SIRIUS ASTRONOMER

www.ocastronomers.org

The Newsletter of the Orange County Astronomers

March 2020 Free to members, subscriptions $12 for 12 issues **Volume 47, Number 3**

M101 Galaxy taken by Gary Schones and Bill Patterson on 30 April 2006 from the club's Anza site using SGIB STL11000 CCD camera though a 16 inch RCOS Ritchie-Cretien telescope

Upcoming Events

Club Meeting - free and open to the public	13 Mar 10 Apr	7:30 PM at Irvine Lecture Hall of the Hashinger Science Center at Chapman University in Orange. The speaker will be Laura Danly from the Griffith Observatory with the topic "Will We Go to the Moon … and Do the Other Things?"
Anza star party	21 Mar 18 Apr	Members are encouraged to check the website calendar for updates on star parties
Local (O.C.) star party	14 Mar 11 Apr	
Outreach	Many	Please check the website calendar for the outreach events this month. Volunteers are always welcome
Beginner's class	6 Mar 3 Apr	7:30 to 9:30 PM at the Heritage Museum of Orange County at 3101 West Harvard Street in Santa Ana
Astro Imagers SIG	4 Mar 1 Apr	6:30 to 8:30 pm, at the Urban Workshop in Costa Mesa
Astrophysics SIG	20 Mar 17 Apr	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

With March, we're already at the Spring Equinox and almost a quarter of the way though the new year, so it's no longer quite so new. Time does seem to be moving fast…

The Club's Special Interest Groups

Every so often I think it's nice to do a kind of tour of our Special Interest Groups, for those who haven't yet checked them out. Over the years, we've had different groups start up, some dissolved after they were no longer as relevant, some changed or merged – it's nice that they have the flexibility to meet the changing needs and interests of our members. At this point, we have two active groups:

AstroImaging SIG: This is probably our longest-lived SIG, if you consider it in a continuum with its predecessors. I've been told that, in the past, there were two distinct groups of imagers in the club, those who used film and those who were exploring the developing world of electronic imaging. The two groups merged by the early 2000s to form what is our current AstroImage SIG, which had a strong contingent of film imagers for many years. Over time, though, almost everyone has gone electronic, and their new reality is that it takes at least as much time to process images as it does to acquire them.

The current AstroImage group meets monthly at 6:30 p.m. on the first Wednesday of each month, at a fascinating place called the Urban Workshop near John Wayne Airport, courtesy of Dave Kodama, who is currently chairing the group as well. The meetings generally include a presentation on a topic of interest, often by a member of the group and sometimes by an outside speaker. Presentations cover a wide range – the February presentation was on using Raspberry Pi computers to help with an imaging setup, other recent talks included two by different members who have set up their equipment at different remote imaging facilities in New Mexico. Many presentations are on different aspects of or approaches to processing. A show-and-tell of member images is also a regular feature of these meetings, generally following the main presentation.

Although some might think that the group is only for experienced imagers, everyone is welcome, regardless of their experience level and regardless of the type of imaging they might want to do. One way beginners advance more quickly is to be around more experienced people, who can answer questions, give advice and warn about some of the pitfalls they've run into themselves. So, if you're at all interested in imaging, try coming to some of the AstroImaging meetings, and don't get discouraged if the topic for that meeting seems too advanced for you at that point (other topics at other meetings won't be).

As another resource if you're thinking about getting into imaging, one of our long-time imagers, Kyle Coker, has been doing a class on Beginning AstroImaging as part of our Beginners Astronomy Class that you might want to check out for a good overview of the basics of astro-imaging. We just had that class on the first Friday of February, so the next one is scheduled on the first Friday of August.

In case you aren't aware of the club's email groups, we do have an email group devoted to astro-imaging, AstroImagers@groups.io. Most of the regulars in the AstroImage SIG are in that email group, as well. Along with sharing information on imaging matters, since many imagers are regulars out at Anza beyond star party nights, this email group is a good source of information on who's going out there, road conditions and other concerns about the site, and expected viewing and weather conditions.

Astrophysics SIG: This group is for those who want to learn more about why the universe is the way it is. It's like the best part of a good seminar that's guided by what interests the participants and it doesn't have tests. I'm sorry to say that I haven't been able to attend these meetings for a while, but I'm on the mailing list so I can see what I'm missing.

The general format of the meetings is to watch a couple of videos from series on different aspects of astronomy or astrophysics. A lot of these come from Great Courses, but other sources are tapped as well. Bob Sharshan has done an excellent job of chairing the group for several years now, and continues to find interesting series for the group to watch – as well as sending out information on talks and other upcoming events in the community that people in the group might be interested in.

The group also discusses aspects of the videos as well as other topics of interest, such as recent discoveries in the news, talks some of them may have attended or programs they've seen. All this may sound a bit formal, but the group really isn't – it's a fun group of folks who share an interest in the universe around us but also enjoy a bit of socializing with their physics. No prior knowledge is needed, everyone is welcome.

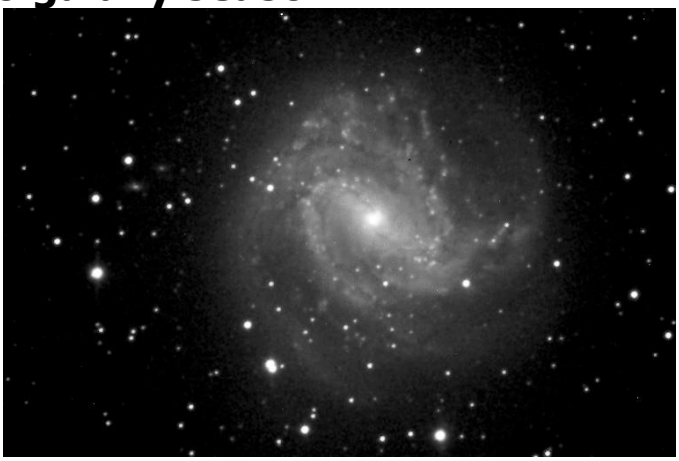
The meetings are generally set at 7:30 p.m. on the third Friday of each month, at the Heritage Museum in southern Santa Ana. If you've got any interest in learning more about the fascinating objects in the universe around us and how it all works, do try attending some of their meetings – I think you'll find them interesting and fun.

Messier Marathon

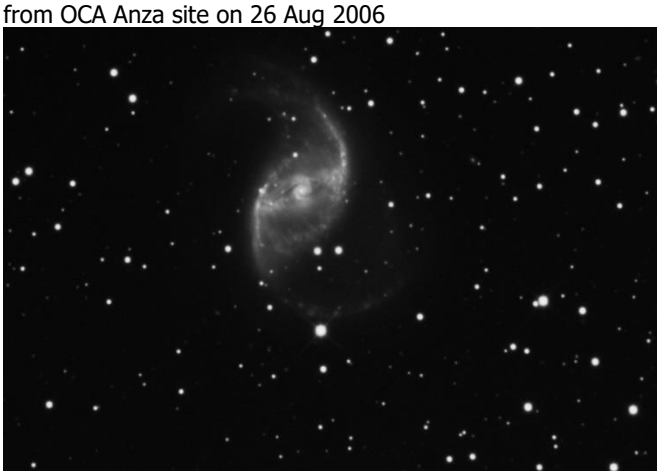
Just a reminder – if weather permits, the "formal" date for our Messier Marathon this year is the Anza star party on March 21, 2020. For those who decide to take that on – good luck, have fun with it, and please send us a copy of your results! There should be a Messier Marathon form posted on the website that you can use to help get through the objects efficiently, though you're welcome to use any form you find helpful. I recommend using a form, as it makes it easier to keep track of what you've seen and what you're trying for next.

A little tribute to galaxy season

NGC7479 galaxy imaged on self-made 16 inch Newtonian telescope using SBIG ST10XME camera by Chuck Edmonds from OCA Anza site on 26 Aug 2006



M83 galaxy imaged on TEC 8 inch Maksutov telescope using SBIG ST-8xe camera. This was taken by David Radosevich



NGC1530 galaxy imaged on self-made 22 inch Newtonian using SBIG ST10XME camera in September 2012 from the OCA Anza site by Chuck Edmonds

NGC2207 taken on the Kuhn telescope by Pat Knoll in January 2009 using SBIG ST8XME camera.

AstroSpace Update

February 2020
Astronomy and space news summarized by Don Lynn from NASA and other sources

New Target For Lucy – The Trojan asteroids are found in 2 groups along Jupiter's orbit, one group at a 60° angle ahead of the giant planet, and the other 60° behind. These are 2 of the Lagrange points, where the combined gravity of the Sun and Jupiter create stable areas in which small bodies may orbit. The Lucy spacecraft, now under construction, is planned to be the first to visit a Trojan. In fact, Lucy was designed to visit 6 of them over a period of 12 years, as well as a main-belt asteroid on the way. New observations of the targets with the Hubble Space Telescope discovered that one of them, Eurybates, has a small satellite, so the mission just got another target for free. The satellite was not noticed previously because it is 6000 times dimmer than Eurybates. From this low level of brightness, it is estimated that the satellite is only about a half mile across. Launch is planned for 2021.

Comet Color – Analysis of Rosetta spacecraft data show that Comet 67P/Churyumov-Gerasimenko underwent color changes that cycled with its position in its orbit about the Sun. The comet coma got redder and the nucleus got bluer while the comet was close to the Sun, and those colors reversed when far from the Sun. Researchers determined that heat from the Sun caused reddish dust to be blown off the nucleus and into the coma. In colder times dust settled back onto the nucleus. Rosetta spent 2014-2016 orbiting that comet.

Pluto Winds – Computer simulations have explained the winds on Pluto. The left side of the heart-shaped feature on Pluto is a huge impact crater filled with nitrogen ice. Pluto's day is about 6 Earth days long. Even as far as Pluto is from the Sun, it gets enough heat during the day to sublimate (turn ice to gas) some of the nitrogen ice. Then at night it refreezes. This action was found to drive winds all over Pluto, including a spiral pattern over the nitrogen ice. Because Pluto's axis is quite inclined, the heating pattern will strongly change with seasons, changing the wind patterns from current ones.

Proxima Exoplanet – Astronomers have found a 2nd exoplanet orbiting Proxima Centauri, the nearest star to our Sun, at a little over 4 light-years distance. Technically it is a planet candidate until confirmed. It orbits far enough from Proxima that its temperature is very likely too cold for liquid water to exist on the planet. Its mass is about half that of Neptune, and its orbit is about 1.5 times the diameter of Earth's orbit. Starspot activity added to the difficulty of finding this planet. The 1st planet orbiting Proxima was found in 2016.

Planets In Globular Clusters – A new study used computer simulations of stars and their planets when located in dense globular clusters. It found that most planets were gravitationally flung away from their stars, and only a few of those ended up orbiting other stars, while most just wandered in the space between stars. Somewhere between 5 and 20 percent of planets survived billions of years still orbiting their original stars.

Hottest Exoplanet – A new study of KELT-9b, the hottest known exoplanet at about 7800°F, shows that the heat there is breaking up the hydrogen molecules in its atmosphere into separate atoms. The planet is tidally locked to its star, meaning it keeps one side always toward its star. The broken-up hydrogen drifts to the night side, where cooler temperatures allow recombining to molecules. This process distributes heat from the hot to the cold side more quickly than winds could do. KELT-9b orbits its star every 1.5 Earth days and has about 3 times the mass of Jupiter.

Young Planet Discovered – Scientists announced the discovery of a very young massive exoplanet only 330 light-years away. It is about 10 times the mass of Jupiter and orbits a star known as 2MASS 1155-7919. The star is about 5 million years old, so the planet is very young. Its orbit is 600 times the size of the Earth's orbit. Astronomers are trying to figure out how it formed or moved to a place so far from its star.

Binary Brown Dwarfs – Volunteer citizen scientists have discovered a rare pair of brown dwarfs orbiting each other. Brown dwarfs are stars without sufficient mass to sustain nuclear fusion. These are over 30 billion miles apart, so it is surprising that they have never encountered anything that would gravitationally disturb and separate the pair. The brighter of the pair had been previously seen by the Gaia spacecraft, and determined to be 78 light-years away. They are 34 and 72 times the mass of Jupiter.

Disk Shadow – In 2018 an image taken by the Hubble Space Telescope showed a shadow near the star HBC 672. It was believed to be caused by a planet-forming disk about the star. Such a disk would be too small to see, but the shadow is much larger, stretching roughly ¼ light-year. Recent observations show that the shadow has moved, probably because the disk wobbled. Astronomers plan to keep observing the shifting shadow to see what they can learn about planet-forming disks.

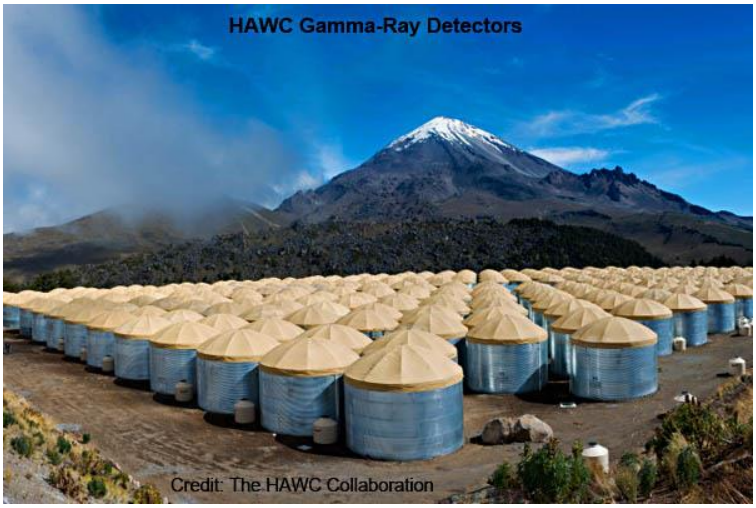
Galaxy Wave – A new study of the locations (in 3 dimensions) of star-forming regions in the Milky Way has found a wave in this material that passes just 600 light-years away from us and stretches 9000 light-years long. Its peaks and troughs reach about 500 light-years above and below the plane of our galaxy. It constitutes much of the Local Arm, the piece of galaxy spiral arm in which the Sun lies. It is now up to the theorists to explain how the wave formed.

Binary Stars Required For GRBs – Long gamma-ray bursts (but not short ones) are known to be caused by massive stars reaching the ends of their lives and exploding as supernovas, leaving behind a neutron star or black hole. A new study using computer simulations of stars shows that the conditions to make such a gamma-ray burst (GRB) occur only when the massive star has a companion star orbiting it closely. Tidal forces from the companion keep the star spinning during the explosion and cause jets of material to be thrown out, necessary conditions for the GRB.

Low Mass White Dwarfs – Scientists have completed a spectrographic study of low-mass white dwarf stars. These have been a mystery because stars take longer in their main sequence stage before becoming white dwarfs according to how low their mass is. So the low mass stars have not had enough time since the Universe began to progress to white dwarf. Yet they exist. The best theory for their existence has been that a stellar companion star stole mass from them after becoming a white dwarf. The new study supports this because every low-mass white dwarf studied was found to be part of a close binary star system. 98 binary white dwarf systems were discovered during the study. From the number of these that were close enough to be found, it was estimated that there are 100 million white dwarf binaries in the whole Milky Way. The LISA mission, planned for launch in 2034, is a space-based gravitational wave detector that will be sensitive to waves emitted by close binary stars, so may add another way to study them.

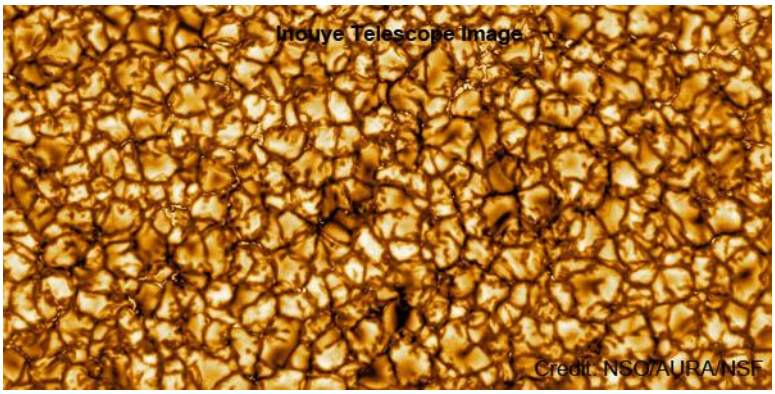
Galaxy Halo Studied – A new study measured the effects of gas on X-ray light emitted by a distant blazar as it passed through the halo of our Milky Way galaxy. Those effects yield the temperature and composition of the gas. Scientists were surprised by the extremes in temperature (up to 10 million degrees) and larger amounts of heavier elements than expected. Those heavier elements, which included neon, oxygen, iron, and others, had to have been formed by stars in the galaxy, indicating that more of the material from stars is flung out into the galaxy halo than expected. These observations were made with the XMM-Newton X-ray space telescope. A blazar is a very active galaxy core emitting blazing light.

Gamma-ray Sources – The HAWC gamma-ray observatory in Mexico is sensitive to higher energy gamma rays than other gamma-ray observatories. So the catalog of gamma-ray sources made from HAWC observations includes some sources that were missed previously. Among these are 9 newly announced sources of gamma rays, all of which appear to be associated with pulsars. The announcement also included some of the highest-energy gamma rays ever seen. These discoveries are important not only for figuring out what processes emit gamma rays, but also for processes that emit cosmic rays. Cosmic rays are charged particles, not forms of light like gamma rays. Magnetic fields deflect charged particles, making it extremely difficult to identify sources of cosmic rays. But cosmic rays that collide near their sources produce gamma rays that appear to come from that same source. Thus we can learn about cosmic rays from the gamma rays that they produce.

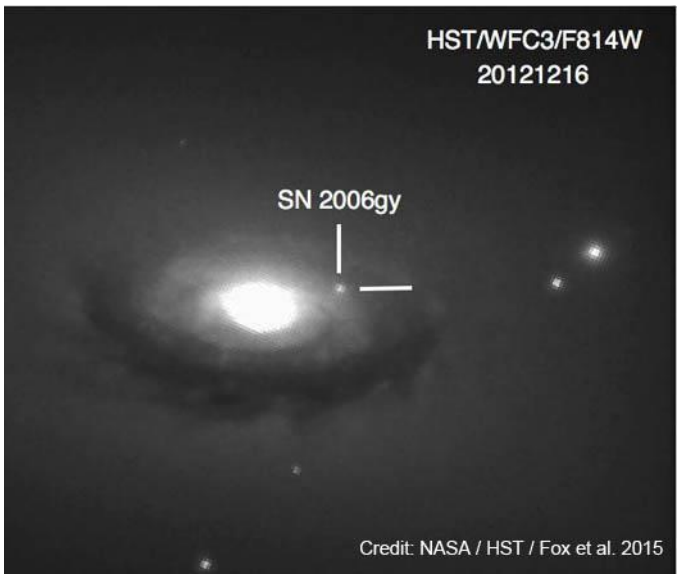


Repeating FRBs – The majority of fast radio bursts (FRBs) occur only once. But some of them repeat from the same location. Now one of the one-timers has been found to repeat. This was announced by an Australian group who continued to watch the location of a strong burst from 2017. No additional bursts were seen with the radiotelescope array used for the original discovery but much fainter bursts were found using more sensitive big dish radiotelescopes. Another announcement by a different group found a repeating FRB that is the 1st known to follow a regular pattern. It bursts about hourly for 4 days, then is quiet for 12 days. This FRB is in a spiral galaxy about 500 million light-years away, relatively close for FRBs.

New Solar Telescope – The Daniel K. Inouye Solar Telescope has produced its 1st images, and they show more detail of solar convection cells and other surface features than ever seen before. It does this by using a 4-meter mirror, adaptive optics to compensate for motions in the Earth's atmosphere, and a massive heat dissipation system. The telescope is located atop Haleakala in Hawaii, and is named after the late senator from that state. In addition to imaging, it has instrumentation to map magnetic fields in the Sun's corona. It is planned to produce more solar data in the next 5 years than all solar data collected since the invention of the telescope.



A Supernova Explained – Researchers have finally identified certain spectral lines that were seen in the light of supernova 2006gy. These researchers were the 1st to compare the lines with known lines of neutral iron, rather than ionized iron, because no one expected neutral iron in a supernova. These neutral iron lines had never been seen in any supernova. This supernova was one of the brightest ever seen, in a class known as superluminous supernovas. The mass of iron necessary to make the lines observed is huge: at least 1/3 of a solar mass. Computer simulations of supernovas showed that the only way to make so much iron and such a bright explosion is this: a hydrogen-rich massive star has a companion white dwarf star orbiting it. When the massive star expands near the end of its life, it engulfs the white dwarf, which then spirals toward the center of the massive star. Material falling onto the white dwarf causes it to explode as a Type Ia supernova while inside the massive star.



Mapping Around a Black Hole – Astronomers would like to see material falling into a supermassive black hole to verify theory, but this area is just too small to resolve with any telescope. A new technique has been developed to map out the area around such a black hole. When a chunk of material falls in, it heats up and gives off a burst of light, including X-rays. That light echoes off the surrounding features. By observing the timing and other characteristics of the echoes, a map can be built of those features. This was done for the 1st time, using the XMM-Newton X-ray space telescope observing the supermassive black hole at the center of a galaxy cataloged as IRAS 13224-3809. It is one of the most variable X-ray sources, providing plenty of bursts to cause echoes. The observations also allowed calculating the mass and spin of the black hole. The map showed a disk of matter lying in a corona of extremely hot (about a billion degrees) matter, as expected. A surprise was that the corona changed size in just days. Astronomers plan to use the technique on other rapidly-varying active galaxy cores.

Spitzer Retired – The Spitzer infrared space telescope has been retired. It was turned off late in January. It produced spectacular data for 16 years in spite of it being originally planned for a 2.5-year mission, and having run out of coolant after about 5 years. One of the 3 instruments partially runs without coolant, so it was able to continue observations more than a decade longer. Retiring Spitzer at this time was based on the estimate that it would be replaced by the James Webb Space Telescope by now (which has been delayed until next year), and on the increased difficulty of operating an aging telescope. Spitzer is one of the originally planned 4 Great Observatories in space, designed together to cover infrared, visible light, ultraviolet, X-rays, and gamma rays. Spitzer made important discoveries about comets, asteroids, rings, dust, star and planet formation, and galaxies and their evolution. Some of the areas it contributed to had not even thought of when Spitzer was designed. Researchers will probably continue making discoveries for many years by studying the archived Spitzer data.

General Relativity – Among other predictions, general relativity says that space becomes twisted around a rotating massive object. This is termed frame-dragging. New study of a white dwarf and a pulsar in very close orbit has been able to measure frame-dragging. The extreme regularity of pulses from the pulsar allowed very precise determination of this pair's orbit. The orbit wobbles (or precesses) in a manner that depends on the frame-dragging occurring near the spinning white dwarf. The pair has been observed for 20 years, so there is plenty of data to work with. The white dwarf was found to rotate every 100 seconds. The pair is 12,000 light-years away, and they orbit each other every 5 hours.

Record Space Stay – Astronaut Christina Koch returned to Earth from the International Space Station, setting the record at 328 days for the longest stay in space by a woman. This is only 12 days short of Scott Kelly's American record. She made 6 EVAs (spacewalks) during the flight, including the 1st all female EVA.

New Radio Dish – NASA broke ground to construct another radio dish in its Deep Space Network, which upon completion will bring to 13 the number of operational dishes. This network is used to communicate with spacecraft in deep space and also does radio astronomy and radar astronomy. This one will add to the group at Goldstone in the California desert. It will also have laser communication ability as well as radio.

Betelgeuse – Not only is Orion's shoulder star Betelgeuse getting dimmer (as you read here last month), it is changing shape. Images taken with the Very Large Telescope in Chile with adaptive optics resolve the star and show this changing shape. One possible explanation is that the star is being obscured by dust, but other causes are being examined.

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. He may be able to accept the scope at the OCA general meeting.

OCA Scopes For Rent

INV#	Type	Size	Mfg	Model	Accessories/Notes	Available	Rent
1	Mac	3.5"	Meade	ETX90	Alt/Az Goto	04/12/2020	$5/Mo
2	Newtonian	4.5"	Meade	DS2114ATS	Alt/Az Goto	04/12/2020	$5/Mo
5	SCT	8"	Meade	LT8	Alt/Az Goto	04/12/2020	$5/Mo
6	Newtonian	4.5"	Celeston	1114EQ	Wt Bars In Storage	01/12/2020	Free
10	SCT	8"	Celestron	Orange Tube	w/Encoders,Wedge,Tripod & SlowMo. Ctl	04/12/2020	Free
16	SCT	10"	Meade	LX200 Classic	Alt/Az Goto	04/12/2020	$5/mo
19	Mac	2.25"	Meade	ETX60	Alt/Az Goto	04/12/2020	$5/mo
20	Reflector	8"	Orion	SkyView	German EQ wTracking & SlowMo, 2 axis	04/12/2020	Free
22	Reflector	4.5"	Celestron	NexStar	Alt/Az Goto	04/12/2020	$5/Mo
24	Reflector	4.5"	Meade	4504	German Mount Goto	04/12/2020	Free
26	Dobsonian	8"	Celestron	Starhopper	Alt/Az Manual	04/12/2020	$5/Mo
29	Schmidt-Cas	8"	Celeston	NexStar 8	Alt/Az Goto	04/12/2020	$5/Mo
31	MAK-Cas	5"	Meade	ETX-125	Alt/Az Goto	04/12/2020	$5/Mo
32	Newtonian	4.5"	Meade	DS-114AT	Alt/Az Goto	04/12/2020	$5/Mo
33	Schmidt-Cas	10"	Meade	LX90-AFCF	Alt/Az Goto	07/12/2020	$5/Mo
34	Dobsonian	12"	Meade	Light Bridge	Alt/Az Manual	04/12/2020	$5/Mo
35	Newtonian	4.5"	Meade	DS-2114	Alt/Az Goto	04/12/2020	$5/Mo
36	Schmidt-Cas	8"	Celestron	Ultima 8	Fork Mount w/Wedge, Tripod Motorized	04/12/2020	$5/Mo
37	SCT	8"	Meade	LX200GPS	Needs Spreader & Hand-box	04/12/2020	$5/Mo
45	Refractor	4"	Tashihaki	106FSQ	Motorized German Mount Astro-Imaging	07/12/2020	$5/Mo
49	Dobsonian	4.5"	Orion	StarBalster 4.5	Table Top Dob - Easy to use	04/12/2020	Free

OCA Scopes For Sale

INV#	Type	Size	Mfg	Model	Price
39	Cassegrain	8"	Celestron	C8 F10 Optical Tube (no mount)	$250
41	SCT	14"	Celestron	C14 Classic w/ Wedge & Tripod	$1,000
42	Dobsonian	16"	Obsession	Truss Tube w/Digital Setting Circles	$600
48	SCT	12"	Meade	LX200 Classic w/Tripod	$1,200
50	Dobsonian	10"	Orion	Classic Dob	$200
51	Dobsonian	12"	Oddessey	Red Tube Dob	$250

Email: Scopes@ssccorp.com with question or for details

Next Scope Pickup Date 12 April 2020

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 Jeff Gortatowsky jeff.gortatowsky@gmail.com

- Jupiter Ridge pad 5 lease privilege – for sale to any OCA member $1200
  This is a pad with no pier on it. Price is negotiable

For Sale contact Val Akins akins7821@gmail.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 Bill Prats b.bill.p@gmail.com

- Meade LX-70 Tripod & Mount 20lb capacity, Meade Polar Scope (#670010), Dual axis motor drive with Controller (#670011), original accessories, fresh 6 volt battery. Very clean, Used 1 year. $300 OBO

For Sale contact John Derks derksjm@yahoo.com

- Meade 14" LX200 GPS UHTC w/ complete original accessories package: 2" diagonal, 8x50 finderscope, zero image shift focuser, Autostar II handpaddle, Series 4000 26mm Super Plossl 1.25 eyepiece, vibration iso pads $3200
- Meade Giant Field Tripod
- Meade Superwedge
- 14" SCT Dewshield

OTA is in like new condition in original Meade foam lined box . Located in So. Orange County

From the Editor

Sirius wants photograph submissions from club members
We need submissions for this year. I will also pull some from the OCA members images section on our website but those will be at my discretion. If you would like your picture on the cover, do send it to me along with a brief description of the subject, where the image was taken, and the equipment used.

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
April	21 Mar
May	18 Apr
June	23 May
July	20 June

Announcement

The Costa Mesa Playhouse presents

SILENT SKY

Written by Lauren Gunderson, Directed by Kathy Paladino

The Play:

A poignant story of a woman's dedication to the stars and the human touch that makes life under a vast universe beautiful and timeless.

The true story of early 20th-century astronomer Henrietta Leavitt, a brilliant, headstrong pioneer who struggled for recognition in the male-dominated world of turn-of-the-century astronomy. "Silent Sky" explores a woman's place in society during a time of immense scientific discoveries, when women's ideas were dismissed until men claimed credit for them.

A celestial romance and true story of discovery.

Cast:

Henrietta Leavitt	Stephanie Noel Garrison
Margaret Leavitt	Sarah McGuire
Peter Shaw	David Rodriguez
Annie Cannon	Marlene Galan Woods
Williamina Fleming	Jennifer Walquist

Performances:

March 20th – April 12th, 2020
Friday and Saturday evenings at 8:00 pm
Sunday afternoons at 2:00 pm
Thursday April 2nd at 8:00 pm

Location:

The Costa Mesa Playhouse
661 Hamilton Street, Costa Mesa, CA
92627

https://costamesaplayhouse.com/

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 16

Crew
John W. Young, Commander
Charles M. Duke Jr., Lunar Module Pilot
Thomas K. Mattingly II, Command Module Pilot

Backup Crew
Fred Haise, Commander
Edgar D. Mitchell, Lunar Module Pilot
Stuart A. Roosa, Command Module Pilot

Payload
Casper (CM-113)
Orion (LM-11)

Launch
April 16, 1972; 12:54:00:567 p.m. EST

Lunar
Lunar Location: Descartes Highlands
Lunar Coordinates: 8.97 degrees south, 15.51 degrees east

Touchdown: 9:24 p.m. EST April 20
Lunar Liftoff: 8:26 p.m. EST April 23

Landing
April 27, 1972, Pacific Ocean
Recovery Ship: USS Ticonderoga

Mission Objectives

Similar to its preceding mission, Apollo 16's primary objectives were to set up surface experiments; survey and inspect a new site, obtain samples, photography from lunar orbit, and conduct in-flight experiments. The selection of this landing site in the Descartes highlands was made to visit a substantially different part of the lunar surface than the previous missions. This site was of volcanic construction.

Some equipment had been revised since Apollo 15 and scientists were anxious to evaluate the improved performance. New cameras were provided for still and motion photography including a 70mm format Hasselblad and a 16mm movie camera. A better set of drills and manual drill equipment were included to overcome problems that had occurred when trying to obtain samples. The Lunar Rover was modified to hold the astronauts better.

One new instrument was a camera sensitive in the ultra-violet band to be used imaging both the Earth and some regions of the celestial sky.

A subsatellite called Particles and Fields (P&F) would be launched into lunar orbit prior to departure for Earth to investigate lunar mass and gravitational variations, composition of particles in space near the moon, and the interaction of magnetic fields between the Earth and the moon.

Mission Overview

While lift-off and lunar insertion phases of the mission went properly, problems arose during the coast phase. The guidance system gymbal lock indicator stuck in the ON state which had to be bypassed by modifying the flight computer code. A second problem arose after the LEM and command module separated in lunar orbit but before lunar decent. A backup circuit in CSM caused yaw axis oscillations in the service propulsion system that was about to be used to circularize the CSM orbit. This delayed both the orbital correction and the lunar decent by nearly 6 hours until further analysis determined the effects of the oscillation to be manageable but not fixable. This would have the consequence of having the mission shortened one day by mission planners with time on the moon reduced and particulars of the EVAs would be changed.

Lunar descent and touchdown were nominal, landing 276 meters from target point. First EVA dealt with setting up the Rover and deploying the ALSEP scientific package. The cable to the heat flow experiment got broken when Astronaut Young accidently tripped over it on the surface. After set-up, the team rode to the west on the Rover first to Flag Crater then to

Spook Crater. The first stop was for photography and sample collection. Second was magnetic field measurement using a portable magnetometer in addition to more photography and sampling. This first EVA took 7 hrs, 11 min with 2.5 miles driven on the Rover.

Second EVA went to the south to Stone Mountain for surface, core, and trench sampling. From there the route turned west and eventually back to the north with 5 stops along the way for more sampling and photography. This EVA was abbreviated because of the landing delays so one stop had to be skipped. In total this EVA was about 7 hrs, 23 min and distance driven was 6.9 miles.

The third EVA suffered the most from the landing delay. In order to meet the ascent schedule 4 stops had to be skipped on the Rover circuit. This route started to the north of the landing site going to North Ray crater where "House Rock" was sampled. On the southern leg of the loop, "Shadow Rock" was visited for sampling and magnetic field tests. A final site near the lunar module was also visited for more of the same. After arrival at the landing site, the crew retrieved film from the ultra-violet camera and samples from the Solar Wind Composition experiment for return to Earth. In total, the third EVA took 5 hours, 40 minutes and driving distance was 7.1 miles.

From the command module, astronaut Mattingly did imaging of areas of lunar terrain not covered by previous missions as well as additional imaging on some of the prior areas.

Lunar ascent and docking went properly with samples and equipment transferred back to the CM. When the lunar module was jettisoned a new problem occurred. They were unable to control its attitude and had to skip its planned deorbit and impact maneuver.

Because of the problems with controlling the CSM service engine, the orbital shaping maneuver intended for CSM prior to deploying the P&F subsatellite was skipped leaving the P&F to deploy directly into a highly elliptical orbit instead of the circular one intended. It lasted only a month before impacting the moon rather than the year that had been planned.

The return flight and descent had no additional problems. Mattingly went EVA for 83 minutes to retrieve film from the SIM bay package while in the coasting phase.

In total, the mission lasted 265 hours, 51 minutes while bringing back 209 pounds of samples.

Lunar Module Experiment Names

Active Seismic
Cosmic-Ray Detector
Far-Ultraviolet Camera/Spectroscope
Heat Flow (broken during deployment)
Lunar Field Geology
Lunar Portable Magnetometer
Lunar Surface Magnetometer
Passive Seismic Experiment (PSE)
S-Band Transponder
Soil Mechanics
Solar Wind Composition

Command and Service Module Experiment Names

Alpha Particle Spectrometer
Biostack
Bistatic Radar
Gamma-Ray Spectrometer
Gegenschein Photography
Handheld Photography
Laser Altimeter
Mapping Camera Aspect Stellar Photography
Metric Photography
Orbital Mass Spectrometer
Panoramic Photography
S-Band Transponder
Skylab-Apollo Contamination Photography
UV Photography
Window Meteoroid Detector
X-Ray Fluorescence

Next Month: The Final Apollo Mission

This means we need something new to write about. Any ideas out there ?

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