SIRIUS ASTRONOMER

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The Newsletter of the Orange County Astronomers

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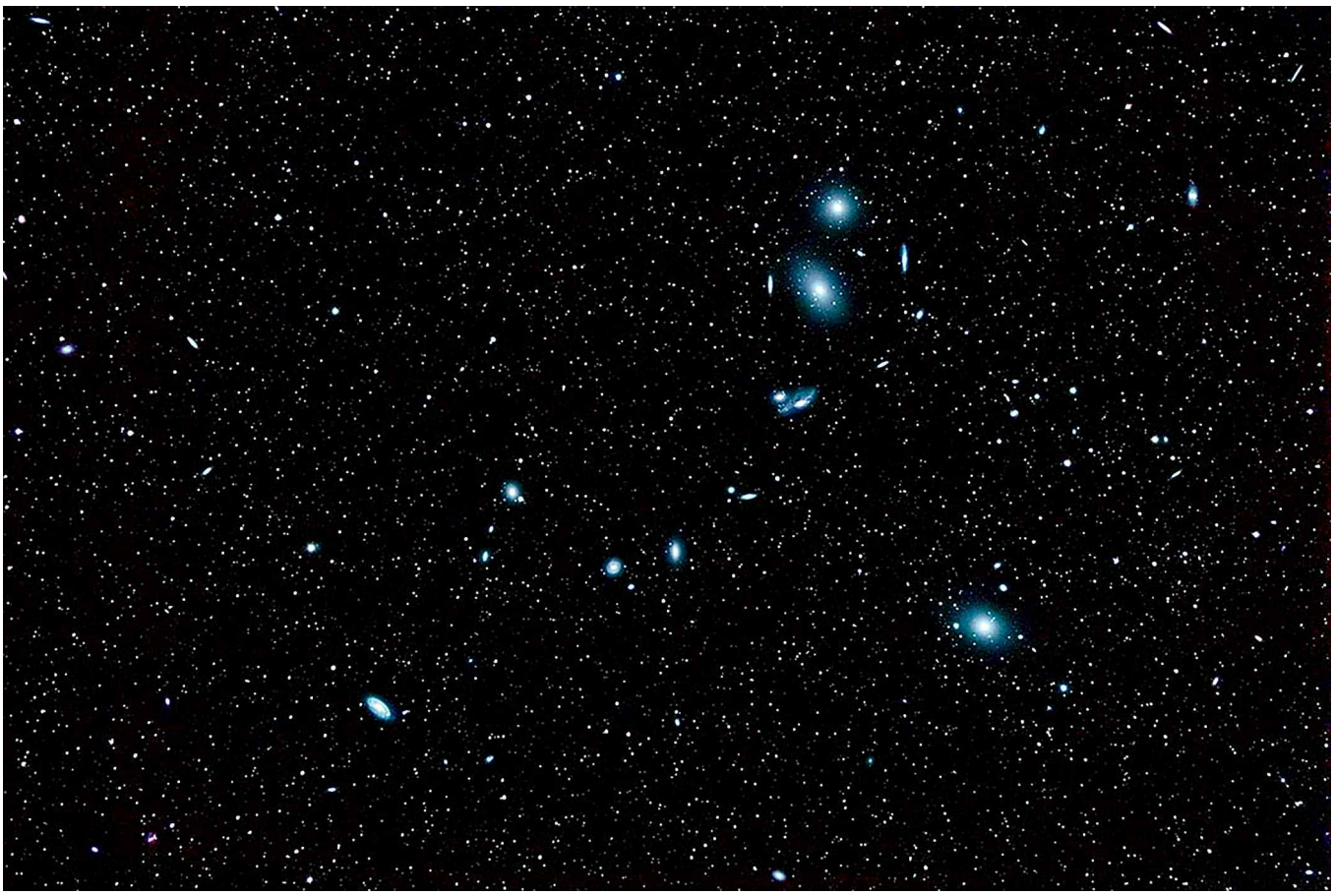


Markarian's Chain is a stretch of galaxies that forms part of the Virgo Cluster. This beautiful image was captured by member Rick Hull at Anza on 2/16/18. He used a William Optics 80mmFD @ f/5.5 & CGEM mount with a Canon 6D stock & Backyard EOS. 19x7min at ISO 1600 were stacked.

OCA CLUB MEETING

The free and open club meeting will be held on May 11 at 7:30 PM in the Irvine Lecture Hall of the Hashinger Science Center at Chapman University in Orange.

This month, Daniel Limonadi on Robotic Exploration of Mars – Highlights and Future Directions.

NEXT MEETINGS:
June 8 – Jonathan Feng
July 13 – (speaker TBA)

STAR PARTIES

The Anza and Orange County site will be open on May 12. Members are encouraged to check the website calendar for the latest updates on star parties and other events.

Please check the website calendar for the outreach events this month! Volunteers are always welcome!

You are also reminded to check the web site frequently for updates to the calendar of events and other club news.

COMING UP

The next sessions of the Beginners Class will be held at the Heritage Museum of Orange County at 3101 West Harvard Street in Santa Ana on May 4 and June 1.

Youth SIG: contact Doug Millar

Astro-Imagers SIG: June 6

Astrophysics SIG: May 18, June 15

Dark Sky Group: contact Barbara Toy

President's Message

By Barbara Toy

Although I was not able to be there myself, I've had several reports that our banquet in March was a great success, enjoyed by all who attended, and that it gave everyone a chance to relive some happy times with the 2017 solar eclipse. I'm also told that the April Anza Star Party was a great success, with clear, steady skies, hopefully a sign we will have good star party weather over the summer. Unfortunately, we weren't so lucky in March, and the formal Messier Marathon night was clouded out (though some intrepid souls may have tried the Marathon on other clearer nights).

In case some of you may be wondering why our club secretary, Alan Smallbone, and I haven't been able to attend club events over the last couple months, Alan had a bad fall in March that left him with a broken femur and a cracked tibia, though at least he managed to avoid hitting his head. He now has a rod and related hardware holding the femur together, spent about three weeks in the hospital and rehabilitation, and is currently in a wheelchair with limited ability to move around on a walker – mobility is a real challenge when you can't put much weight on one leg.

He's making steady improvement, but probably won't be fully mobile until around July. He's been able to keep track of club affairs in spite of these challenges, and we really appreciate the help that others have given to help keep things going. Dave Kodama has taken on chairing the AstroImage group until Alan is back, Sam Saeed has been providing a computer and technical assistance during the general meetings, Doug Millar has handled my usual role there as well as the announcements, and he and Helen Mahoney handled all of the administrative and hosting duties for the club banquet, much more than they originally signed up to do for that event. Others have pitched in as needed as well, and everyone has been very encouraging and supportive – thank you all very much!

Even though Alan and I may be in a form of astronomical hibernation for now, the year is moving on, raising other concerns…

Weeds at Anza

We didn't get much rain this year, but that unfortunately doesn't mean that we don't get any weed growth on our Anza site. This is the time of year when weeds need to be cleared around pads and observatories, and those of you who are pad or observatory licensees should have received a reminder letter about that. If you haven't cleared the weeds in your area yet, please do that as soon as possible. This is to reduce fire risk on our site as well as to make it less likely you will have an unfortunate encounter with local wildlife.

We also need to have the areas around Anza House, the Football Field, the club observatory and the roads and walking paths cleared. Next time you are out at Anza, please plan to spend some time clearing weeds in these areas to help keep these club resources safe for everyone – we all have a stake in these areas in particular.

When I mention fire danger, that's not something hypothetical. Several years back, a wildfire that started some distance away from our site reached us and burned over the top third of our property. The firefighters were able to keep it away from the buildings, but it burned all the way down to Mars Hill. When we checked the areas that had been burned afterward, it was clear that the pads that suffered damage were those where the weeds and grasses were still growing up to the pad, which gave the fire enough fuel to allow it to damage benches, electrical boxes and whatever else was on those pads.

So, at least for the next few times you go out to Anza, take along a weed whacker, clippers and whatever other tools you have that could help in clearing these areas. If you see someone out there with a weed whacker, consider asking him or her if you could spell them on it – whacking those weeds can get pretty exhausting. And remember – we do have showers available in Anza House and the club observatory to help you recover from a satisfying bit of cleanup work out there…

Critters

One of the features of good dark sites is that they tend to be rural, preferably in or around areas that are as close to being wilderness as is possible in our current age, as those are the areas that are darkest. Because of this, they also tend to have more wildlife than we deal with in more urban settings. This is the case for our Anza site as well as the site in the Santa Ana Mountains where we have our Orange County Star Party.

Everyone is in a more concentrated area during the Orange County Star Parties than at Anza, and the parties are shorter, so the larger animals generally avoid them. Rattlesnakes and black widow spiders are probably the most common hazards to watch out – both are hazards anywhere in Southern California, including more urban areas of Orange County.

At Anza, we often hear coyotes howling in the hills, but they seem to avoid the site if there are a lot of people around. Sometimes one will wander through if it's fairly empty, but they tend to avoid people and their main concern seems to be hunting rats, mice, rabbits, etc., which actually can be helpful to us.

We do have rats and mice on the site, so it's a good idea not to leave food out that could attract them, and, if you're using a tent, keep it zipped closed to keep them from getting in. The biggest problem people have reported with them is damage they can do to wiring in a vehicle. They seem to be attracted to the engines areas and, once they get inside, they chew on insulation on the wiring and sometimes on hoses, too. Parking away from any weeds and bushes helps (that's another reason for clearing weeds), some people feel that leaving the hood up while they're parked there helps, and others have other strategies, including putting mouse traps on top of the tires. Generally, this seems to have been more of a problem for people who stay out there for several nights than for people who are just there for one night. Rodents have also been known to chew on wiring in observatories (mounts, computers, even the Kuhn telescope hasn't been immune), which can be a major irritant as well.

As you might expect, we also have rattlesnakes, which don't seem to be aggressive unless threatened. We try to eliminate them when we find them, to help avoid unfortunate encounters after dark, but I recommend that, if you see one, you don't try to kill it or otherwise remove it unless you have enough experience with them and have the right equipment so you can do it safely. It's better to let the snake go than to get bitten yourself, and generally whatever snakes there are on the site stay out of the way if they have enough warning that someone is coming. So, particularly when you're moving around the site at night, it's best to stick to the established roads and walking paths, and to have a flashlight that will show you any snake (or other critter) in your path before you reach it.

Enclosed areas at Anza can attract black widows, wasps and (more rarely) bees, so be wary if you're going into any shed or other area that hasn't been opened in a while and, if you find any of these pests, please take appropriate action to eliminate them. If the problem is bees (at different times we had swarms nesting in the club observatory and in a storage shed), an exterminator will probably be needed – self-help is probably not a good solution there. Aside from a swarm of bees, the best approach with these and other similar pests is to keep a wary eye out, don't put a hand or foot in any area you haven't made sure is free of possibly hostile inhabitants, and eliminate any that you find.

All of this is part of the adventure of being out in nature, and there's a lot of local wildlife that's fun to watch, like kangaroo rats (unfortunately rather rare, and they're protected so if you see one please let it go on about its business), lizards, birds and toads (how they survive out there I don't know, but, again, if you're fortunate enough to see or hear one, enjoy the experience and don't interfere with it). On the bright side, we don't seem to have problems with mosquitos or ticks, and generally the potentially problematic creatures out there aren't much of a problem if you use a bit of caution. They certainly aren't a reason to avoid coming out to Anza for a star party or just for some stargazing on your own – so come on out and enjoy our darker skies and rural environment!

OWENS VALLEY RADIO OBSERVATORY TRIP
SCIENCE BEYOND THE BOOK

June 15th -17th, 2018
With Dr. Doug Millar and Ms. Cecilia Caballero

Please join with us on the above date for an extraordinary adventure in science education at the Owens Valley Radio Observatory outside of Big Pine, CA. Included are science activities at the 40m antenna and a tour, walking a scale model of the distances of the planets, solar astronomy and night time astronomy. All the above is free and courtesy of Dr. Mark Hodges, OVRO and Cal Tech. This trip is open to teachers and their families, members of local astronomy clubs and radio hams. You must RSVP to go on the trip to Dr. Millar so that we know how many to expect. Please also forward your cell phone number.

This is not a school sponsored field trip. Each participant is on their own to arrive at the observatory. Please try to arrive at OVRO about 2:00pm on Saturday. There are several motels in Big Pine to stay at. Please make your own reservations. We usually eat at the Country Kitchen in Big Pine or the Pizza Factory pizza in Bishop. You can also camp out both at the dish or in Big Pine in either tents or campers.

The weather will be warm and dry.

The event is from Friday PM to Sunday AM

You can choose to come for visual astronomy only on Friday evening. We will set up by the main buildings and rail road tracks. 110vac will be available as will restrooms and a kitchen (for coffee, water and tea).

For the main program, you should arrive at the site in the early afternoon on Saturday, you may want to stay over and go back on Sunday afternoon. Some of us will arrive on Friday and enjoy some nighttime astronomy at the OVRO site. Anyone is welcome to join us on Friday night. Let me know if you would like to come then as well. Please call Dr. Millar on the day of the trip and let him know when you are starting out and where you are about 1pm.

Schedule

Friday

- Setup outside the main office building for astronomy by sunset. 110vac available.

Saturday

- 2:30pm arrive at OVRO 30m dish
- 5pm check in at your Motel and go to dinner in Bishop.
- Evening – Astronomy at the site

Sunday

- Breakfast 8:30am at Country Kitchen
- Leave whenever you like. Check web sites about the area and the Highway 395 for sightseeing opportunities.

The directions from the LA area are: Drive North on the 5/14 through Palmdale and Mojave. Continue through Inyokern and join 395. Continue on North through Little Lake and Lone Pine. Continue up to Big Pine. Just as you get to the end of town turn right towards the Westgard Pass. Go out about 2 miles and after Zurich, turn left onto the observatory road. You should be able to see the dish in the distance, but it is 4 miles away! Continue onto the property and go to the large dish. We will be at the base or inside of it. On the right is a more detailed map.

If you would like to bring your own telescope or radio along, please do.
Owens Valley Radio Observatory:
http://www.ovro.caltech.edu/

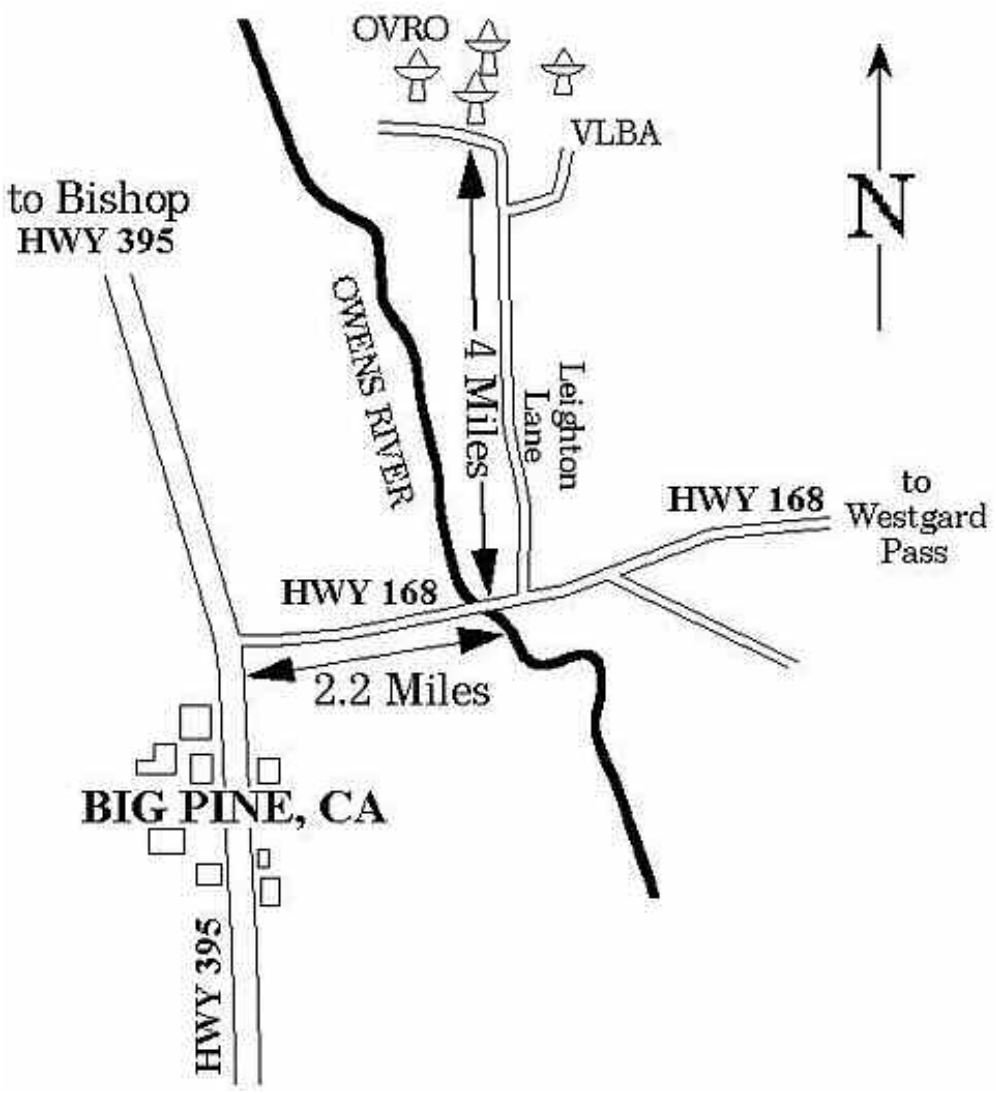
For any questions and RSVPs, my contact information is:

Dr. Doug Millar
Cell: (562) 810-3989
Email: drzarkof56@yahoo.com

Thank you and I hope to see you on the trip!
~Dr. Millar

Local Directions to the dish

Although just 14 miles south of Bishop, the Owens Valley Radio Observatory is located closest to the town of Big Pine. At the northern tip of Big Pine, by a large pine tree, starts Highway 168. The only public access road to OVRO is via Highway 168. From Big Pine, turn onto Highway 168 and follow the road east. After approximately 2 miles you will cross the Owens River. Once across the river, turn down the first paved road to the left, Leighton Lane.



AstroSpace Update

May 2018
Gathered by Don Lynn from NASA and other sources

Dark matter – Last month I reported that a small radiotelescope in Australia had for the first time detected gas clouds ionized by the first stars to form in the early history of the Universe. But the temperature of those clouds was half what theory predicted. More research has now been published regarding whether it is possible that interactions between that gas and dark matter particles could have cooled the gas. The answer is probably not. There is still a narrow range of masses for dark matter particles that has not been ruled out by various dark matter experiments. Further, those particles could cool gas by that much only if the amount of interaction between dark matter and ordinary matter depends very steeply on particle speed. Bottom line: most, but not quite all, of the possible ways dark matter could explain the early gas cloud temperature have been ruled out.

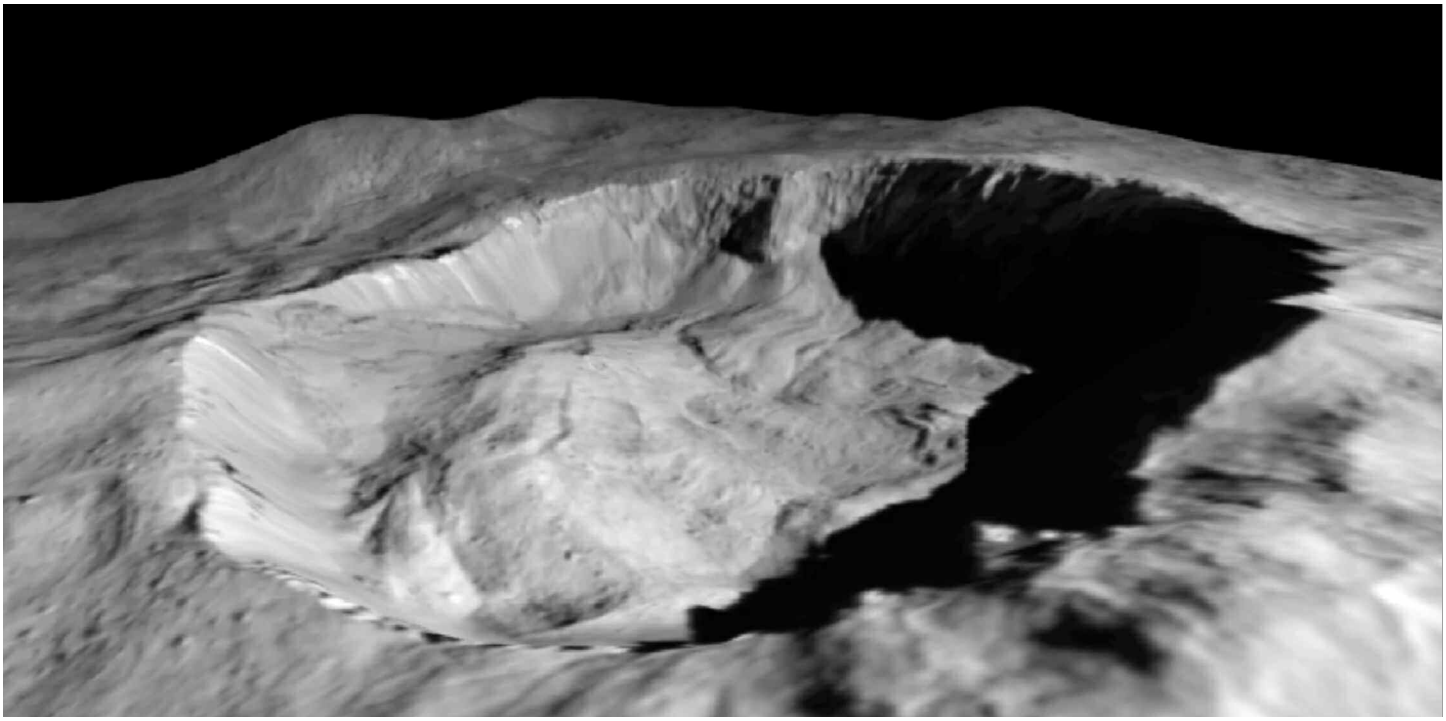
Star-forming filaments in Orion seen in radio and infrared. Credit: ESO/H. Drass/ALMA (ESO/NAOJ/NRAO)/A. Hacar

Star formation – Gas that is in the process of collapsing to eventually form stars is not spherical in shape, but forms long filaments. It is only recently that telescopes have had the resolution to observe structure inside these filaments. New observations by ALMA (radiotelescope array in Chile) have been made of a star-forming region in Orion known as the Integral-Shaped Filament. It is the first time that structure inside a filament that is forming high-mass stars has been seen. Filaments forming lower-mass stars have been previously resolved in Taurus. Both observations found the filaments to be made up of smaller fibers of gas. But the Orion fibers were typically only 1/2 light-year long, while the Taurus ones were 1.5 light-years long, though the Orion ones were more numerous. More observations are needed to help astronomers understand exactly how gas collapses to form stars.

Black hole jets – Monitoring in many wavelengths of light of a black hole that is devouring a star shows that the radio signal nearly duplicates the X-ray signal, but 13 days later. The best explanation for this is that the black hole is producing a jet that takes 13 days for material in it to reach an area conducive to emitting radio waves. It is believed that the X-rays are produced by heated material falling from the accretion disk into the black hole. Jets, sometimes seen with black holes, appear to originate near the accretion disk. Such jets likely produce radio emission throughout their length, but radio waves produced close to the black hole are probably absorbed by material there. Thus in radio waves we see only the outside ends of jets, where they have emerged from the absorbing material. In this case, it apparently takes 13 days for the jet to emerge from the absorbing material. It has been theorized that the strengths of radio waves emitted by jets should be controlled by the amounts of material falling into the black hole, but this is the first observation that demonstrates that. If that were not so, then the shape of the radio observations would not mimic the shape of the X-ray observations.

Central Milky Way black holes found – Black holes that orbit another star (binary black holes) once in a great while give off a bright burst of X-rays, but also continuously give off a dribble of X-rays. Theory has suggested that there should be thousands of black holes, many binary, near the center of our Milky Way galaxy. But previous searches looking for the bright bursts of X-rays have come up empty. A new search looked for the dribble of X-rays and found a dozen black holes near the Milky Way center (within 3 light-years), and therefore near the supermassive black hole that lives there. Knowing how much space they searched, and how often black holes are binary, they extrapolated that there are over 10,000 black holes in the central part of our galaxy.

FRBs – Only 33 Fast Radio Bursts (FRBs) have ever been recorded. They are thought to be common, but almost always missed because we don't know where to look for them (they come from any random place in the sky) and last a tiny fraction of a second. The Parkes radiotelescope in Australia has been used lately in a concentrated effort to observe more FRBs, and it found 3 more in the month of March. One of these 3 is the most powerful FRB yet seen. Astronomers still don't know what causes them. Observations will continue.



Juling Crater on Ceres, where fresh ice was found in the deep shadow. Credit: NASA/JPL-Caltech/UCLA/MPS/DLR/IDA/ASI/INAF

Dawn (Ceres spacecraft) – has found water ice exposed at the surface of Ceres that was not there months ago. The ice may have been uncovered by landslide or condensed on shaded areas from vapor emitted nearby, but in either case it shows the asteroid is more geologically active than thought. The floor of the crater where the ice was found also shows evidence of past flows of ice and rock, glacier-like. In other areas, new observations found a dozen deposits of hydrated carbonates. Under the conditions on Ceres, these chemicals will dehydrate (that is, lose the water in their chemical structure) over millions of years. Thus their exposure on the surface occurred in recent geological times. Their exposure could have been caused by impacts, landslides, or cryovolcanism.

Water worlds – Further research has been done on the TRAPPIST-1 system, the star that was recently found to have 7 planets. The new work shows that the only way to explain the densities of the planets is that they have huge amounts of water, up to 50% of their masses. For comparison, only 0.02% of the Earth's mass is water. This means the surfaces are all ocean (possibly frozen), no land. Those who hoped this system might contain Earth-like life will probably have to give up that dream. The TRAPPIST-1 planets could not have formed with so much water in their current orbits, so must have migrated much closer to their star after forming.

Mercury-like planet – A very dense planet about 20% larger in diameter than Earth has been discovered 339 light-years away in Virgo. It has to have a high iron content to explain the density. This density is near that of the planet Mercury, and the newly-found planet is, like Mercury, the innermost planet in its system (of at least 3 planets). This discovery may imply that Mercury-like planets are not so rare. It is not known if the planet formed like Mercury, or if it formed with a possibly large atmosphere, which its star later stripped away. It is so close to its star that its dayside temperature is over 3600°F. It orbits its K-type star every 14 hours. It was designated K2-229b, since it was the 229th exoplanet system found by the Kepler planet-finding space telescope during its extended (K2) mission. Kepler determined the size of the planet, and follow-up radial velocity measurements determined its mass, allowing the density to be calculated.

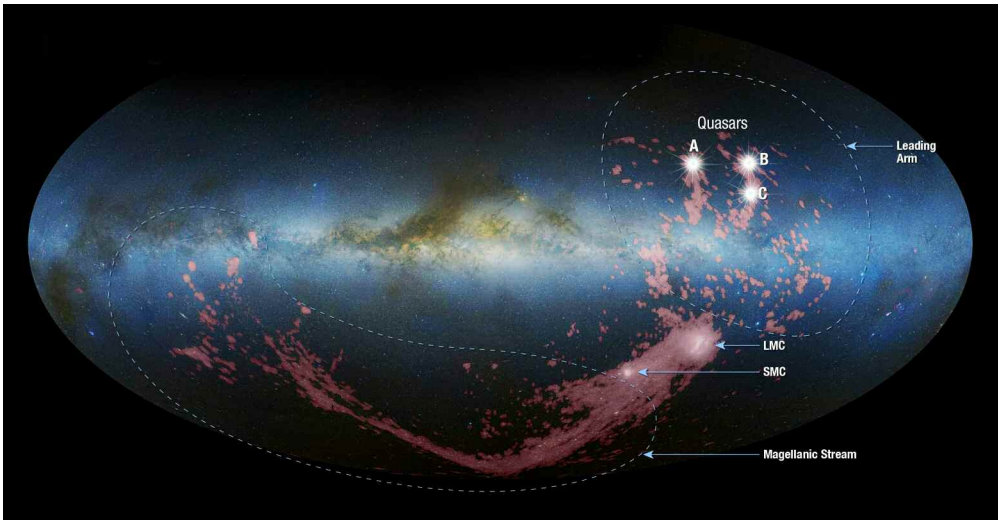
Free-floating moons – Systems of planets (including our own Solar System) show evidence that planets' orbits moved around in the distant past. Planets are often found in orbits where they could not have formed with the composition they now show. A new study, using computer simulations that included moons, shows that such movements of planets' orbits likely threw a lot of moons out of their planetary systems. Also occurring were moons swapping to other planets, moon collisions, and moons moving into their own planetary orbits. Free-floating moons (that is, ones not orbiting a star) should be common. It may be possible to detect free-floating moons by gravitational microlensing, that is, gravitational deflection or magnification of light from more distant sources when a moon passes in front of the light.

'Oumuamua source – I reported here in December on the discovery of the first asteroid (dubbed 'Oumuamua) that came from outside our Solar System. Computer simulations of how an asteroid is thrown out to another planetary system show that 'Oumuamua likely came from a planetary system about a binary star, because binary stars are more efficient at ejecting asteroids than ejecting comets. Further its system likely contained a massive hot star, since such stars form more rocky asteroids around them.

Galaxy lacking dark matter – Astronomers using the Hubble Space Telescope and other observatories have found that a relatively nearby galaxy has almost no dark matter. Typically galaxies have halos of dark matter far more massive than the ordinary matter content. This galaxy, dubbed NGC 1052-DF2, had its total mass (including dark matter) measured by tracking globular clusters in orbit about it. The result was about the same as mass estimates of just the stars. That leaves no room for dark matter. The galaxy is larger in size than our Milky Way, but contains 1/250 the number of stars. The team of astronomers intends to study other galaxies with sparse stars to see if any of them are also lacking in dark matter. If you are a fan of MOND (the alternate theory of gravity that intends to explain observed celestial motions without resorting to dark matter), you are going to hate this galaxy. If MOND explains most the galaxies of similar visible mass to this one (which apparently have huge dark matter halos), it has to utterly fail to explain the orbits of the globulars around this one.

Unchanging galaxy – Astronomers identified a galaxy that appears unchanged for the last 10 billion years. It is fairly common for galaxies to stop forming new stars and have no further galaxy collisions, and therefore remain essentially unchanged, but not so early in the history of the Universe as this one. The galaxy is NGC 1277, which is relatively nearby (240 million light-years away), so is fairly easy to study. Such study may tell astronomers what stops star formation and what conditions held 10 billion years ago. The galaxy has twice as many stars as the Milky Way, but is only ¼ its size. NGC 1277 is in the midst of a huge cluster of galaxies, and so might be expected to interact with other galaxies and intergalactic gas, but apparently has not, probably due to its high speed.

Magellanic Clouds – The Large and Small Magellanic Clouds, neighboring galaxies, have long been interacting gravitationally with each other. There are 2 long streams of gas ripped out of them, one called the Magellanic Stream, located on the trailing side (relative to the Clouds' motion), and the other on the leading side, called (you guessed it) the Leading Arm. In 2013, a spectroscopic analysis showed that the Magellanic Stream contained gas ripped out of both Clouds. A new study of the Leading Arm, using the Hubble Space Telescope, showed its gas was ripped out of just the Small Cloud. Apparently the Large Cloud is winning the gravitational war, once again proving mass wins. The new observations were done with Hubble's ultraviolet spectrograph, finding the spectral lines imprinted by the Arm's gas on light from more distant sources (quasars). The Leading Arm has collided with the Milky Way and is causing star formation in our galaxy.



Credit: Illustration: D. Nidever et al., NRAO/AUI/NSF and A. Mellinger, Leiden-Argentine-Bonn (LAB) Survey, Parkes Observatory, Westerbork Observatory, Arecibo Observatory, and A. Feild (STScI). Science: NASA, ESA, and A. Fox (STScI)

Most distant star – Astronomers have observed the farthest star (excluding supernovas) ever resolved individually. They were using the Hubble Space Telescope to look at massive galaxy clusters to use the gravitational lensing of the clusters to magnify galaxies and supernovas that happen to lie behind. To their surprise, they also found an individual star. The lensing magnified the star 2000 times, so there is no hope of imaging such a distant star without the lensing. As often happens with gravitational lensing, there were actually 2 images of the star. The star is so distant that its light left there 9.4 billion years ago. A spectrum of the star shows it likely to be a B-type supergiant (or at least it was 9.4 billion years ago). Analysis showed that the star's images were lensed by both the mass of the cluster of galaxies and by a compact object of about 3 solar masses. This compact object could be either a star, a neutron star or a black hole.

Runaway star – Only a few dozen runaway stars (ones moving so fast that they are going to escape the gravity of their galaxy) are known, most of them running away from our own galaxy. Another has been found that is unusual in several ways. It is running away from our neighbor galaxy the Small Magellanic Cloud. It is a yellow giant star. These are rare because they turn into red supergiants in only 10,000-100,000 years. It is moving quite fast: 300,000 mph. There are at least 3 reasonable explanations for how runaway stars achieve their speed. The very high speed of the newly discovered one suggests this one explanation: it was part of a binary star, and its companion went supernova, blasting it to high speed.

Supernova didn't finish – A white dwarf star, dubbed LP40-365, that is moving extremely fast through our galaxy was found last year. A new study of its spectrum was made to attempt to understand it better. It had been suggested that it was the result of a Type Ia supernova, which normally obliterates the star, but in this case only partially exploded, which kicked the remnant to high speed. The elements found were unusual, but fit what might be expected after a partial explosion. The surface gravity calculated was unusually low, implying a low mass, which also fits. It is believed that there are 2 different ways to get a Type Ia supernova: 1) a close companion star dumps material over time onto a white dwarf until it explodes, 2) a pair of white dwarf stars collides and the result explodes. The amount of manganese found in LP40-365 implies it formed in the former way, since a collision does not have enough time before exploding to generate large amounts of manganese (the atomic reaction producing manganese is slow).

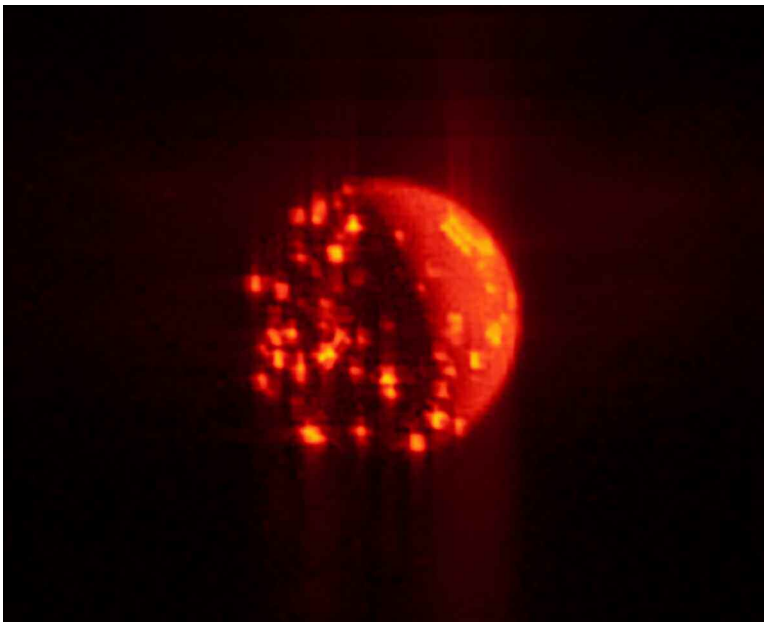
Instant AstroSpace Updates

Juno (Jupiter orbiter) used its infrared instrument (normally used to look at aurora) to observe the moon Io, and it imaged the heat from at least 60 currently active volcanoes.

NASA is delaying the launch of the **James Webb Space Telescope** until about May 2020, in order to further test it after integration of all its parts (problems, probably minor, have arisen that require this). This will increase costs, which will trigger a ruckus in Congress, because past cost increases have caused grumbling and cancellation threats.

Mars rover **Curiosity** celebrated its 2000th Sol (Martian day) on the Red Planet since landing in August 2012.

The first Chinese space station **Tiangong-1** mostly burned up upon atmospheric reentry and then crashed in the South Pacific Ocean on April 1 (no joke). It had not responded to commands from Earth for some time, so it fell where it may, rather than being targeted at a safe uninhabited area.



Io seen in infrared. Credit: NASA/JPL-Caltech/SwRI/ASI/INAF/JIRAM/ Roman Tkachenko

The Library Needs Your Help

You may have noticed that the doors to the cabinets of the OCA library where our meetings are held are in dire need of replacement. I have a couple of ideas, but really need the help of a professional contractor or carpenter. If anyone is willing to take a look at the job and give me some pointers, direction, and/or an estimate, I would appreciate it. The cabinets themselves are in good shape, but the doors need to be changed.

Please contact Karen Schnabel at Karen@schnabel.net or 949-887-9517 if you are able to assist.

June Guest Speaker: Jonathan Feng

The Search for Particle Dark Matter and Dark Sectors.

Jonathan Feng is Professor of Physics and Astronomy at UC Irvine. He was an undergraduate at Harvard, went to Cambridge for two years on a Marshall Scholarship, and then did his Ph.D. at Stanford. He joined the UC Irvine faculty in 2001 and became Professor and Chancellor's Fellow in 2006. His work explores the deep connections between our understanding of the Universe at the smallest and largest length scales and has been recognized by awards from the NSF and the Sloan, Simons, and Guggenheim Foundations. Professor Feng's research and interviews have been featured in Science, Nature, the Washington Post, USA Today, and other popular venues. He has also narrated animated comics about physics that have appeared on PBS television, and he wrote a Scientific American cover story that won the National Magazine Award. At UC Irvine, he is the co-founder of the lecture series "What Matters to Me and Why," which brings together students, faculty, and staff to hear speakers talk about their most meaningful commitments and beliefs, with the goal of fostering an atmosphere of community on campus.

The existence of dark matter is currently the strongest reason to expect the existence of new kinds of fundamental particles. The search for the new particles that make up dark matter has been ongoing for many decades, and I will review the current status. More recently, the search has been generalized to "dark sectors," which may contain not only new matter particles, but also new forces. I will give an overview of dark sectors and some of the exciting new experiments designed to find them.

VOLUNTEER OPPORTUNITY

OCA Representative to WAA

Our club has been a member of Western Amateur Astronomers (WAA) for many years, and our representative for most of that time has been Tim Hogle, one of our Charter Members. He would like to retire from that position, and we are seeking a replacement.

WAA is an association of clubs in the western United States (different organizations serve other areas of the country), and its best known current activity is selecting the annual recipient of the G. Bruce Blair Award, which recognizes excellence in astronomy outreach activities. In the past, WAA organized conferences and provided resources for its members during times when there weren't many options available, and it is still available to provide support for its members, particularly smaller or newer clubs, though local needs have changed over the years.

The basic responsibilities of the WAA representative are to attend two Board meetings per year (one at RTMC and one elsewhere), report back to OCA on those meetings, solicit suggestions for OCA candidates for the G. Bruce Blair Award and formally deliver the nomination to WAA before the Winter Board meeting. Beyond that, our representative would potentially be able to influence the future course of WAA as it adapts to current conditions and determines how it can best serve the needs of its member clubs.

Tim is hoping to be able to overlap with whoever will be taking that over from him as WAA representative, to ease the transition to the new representative, and he is available to answer questions about WAA and what is involved in representing OCA's interests with the WAA. If you are interested in this position, please contact Tim Hogle (TimHogle@aol.com) or Barbara Toy (btoy@cox.net).

Pad License For Sale

Be permanently polar aligned! Have a secure place to store equipment between star parties. An observing pad makes it a breeze to set up for observation. This pad is located in the prestigious Upper Pad Area, so comes with a graveled parking area and the use of warming and storage sheds, with microwave and refrigerator. The pad is carpeted, for comfort and dropped eyepiece protection. Has a sturdy steel pier with built-in wedge, drilled to fit all major fork-mounted telescopes. Includes a tray that fits on the pier to hold eyepieces and star maps. I'm letting it go because I graduated to an observatory. The pad fee is paid up for this year. Asking $1200, but negotiable.

Contact Don Lynn at 714-882-9648 or dlynn@ieee.org

What's It Like Inside Mars?
By Jessica Stoller-Conrad

Mars is Earth's neighbor in the solar system. NASA's robotic explorers have visited our neighbor quite a few times. By orbiting, landing and roving on the Red Planet, we've learned so much about Martian canyons, volcanoes, rocks and soil. However, we still don't know exactly what Mars is like on the inside. This information could give scientists some really important clues about how Mars and the rest of our solar system formed.

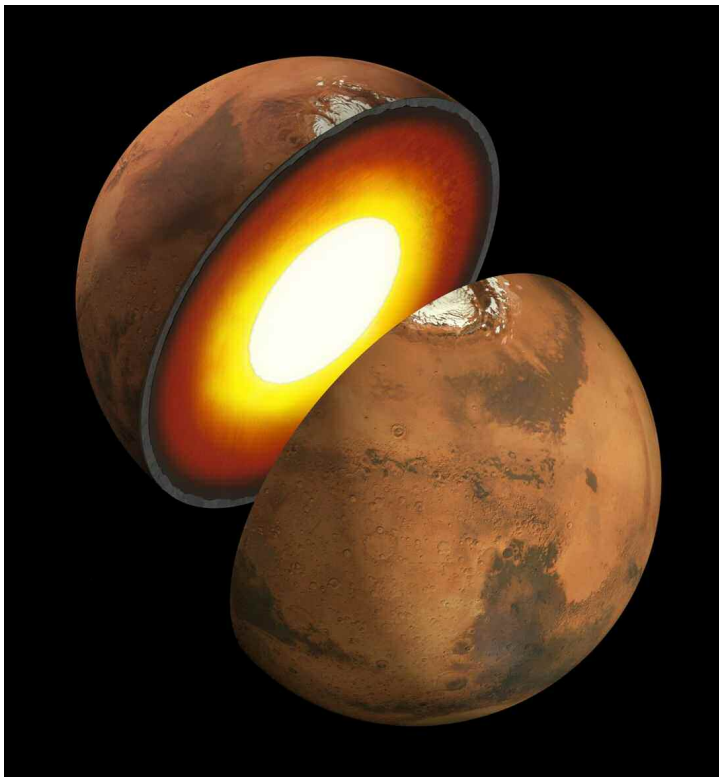
This spring, NASA is launching a new mission to study the inside of Mars. It's called Mars InSight. InSight—short for Interior Exploration using Seismic Investigations, Geodesy and Heat Transport—is a lander. When InSight lands on Mars later this year, it won't drive around on the surface of Mars like a rover does. Instead, InSight will land, place instruments on the ground nearby and begin collecting information.

Just like a doctor uses instruments to understand what's going on inside your body, InSight will use three science instruments to figure out what's going on inside Mars.

One of these instruments is called a seismometer. On Earth, scientists use seismometers to study the vibrations that happen during earthquakes. InSight's seismometer will measure the vibrations of earthquakes on Mars – known as marsquakes. We know that on Earth, different materials vibrate in different ways. By studying the vibrations from marsquakes, scientists hope to figure out what materials are found inside Mars.

InSight will also carry a heat probe that will take the temperature on Mars. The heat probe will dig almost 16 feet below Mars' surface. After it burrows into the ground, the heat probe will measure the heat coming from the interior of Mars. These measurements can also help us understand where Mars' heat comes from in the first place. This information will help scientists figure out how Mars formed and if it's made from the same stuff as Earth and the Moon.

Scientists know that the very center of Mars, called the core, is made of iron. But what else is in there? InSight has an instrument called the Rotation and Interior Structure Experiment, or RISE, that will hopefully help us to find out.



An artist's illustration showing a possible inner structure of Mars.
Image credit: NASA/JPL-Caltech

Although the InSight lander stays in one spot on Mars, Mars wobbles around as it orbits the Sun. RISE will keep track of InSight's location so that scientists will have a way to measure these wobbles. This information will help determine what materials are in Mars' core and whether the core is liquid or solid.

InSight will collect tons of information about what Mars is like under the surface. One day, these new details from InSight will help us understand more about how planets like Mars—and our home, Earth—came to be.

For more information about earthquakes and marsquakes, visit: ***https://spaceplace.nasa.gov/earthquakes***

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