# SIRIUS ASTRONOMER

www.ocastronomers.org

The Newsletter of the Orange County Astronomers

**June 2019** Free to members, subscriptions $12 for 12 issues **Volume 46, Number 6**


Cone Nebula NGC2264, taken by club member Rick Hull in February 2018 at Anza site using 80mm refractor at 444mm focal length and IDAS D1 Light pollution filter on a Canon 6D DSLR

## OCA CLUB MEETING

The free and open club meeting will be held on June 14 at 7:30 pm in the Irvine Lecture Hall of the Hashinger Science Center at Chapman University in Orange.

This month, the speaker is Robert Zellem from JPL talking on the subject "Exoplanets: Finding Life in the Galaxy"***.***

NEXT MEETINGS:
July 12 (speakers TBA)

## STAR PARTIES

Both the Irvine Lake and Anza sites will be open on June 1. Members are encouraged to check the website calendar for updates on star parties.

Please check the website calendar for the outreach events this month. Volunteers are always welcome.

You are reminded to check the club web site for updates to the calendar of events and other club news.

## COMING UP

The next sessions of the Beginner's class are on 7 June and 5 July at Heritage Museum of Orange County at 3101 West Harvard Street in Santa Ana.

Youth SIG:
contact Doug Millar
Astro Imagers SIG: 5 June, 3 July
Astrophysics SIG: 21 June, 19 July
Dark Sky Group:
contact Barbara Toy

# President's Message

By Barbara Toy

Theoretically, we've been experiencing spring and we're on the verge of summer. So far, it's been too much of a continuation of winter – warmer, but cloudy skies and unusually late rains, and our star parties have continued to be clouded out. My memory may be failing me, but it seems that in past years we often have had problems with clouds in March, but star parties in April and May have usually been reasonably clear before we hit June Gloom, which sometimes outlasts June. We then might have monsoon-related thunderstorms in late July, August and maybe into the fall months, but generally those have been less of a problem than the cloudy skies of winter, and often monsoonal clouds break up after sunset.

Well, the weather patterns this year don't really fit the norm – maybe June Gloom won't be such a problem this year. We actually have two star parties in June, on the 1st (which will have passed by the time you see this) and the 29th, and it would be a very nice change if they were clear. Or if at least one of them is clear…

You may have noticed that a common side effect of our hobby is a greatly increased interest in the weather – you can see this in discussions in our email groups, which seem to devote as much time to weather as to more astronomical topics. It's also true for conversations in groups of astronomers. We also tend to be sensitive to the phase of the moon – this is far more likely to lead to misunderstandings with people outside the hobby than exhibiting an interest in the weather, as they often assume any interest in moon phases is for mystical rather than practical reasons.

Of course, the reason we care about these things is that we want clear, dark, and preferably steady skies so we can get the best views (or images) of the wonderful objects out there, beyond our atmosphere. The grouch in me notes that clear, steady skies seem to happen most often near full moon, but here's hoping that won't be the case this summer, and that our new moon periods in particular will be blessed with clear and steady skies!

## Update on Our New Website:

We ran into some glitches with getting our new website on line, which is why deploying it has been delayed. As I write this, the plan is to do the deployment in two phases, initially getting the public portions of the website up, and then adding the Members section and functions such as on line membership renewals later (hopefully not too much later). The first phase may already be operational by the time you see this, and you'll have had a chance to see for yourself how it works across different devices.

When the Members section becomes available, you'll have to go through a process to set up a password, as the passwords from the old website won't be transferred over. There will be instructions, and we don't think you'll find it a difficult process, but the need to do it may catch some people by surprise.

We're sorry that this phase of getting the new website up and running has taken more time than expected, and hope that you'll feel that it was well worth the wait when you have a chance to work with it. The company that built it for us did a very nice job, producing a good looking website based on current technology but keeping all of the functions of our past website along with all the pictures, articles and other information. A bonus from this process was that they cleaned up the databases, so it should be easier to find things, and (if you like delving into our past) you may find older pictures and information you weren't able to access before.

## Weeds Continue:

After such a wet winter and unexpected spring rains, the weeds on our Anza site aren't a one-time problem. Areas that have been cleared will have less of a problem, but we expect that we'll be dealing with multiple generations of weed growth over the summer.

If you're a pad or observatory holder and if you haven't cleared the weeds around your area, please do that as soon as you can. Over the course of the summer, please clear any new weed growth to help keep things under control. If you get rid of them before they set their seeds, that should reduce the weed crop for next year, particularly the mustard.

For anyone who uses the Anza site, please give us a hand with clearing the areas around Anza House, the club observatory, the Football Field and the other general use areas of the site, and keeping them clear.

With all the growth around Southern California due to our wet winter, it's likely we'll have a really tough fire season this year, and not just around Anza. Please be safe around your own homes, and please help with this necessary maintenance whenever you're out at Anza.

## Bring Your Telescope Class:

Twice a year we have a "Bring Your Telescope" class as part of the Beginners Astronomy Class. This is when members of the public as well as club members who may want some help bring their telescopes to get some hands-on help with setting them up and (if the sky cooperates) finding an object or two. What makes these sessions work is club members who come out to the class to help these people learn about their telescopes, how to use them and what they can see with them.

The next session is the first Friday in July, which is July 5 this year, technically at 7:30 p.m. but people start arriving soon after 7:00. If you can volunteer some time that evening, we'd really appreciate the help. The class is at the Heritage Museum of Orange County, specifically in the parking area at the back of the museum. If it rains (anything seems possible this year), we'll move the class into the classroom in the Carriage House, which is next to the parking area.

The museum is located at 3101 W. Harvard St. Santa Ana, CA 92704. Harvard crosses Fairview about midway between Edinger and Warner, and the museum is located about half a block west of Fairview on the north side of Harvard. If you're not familiar with the museum, which is a real Orange County treasure, please check out their website: http://heritagemuseumoc.org/.

These sessions are a kind of mini-star party, and a lot of fun for everyone there. They're a different kind of Outreach, helping newcomers to astronomy get past that initial hurdle of learning the basics with their equipment so they can actually see what's up there for themselves. If you can help us out, please contact Dave Pearson, who teaches the Beginners Class (p.davidw@yahoo.com) or me (btoy@cox.net).

Thanks – and see you all next month! (Isn't it great to have the Sirius Astronomer coming out regularly again? Please thank David Fischer for that!)



# From the Editor

## For the July issue

Please send me your recollection of what you were doing and how you felt when Apollo 11 landed on the moon. I would like to publish a collection of these thoughts in the July issue of Sirius Astronmomer.

## Sirius needs photograph submissions from club members

We are getting a few. Please continue to send in more !

## Ideas for Future articles

The newsletter would like to include articles from members and articles about subjects suggested by our members. We are looking for both ideas and writers to cover them. Anybody who would like to contribute an article or work with the editor to produce one may contact me at newsletter@ocastronomers.org .

To get this started, I will post some examples here and then add in ideas submitted to me from club members.

- The Making of a Personal Observatory
- Borrowing a Club Telescope – the process, the results – real life experiences by club members
- Articles about early history of the club
- "Your idea goes here"

# AstroSpace Update

June 2019
Gathered by Don Lynn from NASA and other sources

**Merging Neutron Stars** – On April 25, LIGO and Virgo gravitational wave detectors caught waves caused by 2 neutron stars merging. This is only the 2nd time such has been recorded. Unfortunately one of the three detectors was not running, and so scientists were not able to pin down where in the sky the event occurred. A couple of candidates have been proposed, but more work is needed to show if one of these is associated with the gravitational waves. No gamma-ray burst was seen at the time, as happened with the first gravitational detection of merging neutron stars. Scientists were able to determine from the gravitational wave that the event occurred 500 million light-years away.

**Merging Neutron Star** – The next day (April 26) LIGO and Virgo saw another gravitational wave, but this time the shape fit what is predicted for a neutron star merging with a black hole. This is the 1st time that this type of event has been detected. The event happened about 1.2 billion light-years away. It was seen at all 3 detectors, and scientists were able to pin down its location to just 3% of the sky. The search is on in gamma rays, X-rays and other forms of light to find the event. It is hoped that with more data regarding this kind of merger scientists can find out more about the state of matter inside neutron stars.

**Measuring Star Diameters** – Astronomers have developed a new way to measure the diameters of stars, which works on stars of much smaller apparent size than previous methods. A star is imaged hundreds or even thousands of times per second as an asteroid passes in front of the star. The diffraction pattern that is produced by the edge of the asteroid can be seen as variations in brightness between successive images. The apparent size of the star can be calculated from the pattern of the diffraction. In order to gather enough starlight for sub millisecond exposures, astronomers used the VERITAS cosmic ray telescope in Arizona. It consists of four 12-meter optical telescopes, each made of 350 mirror segments. The 1st star measured with this method, named TYC 5517-227-1, measured 1/8000 of an arcsecond in diameter, which, at its distance of 2674 light-years, corresponds to 11 times the size of the Sun. The 2nd star, TYC 278-748-1, located 700 light-years away, measured at twice the size of the Sun. The apparent sizes of these two are far smaller than have been measured by any previous method of determining star diameters.


**Titan** – Astronomers examining images of Saturn's moon Titan in an effort to find sources of methane instead found an ice feature that extends almost half way around the moon. It appears to be eroding, so was probably produced by some event in the past, such as a cryovolcanic eruption. The moon does not appear to have any current cryovolcanic activity.

**Asteroid Water** – Two scientists have for the 1st time measured the water in material brought from an asteroid. The material consists of 5 microscopic specks brought to Earth by the Japanese Hayabusa spacecraft from asteroid Itokawa. The result is that the isotopes of the hydrogen in the water match well that of the Earth's water. Therefore much of the water on Earth may have been brought by asteroids like Itokawa when they struck the Earth during the Late Heavy Bombardment about 4 billion years ago. The water was found in the mineral pyroxene. The amount of water found was unexpectedly high. Like most asteroids, Itokawa appeared to be lacking in water from Earth-based observations.

**Steve vs. Aurora** – Steve is the name given a few years ago to purple ribbons that once in awhile are seen in aurora. The name was given as kind of a joke, but was later legitimized by inventing something for it to stand for: Strong Thermal Emission Velocity Enhancement. But last year observations showed that the glow in Steve is not caused by the same phenomenon as aurora. Occasionally the Steve ribbon is accompanied by a green picket-fence-shaped glow. New observations show that the green picket fence is generated by the same phenomenon as aurora, but it appears at places that aurora does not. So the argument over whether Steve is aurora or not may continue.

**Marsquakes** – The InSight Mars Lander detected its 1st marsquake in April. It was only about magnitude 2-2.5, but lasted around 10 minutes. Three other possible signals were reported, but they were quite weak and work is still being done to rule out non-quake causes for these. The frequency of marsquakes is less than predicted. So we may have to wait awhile before a decent-sized quake happens to hit. Since Mars has no plate tectonic motion, it was predicted that only the slow cooling and contraction of the planet and meteor impacts would produce few quakes, but not this few. The pattern of shaking of the new marsquake resembled that of moonquakes recorded by the seismometers placed on the Moon by the Apollo astronauts. This was expected because the Moon also has no plate tectonics. Scientists are hoping for a magnitude 4 marsquake, since this would give them a strong enough signal from InSight to allow calculation of the sizes and properties of the core and layers within the planet.

**More InSight** – The InSight magnetometer has detected Martian surface magnetic fields at least 10 times stronger than have been measured from orbiting spacecraft. The InSight weather station has found that its landing site has winds every day that pick up about noon and weaken every evening.

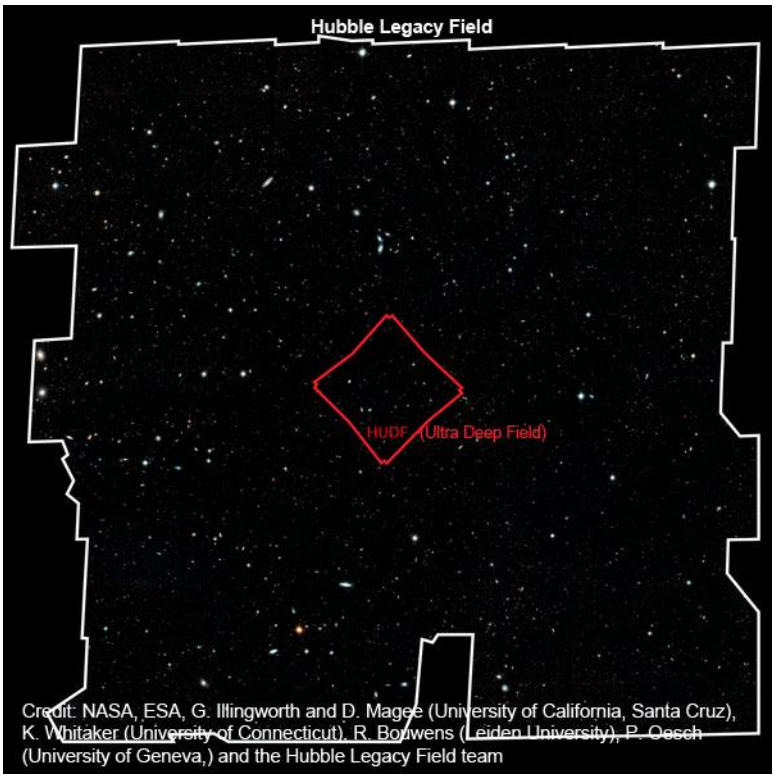
**Martian Global Dust Storms** – Studies of the most recent of the global dust storms that arise on Mars every several years (there have been 7 of them seen in the last 42 years) have yielded some new discoveries:

1) The rising dust pulls along with it a lot of water vapor to altitudes that water vapor normally doesn't reach (at least 50 miles instead of the normal 12). At that height, solar radiation breaks it down into hydrogen and oxygen, much of which is lost to space. This will change the theories on how Mars lost its ocean and lakes that were there about 4 billion years ago.

2) The sand dunes of Mars do not move any faster during the global dust storms, despite much faster winds. This implies that the fast winds do not extend to the ground.

3) The dust devils disappear during the global dust storms and for months afterward. Dust devils have often blown obscuring dust off the solar panels of Mars rovers. So just when your rover needs a cleaning (after the global dust storms), the devils are gone.

**Hubble Legacy Field** – Hubble Space Telescope astronomers have released a new very long exposure image of a small piece of the sky in Fornax, and it has been named the Hubble Legacy Field. The difference in this image is that it covers about 50 times the area of previous Deep Field images. It was made by mosaicing lots of separate exposures. Also, this one includes not only visible light, but near infrared and ultraviolet also (in false color of course). It took 7500 exposures and 16 years to make it.



Credit: NASA, ESA, G. Illingworth and D. Magee (University of California, Santa Cruz), K. Whitaker (University of Connecticut), R. Bouwens (Leiden University), P. Oesch (University of Geneva,) and the Hubble Legacy Field team

The field of view includes the area of the Hubble Ultra Deep Field image of 2004 and the Hubble eXtreme Deep Field image of 2012. Like those, the new image contains a LOT of galaxies – 265,000 of them. The light from the most distant ones took about 13.3 billion years to get here. Because we are seeing the galaxies as they were when the light left them, astronomers can from one image construct a history of how galaxies have changed over the last 13.3 billion years.

The image is expected to generate huge numbers of astronomical discoveries, as the previous Deep Field images have. Future plans include making a similar image of another area of the sky and extending the wavelength coverage of these by using far infrared and X-ray observations.

**Omega Centauri Star Stream** – A team of scientists searching through the 1.7 billion stars in the Gaia catalog found 309 stars that appear to have been gravitationally torn off (by the Milky Way) from the globular star cluster Omega Centauri. They match Omega stars in constituent elements and are moving as a group. Once they knew what they were looking for, they were able to find other stars in this stream buried in dense foreground star fields, leading back to Omega. This is another clue that Omega may have formed as a small galaxy that lost its outer parts rather than as a globular cluster. Previous evidence of this includes that its stars have a wide range of ages, while globular clusters generally have stars of only a single age.

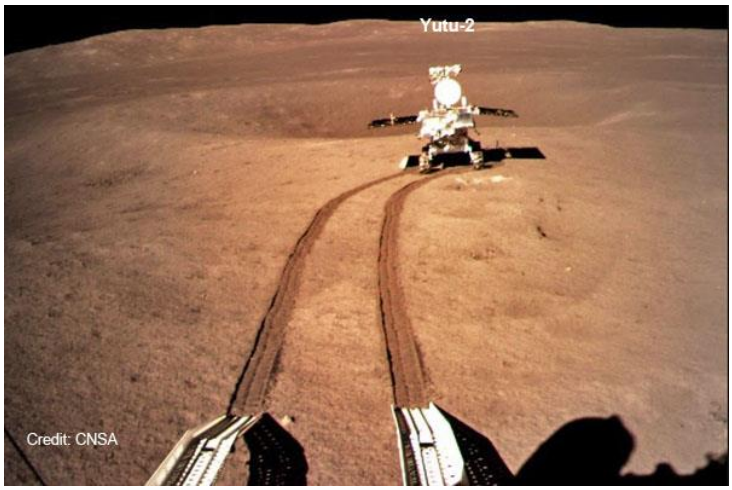
**New Asteroids Found** – In mapping over a billion stars, Gaia stumbled over 14,000 asteroids and tracked them well enough to learn their orbits. A check against known asteroids showed that only 3 of these were new discoveries. All 3 were in the main asteroid belt and had inclined (tilted from the ecliptic) orbits. The inclination is probably what kept them from being discovered before. They were probably near their high or low points when surveys designed to find asteroids were searching the area; but such searches tend to look only near the ecliptic, not higher or lower.

**Early Galaxies Extra Bright** – Observations by the Spitzer infrared space telescope of 135 extremely distant galaxies show that they were brighter than expected in certain wavelengths that are emitted when ionizing radiation interacts with hydrogen and oxygen in space. The galaxies were so distant that their light left less than a billion years after the Big Bang. What this says is that all galaxies during the 1st billion years were giving off a lot more ionizing radiation than theory predicted. This will help explain how the Universe became ionized. It is known that most of the hydrogen in the Universe ionized (that is, electrons were knocked off neutral hydrogen molecules) sometime in the 1st billion years, but the exact timing and causes are still to be determined. More work needs to be done to understand this ionization, but these new observations should help.

**Early Supernovas** – A new study of a star, named HE 1327-2326, which is known to have formed very early in the history of the Universe, showed that it had more zinc than theory predicted. Then the astronomers of the study ran computer simulations of supernovas to try to find what kind would trigger star formation nearby resulting in new stars matching the elemental composition of HE 1327-2326, including its zinc content. The only type of supernova that did this in the simulations was one that exploded asymmetrically and ejected material through jets and was a particularly powerful explosion. In fact it had to be so powerful that it could spread heavy elements into nearby galaxies, not just in its own corner of its own galaxy. This may be how the 1st supernovas after the Big Bang created the 2nd generation of stars.

**Milky Way Star Formation** – Astronomers have fed data from the Gaia space telescope into a computer simulation that is reconstructing the history of star formation throughout the life of the Milky Way. What they found is that about 10 billion years ago, it was forming stars a dozen times faster than it is now. Then star formation declined for 5 billion years. Star formation then rose to a peak of 10 times the current rate, and remained at elevated levels for 4 billion years before falling to the current low rate. This lengthy run of high star formation was likely caused by a gas-rich small galaxy colliding with the Milky Way, supplying gas for star formation over billions of years.

**Lunar Rover** – The Chinese lunar rover Yutu-2 has been exploring the Aitken Basin, which lies on the far side of the Moon, since January. Since this basin is the largest and deepest lunar impact crater, it was hoped to find material dredged up from the mantle, the layer below the surface crust. The rover has a spectrometer to determine what rocks and soil are made of. Mantle material should include the minerals olivine and pyroxene. At first little or no mantle material was found, but good candidate mantle material has now been found inside craters within the larger crater basin.




**Instant AstroSpace Updates**

After 5 years of work, scientists have finished the design of the supercomputer that will process the observations of the **Square Kilometer Array**, under construction in Australia. It will be faster than today's world's fastest supercomputer, in order to take in the 6Tb (6 million megabytes) per second produced by the radiotelescope, and process that into images in real time.

It was predicted that the recently completed upgrades to the **LIGO** gravitational wave detectors should make them sensitive enough to detect gravitational waves every week. Two waves were detected in the 1st two weeks of operation, each the result of 2 black holes merging.

Study of the black hole V404 Cygni during its outbursts shows that its jets spew material not continuously, but in blobs. This is probably due to the spin of the **black hole misaligning** with the black hole's orbit with its companion star.

A new study found that nearly all blue supergiant stars waver in brightness because of vibrations on their surfaces. The science of asteroseismology learns about the internal structure of **blue supergiants** by analyzing those vibrations.

# The Manned Apollo Missions – a Very Brief Summary

Gathered by David Fischer from NASA material available on these web-sites:
https://www.nasa.gov/mission_pages/apollo/missions/index.html
https://airandspace.si.edu/explore-and-learn/topics/apollo/apollo-program/
https://science.nasa.gov/toolkits/apollo-anniversary

Leading up to our celebration of the 50th anniversary of the Man's first landing on the moon, here is the first part of an article about the manned Apollo missions. The NASA sites have much better (but longer) descriptions of the missions along with very nice photographs. I recommend visiting the NASA web pages for a very enjoyable reading experience.

## Apollo 7

**Crew**
Walter Schirra Jr., Commander
R. Walter Cunningham, Lunar Module Pilot
Donn F. Eisele, Command Module Pilot

**Backup Crew**
Thomas Stafford, Commander
Eugene Cernan, Lunar Module Pilot
John Young, Command Module Pilot

**Payload**
CSM-101

**Launch**
Oct. 11, 1968; 11:02:45 a.m. EST
Launch Complex 34
Saturn-IB AS-205
First Block II Apollo CSM
First crewed Apollo CSM mission
First three-person American crew
First live TV downlink

**Orbit**
Altitude: 141.65 miles
Inclination: 31.608 degrees
Orbits: 163 revolutions
Duration: 10 days, 20 hours, nine minutes, three seconds
Distance: 4,546,918.3 miles

**Landing**
Oct. 22, 1968; 7:11:48 a.m. EDT, Atlantic Ocean
Recovery Ship: USS Essex

### Mission Objectives

This is the first manned Apollo Mission. Test operation of the CSM under crew control; interaction between spacecraft, crew and mission control on the ground; execute a rendezvous maneuver; live TV broadcasting from space.

### Mission Overview

Launch went perfectly, no pogo oscillations. CSM separated from S-IVB stage and simulated the rendezvous / docking maneuver that would be used on future missions to mate with the Lunar Module and extract it from the S-IVB stage. Some mechanical problems were found with the Lunar Module Adapter which resulted in a better extraction procedure for future missions. The CSM engine was fired repeatedly over the course of the mission to confirm that it would reliably start even after long periods of disuse. It's performance was spot-on and the rapid thrust build-up gave the flight crew an experience that ground-based simulators didn't come close to.

This flight was 11 days long, more than any mission to the moon was planned to take. This allowed for extensive testing of the craft and its systems.

Television broadcast worked but signal quality and resolution were poor. Electrical systems had some intermittent problems which were later analyzed and resulted in design modifications for future flights. There were problems with the fuel cells and their chargers that required design modification for future flights. In addition, humidity and condensation within the capsule and between the panes of the windows occurred and was dealt with by the crew.

The entire crew caught head colds on the first day of the flight and suffered with it. Head colds are painful to deal with in ordinary flying and much worse in zero gravity environment. The only available medications were decongestants and aspirin. NASA reported that without gravity to promote nasal drip, the mucus built up and required strenuous blowing to expel at some risk to ear drums.

NASA was satisfied with the extensive testing achieved and gained confidence that after addressing the issues found that the next mission could go to the moon.

# Apollo 8

**Crew**
Frank Borman, Commander
William A. Anders, Lunar Module Pilot
James A. Lovell Jr., Command Module Pilot

**Backup Crew**
Neil Armstrong, Commander
Fred W. Haise Jr., Lunar Module Pilot
Edwin E. Aldrin Jr., Command Module Pilot

**Payload**
CSM-103

**Launch**
Dec. 21, 1968; 7:51 a.m. EST
Launch Pad 39A

**Orbit**
Altitude: 118.82 miles
Inclination: 32.509 degrees
Orbits: 10 revolutions
Duration: six days, three hours, 42 sec
Distance: 579,606.9 miles

**Landing**
Dec. 27, 1968; 10:52 a.m. EST
Pacific Ocean
Recovery Ship: USS Yorktown

## Mission Objective

Primary objectives were to execute translunar injection; CSM navigation, communications and midcourse corrections; evaluate usage of all consumables (fuel, air, water, electricity, other supplies); and passive thermal control. There were many specific and detailed tests to evaluate and improve the flight operation procedures for future flights, particularly related to orientation and navigation around the moon.

## Mission Highlights

Launch went correctly to plan parking the S-IVB and CSM in orbit for about 3 hours prior to firing up the S-IVB engine again for the Trans-Lunar Insertion. S-IVB was subsequently dumped off into a solar orbit and CSM proceeded towards the Moon.

Two mid-course corrections were executed using both the ground network and spacecraft onboard navigation systems. Communications at this distance were done using a high-gain directional antenna in the service module for the first time.

Just short of 3 days into the flight, the spacecraft passed behind the moon and the first lunar orbit insertion burn was executed to go into an elliptical orbit. Two orbits (about 4 hours) later a second burn was performed to adjust the orbit to be nearly circular as it would need to be for missions that were to go to the surface.

Moon was orbited for about 20-hours. All of that time was used for scheduled tests such as stereo photography of moon features and practice tracking of landing sites and other lunar landmarks. Navigation and orientation procedures were tried out, both manually and using the Instrumentation Unit. There was no sleeping while at the moon. The famous "Earthrise" picture showing Earth above the lunar surface was made during this time.

After 10 orbits, the trans-Earth injection burn executed perfectly and on the flight back there was one midcourse correction applied.

Telecasts were done from the three main phases of the flight: trans-Lunar coast, lunar orbit, and trans-Earth coast. These were seen live all over the world. Signal and image quality were good, considerably better than those from Apollo 7.

Reentry and recovery went exactly to plan.

# Apollo 9

**Crew**
James A. McDivitt, Commander
Russell L. Schweickart, Lunar Module Pilot
David R. Scott, Command Module Pilot

**Backup Crew**
Charles Conrad Jr., Commander
Alan L. Bean, Lunar Module Pilot
Richard F. Gordon Jr., Command Module Pilot

**Payload**
Gumdrop (CSM-104)
Spider (LM-3)

**Launch**
March 3, 1969; 11:00 a.m. EST
Launch Pad 39A

**Orbit**
Altitude: 118.63 miles
Inclination: 32.552 degrees
Orbits: 151 revolutions
Duration: 10 days, one hour, 54 seconds
Distance: 4,214,543 miles

**Landing**
March 13, 1969; 12:01 p.m. EST, Atlantic Ocean
Recovery Ship: USS Guadalcanal

## Mission Objective

Primary objectives were to test Lunar Module with crew in Earth orbit both connected to CSM and flying independently under crew control and to provide structural testing of the CSM, LM, and docking adapter under realistic thrust and maneuvering conditions. Further testing of CSM systems, with docking exercises for both CSM and LM was planned. Testing was also to include evaluation of the EVA (Extra-Vehicular Activity) suit.

## Mission Highlights

After docking with and extracting the LM, the spacecraft moved away from the S-IVB stage to allow that system to perform the TLI burn test. The S-IVB TLI burn executed but achieved less than the intended velocity.

Rendezvous and docking between LM and CSM was tested with LM manned and prior to it being manned while still inside the S-IVB stage. Crew flew LM as independent spacecraft testing its flight control and life support systems. LM descent and ascent engines were fired to simulate orbital departure for landing, descent abort process, ascent from surface, and subsequent rendezvous with the CSM. This included throttling the LM descent engine under both instrument and manual control which was the first time any manned flight varied the thrust of a rocket engine in space. The LM was flown away from CSM into a different orbit then flown back for rendezvous practice.

CSM engines were tested for Lunar orbital insertion burn, Earth insertion burn, and LM rescue simulation.

This mission was quite successful.

# Apollo 10

**Crew**
Thomas Stafford, Commander
Eugene Cernan, Lunar Module Pilot
John Young, Command Module Pilot

**Backup Crew**
L. Gordon Cooper Jr., Commander
Edgar D. Mitchell, Lunar Module Pilot
Donn F. Eisele, Command Module Pilot

**Payload**
Charlie Brown (SM-106)
Snoopy (LM-4)

**Launch**
May 18, 1969; 12:49 p.m. EDT
Launch Pad 39B

**Orbit**
Altitude: 118.83 miles
Inclination: 32.546 degrees
Orbits: 31 revolutions
Duration: eight days, 23 minutes, 23 seconds
Distance: 829,437.5 miles

**Landing**
May 26, 1969; 12:52:23 p.m. EDT
Pacific Ocean
Recovery Ship: USS Princeton

### Mission Objective

This was a dry run to the moon with all modules and equipment to include orbiting but no landing. Tests included practicing Earth-based tracking and navigational assistance. The Lunar module testing centered on the detachment of the LM and a partial descent towards the lunar surface with subsequent return to CSM. This would run the crew and ship through the rendezvous and docking processes. While in low orbit around the moon, detailed gravimetric data was to be measured for use on future flights and the LM landing systems and radar would also be tested. Testing of the color TV broadcast system and still photography was also planned.

### Mission Highlights

Launch, CSM docking, and S-IVB TLI burn all went to plan. Only one midcourse correction was required. Lunar Orbit insertion also occurred as planned. Once in orbit, color TV pictures of the moon were broadcast to Earth.

On the 13$^{th}$ lunar orbit the manned LM was separated from CSM, briefly fired the descent engine to simulate the initial maneuver to be performed by Apollo 11 and flew over one of the landing site candidates in the Sea of Tranquility while testing the landing radar system. Descent engine was then used to lift LM back part of the way towards CSM prior to separation to use the ascent engine for the remainder of rendezvous and docking. There was a minor problem with the separation process which succeeded on a second try.

Rendezvous went well and LM docked with CSM. The LM ascent stage was jettisoned and flown off into a solar orbit. After further time spent practicing photography and lunar landmark tracking, the CSM executed the trans-Earth insertion burn for return flight. One midcourse correction was performed and the service module was jettisoned on the way back. Re-entry and recovery were right on target.

## Next Month: Apollo 11

**June's Guest Speaker: Robert Zellem**
Exoplanets: Finding Life in the Galaxy

# Advertisements

Buy, Sell or Trade some of your gear ? This is where club members can place advertisements. Please contact the editor at newsletter@ocastronomers.org to place an advertisement or get more information.

For Sale contact Val Akins vlakins@comline.com

Celestron Giant 20 X 80 mm binoculars with Parallelogram binocular mount and tripod. In good condition for $175

Celestron 4" refractor with computer mount and tripod, star diagonal, eyepiece and finder, (includes Li-ion battery and charger
All items in excellent condition. $150

Lumicon OIII 1.25" filter $50
Astromilk 1.25 UHC filter $50
Meade 60 mm ALT-AZI refractor with tripod $25

For Sale contact Ron Choi rongrace2@cox.net 949 – 463 - 2191

Telescope and accessories as a set. The condition of the gear is almost like new.

The asking price is $2000 (45% off from retail value)

Orion SkyQuest xx14g GoTo Truss Tube Dobsonian Telescope
Orion Light Shroud for SkyQuest xx14g Truss Tube Dobsonian
Set of Orion SkyQuest xx14g Padded Telescope Cases
JMI Wheeley Bars for Orion SkyQuest xx14g
Scope Cloak Cover for Orion SkyQuest xx14g

**SIRIUS ASTRONOMER**
www.ocastronomers.org
The Newsletter of the Orange County Astronomers

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| President | Barbara Toy | btoy@cox.net | 714-606-1825 |
| Vice-President | Reza AmirArjomand | reza@ocastronomers.org | 949-791-7072 |
| Treasurer | Charlie Oostdyk | charlie@cccd.edu | 714-751-5381 |
| Secretary | Alan Smallbone | asmallbone@earthlink.net | 818-237-6293 |
| Trustee | Andy Lowry | andy@ocastronomers.org | 410-615-2210 |
| Trustee | Cecilia Caballero | caballerocecilia21@gmail.com | 949-333-3283 |
| Trustee | Doug Millar | drzarkof56@yahoo.com | 562-810-3989 |
| Trustee | Sam Saeed | samsaeed4241@yahoo.com | 714-310-5001 |
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| Trustee | Gary Schones | gary378@pacbell.net | 951-687-7905 |
| Trustee | John Hoot | jhoot@ssccorp.com | 949-498-5784 |

### COMMITTEES, SUBGROUPS, AND OTHER CLUB VOLUNTEERS

| | | | |
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| Anza House Coordinator | Manuel Baeza | manugb33@yahoo.com | 323-394-3042 |
| Anza Site Maintenance | Don Lynn | dlynn@ieee.org | 303-719-7490 |
| Beginner's Astronomy Class | David Pearson | p.davidw@yahoo.com | 949-492-5342 |
| OC Star Parties | Steve Mizera | mizeras@cox.net | 714-649-0602 |
| MTW Star Parties | Bob Nanz | bob@nanzscience.com | 760-751-3992 |
| Librarian | Karen Schnable | karen@schnabel.net | 949-887-9517 |
| Membership, Pad Coordinator | Charlie Oostdyk | charlie@cccd.edu | 714-751-5381 |
| Mt. Wilson Trips | Michele Dadighat | mmpkb8@gmail.com | 573-569-3304 |
| Observatory Custodian / Trainer / Member Liason | Barbara Toy | btoy@cox.net | 714-606-1825 |
| OCA Outreach Coordinator | Andy Lowry | outreach@ocastronomers.org | 410-615-2210 |
| Sirius Astronomy Editor | David Fischer | newsletter@ocastronomers.org | 949-831-1163 |
| Telescope Loaner Program | John Hoot | jhoot@ssccorp.com | 949-498-5784 |
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| Webmaster | Reza AmirArjomand | webmaster@ocastronomers.org | 949-791-7072 |

### SPECIAL INTEREST GROUPS (SIGS)

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| AstroImagers SIG | Alan Smallbone | asmallbone@earthlink.net | 818-237-6293 |
| Astrophysics SIG | Bob Sharshan | rsharshan@aol.com | 714-845-6573 |
| Dark Sky SIG | Barbara Toy | btoy@cox.net | 714-606-1825 |
| Youth SIG | Doug Millar | drzarkof56@yahoo.com | 562-810-3989 |