



Meteor, taken on 6 April 2019 by club member Dave Kadoma from the Anza site using Nikon D850 camera and Sigma 15mm fisheye lens.

## OCA CLUB MEETING

The free and open club meeting will be held on July 12 at 7:30 pm in the Irvine Lecture Hall of the Hashinger Science Center at Chapman University in Orange.

This month, the speaker is Simon Birrer from UCLA talking on the subject "From the Big Bang to the Empty End - the Universe from the Point of View of Modern Cosmology".

NEXT MEETINGS:  
Aug 9 (speakers TBA)

## STAR PARTIES

Anza and OC site star parties will be June 29. Starbecue will be at Anza 27 July and the OC Potluck will be 3 August. 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: 3 July, 7 Aug

Astrophysics SIG: 19 July, 16 Aug

Dark Sky Group:

contact Barbara Toy

# President's Message

By Barbara Toy

For those of you who missed the June General Meeting, you missed another great speaker, Dr. Rob Zellen, discussing the rapidly growing field of discovering and studying exoplanets, and a "What's Up" presentation by John Garrett, a regular visitor from one of our sister clubs, Temecula Valley Astronomers (TVA). Starting with the second of these...

## **John Garrett and Dark Sky/Light Pollution Issues:**

For those who may have seen him in action as a "What's Up" presenter but not known much about him, John has been president and vice president of TVA in the past and remains active with his club (his daughter, Emma, who often comes to our meetings with him and who has helped with some of his presentations, is also an active member). His interest in astronomy goes back a long way, and besides imaging, viewing and outreach activities, John has worked on dark sky issues for a long time.

I'm not sure how many people in his club are actively involved with the International Dark-Sky Association (IDA) and related activities, as John has been our main contact with TVA on those issues. I remember one time in particular when John advised us about an informational event the local authorities were having regarding proposed LED lighting in the Temecula area. LED lights may be more efficient than other types of lighting, but they also can produce light in wavelengths that increase light pollution, particularly if the fixtures aren't designed to send all of the light they produce toward the ground or area that needs illumination. There was a lot of concern about the push to install LED lights and whether the lights that were used would increase light pollution, so we definitely were interested in this event. Unfortunately, I wasn't able to go myself, but Charlie Oostdyk did and told me it was very informative, and that there were actually several different types of LED fixtures they were considering, some more harmful to astronomical activities than others, and that the authorities actually seemed more sensitive to concerns about light pollution than we feared.

John has continued to monitor lighting in the Temecula Valley area and continues to do talks and other activities to educate members of the public on good lighting practices that minimize light pollution. He even did a TEDx Temecula talk on light pollution, which you can find at <https://www.youtube.com/watch?v=jIZYTFUrhCY>. The goal is to reduce light pollution where possible and to continue the protections of the Palomar Protected Zone around the Palomar Observatories. Our Anza site is within that zone (not a coincidence), so we have a strong interest in having those protections continue as much as possible for our own astronomical activities as well as to help researchers using the 200-inch on Palomar Mountain.

Light pollution is a pervasive problem in Orange County as well as a concern for the area around our Anza site. I don't think there's any area in Orange County where the Milky Way can be seen at this point, as the sky glow is so pervasive (as a sad commentary, many students from Irvine Valley College who come out to Anza for field trips in years past had never seen the Milky Way themselves before their field trips, as they'd never been under skies that were dark enough).

Conditions are better out at Anza than even the darkest areas of Orange County, but every year the horizons to the west and north get a bit brighter and the light dome around the Palm Springs area gets more noticeable to our northeast – and too many of our neighbors seem to equate bright lights with security. There are a lot of areas where education about better lighting practices and fixtures could help reduce light pollution, where local governments could be persuaded to pass ordinances protecting their residents from light trespass and reducing light pollution in their towns or cities, where landscape designers and developers could be educated and persuaded to use better lighting designs and fixtures in their projects – as just a start.

Theoretically, our club has a Dark Sky Special Interest Group – it's listed among our Special Interest Groups but has been inactive for a long time. I'm listed as the chair, but have not had any time to devote to it since the group's early days, even though the issue is vitally important to our ability to do astronomy, both visually and through imaging. If any of you would be interested in working on Dark Sky issues and in reactivating the Dark Sky group, please send me an email ([btoy@cox.net](mailto:btoy@cox.net)). It would be really nice to have folks in our own club doing the kinds of things John Garrett has been doing in the Temecula area in the areas where we have a presence.

## **Dr. Robert Zellen's Citizen Science Project, OCA Science SIG**

Those who were at the June meeting may recall Dr. Zellen ( "Rob") talking about the Citizen Science project he's working on to help improve the data they obtained through recent survey missions on transiting exoplanets. As he said, the more time that passes since the data was collected, the greater the uncertainty about when future transits will happen, so observations from big telescopes that would have the resolution to gather more information on these planets in the future would have to be scheduled over longer periods of time to make sure that they covered the period of the actual transit.

He explained that for planets transiting brighter stars, even fairly small telescopes and simple cameras can collect data that will help determine the orbits and timing of exoplanets transits better. Transits of dimmer stars would probably take larger telescopes that would be able to gather more light, yet there are a lot of candidates for all kinds of telescopes. This would be an opportunity to use your own equipment to make scientific observations that would give us more information on the planets you observe and help with future studies as well. It seems like a really exciting opportunity to make important contributions to exoplanet studies. Other NASA Citizen Science projects involve working with data gathered from various projects to help determine what's there – also a great way to make important contributions, but for many of us, the chance to make a contribution with new data gathered by our own equipment is even more enticing.

Rob told me after his talk that they are working out the details on this new citizen science program, including software to help people reduce the data obtained on transits that they capture. He promised to contact us when the program is ready to go live, and may even do an article for the Sirius Astronomer on it. It would be great to have club members involved with this, and I hope many of you will consider it, and will let us know about your experiences with it. That could be by way of posts to the club's email groups ([ocastronomers@yahoo.com](mailto:ocastronomers@yahoo.com), [AstroImagers@yahoo.com](mailto:AstroImagers@yahoo.com)) or maybe an article for the Sirius Astronomer.

Our club has had quite a few members involved in different science projects over the years. As just two examples, you may remember Bob Buchheim, our former Secretary, who wrote a couple of books about doing science as an amateur astronomer ("The Sky Is Your Laboratory" and "Astronomical Discoveries You Can Make, Too"). He remains active with the Society for Astronomical Sciences (SAS) and is now doing his own research projects near his new home in Arizona.

John Hoot, one of our current Trustees, has also been active with SAS for a long time, as well as with Mt. Wilson, and does his own research projects from his observatories in San Clemente and the Mojave desert at the Center for Solar System Studies; he also is part of the consortium operating the Las Campanas Observatory Online Telescope, used for science, imaging and public outreach. You could say that he's really committed to his scientific activities, and he's always been willing to help others who are interested in doing science as amateur astronomers.

We actually had a group form several years back for members who were interested in doing scientific research, OCA Science, but it has been pretty dormant for quite a while even though there continue to be a number of club members actively pursuing their own research projects. John has indicated an interest in revitalizing this group as a way of encouraging more members to get involved in research, share information and assistance among those working on different projects, as well as camaraderie among those who are involved with this aspect of amateur astronomy. Having an active group would also be helpful with projects like the one that Rob Zellen is proposing, as it could provide a support group that could be particularly helpful to newcomers to the research environment.

If you're interested in getting involved with a revitalized OCA Science group, please contact John Hoot ([jhoot@scccorp.com](mailto:jhoot@scccorp.com)). If you're interested in Rob's proposed project to help get data on transiting exoplanets, stay tuned for more information as they finish putting that together, but you might want to try capturing some other types of light curves if you haven't done that before, for practice – and John would be a good resource for how you might do that, as would Bob Buchheim's book "The Sky is Your Laboratory."

## **Our Annual Starbecue and Our First Orange County Potluck**

Our annual Starbecue at the Anza site will be on July 27, 2019, starting around 6:00 p.m. in the area behind the club observatory (i.e. on the east side of the observatory), which will be in shade by then. We'll have the club barbecue going, and club members have been very generous about bringing a couple of additional barbecues as well, so there should be grill space for whatever you might bring that would need grilling. We'll also have paper plates, bowls, eating implements and bottled water – if you want to drink anything else, please bring it, and also something to sit on.

Please bring food to share, as this is a potluck, and estimate it to serve about 6 people. We don't have any formal sign-up, so bring something that appeals to you – it could be a main dish, salad, appetizer, side dish or desert. If any is left when the party is breaking up, please be sure to take it with you – we don't have facilities to store it, and we don't want to leave it out to attract wildlife.

This year will be our first Orange County Potluck, which will be at the Orange County Star Party on August 3, 2019, a week after the Anza Starbecue. New Moon is on Wednesday that week, so there are actually two Anza star parties a week apart, and the Orange County Potluck will be the same night as the second Anza star party. Hopefully that won't cut into the festivities at all.

We don't have power or barbecues available for the Orange County Potluck, so there won't be any way to heat anything up or cook it at the site. If you bring something hot, it would be best to pack it so it's well insulated, so that not much heat is lost before the party starts.

I expect that Steve Mizera will be sending out more information on this in his regular emails for the star party. We're really glad that our members who don't make it out to Anza and so miss out on the Starbecues will have a chance to get together with this new potluck closer to home, and hope that it will become a fun new tradition for the club.

### **More on Anza Weeds:**

It may not be much of a surprise to folks who are familiar with the Anza area, but the weeds really took off by the end of May, and made some areas of the Anza site pretty much impassible (the west side of the Football Field, the side away from Anza House, was one of the worst areas). Although a number of members worked hard at clearing around Anza House and some other areas while they were out there for the May star party, it's a massive job, and as of the time I'm writing this, we're trying to find some professional help for clearing the remaining weeds and repairing some areas that were severely damaged by winter storms.

Much of what's needed out there is essentially weed whacking, and nobody we've been able to contact out there so far wants to do that, even for a fee. We're still looking, but if you're out at the site, please do anything you can to help clear the weeds, particularly in roadways and around the buildings. This will help in case we're not able to hire anyone to do it, and to help keep things under control even if we do find someone we can pay to do the major clearance.

Thanks, and may your skies be clear whenever you plan to be out under the stars!

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# AstroSpace Update

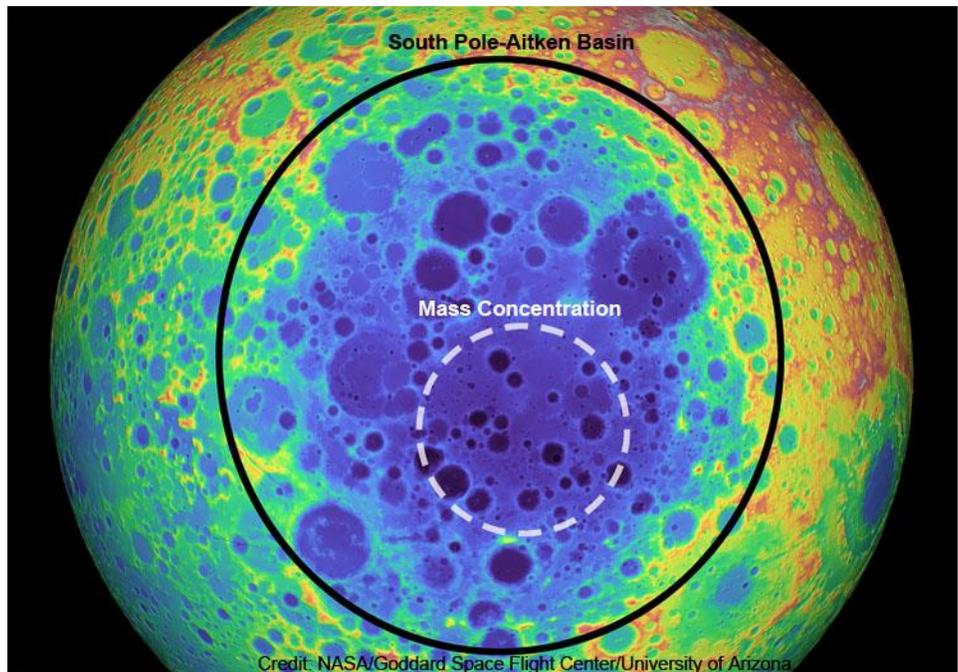
July 2019

Gathered by Don Lynn from NASA and other sources

**Possible Liquid At Pluto** – Further study of the New Horizons spacecraft data taken during its Pluto flyby shows that ammonia exists on that world's surface. The ammonia was found in the region known as Virgil Fossae, which has surface cracks. Ammonia should be eventually destroyed by conditions on Pluto, so it is likely the ammonia was released from within a geologically recent time. A good explanation is that there is a body of liquid water-ammonia mixture below the surface, and it leaks up through the cracks. Such a mixture remains liquid at a lower temperature than pure water, so such is possible, given estimated subsurface temperatures.

**Martian Clay** – Observations from orbit years ago showed clay deposits near where the Mars rover Curiosity landed. Clay often forms in liquid water, which would indicate this area was long ago a lake. The rover reached this area recently and drilled and analyzed 2 samples. This found the highest amount of clay yet found by Curiosity. Very little hematite (an iron mineral) was found, compared to previous samples taken on a nearby ridge.

**Asteroid Remnant** – The largest impact crater in the Solar System is the South Pole-Aitken Basin on our Moon. Analysis of data from the GRAIL mission (mapped gravitational pull of the Moon) showed that there is a large mass beneath that crater. According to a new study, that mass fits what is expected if the impactor that created the basin was a metallic asteroid that crushed and remains embedded in the Moon's mantle. The mass is actually weighing down the crater floor by over a half mile. The crater is believed to be about 4 billion years old.



**Ceres Mountain Explained** – The asteroid and dwarf planet Ceres has one mountain, named Ahuna Mons, much taller than others. The data about it returned by spacecraft Dawn showed it was probably a cryovolcano (a volcano at low temperatures that spews icy slush). A new study, using a computer simulation of Ceres' interior, shows that it formed when a bubble of mud and rock mixed with salt water rose (because it was lighter than surrounding material) through a weak point in the crust. In other words, it was a mud volcano.

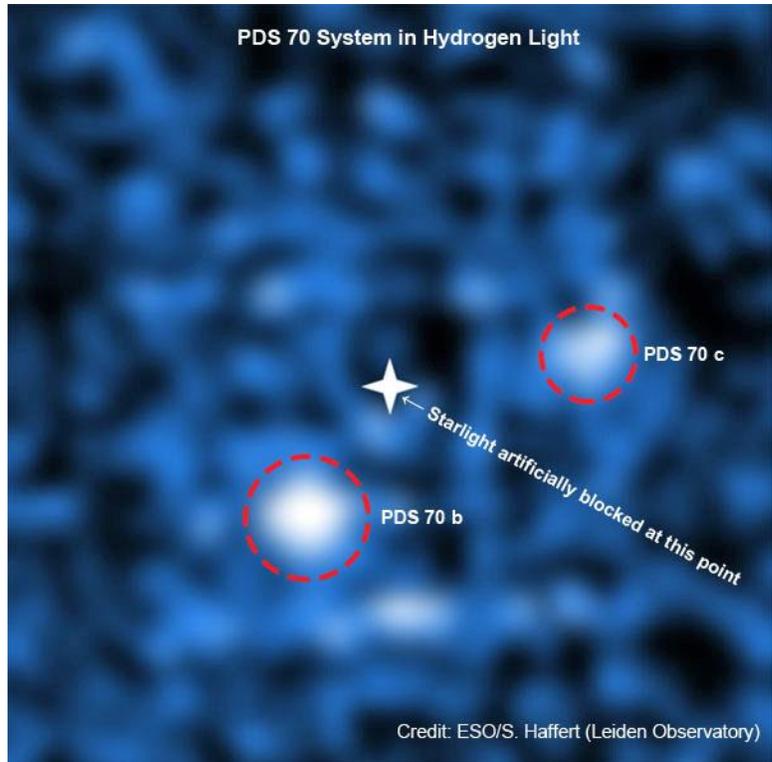
**Ejected Binaries** – A new study of the Fornax galaxy cluster using data from the Chandra X-ray space telescope has found about 30 X-ray sources that are outside any of the galaxies in the cluster, and appear to have been ejected from one of the galaxies. They are thought to be pairs of stars with one of them gravitationally pulling material off the other. The material becomes extremely hot from friction as it falls in, which emits X-rays. It is believed that supernova explosions are one cause of ejecting stars from galaxies. Collisions of galaxies could also eject stars. Whatever the cause, the new study shows that sometimes a binary pair of stars is ejected without ripping the pair apart.

**Earth-Sized Planets Found** – Scientists have developed new techniques for finding weak signals of exoplanet transits in data from the Kepler spacecraft. When run on just part of the Kepler data, it found 18 new planet candidates that are roughly Earth-sized. These 18 range from 69% Earth's diameter to just over twice Earth's. Most of the newly found objects orbit close to their stars, and so are quite hot. Only one of them is in its star's habitable zone, that area where temperatures may allow liquid water to exist. About 96% of the more than 4000 known exoplanets are substantially larger than Earth, not because Earth-sized planets are rare, but because they make such a weak transit signal that they are hard to detect. They expect to discover more than 100 roughly Earth-size planets when run on the complete Kepler data.

**Hot Neptune** – Theory has it that Neptune-like planets that orbit quite close to their stars should lose their huge gaseous atmospheres from overheating. Their cores, being much smaller, would then no longer be in the Neptune class of planet size. This area close to stars has been termed the Neptunian Desert. Rules have exceptions, and first exception has been found to this theory. A team of astronomers just found a planet about 80% the size of Neptune, dubbed NGTS-4b, orbiting so close to its star that its year is only 1.3 Earth days, and its temperature is about 1800° F. Theorists claim that it must have moved close to its star recently (say, less than a million years ago), or it was REALLY huge before losing most of its atmosphere.

**ExoCME** – Our Sun frequently throws off chunks of plasma (hot electrically charged gas) in a process known as a CME (coronal mass ejection). Astronomers have now observed a CME on another star. That star is OU Andromeda, a variable star 455 light-years away that is known to have a strong magnetic field. The star is a giant, 2.86 times the mass of our Sun, and more than 9 times the diameter. The CME was seen in X-rays, using a spectrometer on the Chandra X-ray space telescope. It was roughly 10,000 times more powerful than the Sun's CMEs, which allowed it to be seen at such a distance. The speed patterns seen by the spectrometer aligned well with what was expected of a powerful CME. However the speed itself was lower than expected, which will take some work to explain.

**Young Exoplanets Imaged** – Last year the Very Large Telescope in Chile, using adaptive optics, imaged an exoplanet known as PDS 70b. The planet is so young (about 5 million years old) that it is still forming, as is its star. Using the same telescope, but with a camera that can take images in just hydrogen light and that can cancel out the glaring star, astronomers imaged the same target and found a second planet forming there. With this camera, it showed hydrogen flowing onto the planets, further evidence that they are still forming. This is only the second ever image of any multi-planet system.



**Supernova Search** – The Subaru Telescope in Hawaii has been using its wide-field camera (Hyper Suprime-Cam) to search for very distant supernovas. 1824 of them were found. Of these, 58 were Type Ia supernovas so distant that their light took over 8 billion years to reach us. A previous search of Hubble Space Telescope images taken over a decade found only 50 Type Ia supernovas at similar distances. So the Subaru camera is a much more efficient locator of these. Distant Type Ia supernovas are important because they are used to determine the expansion rate of the Universe and the strength of Dark Energy. The Subaru study also found 5 superluminous supernovas, a rare type that are much brighter than normal. They are thought to be caused by extremely massive stars collapsing at the ends of their lives.

**Europa Salt** – Observations using the Hubble Space Telescope have found sodium chloride (table salt) on the surface of Jupiter's moon Europa. This salt likely came up to the surface through cracks. Europa has long been believed to contain a liquid water ocean below the icy surface. Previous work has pointed to sulfate salts in that ocean, but the new observations indicate chloride salt.

**Gas Ripples Explained** – In 2009, an analysis of motions predicted that there must be a dwarf galaxy in the constellation Antlia (actually another, since there was already a known dwarf galaxy in another location within that constellation). Recently the galaxy was found in Gaia data (Gaia is mapping more than a billion stars in location and motion), and named Antlia 2. It was found to be light in stars, but heavy in mass, which had to be dark matter. Now a group of astronomers has traced back the motion of Antlia 2 and concluded that it collided with the Milky Way in the past. Further, computer simulations of the collision show that it caused the ripples that had been observed in the outer gas of the Milky Way. The simulation also showed that collisions with the Magellanic Clouds or the Sagittarius Dwarf Galaxy would not have caused the observed ripples.

**Gas Disk Imaged** – The supermassive black hole at the center of our Milky Way galaxy has long been believed to be surrounded by orbiting stars, orbiting dust clouds, an accretion disk of very hot gas (about 18 million °F.), and a disk of colder gas (comparatively colder, at only about 18,000° F.) All have been imaged in detail except the cold gas disk, until now. Using ALMA (radiotelescope array in Chile) the cold gas disk has been imaged in detail, including tracing the motions of the gas by its Doppler shift.

**Colliding Galaxy Clusters Connected** – It has long been known that the galaxy clusters known as Abell 0309 and Abell 0401 are colliding and merging. A strip of plasma that connects the 2 galaxy clusters had been found in Planck space telescope data. This appears to be part of the cosmic web that connects the galaxy structures of the Universe. New observations of this region used LOFAR (network of low-frequency radiotelescope arrays in Europe) to find evidence of magnetic fields and fast moving particles in the plasma strip. It is about 10 million light-years long. The area emitting radio was larger than expected. This probably means that shock waves from the galaxy cluster merging are present that add to the acceleration of particles, which are producing the radio waves. This is yet another example of how observations in different wavelengths of light can add to our understanding.

**Snoopy Apparently Found** – Nine Apollo LEMs (Lunar Excursion Modules) were flown in space. They consisted of a lander section, and an ascent section. All of the sections (stages) soft landed on the Moon, or were crashed intentionally on the Moon, or burned up intentionally in Earth's atmosphere, except one: the ascent stage of Apollo 10 was sent off into orbit about the Sun, and was never seen again. Apollo 10 was the rehearsal for landing people on the Moon, but did not quite descend to the Moon's surface. The rocketing off into solar orbit was designed to test its ascent engine, without actually ascending from the Moon's surface. Astronomers believe they have just found that ascent stage, which was named Snoopy (after the cartoon dog). They found an object in about the orbit expected, about the right size, and apparently artificial. 100% assurance probably cannot be made until the object more closely approaches Earth, many years in the future.

**Martian Samples** – The NASA Mars rover to be launched next year (named simply Mars 2020) has long been planned to gather samples (rocks, dirt, drillings, etc.) and stack them up for a future retrieval and return to Earth. Originally there was no budget nor even a plan for how to make the retrieval. The European Space Agency has come to our rescue and announced a cooperative plan for that retrieval. The plan consists of a rover that packages samples and puts them on a lander that then blasts off into Mars orbit. A Mars orbiter then grabs the samples and blasts back to Earth. There are going to be a bunch of meetings of scientists to decide how to protect the Martian samples from Earthly contamination and how to protect Earth from possible Martian contamination.

**Spitzer Mission To End** – In 2003, the Spitzer infrared space telescope was launched. It had to be placed far from infrared sources that would overwhelm it, like the Earth, so it was sent to orbit the Sun in nearly the same orbit as Earth, but trailing it considerably. The liquid helium used to cool 2.5 of its 3 instruments ran out in 2006. But the other half instrument has remained operable to this day. It has a long history of amazing discoveries, even after the helium ran out, observing everything that emits infrared, from asteroids to exoplanets to stars to the most distant galaxies. Its Earth-trailing orbit means that it gets farther from us every year. It has exceeded the angle from Earth that it was designed for, and so has to periodically turn its solar panels away from the Sun in order to turn its antenna toward Earth to send its observations to us and receive new instructions. It does this on battery power, which lasts only about 2.5 hours. Spacecraft controllers decided that it will no longer be profitable to operate Spitzer, starting next year. So it will be turned off next January 30.

**Correction** – I use the term "excess gravity" to describe the many places that larger gravitational force has been found than can be explained by Newtonian or Relativistic gravitational equations. This includes galaxy rotation speeds, galaxy motions within galaxy clusters, gravitational lensing by galaxies, gravitational lensing by galaxy clusters, the statistical lumpiness of the Cosmic Microwave Background, the statistical lumpiness of large-scale structure in the Universe, and more. The mainstream of physics takes excess gravity to mean that there is dark matter at those places. Another group takes excess gravity to mean that we need a modified equation for gravity instead of dark matter. In this column in May I stated that 2 dwarf galaxies without excess gravity "pretty much rule out all modified gravity theories". An alert reader pointed out that a paper was published on arxiv.org last September that shows consistency of a modified gravity theory with the first of these 2 dwarf galaxies without excess gravity. I should have stated instead of "rule out" that those 2 dwarf galaxies added yet more constraints on any modified gravity theories.

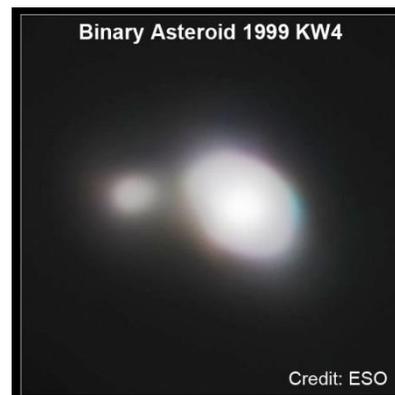
### Instant AstroSpace Updates

**SPHERE**, an adaptive optics system on the Very Large Telescope in Chile, was used to observe a **binary asteroid** as it closely approached Earth (somewhat over 3 million miles) on May 26. Both components were clearly seen, though only 1.6 miles apart.

The most accurate clock ever launched into space, dubbed **ACES**, will be sent to the International Space Station next year. It will be used to test how gravity and speed affect time, so that can be compared to predictions of Relativity.

Two more **exocomets** have been found orbiting the star Beta Pictoris (one comet was found there earlier). Together with 3 exocomets recently found at other stars, it appears that comets are quite common orbiting young stars (those only millions of years old, rather than billions).

**InSight** (Mars lander) and Curiosity (Mars rover) have been taking simultaneous pictures of **clouds** to triangulate on the cloud positions. The craft are about 370 miles apart.



# 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://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 50<sup>th</sup> anniversary of the Man's first landing on the moon, here is the second 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 them for a very enjoyable reading experience.

## Apollo 11

### Crew

Neil A. Armstrong, Commander  
Michael Collins, Command Module Pilot  
Buzz Aldrin, Lunar Module Pilot

### Backup Crew

James A. Lovell, commander  
William A. Anders, command module pilot  
Fred W. Haise, lunar module pilot

### Payload

Columbia (SM-107)  
Eagle (LM-5)

### Launch

July 16, 1969; 9:32 a.m. EDT

### Lunar

Landing Site: Mare Tranquillitatis 0.67 N, 23.47 E  
Touchdown: July 20, 1969; 4:17:40 p.m. EDT  
First step: July 20, 1969; 10:56:15 p.m. EDT  
Lunar Liftoff: July 21, 1969; 1:54:01 p.m. EDT  
Rendezvous: July 21, 1969; 5:35 p.m. EDT

### Landing

July 24, 1969; 12:50:35 p.m. EDT  
Recovery Ship: USS Hornet

### Mission Objectives

Moon landing, extra-vehicular activity (walk) on lunar surface, surface sample collection, return to Earth.

### Mission Overview

The launch was nominal and was followed almost 3 hours later by Trans-Lunar Injection to leave Earth orbit for the journey to the moon. Shortly after this the Command Service Module detached and turned about to extract the Lunar Module from the S-IVB stage. Over the next 3 days the spacecraft coasted to the moon, executing one mid-course correction burn.

Passing behind the moon on 19 July, the first of two lunar orbit insertion burns was done to establish an initial elliptical orbit. The second burn then circularized the orbit at an altitude of 62 to 70.5 miles in preparation for lunar descent.

Lunar descent was initiated with the LM 300 miles uprange of the targeted landing side. LM's descent engine was fired continuously for a little over 13 minutes slowing the craft down and lowering it under control towards the surface. Actual landing point was adjusted on the fly by Neil Armstrong to avoid a crater and ended up about 4 miles downrange of the initial target.

EVA began about 4 hours after landing with Armstrong stepping down the ladder onto the moon first and Aldrin following about 20 minutes later. The astronauts walked about near the spacecraft gathering samples and setting up a scientific experimental package (Early Apollo Scientific Experiments Package). Nearly 22 kg of samples were taken and stored aboard the Ascent stage. Within 2.5 hours both astronauts had returned to the LM for a period of rest.

After about 21.5 hours on the moon they launched ascent stage back into lunar orbit. A series of secondary burns were used to circularize the orbit prior to maneuvering for rendezvous with the CSM.

After docking with CSM, the LM was jettisoned. Later they used the CSM engine for trans-Earth injection to start the coast back to Earth. Upon return to Earth, the splash-down point was adjusted by about 250 miles to avoid bad weather. The descent was otherwise nominal.

Upon retrieval, the astronauts were immediately put into a quarantine module on the deck of the recovery ship where they remained for 3 weeks to prevent possible contamination of Earth by unknown factors brought back from the moon.

# Apollo 12

## Crew

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

## Backup Crew

David R. Scott, commander  
Alfred M. Worden, command module pilot  
James B. Irwin, lunar module pilot

## Payload

Yankee Clipper (SM-108)  
Intrepid (LM-6)

## Launch

November 14, 1969; 11:22:00 a.m. EST

## Lunar

Landing Site: Oceanus Procellarum,  
(3.01S, 23.42W)  
Touchdown: Nov 19, 1969, 1:54:35 a.m. EST  
Lunar Liftoff: Nov 20, 1969, 9:25:47 a.m. EST

## Landing

Nov 24, 1969, 3:58:24 p.m. EST  
Pacific Ocean  
Recovery Ship: USS Hornet

## Mission Objectives

Precision moon landing near Surveyor III probe, retrieval of sample parts from Surveyor III for study of the effects of prolonged exposure on lunar surface, obtain lunar surface samples from an area significantly different from that visited by Apollo 11, photograph future landing site candidates, evaluate work practices for lunar surface environment, deploy science package.

## Mission Overview

The launch succeeded although the Saturn rocket was hit twice by lightning shortly after launch with momentary disruptions to internal power. Remainder of the boost phase and the transit to the moon went nominally. Lunar descent and landing used automatic guidance to achieve a precise landing point with minimal human intervention. Actual landing spot was within 600 feet of target.

The science package (Apollo Lunar Surface Experiments Package) included a plutonium based electric power generator, a solar wind composition analyser, and a seismometer in addition to the color TV camera. This package also had a directional helical antenna to enable it to transmit science data directly back to earth after the departure of the Apollo spacecraft. Much more information on this science package is found via the URLs below. Its engineering aspects are fascinating.

<https://nssdc.gsfc.nasa.gov/nmc/spacecraft/display.action?id=1969-099C>

[https://www.lpi.usra.edu/lunar/missions/apollo/apollo\\_12/experiments/](https://www.lpi.usra.edu/lunar/missions/apollo/apollo_12/experiments/)

This mission had two EVA sessions with the first used to deploy the science package, collection of surface samples and some core-tube samples to learn about top-most layers of the regolith. A flag was also set up during this EVA. Part of the activity was imaged with a color TV camera and broadcast back to Earth until an inadvertent pointing of the camera at the sun damaged it and ended telecasting.

After a rest period the crew went out for second EVA. This was a hike covering 1.3 km over which surface and core-tube samples were obtained. The Surveyor III probe was visited and several parts were removed from it for analysis on Earth. A total of 34.4 kg of samples were brought back on this mission. Still-image photography from this mission was excellent. The two EVAs totaled about 7.5 hours which is 3 times that of the single EVA of Apollo 11.

A second rest period was taken on the surface after this EVA prior to taking off for rendezvous with the command module. After jettison, the LM was intentionally crashed back onto the moon to provide a test stimulus for the seismometer in the science package to learn about lunar structure.

Return to Earth went smoothly with only a single mid-course correction required. Splashdown was on target. Upon recovery, this crew was quarantined for 3 weeks.

## Next Month: Later Apollo missions

# From the Editor

## For the August issue

OK, now that you've relived that the experience from the first lunar landing, please send me your recollection of what you were doing and how you felt during that mission and its time on the moon. I would like to publish a collection of these thoughts in the August issue of Sirius Astronomer. So far, I have only a single submission.

## 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](mailto: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"

## July's Guest Speaker: Simon Birrer



Exoplanets: From the Big Bang to the Empty End - the Universe From the Point of View of Modern Cosmology

## 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](mailto:newsletter@ocastronomers.org) to place an advertisement or get more information.

For Sale	contact	Val Akins	<a href="mailto:vlakins@comline.com">vlakins@comline.com</a>	
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](mailto: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 Wheelley Bars for Orion SkyQuest xx14g  
Scope Cloak Cover for Orion SkyQuest xx14g





# ASTRONOMER

The Newsletter of the Orange County Astronomers

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