SIRIUS ASTRONOMER

www.ocastronomers.org

The Newsletter of the Orange County Astronomers

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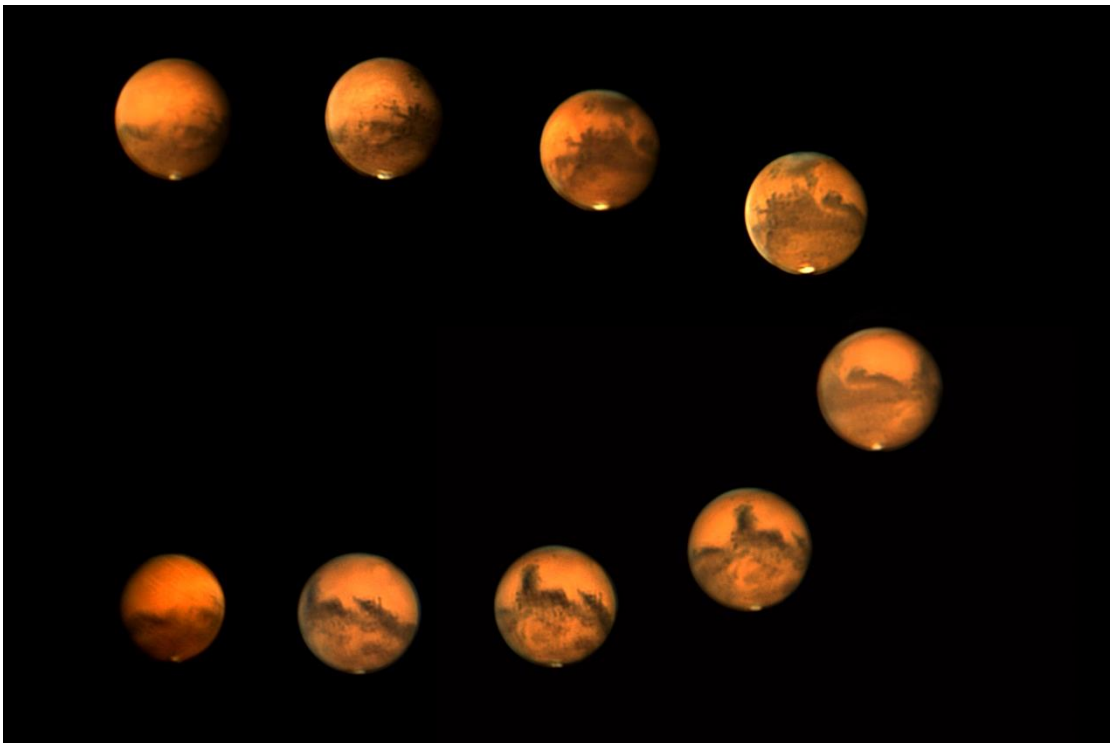


Faces of Mars by Dave Cook. The images in this composite picture were taken between 23 Sept and 30 Oct 2020 using a Celestron CE-8 with Teleview Powermate 4X tele-extender and Meade LPI-G Advanced Color Camera using lucky imaging techniques

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, 5 March at 7:30 to 9:30 PM ONLINE The topic this month will be an overview of celestial objects with background information about them and our understanding of the universe
Club Meeting	Friday, 12 March at 7:30 to 9:30 PM ONLINE "What's Up?": John Garrett from Temecula Valley Astronomers Main speaker will be Tracy Drain from JPL whose talk will be "Gearing Up to Explore an Icy Moon: the Europa Clipper Mission"
Open Spiral Bar	Saturday, 13 March at 10:00 to 11:30 PM ONLINE Want to socialize? Grab your images, experiences, questions, or none and see your fellow Orange County Astronomers face-to-face.

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

Response to COVID-19 Crisis

COVID-19 continues to affect all of our activities. All in-person club events remain cancelled through at least the spring 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

If you would like your picture on the cover, please 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 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	20 March
May	24 April
June	22 May

President's Message

By Barbara Toy

We are now approaching the spring equinox (March 20) and, shortly after that, the end of the first calendar quarter of 2021 – time passes even if it sometimes seems to drag. March also marks the anniversary of lock-downs and other measures taken to try to stop Covid-19, or at least slow its spread. There are some signs the end may finally be coming into sight on the Covid-19 front, but we've still got a long way to go.

OCA Status Update

We don't expect to have access to our regular meeting site at Chapman University for the rest of this school year, as the campus is still completely closed as I write this. It's too early to estimate when Chapman will be able and willing to make the Chapman Auditorium available to us. We're continuing to assess the situation there and as to our other activities, including the availability of the Heritage Museum of Orange County for our Astrophysics group and Beginners Class, and will let you know of any changes regarding them. Our website, email groups (ocastronomers@goups.io, Astroimagers@groups.io) and social media links are all good sources for updated information.

Our on-line meetings continue to do well, and we had a record number of people attending our February meeting, which featured Dr. Brian Monacelli from JPL talking about the Perseverance Rover and his work on the SHERLOC Instrument on Perseverance that will allow detailed analyses of the composition of Martian rocks to get a better understanding of Martian geology. It was a timely talk – and about six days later, to the relief and jubilation of all concerned, Perseverance successfully landed on Mars to begin its mission of scientific discovery. We're hoping Dr. Monacelli will return in a few months to give us an update, particularly on SHERLOC, how it and the other instruments are doing in the field and maybe some early results…

People periodically ask about recordings of our meetings. These and some other events are recorded, and those which we are allowed to post can be found on the club's YouTube channel. You can find the link to this channel on our website, near the bottom left side of the home page, along with our social media links. Unfortunately, not all of our speakers can allow their talks to be posted, but if you missed a talk or want to hear it again, it's worth checking to see if it's there. These are recordings straight from Zoom that are essentially unedited so there may be some rough spots. You can view the entire meeting or skip around to view just the parts you really want to see.

I just checked one of the videos and found that they include the pre-meeting slide show as well as the meeting proper, with the live harp accompaniment generously provided by Kim Kanahele for the slide shows, as a bonus. Thank you very much, Kim, for these wonderful monthly concerts!

Messier Marathon

This is the time of year, right around the spring equinox, when all 110 Messier objects can be seen (at least theoretically) in one night. The bright folks who figured this out made an event out of finding as many of them as possible in one night, and these "Messier Marathons" are now a well-established tradition in the world of amateur astronomy.

In past years, our club has scheduled its own Messier Marathons for the March star parties and provided a form that organizes the objects by when they're available for viewing (basically west to east). The biggest problems for finding objects tend to be at the beginning and end of the night, when objects that set shortly after sunset or rise just before the sun tend to get lost in the glare, leaving participants with an ethical dilemma as to whether they have actually seen them and can legitimately claim them for the Marathon. How that is resolved is left up to the individual astronomer and his/her conscience…

One of the on-line resources for this event is provided by our neighbors to the north, the Royal Astronomical Society of Canada in Calgary. That is Larry McNish's Messier Marathon Planner which claims that M31, M32 and M110 are all too close to the setting sun to be viewed for the Marathon by March 13, but can be viewed on March 1, so an earlier Marathon may be more successful this year. The planner can be found here: *https://calgary.rasc.ca/darksky/messierplanner.htm*

Other challenges with the Marathon itself are wading through all the Messier galaxies and distinguishing them from each other and from the non-Messier galaxies in their vicinities in the Virgo Cluster (difficult to do honestly even with a go-to scope) and getting through the gap in the early hours of the morning when no new objects are coming up and most people decide to take a nap – and then fail to wake up in time to get through the rest of the objects when they do rise.

Most of us who view regularly have favorite Messier objects we visit frequently during our viewing sessions, varying with when they're in good position for viewing through the year, but there are others that we forget about or just never get to. One nice aspect of the Messier Marathon is that you have to visit all of the objects, not just the favorites, which can make you realize that there are other objects in that catalog that are worth a return visit when you can spend more time on them.

An additional challenge that we frequently have at Anza for the Messier Marathon is weather. Thinking back on Marathons I was planning to do over the years, it seems that the times they got cancelled due to clouds or fog or (more rarely) rain outnumber the times we had clear skies for the event. As I recall, even if we hadn't been coping with the start of all of the Covid-19 regulations and orders around that time in 2020, the March Anza star party when we would normally have had the Marathon was clouded out, which isn't all that unusual in March.

So, what about Messier Marathon 2021? We still won't be in a position to have any formal star parties on the date we would normally have it at Anza, March 13, 2021 (which actually is the night of the new moon), and we won't be able to have a formal Marathon, either. Often in the past we've had combination Messier Marathons and viewing parties in the club observatory with the Kuhn telescope, with different people joining in over the course of the evening, but that's not an option right now as there's no way to keep consistent social distancing in the observatory (plus, as I write this, the Kuhn is not yet operational). Hopefully we'll be back to doing events like that by Messier Marathon time in 2022!

We've often had folks who did the Marathon on their own, from wherever they were viewing on a convenient date near the formal Messier Marathon date. To the extent we have the Marathon this year – whatever we'll be doing is at this point, far from organized – I think that is how everyone will be doing it, which means they can do it where and when it's convenient for them. It may not be as convivial as when you do it around a bunch of other marathoners, but you can consider yourself part of a wide-ranging group of fellow amateur astronomers who are going forward with the Messier Marathon in spite of all of our current woes. We're planning to post the OCA form on the website, to help those of you who want to do the Marathon, or you can use other forms available on the Internet (including Larry McNish's planner mentioned above).

If you decide to do the Messier Marathon this year, remember to have fun with it, and take a bit of time to admire the wide range of objects that Messier thought could be mistaken for comets. It really is an impressive collection!

Whatever astronomical activities you choose to pursue as we mosey our way toward spring, I hope you enjoy them and that you all stay healthy and safe!

Accessing the Sirius Astronomer Newsletter

Each month, our Treasurer Charlie Oostdyk prepares and mails out the club's newsletter, the *Sirius Astronomer* to all active members, as a benefit of their membership. It is a labor-intensive operation. In addition, the club pays for the printing and postage for all the copies mailed.

The Sirius Astronomer is also available to view on the club's website each month.

The Board would like to conduct a survey to find out how many of our members prefer to continue to receive a paper copy of the newsletter (in addition to being able to access it from the website), and how many would be content just to access it from the club website, or through an email.

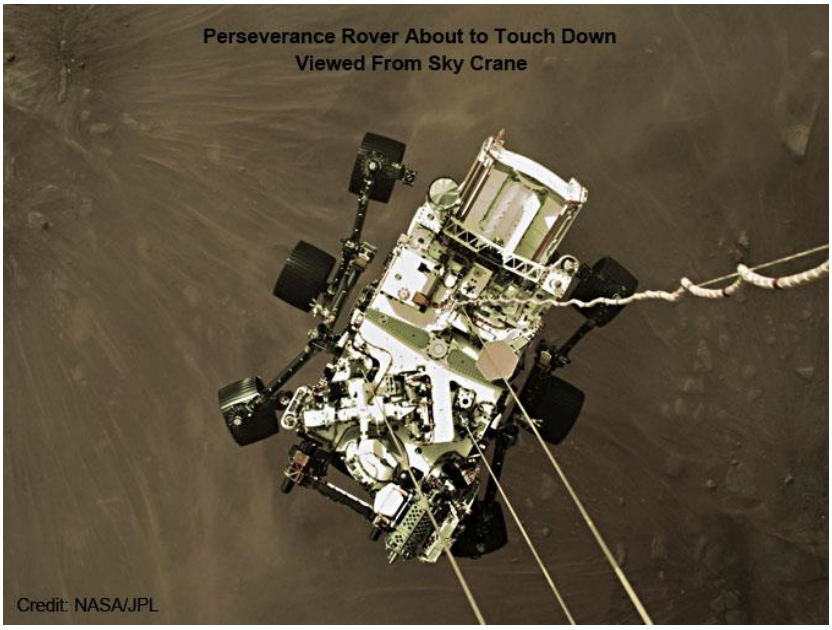
Please send an email to: helen@ocastronomers.org and indicate your preference;

- Paper copy (you can still access the newsletter through the website)
- Access the newsletter from the website
- Email to you with a link to or attachment of an electronic copy

Please note, responding to this survey will not change the way you receive the newsletter, it is just to collect information. If there is to be a change in the delivery of the *Sirius Astronomer,* there will be a formal request for your preference appearing in the newsletter or the website, or both.

AstroSpace Update

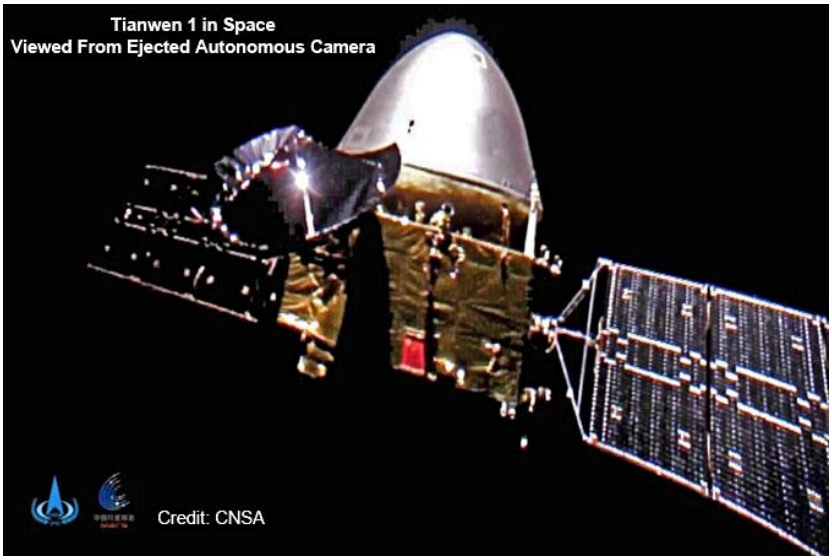
March 2021
Astronomy and space news summarized by Don Lynn from NASA and other sources



Perseverance Lands – NASA's latest mission, a rover named Perseverance, landed on Mars February 18. The rover weighs over a ton (on Earth), and is 7 feet high and 10 feet long, not including the arm. There are 23 cameras onboard, including ones with color, zoom, and stereo capabilities. Instruments include spectrometers, a ground-penetrating radar, microphones, an experimental device to produce oxygen from the atmospheric carbon dioxide, and a weather station. The rover used a heat shield, a supersonic parachute, and a rocket-powered sky crane to land, similar to the previous rover Curiosity. It had some upgrades though, including an avoidance system that had a map of all the dangerous places (rocks, cliffs, soft sand, etc.) to avoid. Another upgrade was a triggering system to open the parachute at the optimal time, taking into consideration the atmospheric conditions found, rather than average conditions used on previous landings. The entire landing sequence is controlled by computers on the spacecraft, due to the 11 minutes it takes to send, at the speed of light, any commands from Earth. The spacecraft Mars Reconnaissance Orbiter (MRO) relayed data during the landing to the NASA radio dish in Spain. MRO managed to take a snapshot of the rover descending under its parachute.

A helicopter named **Ingenuity** is fastened under the rover, and will be released onto the ground in a month or so, after a suitable place for its takeoffs is found. Then it will perform 5 flights to test how a helicopter can aid in finding places for a rover to visit or travel through. Flying on Mars is not easy, as the atmosphere is more than 100 times thinner than on Earth. This will be the first powered aircraft on another planet, though 2 unpowered balloons were used on Venus decades ago. After the helicopter test flights, it will not try to keep up with Perseverance as the rover drives off to perform its mission. That mission is to explore Jezero Crater, searching for signs of ancient life and collecting soil samples to be returned to Earth by future missions. Jezero was a lake 3 or 4 billion years ago, and the deltas where 2 rivers entered the lake remain little changed since the planet, including this lake, dried up. Scientists believe such deltas are likely places to have preserved signs of ancient life if such developed on Mars. The landing hazard avoidance system produced the landing spot only 1.2 miles from the larger river delta in Jezero. This is only a few days rove for Perseverance.

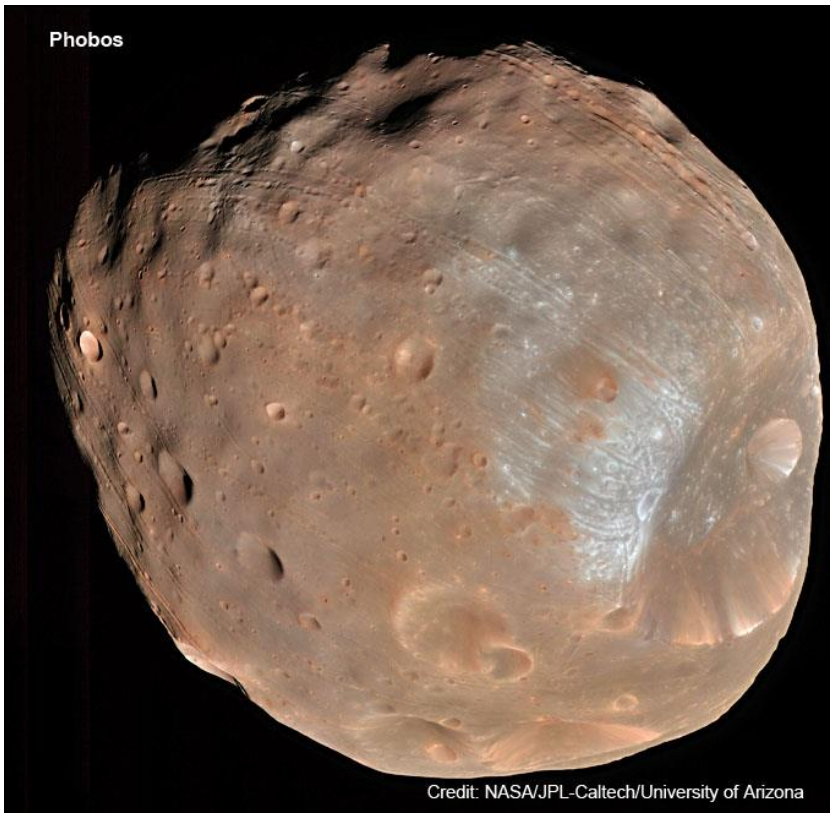
China's **Tianwen 1** mission entered Mars orbit February 10. Part of the craft will remain in orbit to study the Red Planet from 165 miles up, while the other part is scheduled to leave orbit about May to land and deploy a rover. This rover has a radar that can penetrate ground to a depth of about 100 yards.



Currently **operating spacecraft** at Mars consist of 8 orbiters, 2 rovers, and a lander. With the successful landing of the Chinese spacecraft, there will be 3 rovers and 2 landers. The orbiters represent 6 different space agencies. All successful landers and rovers ever operated on Mars have been NASA products. This is planned to change with the Chinese mission.

More Mars Missions – Every 26 months the Earth and Mars line up to allow optimal travel between. That happened about last July, and the 3 missions to Mars launched then arrived at the Red Planet in February. On the 9th, the Hope spacecraft from the United Arab Emirates went into Martian orbit. Using infrared and ultraviolet spectrometers, it will study the various regions of the atmosphere. It is designed to complement previous Martian atmospheric missions, such as MAVEN. It is the first planetary mission by any Arab nation, and was a joint effort with U.S. universities and was launched from Japan.

Martian Atmosphere – Astronomers have been trying to determine when and how Mars lost its atmosphere, chiefly by extrapolating back from current measurements of atmospheric loss. The evidence of water flowing on the planet's surface billions of years ago requires that it had a thicker atmosphere back then. A new study of the current atmospheric loss showed that escaping gases should strike the Martian moon Phobos and accumulate as a historic record. The Japan space agency is planning a mission to Phobos in 2024 with sample return. Maybe then scientists can put together a history of Martian atmospheric loss.



Venus Plate Tectonics Lacking – A new study of the largest impact basin on Venus, known as Mead, compared with computer simulations of such impacts, shows that the heat flow and thickness of the crust at the time of impact did not match that of a planet with moving surface plates. This means that if Venus ever had plate tectonics, it ended before the Mead impact, estimated at 0.3 to 1 billion years ago.

Mercury Impact – New study of old MESSENGER data showed that the spacecraft observed a meteoroid striking the surface of the planet Mercury. The impact itself was not seen, but the material thrown up over 3000 miles into space by the impact was seen. The BepiColombo spacecraft on its way to Mercury will look for similar events.

Titan Sea – New analysis of old Cassini spacecraft data shows that Kraken Mare, the largest liquid methane-ethane sea on Saturn's moon Titan reaches at least 1000 feet deep. The depth of smaller Titan seas had been previously determined. The composition of Kraken Mare was also determined, and it was found to be mostly methane, with some ethane. This was a surprise because previous estimates based on the body's latitude had shown it was likely mostly ethane. Kraken Mare is nearly as large as the earthly Great Lakes combined.

Earth Trojan – A Trojan asteroid is one that shares the orbit of a planet, but ahead or behind the planet, near one of the Lagrange gravitationally stable points. The original ones were found in Jupiter's orbit, where about 9000 are now known, but a few have been found in the orbits of most other Solar System planets. Earth had only one known, until now. A second has been found, dubbed 2020 XL_5. It takes a rather wide loop around Earth's L_4 Lagrange point, so wide it occasionally approaches Venus. From its brightness, it is a few hundred yards across. An analysis of the orbit shows it will be stable for 2000 to 4000 years, but then will be perturbed away from the L_4 region by gravitational interactions with other bodies. Because Earth Trojans are small and close to the Sun from our viewpoint, they are hard to find. Astronomers believe that there may be many undiscovered ones, so the search for more of them is on.

Resonant Planets – Observations from Cheops revealed that 5 of the 6 exoplanets orbiting a star 200 light-years away in the constellation Sculptor are in resonance with each other. This resonance is given as 18:9:6:4:3, meaning that the innermost planet of these 5 makes 18 orbits in the same time period as the next planet outward makes 9 orbits, and so on. The exoplanet closest to the star does not participate in the resonance seen with these 5 outer planets. Cheops is a European space telescope dedicated to precision follow-up observations of exoplanets orbiting nearby stars. Scientists then looked for a pattern in the sizes, masses and densities of the planets, but could find none. It has been hypothesized that the way in which planets form should yield a progression in sizes, masses or densities. All 6 of the planets are closer to their star than the habitable zone, meaning that they are all too hot for liquid water to exist on their surfaces. Astronomers plan to look for more planets in this system, possibly in the habitable zone.

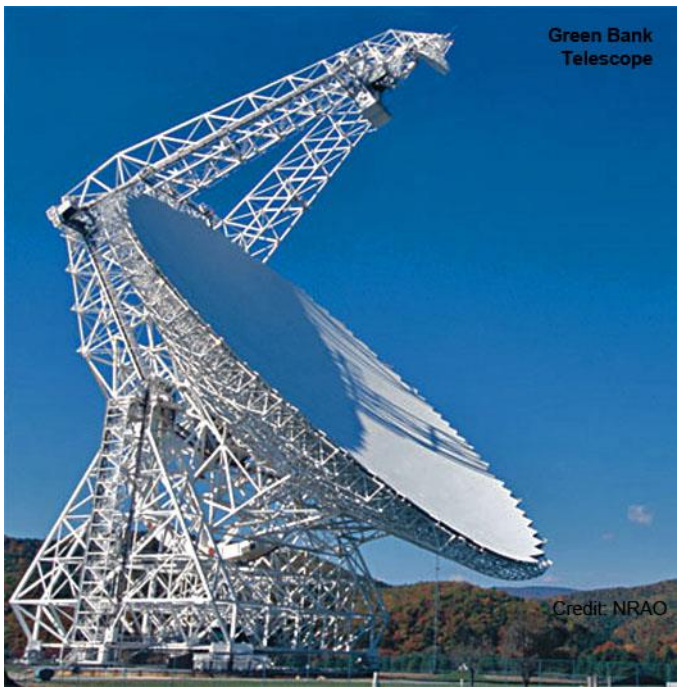
Clear Skies – Astronomers have determined that a gas giant exoplanet discovered in 2012 has an atmosphere free of clouds or haze. Spectroscopic observations using the Hubble Space Telescope showed that the spectrum of sodium penetrated the atmosphere. This does not happen if there are clouds or haze. The planet is known as WASP-62b and is about 575 light-years away. It is about half the mass of Jupiter and orbits close enough to its star to be classified as a "hot Jupiter" planet. Only one other exoplanet with a clear atmosphere is known. It may be possible to determine the surface composition of a planet with a clear atmosphere.

Sky Brightness Measured – Astronomers would like to measure the brightness of the night sky in between stars or galaxies that can be resolved. Unfortunately the dust within the Solar System outshines whatever is there between the stars. Fortunately, the New Horizons spacecraft, after its encounter with Pluto and a Kuiper Belt object, has traveled beyond the Solar System dust. So astronomers measured the brightness of the sky between objects with the New Horizons camera. The result was a brightness half of one previous estimate and twice another. It is expected that galaxies too small or too distant to resolve make up the light measured.

Gravitational Lenses Found – Astronomers love to find gravitational lenses. These are where the massive gravity of a galaxy or a cluster of galaxies bends light, and there happens to be one or more galaxies almost perfectly lined up behind. A number of things can be calculated from the shape of gravitationally lensed images, including the location of dark matter in the foreground object and the expansion rate of the Universe. But because astronomical objects rarely line up well, such lensed images are rare, occurring at only about 1 in every 10,000 massive galaxies. That makes it tedious to find new gravitationally lensed images. So astronomers taught a computer to search for them. They fed it a pile of images marked lensed or not-lensed, and instructed it to determine how to recognize similar objects. Then they fed it the images from surveys of a large fraction of the sky, known as the DESI Legacy Imaging Surveys. The computer found 1210 previously unknown gravitational lenses, about doubling the number known.

Intermediate-Mass Black Holes – Lots of black holes are known at the centers of galaxies, with masses of millions or more times the Sun's mass. Lots of black holes the mass of a single collapsed star are known. But only a handful of black holes are known with mass intermediate to these, and these may be considered merely candidates, needing further confirmation. It is known that tightly bunched clusters of stars will over time result in more massive objects sinking to their centers and less massive ones moving to the outskirts. This is caused by the way objects gravitationally throw each other around during close chance encounters. So theorists concluded that black holes in tight globular star clusters ought to sink to the center, where they might merge to form intermediate mass black holes. A new study of globular cluster NGC 6397 tracked the movements of the stars to calculate where the masses were that affected the stars' orbits, hoping to find a huge mass at the center that could only be an intermediate-mass black hole. But instead they found a number of not-seen masses spread about the central region. So the expected black holes likely exist, and apparently sank to the center, but failed to merge into a single intermediate-mass black hole. The intermediate black hole mystery continues.

Radar Astronomy Experiment – An experiment to radar Solar System objects was successful using one radiotelescope to broadcast and several others linked together to receive the echoes. The Green Bank telescope did the sending, and the Very Long Baseline Array did the receiving. The use of an array to receive gives far better resolution in the radar images than is possible with a single receiver. When a more powerful transmitter is built than the one used for the experiment, this technique could image objects as far as Neptune. This could replace or exceed much of the radar capability lost with the collapse of the Arecibo radiotelescope. The experiment was planned before that collapse. Coincidentally, the Green Bank Telescope collapsed in 1998, but was rebuilt with more capability in about 5 years. The experiment imaged the area where Apollo 15 landed on the Moon.



No Supernova Yet – A new study of Betelgeuse, perhaps triggered by the rumors that its recent dimming might portend its explosion, found that the star is in the early part of its helium-fueled phase, which means it won't be ready to go supernova for more than 100,000 years. The known brightness cycles of about 185 and 400 days match what is expected for a star in this phase. The study found that the mass, radius, and distance are all somewhat smaller than previously accepted values. The new values are 16.5 to 19 Sun's masses, 750 times the Sun's radius, and 530 light-years away. The dimming event a few months ago was caused, as some previous studies suggested, by a dust cloud, not by preparing to explode.

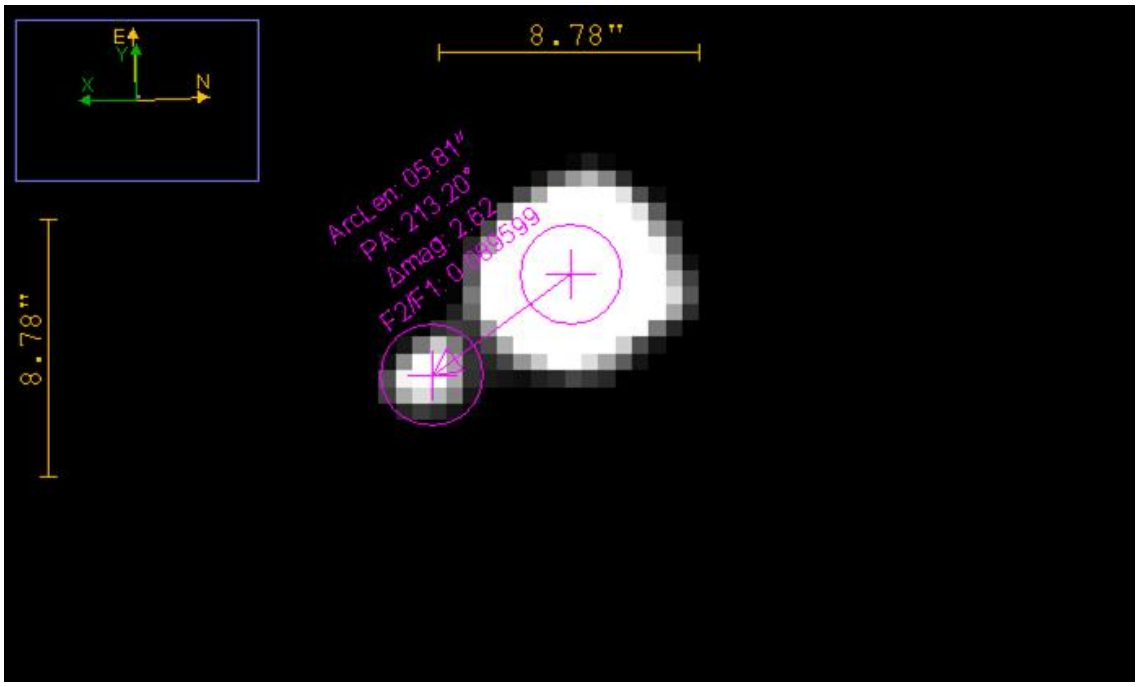
Wrong-Way Planets – A pair of exoplanets has been found that orbit their star, dubbed K2-290, in the opposite direction to that star's rotation. Only a few such cases are known. Planets should form in a disk that shares the rotation direction of its star, since the star and disk formed at the same time and nearly the same place. So something is changing the planets' orbits or the stars' rotation after formation in these few cases. In the newly discovered case, the "something" is apparently a companion star, orbiting the main star, and gravitationally disturbing the planets' orbits. It doesn't so much reverse the orbiting, it is more a slow tilting the plane of the orbit until that plane has tipped over. But this cannot explain some of the other cases, so more observations of wrong-way planets are needed.

Solar Activity – Astronomers have records of the Sun's activity (by counting sunspots, etc.) only since the telescope was invented, and the earlier years of that period are somewhat sparse. A team of scientists using new more sensitive mass spectrometers than before have measured the carbon14 isotope content of tree rings of known age and calculated the solar activity to extend the record back to about 1000 years ago. They confirmed a known solar outburst in the year 993, and discovered new ones in 1052 and 1279. Carbon14 in the atmosphere, and therefore in tree growth, depends on the strength of cosmic rays striking the Earth, and cosmic ray strength depends on the Sun's magnetic field, which varies with solar activity. This technique can be extended further back using older wood samples of known age, which do exist.

Astrometric Measurements of Double Star WDS 06047-4505

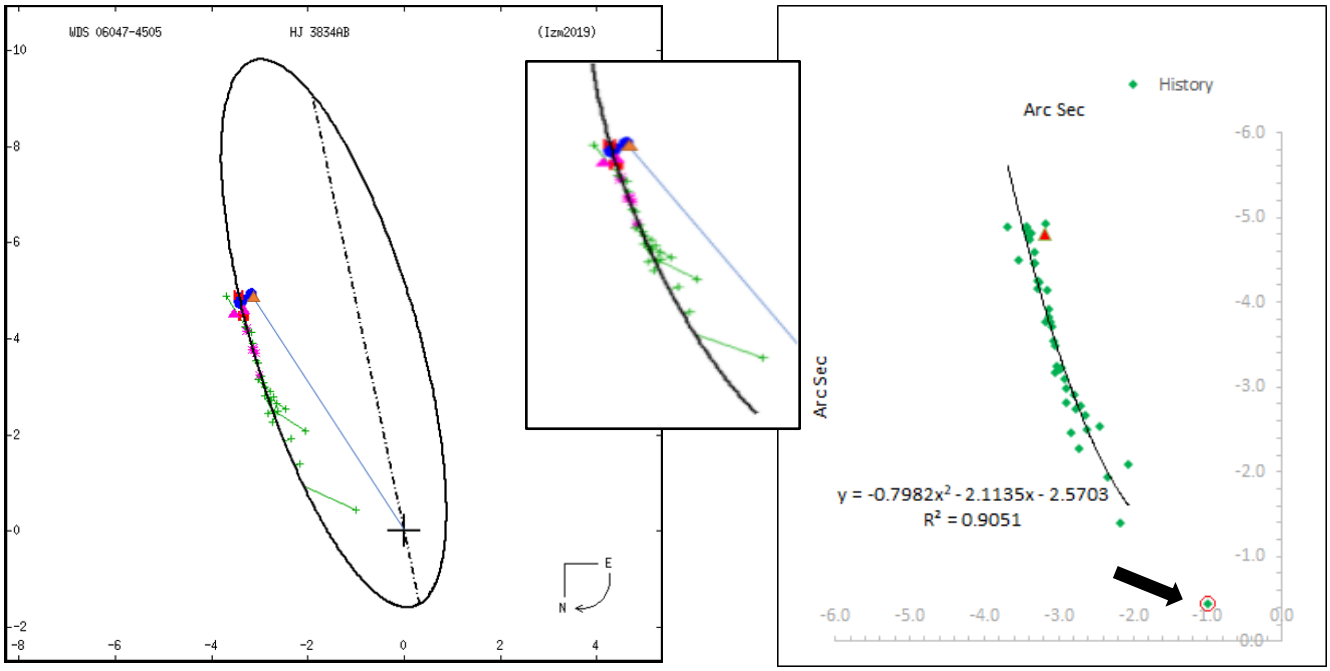
By David Pham

Double star systems consist of two stars who appear to be in close proximity when viewed from Earth, and they may be gravitationally bound (orbiting around a common center of mass) or simply optical doubles with a common proper motion through space. WDS 06047-4505 is a quintuple star system whose AB component is shown above. It was originally discovered by John Herschel in 1837 and has been classified in the Stelle Doppie database as an "uncertain" double star. Since its discovery, WDS 06047-4505 HJ 3834AB has been observed 42 times with the latest observation in 2015. The double star was first measured with a position angle of 246° and separation of 1.1" in 1837. The most recent observation in 2015 shows that it has a position angle of 215° and separation of 6.0".



The research goal was to take astrometric observations of a double star candidate selected from the Washington Double Star Catalog and determine the system's position angle (θ) and separation (ρ). These observations were made by OCA member David Pham and his team of student researchers (Team Gamma) on 10/2/2020, 10/4/2020, and 10/11/2020, using the Las Cumbres Observatory 0.4 meter SBIG telescopes at the Siding Spring site. This work was done through the Institute for Student Astronomical Research's (InStAR) Double Star seminar led by Rachel Freed.

The processed image shown above of the AB component was measured using AstroImageJ software. AstroImageJ is an image analysis tool that provides quick position angle and separation measurements using the "aperture photometry" setting which works by locating the center of the target star(s) when an object radius is set. The primary star is the object in the center and the secondary star is slightly bottom left. Imaging proved to be a challenge due to the stars' close proximity and large delta magnitude (ΔM). According to Stelle Doppie, the primary star had a magnitude of 6.02 while the secondary had 8.98, resulting in a ΔM of 2.96. The contrast in brightness between the two stars resulted in the need for additional imaging at shorter exposure times.



Using Richard Harshaw's plot tool, the star's historical data was plotted in a Cartesian graph. Looking at the graph, the most recent observation made by Team Gamma is marked with a triangle and John Herschel's original observation (which has been classified as an outlier) is indicated by the arrow. The Cartesian graph strongly suggests that the star's AB component is a short arc binary system with an R^2 value of 0.9051. Using parallax data from ESA's Gaia, the minimum physical distance between the primary and secondary star was calculated to be 157 AU, well within the separation range of most binaries. The changes in position angle and separation along with very similar parallax and proper motion values all suggest that this is a gravitationally bound system.

Lastly, note that Team Gamma's triangular data point deviates from the calculated orbit but closely aligns with recent speckle interferometry observations shown in the zoomed-in view of the orbital plot. Since speckle interferometry is highly accurate, this may call for a recalculation of the secondary star's orbital path using more current observations.

A full paper on the observations of double star WDS 06047-4505 is published in the January 1st, 2021 issue of the ***Journal of Double Star Observations***, http://www.jdso.org/

We Made It Ourselves

This column will feature astronomy related things made club members or with the help of friends.

Next month the column starts by listing some of the approximately 40 creations submitted to date. These include:

- Adapters for telescopes and cameras
- Home-made mounts and accessories for mounts
- Self-made telescopes and optical test equipment
- Things to support mounts such as piers and mount adaptation plates
- Focusing masks flat boxes and diffusers for sky flats
- Dew prevention devices automation software for an observatory and image management
- Spreadsheets for image planning and system analysis

and more good stuff. If room permits one or more will be shown in detail.

Submissions for the column should be sent to the editor (newsletter@ocastronomers.org).

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			reduced price	$ 220
• Orion Mini 50mm Guide Scope			reduced price	$ 50

For Sale	contact	David Fischer	Leyes-Fischer@cox.net	
• ATS Portable Pier, 8 inch diameter, 52 inch height				$1,500
• Excellent condition				
• Detachable aluminum shelf and eye-piece holder				
• No pier adapter (top plate) is included – these are specific to the user's mount				
• Orion ST-80 refractor model 09948 - f/5 achromat, used for a while as guide scope				$ 70
• Just the telescope – no rings, no diagonal, no eye-pieces, no case				

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