SIRIUS ASTRONOMER

www.ocastronomers.org

The Newsletter of the Orange County Astronomers

September 2021 Free to members, subscriptions $12 for 12 issues **Volume 48, Number 9**

M82 galaxy taken by Bill Hall from Yorba Linda in 2009 using a with ST-402ME camera and 6 inch Newtonian telescope for color and a C-9 Schmidt–Cassegrain telescope for luminosity

Because of the COVID-19 crisis and ongoing efforts to reduce exposure to the virus:

. **All in-person club events are cancelled**

. **Use of the Anza site is discouraged**

Please read more about how OC Astronomers has modified its activities on page 2.

Upcoming Events - free and open to the public

Beginner's class	Friday, 3 September at 7:30 to 9:30 PM This month is the introductory session which gives an overview of visible celestial objects with some background on Cosmology. The presenter will be David Pearson.	ONLINE
Club Meeting	Friday, 10 September at 7:30 to 9:30 PM "What's Up?": John Garrett from Temecula Valley Astronomers Main speaker: Carolina Ödman from University of the Western Cape whose talk will be "Radio Astronomy in South Africa"	ONLINE
Open Spiral Bar	Saturday, 11 September at 10:00 to 11:30 PM Want to socialize? Grab your images, experiences, questions, or none and see your fellow Orange County Astronomers face-to-face.	ONLINE

Please consult the calendar on the OCA website to RSVP (required)

Response to COVID-19 Crisis

COVID-19 continues to affect all our activities. All in-person club events remain cancelled through at least the summer of this year. Cancellation periods for specific events are detailed below. Please see the President's Message for additional information.

Any use of the club's Anza site by members is at their own risk as we have no way of cleaning or sanitizing the site to CDC standards. If you must go to the site, be sure to clean and sanitize surfaces you have contact with and make sure it is cleaner when you leave than it was when you arrived. You must bring cleaning supplies and sanitizer with you as it is not provided at the site. Be sure to take any trash that you generate or find on the site out with you, and please maintain social distancing if anyone else is out there.

If you have any questions, feel free to contact board members or post them to the email groups or through social media. We will do our best to respond, but please bear with us if there is a delay as we all have other responsibilities as well.

We hope you and your families and friends all remain safe and healthy, and best wishes to all of you!

Summary of Cancellations of OCA In-Person Events

Due to the ongoing COVID-19 crisis, all in-person club events are cancelled through at least the following periods:

General Meetings	Cancelled until further notice; please try our virtual meetings instead
Anza Star Parties	Cancelled indefinitely
Orange County Star Party	Cancelled indefinitely, until allowed by Orange County Parks
Outreaches	Cancelled indefinitely
Beginners Astronomy Class	Cancelled indefinitely, please contact Dave Pearson to attend Zoom classes
SIG Meetings	Cancelled indefinitely, depending in part on availability of facilities and when meetings could go forward safely. Some may schedule Zoom events.

Please check the website, email groups and social media for updates.

From the Editor

Sirius wants photograph submissions from club members

Sirius needs more picture and home-made project submissions from the club. The editor is running low !

Please send pictures to me along with a brief description of the subject, where the image was taken, and the equipment used.
For projects made, send an email with a brief description and the editor will work with you to produce an article.

Ideas for Future articles

The newsletter includes articles from members 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
October	18 September
November	23 October
December	20 November

President's Message

By Barbara Toy

In days of old, meaning a few decades ago, September marked the beginning of the school year, which, in those ancient days of my youth, actually started around the second week of the month. I'm not sure why, but the start of school also always corresponded with a heat spell, which seemed to last forever and – I do hope this part has changed for modern elementary schools – there wasn't any air conditioning. "Back to school" often involved a lot of sweat.

These days, school seems to start well before the end of August for those who have to worry about these things, before many of us are ready to let go of summer. Starting the school year earlier doesn't circumvent the autumn heat spells, though, and I expect we'll all be dealing with hot days and warm nights in September and October – astronomically speaking, warm nights do make for more comfortable viewing than we can expect as the year winds down and the nights turn colder.

In Southern California, our fire risk generally goes up in the fall, with the heat and then the onset of the Santa Ana season. So far, we've had a lot fewer fire problems than other parts of our state, but that's likely to change as we move into the fall months. Club-wise, we need to continue to be vigilant about fire hazards at our Anza site, as the weeds and shrubs do manage to continue growing. Individually, we need to keep our home and work environments as fire-safe as we can. I hope none of us winds up in the path of any fire, and certainly not any fire like those that have been ripping across Northern California and other states as well this summer.

Covid Concerns

As if fire isn't enough of a worry, as I write this the uncertainty of how schools and other institutions will respond to the current spike in new Covid cases due to the Delta variant is adding to our challenges. We'd really hoped we'd be putting the pandemic behind us by now, but it looks like it'll continue to be a worrying fact of life for a long time to come.

Although we were told a couple months ago that Chapman University expected to start calendaring meetings and other events with outside groups in August, when they actually do so is still up in the air. Their plans seem to have been postponed due to the current surge in Covid cases. Per the Covid part of their website (which is quite informative), they're reopening carefully, while keeping the number of people physically at the campus as low as possible and focusing on "mission critical" activities. We can't claim that our meetings are "mission critical" to the university or its students, so I expect it will be a while before we can schedule meetings there again, possibly not until 2022.

Steve Mizera has been working on setting up dates for the Orange County star parties, which are less risky that other meetings as they are held outside and participants can spread out, but as I write this, they haven't finalized a schedule. When we get them, the dates will be posted on the website, so please check there periodically for updated information.

For updates on the Astrophysics meetings, please contact Bob Sharshan as he is working with the Heritage Museum to determine when those meetings can start again. For the AstroImagers meetings, our access to the meeting site at the Urban Workshop pre-Covid was courtesy of Dave Kodama, and we do not yet know when the facility will be available to us again. For all of these meetings, dates will be posted on the website when we get that information.

As for the Anza site star parties, that is an agenda item for our September Board meeting, and we are hoping we'll be in a position to set a date when they can safely start again as formal events. And we're hoping that our in-person Outreach events can start again by around November, which is when our current Outreach Coordinator, Cecilia Caballero, has started scheduling them.

2021 remains a challenging year. One challenge we've continued to meet well, thanks largely to the ongoing efforts of our Vice President, Reza AmirArjomand, is our general meetings. He continues to get great speakers for us (for the "What's Up" presentations as well as the main speakers), and the meetings have been running very smoothly. Even if you think you don't like attending meetings via Zoom, you should give them a try if you haven't already – I've enjoyed all of the talks, but there have been some that have been incredibly good, and we're getting to see speakers who would most likely never be able to attend one of our meetings in person. That's truly been a silver lining to the dark Covid cloud we've been dealing with for over a year now.

The Perseids

Judging by emails I received, the Perseid meteor shower remains a popular August attraction. Several people contacted me for suggestions for good dark spots in Orange County where they would be able to see the shower, but I'm afraid I was a bit of a weak reed on that as I find it hard to think of any place that's publicly accessible around midnight and later, reasonably safe, and likely to be dark and clear enough to see a good array of meteors.

The best I could come up with was Caspers Regional Park (though I don't know how dark it is there these days) or a couple of locations further up Ortega Hwy. If anyone tried those suggestions, I hope they had a good time and saw some Perseids – nobody emailed me one way or the other.

If any of you know of any reasonably dark Orange County locations where members of the public can go to do a bit of viewing, please send that information. And I hope, wherever you were, you had a chance to see some Perseids – I got clouded out where I was, but maybe the persistent "June Gloom" this summer will lower the chance of fire here…

The Sirius Astronomer

In spite of limitations from the pandemic, I know a number of you out there have managed to get in some imaging, or have used the time to process or reprocess older data. So, images are being produced, and our club has a long-standing (and well-deserved) reputation of having a lot of good imagers. The reason for mentioning this is that our esteemed editor would appreciate you sending him at least some fruits of your labor for possible use in the Sirius Astronomer, and could get you a period of undying fame by publishing one or more of your images. If you could include some information on the equipment used, when and where it was taken, anything interesting that happened while taking it, that would be great – it all helps people connect with your image.

The Sirius Astronomer is our club newsletter, and we do like content from club members. So, if you've had any interesting astronomical experiences or have some knowledge you'd like to share, or some new piece of equipment you'd like to comment on (maybe even do a review) – please write them up and send them in to Dave Fischer at newsletter@ocastronomers.org.

The Electronic Option

Several members have contacted me over the last few weeks about changing their paper copy of the Sirius Astronomer to an electronic version. If you want to do that, please contact Charlie Oostdyk (Charlie@cccd.edu), who keeps track of those preferences in the membership records and is also the person implementing the changes as he sends out the Sirius Astronomer each month.

Please remember that Charlie works full time in addition to all he does for the club and he also has family obligations (as well as that unfortunate broken ankle), so he may not be able to get back to you immediately. And you may not see a change in newsletter delivery immediately if your request gets to him after he updates the membership records for the month.

With that, I'll wish you happy September and happy viewing (or imaging) – and may you all stay safe from the hazards around us!

© Barbara Toy, August 2021

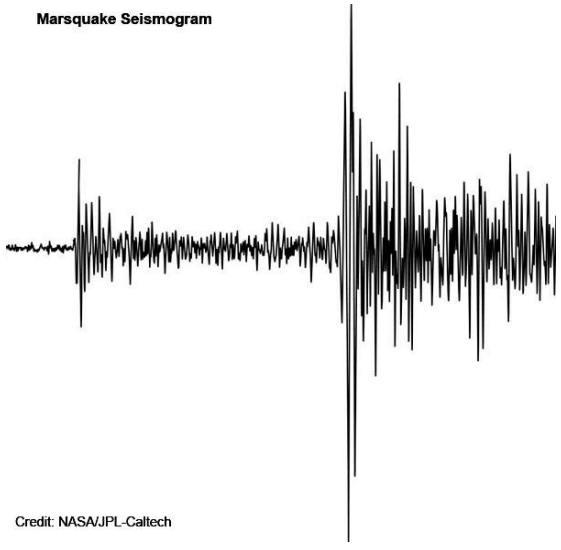
AstroSpace Update

September 2021
Astronomy and space news summarized by Don Lynn from NASA and other sources

Sampling Mars, Or Not – Mars rover Perseverance was commanded to drill its first sample of Martian rock and soil, and store it in one of its 43 titanium sample tubes, to be returned to Earth by a future mission. Telemetry showed the rover completed all steps as designed but checks of the sample tube found it empty. Spacecraft controllers believe that the material sampled was just too powdery and fell out of the coring drill. This never happened in more than 100 tests of the sampling process on Earth using a variety of simulated Martian rocks and soil. Mars can surprise us. Controllers are giving up on this place and will proceed to a new sample location.

Ingenuity –The Mars helicopter added 3 more flights in this past month, for a total of 12, exceeding 1.6 miles in total distance flown and 21 minutes total flight time. It set new records for flight time (169 seconds) and altitude (39 feet). It imaged in stereo Raised Ridges and Séítah, areas that the rover Perseverance may visit. The latter area is named with a Navajo word meaning "amidst the sand".

Martian Interior – The InSight Mars lander has been monitoring marsquakes for a couple of years, and scientists just released their first report on what has been learned about the interior of the planet. The Martian core is molten, though it is not yet known if there is also a solid portion to the core, like the Earth's core. The Red Planet's crust was thinner than expected and stretches to one or two dozen miles thick. It has at least 2 distinct layers, and possibly 3. The mantle occupies the space between the crust and core, and extends to 969 miles depth. The new results were based on the 35 strongest marsquakes yet recorded, all between magnitude 3.0 and 4.0. There were 733 marsquakes, but most were quite weak, and therefore did not provide a strong enough signal to distinguish what internal layers they had passed through or reflected from. The InSight seismometer continues to take data, and scientists hope to discover more about the Martian interior. Scientists were surprised to find that all of the planet's strong quakes originated in a single area, that known as Cerberus Fossae, which is believed to have had volcanic activity in geologically recent times. However other areas that have obvious volcanic features did not contribute any marsquakes. It is not known whether this means those areas do not have quakes or that the core is shadowing the quake waves from reaching InSight.



Venus Weather – The night side of Venus has been little studied due to the difficulty of observing in the dark. Using infrared capabilities of the Japanese Venus orbiter Akatsuki, researchers have discovered atmosphere circulating toward the planet's equator only on the night side. Combined with other currents on the dayside, this may be driving Venus's super-rotation, which is an extreme east-west circulation of all Venusian weather. The infrared images were not bright enough to show the new discovery until multiple images were stacked using compensation for motion between images.

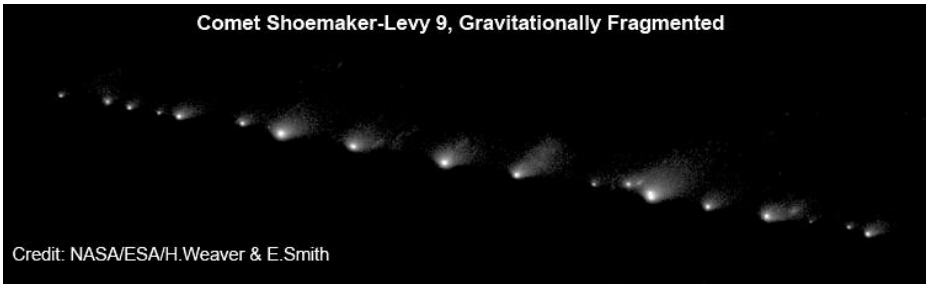
Jovian Radio Source – Using data from Juno (Jupiter orbiter), researchers have pinned down where radio emission originates at Jupiter. The source is a hollow cone-shaped region aligned with the planet's rotating magnetic field. Electrons in the region create the radio waves, which were found to be much more energetic than previously believed. The electrons are generated when material expelled from the moon Io's volcanoes is broken apart into ions and electrons.

Jupiter's Energy Crisis – It has long been known that the amount of sunlight at Jupiter's orbit should warm the planet's upper atmosphere to only about minus 100° F, but measurements show it much warmer at 800° F. Some scientists refer to this as Jupiter's energy crisis. A team of astronomers used observations from the Juno spacecraft, the Keck Telescope in Hawaii, and the Japanese Hisaki spacecraft to understand this crisis. They found that Jupiter's aurora is heating the upper atmosphere in the planet's polar areas. The heat was then observed to spread towards the equator, explaining the warm temperature of the entire atmosphere. This spreading of the heat was not expected because computer models of Jupiter's atmosphere have always showed that heat applied near the poles would get trapped there.

Ganymedean Water Vapor – Water vapor was discovered in the atmosphere of the Jovian moon Ganymede using new and archived ultraviolet spectroscopic data from the Hubble Space Telescope. The source of this is surface ice turning to vapor, or sublimating. It is believed that water on Ganymede is in the form of ice to a depth of about 100 miles, but likely has a liquid ocean below that, too far below to contribute vapor. The discoverers were actually looking to confirm previous reports of atomic oxygen in Ganymede's atmosphere, but instead found water vapor, but hardly any atomic oxygen.

Bennu – The OSIRIS-REx spacecraft spent over 2 years in close proximity to the asteroid Bennu. An analysis of precision spacecraft tracking data was made in order to know precisely where Bennu was over that time, allowing astronomers to predict the asteroid's position much farther into the future. Also measured were Bennu's size, shape, mass, composition, spin, and proclivity to spit particles, all of which very slightly affect its orbit. Bennu is classified as a potentially hazardous asteroid because it is known to occasionally pass quite close to Earth. After this analysis we now know that Bennu will not strike the Earth in 2135, as was predicted in the past by some. But it will come close enough for Earth's gravity to deflect it into a somewhat different orbit, allowing the possibility that it may hit our planet in the 2180s. The most likely hit is September 24, 2182, with a probability of one chance in 2700. Needless to say, astronomers are worried about collisions and will try to refine the precision of this possibility, even though our knowledge of Bennu's orbit is already the most precise of any asteroid's orbit ever.

Lunar Magnetic Field, Or Not – The Earth has a magnetic field that protects it from some kinds of solar radiation. That magnetic field is generated by electric currents in the planet's core. The Moon does not now have such a magnetic field, but it has long been debated whether it had such in the past. Differences between the Moon's core and Earth's core may have made such a field impossible. However, studies of Moon rocks from the Apollo Moon landings found some rocks that retained magnetic fields apparently from the time the rocks formed. A new study of Moon rocks using an extremely sensitive superconducting magnetometer has concluded that the Moon never had a protective magnetic field and that the Moon rocks that do have a residual magnetic field were magnetized by meteorite impacts. Every rock in this study found to have a strong residual magnetic field was also found to have evidence of meteorite impact.



Carolyn Shoemaker, discoverer of dozens of comets and hundreds of asteroids, has died at age 92. Many of her discoveries were shared with her husband Gene Shoemaker, who for many years headed a project to search for near-Earth objects using the small Palomar Schmidt camera. The couple along with David Levy discovered one of the most famous comets, Comet Shoemaker-Levy 9, which impacted Jupiter in 1994. Carolyn served as a pioneer for women in science. Gene died in 1997 in an auto collision.

X-ray Echoes – The XMM-Newton and NuSTAR X-ray space telescopes were used to monitor X-ray flares from the material surrounding a black hole. Shortly after the flares, fainter echoes of the flares were observed, which had reflected off material behind the black hole. These echoes would have been obscured by the black hole itself, except that the X-rays were bent around the black hole by the curvature of space due to the extreme gravity of the black hole, as prescribed by general relativity. The black hole is the supermassive one at the center of a galaxy known as I Zwicky 1, which is 800 million light-years away.

Unusual Gamma-ray Burst – About a year ago the Fermi Gamma-ray Space Telescope detected what appeared to be a short gamma-ray burst. It is believed that long (longer than about 2 seconds) gamma-ray bursts are caused by supernova explosions of massive stars and that short gamma-ray bursts are caused by merging of neutron stars. However, there has been some evidence that a small fraction of the short bursts have the long-burst cause. The Fermi-detected burst in question supports this, in that it was definitely caused by a supernova and lasted less than 1 second. The source is so distant that it took the gamma rays 6.6 billion years to reach us. Infrared light that matched the brightness pattern and spectrum of a supernova was detected in follow-up observations. It was observed in radio also. The best theory explaining this burst is that the gamma rays are produced by particle jets after they punch out of the exploding star, and that this particular supernova's jets fizzled shortly after punching through, resulting in the anomalously short gamma-ray burst.

Moon-Forming Disk – Using ALMA, an array of radiotelescopes in Chile, astronomers made the first unambiguous detection of a disk about an exoplanet, which is possibly forming moons. The still-forming planet is known as PDS 70c and is one of two gas giants in the system. The other planet does not appear to have such a disk. The diameter of the disk is about one AU, the distance of the Sun from the Earth. Astronomers hope that study of the newly-found disk will help them understand how moons and planets form. The two planets were discovered in the past 3 years using the Very Large Telescope, a group of 8-meter optical telescopes in Chile.

Exoplanet Imaged – There is a survey designed to image exoplanets that happen to orbit far from their stars, which makes imaging much easier. The name of the survey is Coconuts, a strangely forced acronym for Cool Companions on Ultrawide Orbits. This explains why a recently discovered exoplanet was dubbed the unlikely-sounding name of Coconuts-2b. It is the closest imaged exoplanet, at 35 light-years distant. It has about 6 times the mass of Jupiter. When discovered, it was believed to be a free-floating planet, not orbiting any star, but eventually a star quite distant was found that it orbited. Because it is imageable, astronomers hope to study it and learn much about gas giants. An observer above the cloud tops of Coconuts-2b would see little difference between night and day since its sun is so far distant.

Small Exoplanet – Astronomers have found the least massive exoplanet whose mass has been measured by the radial velocity method. The planet has about half the mass of Venus. It orbits a star known as L 98-59, which is only 35 light-years away. Three planets in this system were measured using telescopes in Chile. They are rocky planets, and 2 of them may contain a little water, and the other (the half-Venus mass one) considerable water, according to their densities. These 3 planets were first detected by the planet-finding space telescope TESS. A 4^{th} planet has now been found in the system, and there are hints of a 5^{th} in the data.

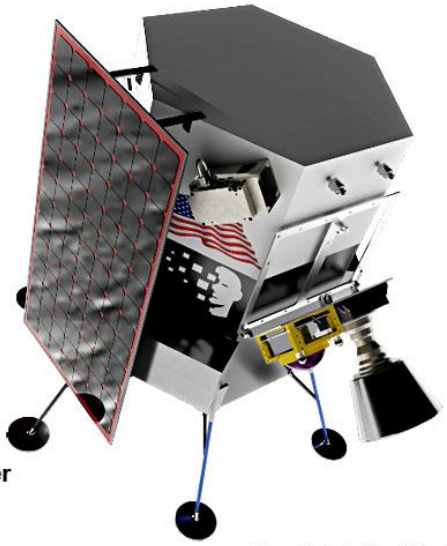
Red Dwarf Flares – It has been pointed out many times that life is unlikely on a planet orbiting a young red dwarf star because such stars frequently blast out deadly flares. A new study shows that is not as dangerous as it sounds, because the flares from such stars are emitted from near the stars' poles, while planets usually form in the equatorial plane of their star. So the flares would usually miss any planets. The new study used observations from the spacecraft TESS. By monitoring the light curves of flares as they rotate in or out of view, scientists were able to determine the latitude upon the stars of some of the flares. Only 4 cases produced accurate latitudes, but all 4 were found to be poleward of latitude 55 degrees.

Sun-like Star – Scientists are studying a star found to be much like our Sun in mass and temperature, except it is much younger. They hope to better understand our Sun's history. The star is Kappa 1 Ceti and is located about 30 light-years away. It is estimated to be only 600 to 750 million years old. When our Sun was this old, life was just developing on Earth. Scientists have developed a computer model of the star to predict its stellar winds, which may affect any planets significantly. They plan to use similar techniques to study the star EK Draconis, which is only 100 million years old.

Milky Way Survey – Astronomers using the Jansky Very Large Array of radiotelescopes in New Mexico and the 100-meter Effelsberg radiotelescope in Germany have made a detailed survey of much of the Milky Way. The former telescope is most sensitive to smaller structures and the latter to larger structures. Because radio waves penetrate dust better than many other wavelengths of light, the survey found many areas of star formation and many supernova remnants that were previously unknown because they were hidden by dust. The latter will help solve the "missing supernova remnant" problem, which is based on far fewer such remnants being known than theory predicts should have been created by supernova explosions.

Cosmic Rays and Supernovas – A new study using computer simulations of supernovas took into account the generation of cosmic rays and how that affected the supernovas' properties. Cosmic rays are charged particles moving at extreme speeds, thought to be generated during supernova explosions of massive stars. The simulations showed that the cosmic rays boosted the speed of gas flowing away from supernovas by 4 to 6 times. The effect was found to be greater on less dense gas. These findings could help explain bubbles around supernovas or shutting down of star formation.

Hopper – NASA has funded development of a small spacecraft that will hop, rather than rove, to explore our Moon. It is planned to be sent to craters near the lunar south pole. It will ride to the Moon with the much larger Nova-C lander, planned for flight in December next year.



Hopper

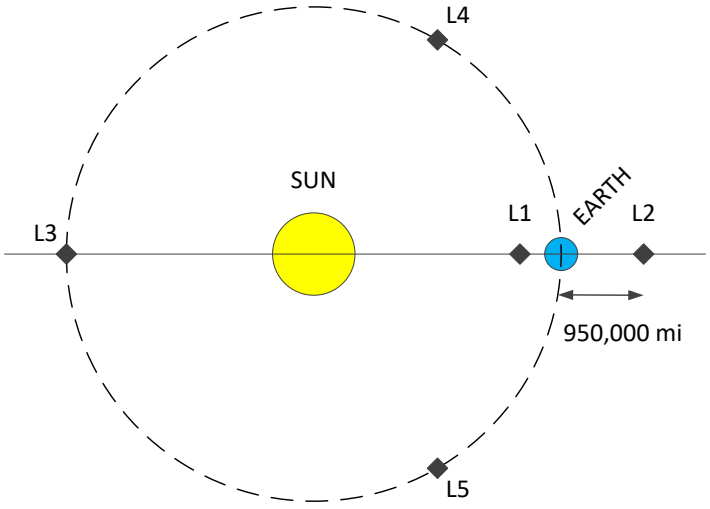
Credit: Intuitive Machines

X-ray Telescope – The German X-ray space telescope eRosita was designed with a large field of view so that it could complete surveys of the entire sky in a matter of months. Recently released data contain more than 3 million newly-discovered X-ray sources. Black holes, neutron stars, and hot gas in galaxy clusters commonly are easily seen in X-rays, and yet are difficult in other forms of light. Of the 3 million new objects, 77% are black holes in other galaxies, 20% are objects in the Milky Way, and 3% are galaxy clusters. eRosita is sensitive enough to see many objects so far that their X-ray light takes 7 billion years to reach us. This will allow astronomers to put together a history of how X-ray objects have evolved over the last 7 billion years. eRosita is an instrument aboard the Russian-German spacecraft Spectrum-Roentgen-Gamma, which observes from the Sun-Earth Lagrange point 2, about a million miles anti-sunward from Earth.

Nauka and Starliner – Hours after the new Russian module Nauka latched onto the International Space Station (ISS), its thrusters fired when they were not supposed to, slowly tumbling ISS. Other thrusters were then fired to stop the motion, which took about an hour, and return ISS to its proper orientation. The situation forced postponement of what is supposed to the final test flight of the Boeing Starliner without crew before it goes into service transporting astronauts to and from ISS. However the next attempt to fly Starliner was also postponed to investigate a problem with rocket valves.

Halo Orbits

In a simple gravitationally bound 2 body system there are 5 points of relative orbital stability formed in the orbital plane where centrifugal acceleration is balanced by gravity from the two masses. These are called the Lagrange points and are usually denoted as L1 through L5 as shown in the diagram below. As the two bodies rotate around their common center of mass, the set of five Lagrange points rotates with them.



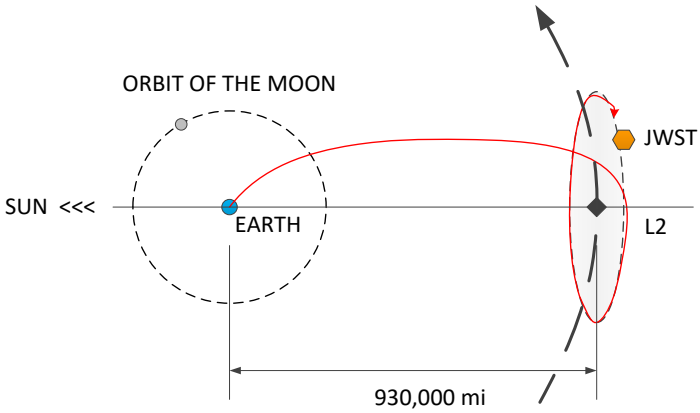
In this article we are interested in the Lagrange points formed by our Sun and the Earth. After a brief discussion of the other Lagrange points, we will delve deeper into the properties of the L2 point.

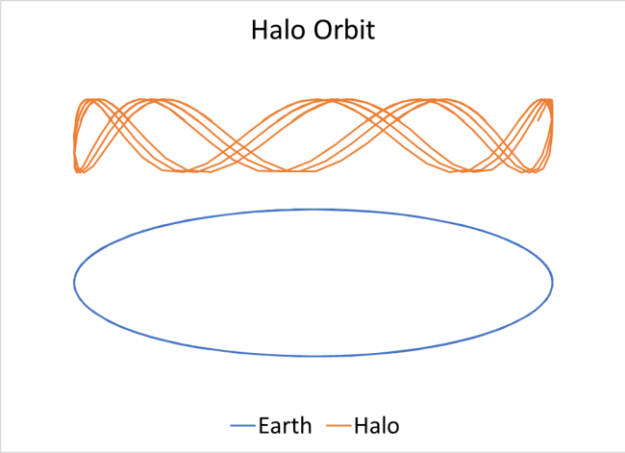
L1 is a point of relative stability directly between the Earth and the Sun which has been used to position some man-made satellites, giving them continuous visibility on both bodies. For a project requiring very cold sensors, this would be a poor choice of location.

L3 rotates about the Sun diametrically opposite the Earth's position. If a satellite were to be placed there, the intervening Sun would prevent direct communication with the Earth.

The L4 and L5 positions have a smaller potential energy associated with them than nearby space and so provide some retention force to capture objects that enter those regions with velocity vectors that nearly match the motion of the points. An example of this is seen with Jupiter which has a large collection of asteroids (the Trojan asteroids) collected in its leading and trailing Lagrange points. Sometimes we find small asteroids captured in Earth's L4 and L5 points though they don't remain there for long periods of time due to interplay with gravity from the moon and the nearer planets.

The Lagrange 2 location is a spot outside of the Earth's orbit and in line with both Earth and Sun. It sits approximately 930,000 miles from the Earth. Objects riding in the L2 point don't follow a rigid and predictable orbit, but rather a wobbly orbital trail called a "halo" orbit which circulates somewhat perpendicularly to the orbital plane of the earth around the sun. Imagine for a moment an automobile driving in a circle. The halo orbit is somewhat like the path traced out by valve used to inflate one of the tires. The L2 halo orbit oscillates above and below the Earth-Sun orbital plane.





Here we see the path traced out by one possible halo orbit as the Earth revolves around the Sun a few times. A halo orbit is, of course, centered on the orbital plane but in this diagram it has been raised above for clarity.

This is of special interest to the James Webb Space Telescope project because by locating the telescope there, its heat shield can simultaneously block radiation from Sun, Earth, and Moon. To do so from the L4 or L5 positions would require a much larger heat shield and (because of their much greater distance from Earth) larger antennas to maintain communication. Lagrange halo orbits have been used since at least 2001 by both NASA and the ESA. Some satellites already in such orbits include the Planck Space Observatory and the Wilkinson Microwave Anisotropy Probe

To see a video of the halo orbit of the halo orbit planned for the James Webb Space Telescope, one may visit this site:
https://webb.nasa.gov/content/about/orbit.html

Online Screening of the Luminous Astronomy Documentary for OCA

Friday September 17th at 8:00PM

Online screening of "Luminous", a new film by award-winning filmmaker Sam Smartt. "Luminous" chronicles the scientific journey of Calvin University astronomy professor Larry Molnar after he made a prediction about a luminous red nova in the constellation of Cygnus. Smartt, an associate professor of Film and Media at Calvin University, said "Luminous" isn't a "pure science" film as it follows the personal journey of Molnar and some of his students, while exploring the sometimes-circuitous path of scientific research.
"It has been the longest project I've worked on", Smartt said in an interview, describing the project as a "longitudinal film" since it documents a story that unfolds over several years.

More information can be downloaded here:
https://www.dropbox.com/sh/m299r78656f2jc2/AACfNs-HjRw8A_VElL59_4yOa?dl=0

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 David Hobbs david_hobbs714@yahoo.com
- 20" F5 Research grade early Coulter mirror and secondary mirror $2800
- Primary mirror is 2 ¾" thick, Secondary is 4" x 5 5/8"

For Sale contact Ron Choi rongrace2@cox.net
- Orion StarShoot AutoGuider further reduced price $ 200

For Sale contact Jerry L Floyd jlfloyd720@gmail.com 562-252-5666
- ZWO Electronic Filter Wheel, 7x36mm $ 850
- Includes set of ZWO brand 36mm LRGB, S2, H-Alpha, O3 narrowband (7 nm) filters

This item was originally purchased in May 2020. It has been used a few times (with a ZWO ASI1600MM camera) but is in virtually new condition. I am selling it because I replaced it with a filter wheel that accommodates my 7 1.25" Astrodon filters.

The cost of the items as purchased new from a vendor such as OPT would be $299 for the filter wheel, $199 for the LRGB filter set, and $479 for the SHO filter set, a total of $977.

I am willing to deliver in person to the OCA Anza site or other Southern California locations.

For Sale contact Robert Fritz bobfritz1@gmail.com
- Vintage Celestron 14 (fork mount)
- Celestron C11 with CG-5 mount
- Meade LX200 10"
- Losmandy G-11 with tripod and Gemini GoTo

If you are interested, please email me for details and to discuss the price. I will consider any reasonable offers.

Magazine Subscriptions

Effective this year, the OCA will no longer be accepting renewals or new subscriptions to either **Astronomy** or **Sky and Telescope**. During the last few years the publishers have lost or been unable to provide timely processing of member subscriptions mailed to them. Both **Astronomy** and **Sky and Telescope** allow members to subscribe or renew on-line at the club rate anytime during the year and for multiple years. **Astronomy** also gives product discounts to club members.

Any subscriptions or renewals sent to the club will be returned to you.

E-mail Charlie@OCAstronomers.org for current on-line subscription or renewal information and instructions.

Newsletter Delivery Preferences (Save A Tree)

The OCA Board of Trustees has always considered the mailed paper copy of the current Sirius Astronomer newsletter to be the most tangible asset of membership in the OCA. However, in our recent poll, 2/3 of members indicated they would prefer to receive the newsletter electronically. Electronic delivery will help the club cut down on expenses for printing and postage, as well as manpower and time. And the pictures are in color!

If you want to continue to receive the mailed paper copy, you do not need to respond to this notice. However, if you are annoyed that the newsletter arrives after the meeting, or too late for some of the time-critical events, you can pay for First Class delivery along with your next membership renewal.

If you are **already** receiving the newsletter via an electronic format, you will continue to do so, and do not need to respond to this notice.

If you are interested in receiving an electronic copy of the newsletter, below are the available options. Remember, if you do not respond, you will still receive the paper copy of the newsletter, delivered by USPS bulk mail.

1. Paper copy and E-mail with a link to the newsletter in PDF format
2. Only electronic delivery by E-mail with a link to the newsletter in PDF format

Please send an E-Mail to: Charlie@OCAstronomers.org stating your delivery preference.
Please allow at least 2 months for your preferences to be updated.

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