ever wanted to see the flag on the Moon left behind by the Apollo astronauts? While no telescope on Earth is powerful enough to see any items left behind the landing sites, you can discover how much you can observe with the Flag on the Moon handout: [bit.ly/MoonFlag](http://bit.ly/MoonFlag)

This article is distributed by NASA Night Sky Network.

The Night Sky Network program supports astronomy clubs across the USA dedicated to astronomy outreach. Visit [nightsky.jpl.nasa.org](http://nightsky.jpl.nasa.org) to find local clubs, events, and more!

You can catch up on all of NASA's current and future missions at [nasa.gov](http://nasa.gov).

With articles, activities and games NASA Space Place encourages everyone to get excited about science and technology. Visit [spaceplace.nasa.gov](http://spaceplace.nasa.gov) to explore space and Earth science!



Earth-based telescopes can't see any equipment left behind at the Apollo 11 landing site, but the cameras onboard NASA's Lunar Reconnaissance Orbiter (LRO) can. This is Tranquility Base as seen from the LRO, just 24 kilometers (15 miles) above the Moon's surface, with helpful labels added by the imaging team.

Image Credit: NASA Goddard/Arizona State University.  
See more landing sites at: [bit.ly/ApolloLRO](http://bit.ly/ApolloLRO)

# The Moon

## Copernicus

This crater (left) is easy to spot. It formed about 800 million years ago, and is 57 miles (92 km) wide. Note central peaks and terraced walls, caused by impact.

## Aristarchus

Young crater. So bright that Sir William Herschel thought it was an active volcano.

## Kepler

Small version of Copernicus

## Grimaldi

Lava-filled crater is one of the darkest spots you can see on the Moon. It's 145 miles wide (233 km).

## Mare Humorum

The Sea of Moisture is about 220 miles (350 km) across. You can spot it with the naked eye. With a telescope, you might notice two craters along its edge.

## Tycho

Young crater best seen during a full Moon. Rays of bright material are ejecta blasted out of the crust when a large asteroid struck about 109 million years ago.

## Mare Serenitatis

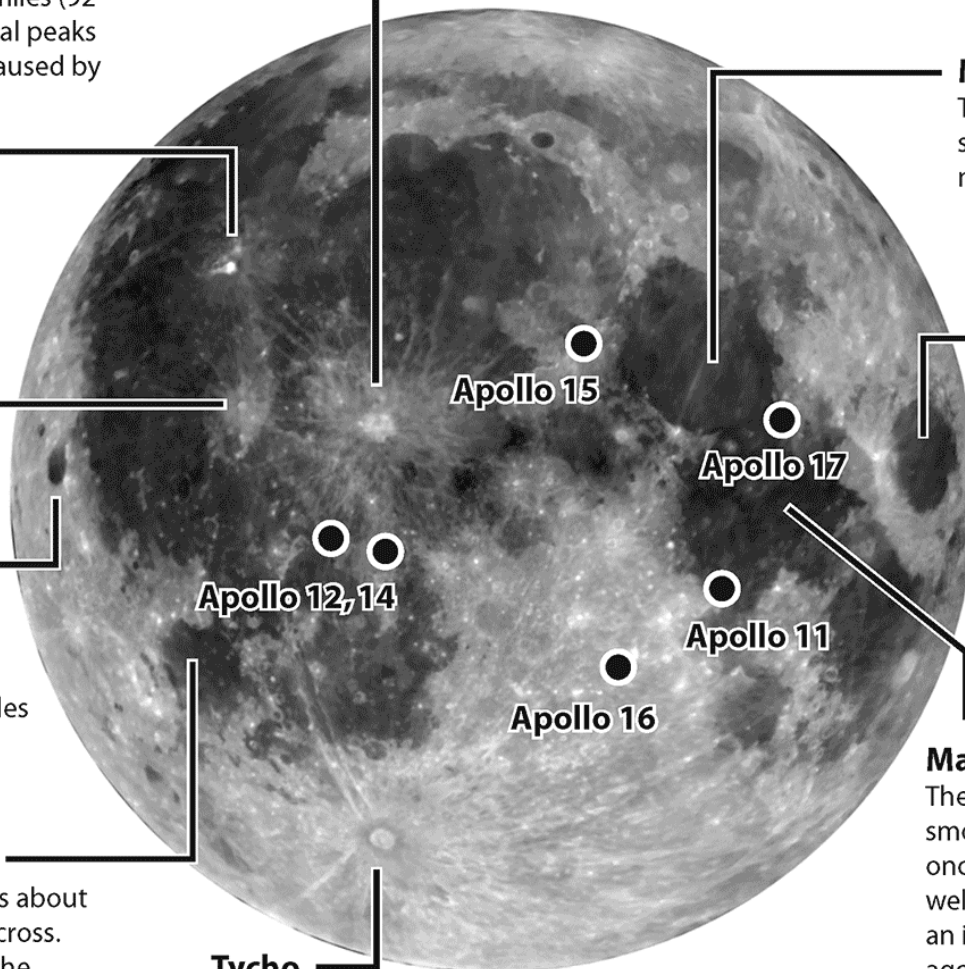
The Sea of Serenity is solid lava, some 380 miles (610 km) across.

## Mare Crisium

The Sea of Crisis is about 340 miles wide (550 km) and visible to the naked eye.

## Mare Tranquillitatis

The Sea of Tranquility is a smooth plain filled with once-molten lava that welled up from below after an impact billions of years ago. The first humans to walk on the Moon, Apollo 11 astronauts, landed near the edge.



SOURCES: NASA; ADVANCED SKYWATCHING; CAMBRIDGE ATLAS OF ASTRONOMY; DK VISUAL ENCYCLOPEDIA

**Photos: James Scala. Layout and text for Moon map used with permission: Robert Roy Britt/SPACE.com.**

Caption: Observe the larger details on the Moon with help from this map, which also pinpoints the Apollo landing site.

Full handout available at [bit.ly/MoonHandout](http://bit.ly/MoonHandout)



In honor of the club's 90th anniversary we partnered with Hatch Show Print to create a unique poster that would honor the achievement of the club. For those who don't know Hatch Show has been making posters for a variety of events and concerts for 140 years. In all that time we are their first astronomy club.

On the poster at the center is the moon. This was made from a wood grained stencil that the shop has used for over 50 years. To contrast that the telescope that the people are using is a brand new stencil made for our poster. The poster has three colors. First the pale yellow color of the moon was applied. Next the small stars, circles, and figures at the bottom were colored in metallic gold.

The third color is a blue for the night sky. Where it overlaps with the metallic gold it creates a darker blue leaving the figures at the bottom looking like silhouettes. This was a one time printing so the 100 that we have are all that will be printed.

The prints are approximately 13 3/4" x 22 1/4" and are available for \$20 at our membership meetings, or \$25 with shipping by ordering through [bsasnashville.com](http://bsasnashville.com). Frame not included.

**Barnard-Seyfert Astronomical Society**  
**Minutes of a Regular Meeting of the Board of Directors**  
**Held On Wednesday, June 5, 2019**

The regular meeting of the Board of Directors of the Barnard-Seyfert Astronomical Society was held June 5, 2019, at the Girl Scouts Center, 4522 Granny White Pike, Nashville, TN 37204. Present were Tom Beckermann, Chip Crossman, Gary Eaton, KC Katalbas, Andy Reeves and Theo Wellington. A quorum being present, Tom called the meeting to order at 8:05 PM. Tom asked for a motion to approve the Board minutes of the May 1, 2019 meeting. Chip so moved, Theo seconded, and the minutes were adopted by unanimous voice vote. Theo Wellington had reported that there was \$8,797.26 in the bank account. Tom reported that there are 115 members in good standing out of a total of 121.

Tom discussed the possibility of moving future monthly member meetings to the ASC, as well as doing future “What’s Up” presentations at the ASC planetarium, along with the scheduling and financial aspects of such a move. Also, having a spreadsheet (or other document) for members and guests to use to follow along with during the “What’s Up” presentation. It was discussed having a sign-up table at the next planetarium event.

Tom discussed the upcoming presentations at the monthly member meetings, and the need to find presenters for the October and December meetings.

Theo reported that the BSAS equipment has been tagged, and the remaining tags have been given to Todd. It was discussed about adding the equipment list to Google Groups site for members to see. Theo also stated that other Board members can be given permission to post on BSAS social media accounts.

Gary informed the Board of a Pickin’ Party at Cornelia Fort Airpark on July 27, as well as August 24 and September 21, 2019, and the possibility of staffing a telescope viewing during those events.

There being no further business, Tom asked for a motion to adjourn. Theo so moved, Chip seconded, and the meeting was adjourned at 8:58 PM.

Respectfully submitted,

Andy Reeves  
At-Large Board Member (Acting Secretary)



**Barnard-Seyfert Astronomical Society  
Minutes of the Monthly Membership Meeting  
Held On Wednesday, June 19, 2019**

The Barnard-Seyfert Astronomical Society held its monthly meeting at the Girl Scout Center, Nashville, Tennessee, on Wednesday, June 19, 2019. Twenty-three members and guests signed in. Keith Rainey called the meeting to order at 7:30 PM and asked for a motion to approve the minutes of the May 15, 2019, meeting. Tony Powers so moved, Spencer Buckner seconded, and the minutes were approved by a unanimous voice vote. Theo Wellington reported that there was \$8,797.26 in the bank account and \$14.26 in the PayPal account. Keith reported that there were approximately 125 members. Keith announced the upcoming private star party on June 29 at Water Valley Overlook, the public star party on July 5 at Bells Bend Outdoor Center, and outreach events on August 2 at Timberland Park and on August 14-15 at Belmont University. Theo said that Park Ranger Michael Hodge announced that the astronomy weekend at Pickett State Park will be the last weekend in August.

John Kramer presented “Electronic Assisted Astronomy” and the “At the Eyepiece” channel on Youtube (<https://www.youtube.com/user/attheeyepiece>).

“Oz” Gonzales announced that the Adventure Science Center will have an Apollo 11 related event from 9 AM to 5 PM on July 20.

There being no further business the meeting was adjourned at about 9 PM. Respectfully submitted,

Bud Hamblen  
Secretary

# xkcd

## WHAT THE NUMBER OF DIGITS IN YOUR COORDINATES MEANS

LAT/LON PRECISION	MEANING
28°N, 80°W	YOU'RE PROBABLY DOING SOMETHING SPACE-RELATED
28.5°N, 80.6°W	YOU'RE POINTING OUT A SPECIFIC CITY
28.52°N, 80.68°W	YOU'RE POINTING OUT A NEIGHBORHOOD
28.523°N, 80.683°W	YOU'RE POINTING OUT A SPECIFIC SUBURBAN CUL-DE-SAC
28.5234°N, 80.6830°W	YOU'RE POINTING TO A PARTICULAR CORNER OF A HOUSE
28.52345°N, 80.68309°W	YOU'RE POINTING TO A SPECIFIC PERSON IN A ROOM, BUT SINCE YOU DIDN'T INCLUDE DATUM INFORMATION, WE CAN'T TELL WHO
28.5234571°N, 80.6830941°W	YOU'RE POINTING TO WALDO ON A PAGE
28.523457182°N, 80.683094159°W	"HEY, CHECK OUT THIS SPECIFIC SAND GRAIN!"
28.523457182818284°N, 80.683094159265358°W	EITHER YOU'RE HANDING OUT RAW FLOATING POINT VARIABLES, OR YOU'VE BUILT A DATABASE TO TRACK INDIVIDUAL ATOMS. IN EITHER CASE, PLEASE STOP.



Become a Member of BSAS!  
Visit [bsasnashville.com](http://bsasnashville.com) to join online.

All memberships have a vote in BSAS elections and other membership votes. Also included are subscriptions to the BSAS and Astronomical League newsletters.

Annual dues:

Regular: \$25  
Family: \$35  
Senior/Senior family: \$20  
Student:\* \$15

\* To qualify as a student, you must be enrolled full time in an accredited institution or home schooled.

## About BSAS

Organized in 1928, the Barnard-Seyfert Astronomical Society is an association of amateur and professional astronomers who have joined to share our knowledge and our love of the sky.

The BSAS meets on the third Wednesday of each month at the Cumberland Valley Girl Scout Building at the intersection of Granny White Pike and Harding Place in Nashville. Experienced members or guest speakers talk about some aspect of astronomy or observing. Subjects range from how the universe first formed to how to build your own telescope. The meetings are informal and time is allotted for fellowship. You do not have to be a member to attend the meetings.

Membership entitles you to subscriptions to *Astronomy and Sky & Telescope* at reduced rates; the club's newsletter, the *Eclipse*, is sent to members monthly. BSAS members also receive membership in the Astronomical League, receiving their quarterly newsletter, the *Reflector*, discounts on all astronomical books, and many other benefits.

In addition to the meetings, BSAS also sponsors many public events, such as star parties and Astronomy Day; we go into the schools on occasion to hold star parties for the children and their parents. Often the public star parties are centered on a special astronomical event, such as a lunar eclipse or a planetary opposition.

Most information about BSAS and our activities may be found at [bsasnashville.com](http://bsasnashville.com). If you need more information, write to us at [info@bsasnashville.com](mailto:info@bsasnashville.com).

## Free Telescope Offer!

Did someone say free telescope? Yes, you did read that correctly. The BSAS Equipment & Facilities Committee has free telescopes ranging in size from 2.6" to 8" that current members can actually have to use for up to 60 days at a time. We also have some other items in the loaner program such as a photometer, H-alpha solar telescope, educational CDs, tapes, DVDs, and books. Some restrictions apply. A waiting list is applicable in some cases. The BSAS Equipment Committee will not be held responsible for lost sleep or other problems arising from use of this excellent astronomy gear. For information on what equipment is currently available, contact [info@bsasnashville.com](mailto:info@bsasnashville.com).