SIRIUS ASTRONOMER

www.ocastronomers.org

The Newsletter of the Orange County Astronomers

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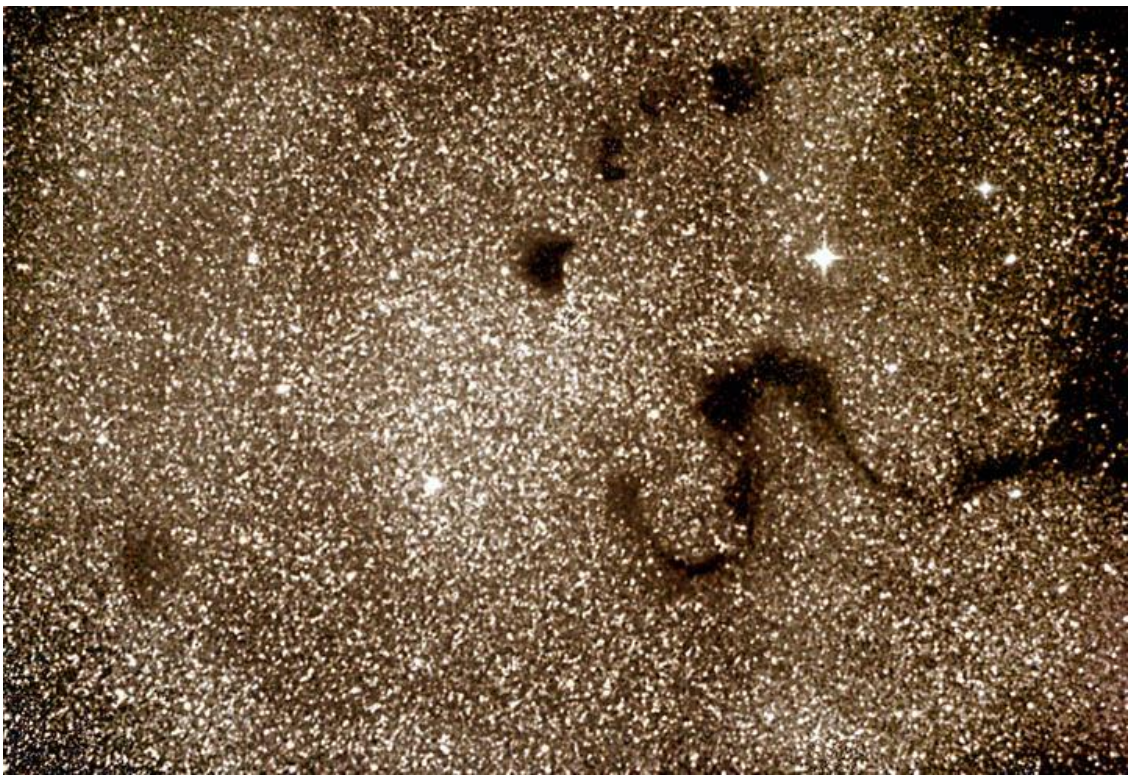


Dark nebula "The Snake", B72 in the Barnard catalog seen with the Milky Way as a backdrop. This was taken by Bill Hall with a Canon 350D camera through an 8 inch Newtonian telescope back in June 2012 from the club's Anza site

Upcoming Events

Club Meeting - free and open to the public	10 Jan 14 Feb	7:30 PM at Irvine Lecture Hall of the Hashinger Science Center at Chapman University in Orange. The speaker will be Prof. Simeon Bird from UC Riverside. "Music of the Spheres – Gravitational Waves from Black Holes"
Anza star party	25 Jan 22 Feb	Members are encouraged to check the website calendar for updates on star parties
Local (O.C.) star party	18 Jan 15 Feb	
Outreach	Many	Please check the website calendar for the outreach events this month. Volunteers are always welcome
Beginner's class	3 Jan	7:30 to 9:30 PM at the Heritage Museum of Orange County at 3101 West Harvard Street in Santa Ana
Astro Imagers SIG	none	--- note that there is no AI SIG meeting in January 2020 ---
Astrophysics SIG	17 Jan	7:30 to 9:30 PM, at the Heritage Museum in Santa Ana
Youth SIG		Contact Doug Millar
Dark Sky Group		Contact Barbara Toy

President's Message

By Barbara Toy

This time of year is usually a time of optimism for the New Year, hopefully with some pleasant memories to close out the old year. We were hoping for a couple of nice star parties as a pleasant way close out 2019, one before and one after Christmas, but as I write this the first was clouded out because of incoming storms and it's looking like rain will wash out the second one as well. One hope I have for 2020 is that we'll have a lot fewer star party nights that are clouded or rained out than we did in 2019. Not that I want to get rid of the rain, but it would be nice if it could confine itself to the week around full moon and leave the new moon period clear.

On the bright side, if the sky is clear, it looks like this should be a good year for the Leonid and Geminid meteor showers (November 16-17 and December 13-14, respectively), as the moon will be a sliver during both peaks. The Perseids in August will be more moony, unfortunately – per the American Meteor Society website, the moon will be 47% full at peak activity. However, the Lyrids (April 21-22) will be with just a 1% moon, and the Orionids (October 21-22) will be a 34% moon, so there's a prospect for some good meteor shows in 2020.

Another cause for optimism for 2020 – the March star party (March 21) will be just after the equinox (March 20) and three days before new moon (March 24), so conditions look good for the Messier Marathon that weekend, with the nights still pretty long and not much moon.

I expect you may have your own astronomical high points that you're looking forward to in 2020. Here's hoping we have clear skies so we can enjoy them all!

OCA Election – Should Still be Under Way When You Receive This in the Sirius Astronomer…

As has been mentioned in the past few President's Messages and at the general meetings, we're going through the OCA annual election process, which ends at the end of the general meeting on January 10th. You should have received a copy of the ballot in your December Sirius Astronomer, but you can also download it from the website or, if you haven't voted by the time of the January meeting, you can get a ballot (and envelope) at the meeting. We'll also have a ballot box at the meeting, for those who vote there. However, feel free to vote in advance by mailing in your ballot any time before January 10th.

Although we have just one candidate at this point for each of the positions on the Board, your votes are important to keeping a strong Board and reminding us that we are all answerable to our membership, and that the membership cares about the management of the club.

Please do vote, and if you have any questions about the process, please ask Charlie Oostdyk, Alan Smallbone or me.

And, if you don't know any of the current Board members personally, you'll find several of us at the general meetings and some at the AstroImagers meetings as well; those events seem to have the highest concentration of Board members outside of Board meetings. I think you'll find my fellow Board members to be interesting to talk to and good people to know – I've certainly found them to be so.

Rain and Anza

We're closing out 2019 with quite a bit of rain, and should be getting more as we move into 2020. As many of you know, we have about five miles of dirt road to travel over to get to our Anza site, and all of the roads on the site are dirt (though most are covered with gravel, thanks to Gary Schones) as well. It is the nature of dirt roads to erode rapidly when they are exposed to flowing water, and the rains we've been getting this season have produced a lot flowing water.

Fortunately, as of December, our neighbors along the dirt roads coming in have been keeping them in pretty good repair. The major exception is the last slope that passes the entrance to our site, which is very difficult to keep in decent repair as it erodes so quickly due to the slope and the nature of the soil; also, dirt often needs to be brought in to fill the deep ruts that develop along the slope in the rains. Even though we expect there will be attempts to do repairs, it is likely there will continue to be deep ruts at least at the sides of the road, and that it

will be a challenge to navigate throughout the rainy season. If you go out there, having a vehicle with good sized tires and a lot of clearance, like a truck or SUV, would help to get through that stretch.

Although the gravel helps a lot to stabilize the roads on our site, there are some areas where we already have significant erosion as I write this, particularly the exit road from Anza House and the Football field down to the road by the gate. If you're thinking of taking that route out, you should check its condition before committing your vehicle to it as it's likely to erode more if the expected rains do come through there.

If you're able to help with repairs to any of the roads or other areas damaged by runoff from the rains, please do. And, if you see anyone out on the roads dragging them or with a bulldozer making repairs, please stay out of their way, and thank them if you have a chance. We are all benefitting from their activities.

Happy New Year, everyone – may we all have a wonderful 2020!

Review of Astronomy 20, Irvine Valley College, Summer 2019

Submitted by Mark Price

I have a lifelong personal interest in Astronomy. After an absence from the classroom of several decades I decided to take an Introductory Astronomy course. So, for the Summer 2019 term I signed up for Astronomy 20 at Irvine Valley College (IVC) taught by Dr. Allen Schiano. Dr. Schiano is an Astrophysicist trained at UCLA and the University of Arizona (Tucson). Before retiring (and later unretiring) he taught and/or did research at the University of North Carolina, Chapel Hill, and the University of Pittsburg and locally at UCI. He has a real passion for Astronomy and Astrophysics and it comes through in the classroom. Dr. Schiano is now teaching Astronomy 25 at IVC, Observational Astronomy, and very capable others are teaching the Introductory Astronomy course that is the subject of this review.

Astronomy 20 is a wide ranging introduction starting with the earth and solar system and working its way through the Big Bang. The course includes complementary physics topics including Newton's and Kepler's laws and aspects of Special and General Relativity. This physics background allows the course to successfully migrate through topics such as stellar and galactic structure and evolution including Black Holes and expansion of the Universe. Due to the community college venue and typical audience Astronomy 20 is mainly a non-mathematical introduction focused on describing how it all works rather than mathematical modeling of phenomena.

The course book for last summer was comprehensive and available free from Openstax. You can obtain a pdf copy at https://openstax.org/details/books/astronomy. The Openstax webpage has a link to the Amazon site where you can download a copy for Kindle free or order a hard copy if you want to go "old school". It is available for roughly the same price at the IVC bookstore.

Course costs at IVC are quite nominal and you will definitely want to purchase a parking pass if you plan to drive there. Registration is entirely on-line. If you are signing up for "Educational Development", instead of pursuing a degree, typical matriculation activities like counseling are not required. You just register and show up at the first class. IVC is, in my opinion, a very pleasant venue with nice facilities and classrooms that are easy to find. The pace around campus seems a little more laid back than at a typical University.

I enjoyed Astronomy 20 so much that I am signed up for Dr. Schiano's Observational Astronomy (Astronomy 25 in the IVC catalog) this spring. It combines lecture, introduction to different telescope types and auxiliary equipment and observation. I plan to review that course for Sirius Astronomer after completion in May 2020.

AstroSpace Update

December 2019
Astronomy and space news summarized by Don Lynn from NASA and other sources

Milky Way Disk – It has been known for more than 20 years that the disk of our Milky Way galaxy consists of 2 distinct populations of stars, differing in age and composition. They are known as the thin disk and thick disk, with the thin embedded within the thick. A new study of data from Gaia (star cataloging spacecraft) and the ground-based Sloan Digital Sky Survey has found a third population, which is being called the metal-weak thick disk (MWTD). The stars of the MWTD have about half the heavy element content, have slower average orbital speeds, and their orbits reach farther above and below the disk plane, as compared to thick disk stars. Unexpectedly the abundance of some heavier elements, such as magnesium, is higher in the MWTD. The differing elemental content indicates that the MWTD formed at a different time or possibly different place than the thick disk. The abundance of heavier elements in a galaxy generally rises over billions of years as those elements are manufactured in stars and supernovas.

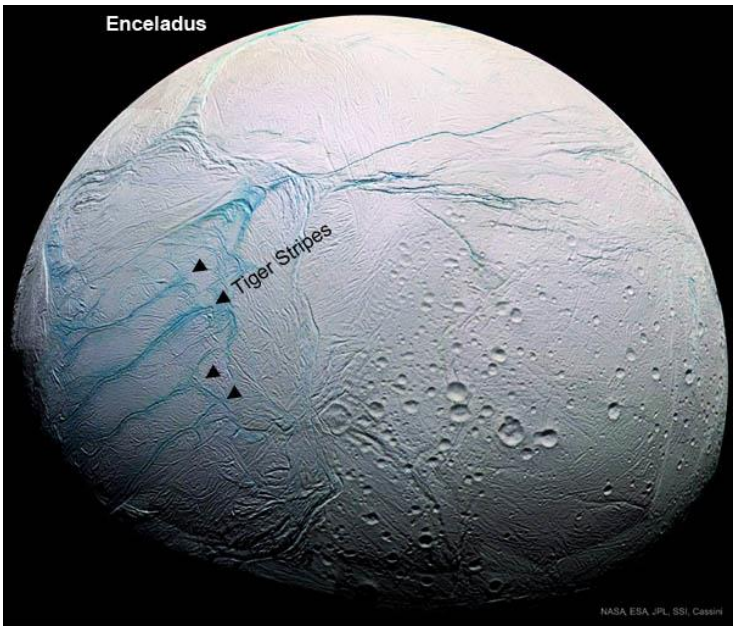
Thick Disk Age – In recent years it has been found that measuring the oscillations in the surfaces of stars – asteroseismology – can allow calculation of stars' ages more precisely than other methods. The Kepler planet-finding spacecraft produced a huge archive of star brightness oscillations, and so became a treasure trove for asteroseismologists. Analysis of Kepler data on stars in the Milky Way's thick disk showed age distributions that did not agree with computer simulations of star ages. Therefore there was skepticism whether the Kepler-derived ages for the thick disk should be believed. A new study found that the chemical composition of thick disk stars used in the computer simulations did not agree with the latest spectroscopic observations of thick disk stars. So they corrected the computer simulations and found agreement with the Kepler ages. Now we can all believe what the Kepler data said: the Milky Way thick disk is about 10 billion years old.

Dark Matter Missing – The discovery in the last 2 years of 2 dwarf galaxies that appeared to have no dark matter halo has been met with considerable skepticism. The total mass, including dark matter, was calculated from the speeds of orbiting globular clusters. The mass of stars was estimated from their brightness. In both cases, the total mass was about the same as star mass, whereas essentially all previously weighed galaxies had total mass, and therefore dark matter mass, far in excess of the star mass. So to address the skepticism, a team of astronomers analyzed 324 more dwarf galaxies and found 19 more with little or no dark matter. They were found in data from the Arecibo radiotelescope that had measured orbital motions of gas clouds about galaxies. It was hypothesized that dark-matterless galaxies could result if a neighboring galaxy gravitationally stole the dark matter. But many of the 19 have no neighbors. More work is needed to explain these.

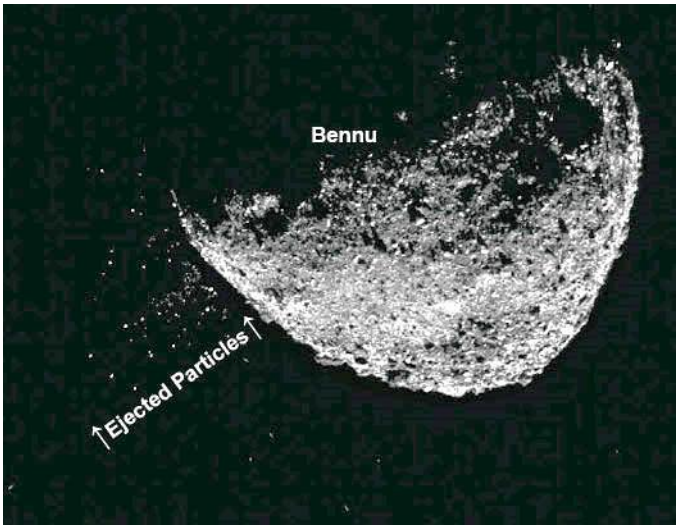
Most Massive Black Hole – Spectral observations of the central galaxy in the galaxy cluster Abell 85 show that the central black hole has a mass of 40 billion Sun masses. This is the largest known confirmed mass for a black hole. It is also the farthest away (700 million light-years) that the mass of a black hole has been measured directly from speeds of matter orbiting it. The center of the galaxy is unusually faint however. The best explanation for this is that many of the stars near the center of the galaxy have been thrown out by interactions during galaxy collisions. Dim centers have been seen in some other massive galaxies for this reason. The astronomers involved think that maybe the dimness of galaxy centers could be used to estimate the mass of a central black hole in cases where direct mass measurements have not been or cannot be made.

Pulsar Properties – An instrument named NICER aboard the International Space Station has been studying the X-rays emitted by pulsars. It records precise timing (better than 1/10 microsecond) of every X-ray photon it detects. This has allowed scientists to calculate the diameter and mass of a pulsar more precisely than previous methods. The results for a pulsar named J0030+0451 are that it is 16 miles across and 1.3-1.4 solar masses. 2 teams independently did the calculations, and their answers agreed well. Further, they were able to map out where on the pulsar the hot spots lie that emit X-rays. It is a difficult calculation because the extreme gravity near the surface of the pulsar bends the paths of the X-rays. The 2 teams agreed fairly well on the location of 2 hot spots, but one team found a third spot. The locations of the spots did not agree with a simple model of a north and south magnetic pole, opposite each other, creating the hot spots. This implies that the pulsar magnetic field is more complicated than thought. The pulsar spins 205 times per second and lies 1100 light-years away in Pisces. Similar observations and calculations will be made on other pulsars.

Tiger Stripes Explained – In 2005 the Cassini spacecraft took images of Saturn's moon Enceladus that showed 4 long (about 80 miles) parallel cracks in the surface, near the moon's south pole. These became known as the tiger stripes. Since then, scientists have been trying to explain how they formed, why they are parallel, why they formed at that location, and why there is nothing like them elsewhere. New computer simulations of the structure of Enceladus appear to have found answers. The first crack formed due to stresses from internal heating due to tidal forces. The tidal forces are a result of Enceladus having a slightly elliptical orbit, so it varies its distance from Saturn during the course of every orbit, which varies the gravitational force from the planet. This internal heating melted much internal ice, resulting in a subsurface ocean. After the crack formed, internal water erupted from the crack. The simulation showed that the layer of ice covering the ocean was thinnest at both of the poles, so the stresses would crack the layer first at one of the poles. It was probably just chance that it was the south pole. The eruptions rained ice and snow onto the surface all along the first crack. Eventually the weight of this rained material flexed the surface until a parallel crack formed. This continued until there were 4 cracks. The whole process depends on a balance of moon size, distance from its planet, and how non-circular its orbit is. It also requires a lot of water ice. This combination didn't happen anywhere else in our Solar System, so the stripes are unique.



Bennu Particle Ejection – Soon after the OSIRIS-Rex spacecraft went into orbit about its target asteroid Bennu, it took images showing particles being thrown off the surface. Analysis of images of the 3 largest particle ejection events has narrowed the cause to 3 possibilities: 1) meteoroid impacts, 2) thermal stress, 3) evaporation of a pocket of ice. The 3 events all happened in the asteroid afternoon and occurred at differing locations. The first 2 causes should commonly occur on any asteroid, and the third only on asteroids with substantial water ice content.

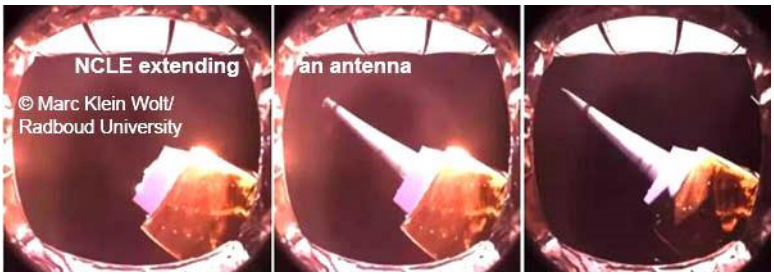


Martian Ice – Scientists have figured out a new way to detect near-surface water ice on Mars. The presence of the ice affects how the surface warms in summer and cools in winter. The closer the ice is to the surface, the stronger the effect. This is more precise in determining small depths than previous methods, such as ground-penetrating radar. A team applied this method to archived temperature data and found that ice is within inches of the surface over huge portions of Mars, including equatorial areas. The Phoenix lander scraped up ice within inches of the surface where it landed in the Martian Arctic, but it was not known until now if that would occur over widespread areas. This is good news for future crew missions to Mars, which will require easy access to water.

Solar Discoveries – The Parker Solar Probe has completed the third of 24 planned passes close to the Sun, each pass coming closer to our star. New discoveries have already been published: The solar wind spins with the speed of the Sun's rotation when it is emitted, but loses its spin by the time it reaches Earth. This had been predicted theoretically, but has now been measured by Parker flying through the wind close to the Sun. The shape of the Sun's electric and magnetic fields has surprises. There are kinks in these, where the field reverses briefly while traveling outward from the Sun. There are jets of material traveling faster than the rest of the solar wind. There is known to be cosmic dust all over the Solar System, but theory says that closer to the Sun there would be a dust-free zone caused by the Sun's heat. Parker has begun to see thinning of dust, and is expected to see the totally dust-free zone on closer approaches. It is known that bursts of particles from the Sun can reach speeds of a large fraction of the speed of light. On closer passes to the Sun, Parker will try to find how these particles attain such speeds. Parker has observed rare bursts with large content of heavier elements.

Exoplanet Atmospheres – A new study was made of the temperature and spectral data of the atmospheres of 19 exoplanets, the most extensive such survey yet. The planets ranged in temperature from room temperature to over 3600°F, and ranged in size and mass from mini-Neptunes to super-Jupiters. Like our local giant planets, the atmospheres were rich in hydrogen. Water vapor was common, but in amounts less than expected, compared to the abundance of other elements, such as sodium and potassium. This would suggest that our theories of how giant planets form need to be modified to include less water in those planets.

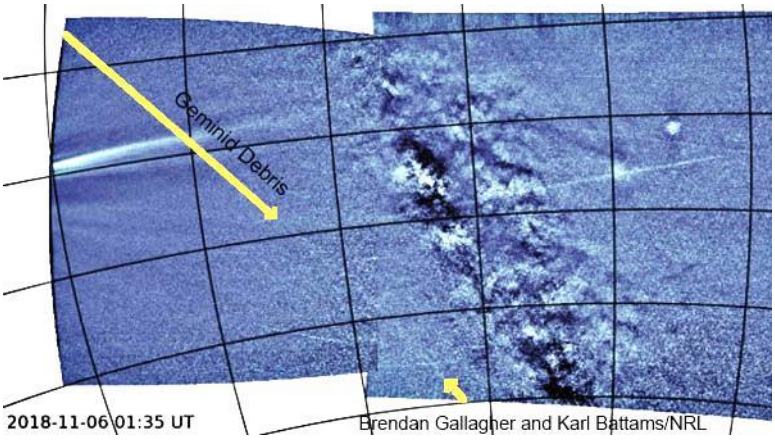
Exoplanet Orbiting White Dwarf – A ring of gas has been found orbiting a white dwarf star known as WDJ0914+1914. The ring was found to contain oxygen and sulfur, and an occasional spike in hydrogen content. Much of the hydrogen is blowing away in a comet-like tail. The best theory to explain these observations is that the star is evaporating an ice giant planet, similar to Uranus or Neptune. The star is hot enough and the cloud is close enough to the star to receive the heat necessary to evaporate such a planet. This is the first time evidence of a giant planet orbiting a white dwarf star has been found. Because white dwarfs are extremely dense, an ice giant planet would be about 4 times the diameter of its star, though far smaller in mass. The system is 1500 light-years away in Cancer. There have been previous observations of material that appeared to be rocky planet debris falling into white dwarf stars, but not evidence of giant planets doing so. It had even been theorized that planets would be destroyed by their star going through the red giant phase, which occurs before the white dwarf phase. But these observations seem to show that planets can survive until the white dwarf phase of their star. The involved astronomers believe that planet evaporation might be relatively common, so finding more examples would be a good way to find out more about the content of exoplanet atmospheres. However a search of spectral data on 7000 white dwarfs did not find another system evaporating a gas planet. The Gaia spacecraft data has 260,000 white dwarfs in it, so there is plenty of data to be searched for similar systems.



Space Radiotelescope – The Chinese spacecraft QueQiao has been relaying communications with the Chang'e4 rover, which is roving on the back side of the Moon. QueQiao is in orbit about the Earth-Moon L2 Lagrange point, and from that vantage, its radios have a direct line-of-sight to both the Earth and the lunar back side. The spacecraft carries aboard a radiotelescope, jointly built by a Netherlands team, and known as NCLE (Netherlands-China Low Frequency Explorer), but the plan was not to deploy it until communications with the rover had settled down, making time on the communications radio available. That just happened, and the NCLE antennas were extended and observations begun. The frequencies used by NCLE were designed to receive radio emitted by hydrogen clouds, redshifted by the amount experienced by objects that existed shortly after the Big Bang. So expect discoveries about the early Universe. Those frequencies do not penetrate Earth's atmosphere, so ground-based radiotelescopes cannot make this kind of observations. The relatively radio-noise-free conditions near the Moon also put NCLE in unique position to make such observations.

Instant AstroSpace Updates

The Parker Solar Probe spacecraft imaged the stream of debris left by the asteroid Phaethon, which causes the **Geminid** meteor shower when that debris strikes Earth's atmosphere. This is the first time the Geminids have been viewed from space.



TESS (exoplanet-hunting space telescope) observed for a lunar month an area of the sky that included comet 46P/Wirtanen, yielding images of the comet's development every 30 minutes, which included an unexpected comet outburst. Other comets are expected to pass through TESS's view in coming months.

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

Our celebration of the 50th anniversary of the Man's first landing on the moon continues with the third 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 14

Crew
Alan B. Shepard Jr., Commander
Edgar D. Mitchell, Lunar Module Pilot
Stuart A. Roosa, Command Module Pilot

Backup Crew
Eugene A. Cernan, Commander
Joe H. Engle, Lunar Module Pilot
Ronald E. Evans, Command Module Pilot

Payload
Kitty Hawk (CM-110)
Antares (LM-8)

Launch
January 31, 1971; 4:03 p.m. EDT

Lunar
Landing Site: Fra Mauro
Lunar Coordinates: 3.65 deg south, 17.48 deg west

Touchdown: 5 Feb 1971; 04:18:11 AM EST
Lunar Liftoff: 6 Feb 1971; 03:48:42 PM EST

Landing
Feb. 9, 1971; 4:05 p.m. EST
Pacific Ocean
Recovery Ship: USS New Orleans

Mission Objectives
Exploration of the Fra Mauro region, geology investigations, sample collection, deployment of science experiments including the Apollo Lunar Surface Scientific Experiments Package as well as other packages. The command module was assigned a variety of photographic objectives including images of potential future landing sites and zodiacal light. Very High Frequency radio and microwave communication and propagation tests were also assigned to the CM.

Mission Overview
Clouds and rain at the Kennedy Space Center delayed the launch by 40 minutes on an otherwise normal launch. After Trans-Lunar Insertion, there was difficulty docking the Command Module to the Lunar Module caused by the catches on the docking ring failing to release. 5 attempts were made to dock prior to success on the sixth. The cause of this failure was not discovered and there were no subsequent problems with the docking ring.

LM landed on target in a hilly region north of the Fra Mauro crater which is about 110 miles away from where Apollo 12 had landed. Shortly after landing there were some communication system problems which delayed the first EVA by about an hour. On the first of two moonwalks, the ALSEP was set up and the astronauts deployed their newest tool – a wheelbarrow – which enabled them to haul samples farther and much more easily than had previous astronauts. Taking advantage of this, the first moonwalk extended more than half a mile from the LM and brought back many rock samples. They walked partway up the 300 foot tall rim wall of nearby Cone crater before reaching the turnaround point for excursion # 1.

Excursion # 2 was also quite long and combining the two, Astronauts Shepard and Mitchell traversed approximately 1.8 miles, collected 94 pounds of lunar samples, and spent 9 hrs 23 min walking on the surface. During both moonwalks the astronauts took extensive photographs. At the end of the second EVA Alan Shepard brought out a golf club used it to hit 2 golf balls. We see footage of this event to this day, most often embedded in commercial advertisements.

While LM was away, Astronaut Roosa ran experiments on the CSM. Some of those tests involved use of a motion-compensating high resolution camera to image the prospective landing area for Apollo 16 but the system did not work well. Other experiments using S-band and VHF radio systems were accomplished and met their goals.

Return from the lunar surface to the command module went smoothly and on schedule. There were no difficulties with the docking ring this time. After the Trans-Earth Insertion burn, the return to earth required only one small mid-course correction and splashdown was within 4 miles of the recovery ship. As with the previous missions, the crew were quarantined after recovery.

Apollo 15

Crew
David R. Scott, Commander
James B. Irwin, Lunar Module Pilot
Alfred M. Worden, Command Module Pilot

Backup Crew
Richard F. Gordon Jr., Commander
Harrison H. Schmitt, Lunar Module Pilot
Vance DeVoe Brand, Command Module Pilot

Payload
Endeavor (CM-112)
Falcon (LM-10)

Launch
July 26, 1971; 9:34:00 a.m. EDT

Lunar
Landing Site: Hadley-Apennine
Lunar Coordinates: 26.08 deg north, 3.66 deg east

Touchdown:
Lunar Liftoff:

Landing
Aug. 7, 1971, Pacific Ocean
Recovery Ship: USS Okinawa

Mission Objectives
Exploration of the Hadley-Apennine region, taking advantage of having more life-support supplies and the first Lunar Rover (LRV) to get extended surface mobility and stay time. Deployment of another ALSEP package of experiments, and evaluation of engineering modifications made to the Lunar Module for the purpose of allowing a longer stay on the moon. This mission was also assigned to evaluate a newly designed communications relay unit and ground controlled television system.

CSM carried a sub-satellite called the Particles and Fields which it was to deploy into lunar orbit using a spring-loaded launcher. The P&F would investigate lunar mass and gravitational variations, interaction of the lunar magnetic field with the Earth's and assess composition of particles found in space near the moon.

Mission Overview
This mission was the first of 3 to use a new variant of the Lunar Module which was heavier and carried more supplies and the lunar rover. Launch was on time and nominal orbit was achieved. Trans-Lunar Insertion went smoothly but prior to the Lunar Orbit Insertion burn, a short circuit was found in the CSM main propulsion engine which had to be worked around for this and all of the later burns.

Lunar landing used a very steep descent path (26 degree slope) because of the ruggedness of the Apennine mountain range in the landing area yet ended up very much on target.

On the first EVA after landing (31 July), the LRV was deployed and driven about. The first trip covered about 10km to the edge of Hadley rille then Elbow crater and near to St. George crater. After return to the lunar module, the astronauts used a special drill rig to obtain a core sample from 10 feet below the surface. Before ending this EVA, they also deployed the ALSEP.

Second EVA (1 August) included a 12.5 km drive to explore the base of the Appenine Mountains, 5 craters (Index, Arbeit, Crescent, Dune, Spur).

In the third EVA (2 August), they drive 5 km covering Scarp crater and more of the Hadley rille. After return to the LM, Astronaut Scott brought out a hammer and a feather and proceeded to televise a demonstration that in vacuum they do actually fall at the same rate. A plaque was left on the moon to memorialize the American and Soviet astronauts and personnel who had died in the course of these two space programs.

Taking advantage of the increased amount of life support supplies on this mission, the crew was able to conduct 3 EVAs totaling 18 hrs 37 min spread out across 3 Earth days. They spent about 66 hours on the moon. The rover was driven 17.5 miles and 170 pounds of samples were collected. Extensive photographs were taken along their excursions to document where samples were taken as well as structure and features of the surface. Videos of the rover being driven across the moon were shown in real-time and have since been seen widely around the world.

The lift-off from the moon was captured by the LRV's video camera and broadcast to the earth. After docking with the CSM and jettisoning the Lunar Ascent stage, the P&F sub-satellite was launched into orbit. The CSM burn for Earth Insertion went normally. 3 days later, Astronaut Worden went EVA to retrieve film cassettes from the service module's SIM bay cameras. Flight back to earth was on target as was the descent though one of the 3 main parachutes did not deploy fully and the landing speed was slightly higher than intended as a consequence.

Next Month: Final Two Apollo missions

OCA Loaner Scope Program

Telescopes are checked out only on one designated weekend every 3 months. The loan period is 6 months. Available scopes are listed on the club website. Reservations will be accepted until 7 days prior to the next pickup day. To reserve one, send the program director an email at scopes@ssccorp.com

The request should contain the desired scope's inventory number, the member's name, address, telephone number and email contact address. Pick up time and location will be sent to the borrower via email. Please bring proper identification and sign the club's loan agreement at the time of scope pickup. When ready to return a borrowed scope, please contact John Hoot to make arrangements.

NEXT SCOPE EXCHANGE DATES

25 January, 2020 – Returns **26 January, 2020 – Pickups**

Email: scopes@sscorp.com

From the Editor

Sirius wants photograph submissions from club members
We have sufficient submissions for remainder of this year. New submissions will be queued up for inclusion starting in January.

Ideas for Future articles
The newsletter includes articles from members and / or about subjects suggested by our members. We seek ideas and writers to cover them. To contribute an article or work with the editor to produce one, please contact me at newsletter@ocastronomers.org .

Due dates for submission of articles, pictures and advertisements

Issue	Due date
February	25 Jan
March	22 Feb
April	21 Mar

Get gravitational wave detection alerts on your cell phone:

Stephan Donovan has found these apps which alert smart-phone users when Gravitational Waves are detected by LIGO and the other labs:

For iOS: apps.apple.com/app/chirp-gravi … ave-app/id1484328193

For Android: play.google.com/store/apps/det … =org.laserlabs.chirp

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 to learn more about placing one. There is no cost to club members for non-commercial advertisements in the newsletter.

For Sale contact Val Akins vlakins@comline.com

- Celestron piggyback mount for 35mm DSL cameras or finderscopes $20
- Orion Astro View 120ST f/5.0 Richfield refractor OTA with two inch mirror star diagonal, rings and dove trail attached. $175

For Sale contact Jeff Gortatowsky jeff.gortatowsky@gmail.com

- Pad Jupiter Ridge pad 5 lease privilege – for sale to any OCA member This is a pad with no pier on it. Price is firm $1500

For Sale contact Catherine Bailey oneleaf1@cox.net

- Astrophysics Mach 1 GTO mount, control box, keypad, counter weights, shaft, pier adapter, 2-12v power supplies, Y cable for RA & Dec $6,174
- TEC 140 APO Refractor, Starlight Feathertouch focuser, tube rings, dew strap, Scopeguard case, Losmandy dovetail plate, 7x50 viewfinder. Has just been cleaned and serviced by manufacturer; optics tested as "near-perfect performance." $5,010
- Denkmeier Bino-viewer and 2 SW 6 mm eyepieces. $690
- CG-4 Equatorial Mount with CG-4 stainless steel tripod, dual axis drive, motors, hand controller, eyepiece tray, Losamandy vixen style saddle, shaft & weights $395
- ST-4 autoguider system with flip mirror, complete with case $200
- Orion Short Tube 80 mm telescope $80
- Binoculars, eyepieces, and accessories also for sale. Send inquiries to: oneleaf1@cox.net

For Sale contact Rick Hull hull3@cox.net

Prices are for OCA members and local pickup. Get these now before I place ads on CN / Astromart

- Moonlite CF 2" focuser for refractors, BLUE anodized, Dual speed w/ Shaft Lock, 4.5" Drawtube, Dual finder dovetails for Synta, Vixen, etc, 1 1/4" EP adapter — $200
- Stellarvue SFF-3 Field Flattener for refractors, threaded metal dust caps, supports Full Frame image circle > 43mm, 63mm threaded fit to Feathertouch 2.5", can use adapter for other large focusers, Camera side is M48 threads — $225
- Losmandy DVR-108mm Guide Scope Rings, like new never used, work with both Losmandy D and Vixen V plates — $80
- Losmandy DUP-14inch Universal Dovetail Plates, like new never used. These are the newer version with Scale imprinted, 2 plates available — $65 for one $120 for pair
- Lymax R1 SCT Cat Cooler / Ventilator, new in box never used. C11 size, should also work on Meade10 / 12 or larger Mak — $65
- Refractor hard shell carrying case, printed with Astro Tech sized nominally for 4" to 5" scopes. Inside padded dimensions: 30x7.5x7.5 inches — $65
- For the ATMs in the group contemplating a large Newtonian: I have a Carbon Fiber / Kevlar tube, mirror cell, and spider sized nominally for a 22 inch. Inquire if interested in knowing more — Email me

Contact Rick Hull hull3@cox.net for more info, to request photo, etc.

UPCOMING TOTAL SOLAR ECLIPSE TRIPS

- December 2020 – Patagonia/Argentina*
  - 6 Day/5 Night Tour
  - "Glamping" at the observation site night before the eclipse
  - 2 Nights in Buenos Aires
  - 2 Nights in San Carlos de Baraloche
  - Best weather prospects along eclipse path
  - Price includes hotels, ~ ½ meals, ground and air transportation, technical support
  - Nearly 2 minutes of totality
  - Nighttime sky observing before eclipse day
  - Optional extension to the Patagonian ice field, Glacier National Park, Moreno Glacier
- April 2024 – San Antonio, TX*
  - 4 Day/3 Night Tour
  - 5 Star hotel accommodation in the famous Riverwalk tourist area (Alamo, etc.)
  - Daily breakfast, transportation to reserved site 20 km from centerline (4 min 15 sec totality)
  - Celebration banquet following the eclipse
  - Optional added days in San Antonio available
  - Transportation to/from eclipse site, daily breakfast, early equipment setup on site with security

*** Led by 30 year OCA Member Joel Harris**
Veteran of 21 Total Eclipses/Tours
90%+ Success Rate Seeing Totality

TWILIGHT TOURS

For more information, go to: www.twilighttours.net

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