SIRIUS ASTRONOMER

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The Newsletter of the Orange County Astronomers

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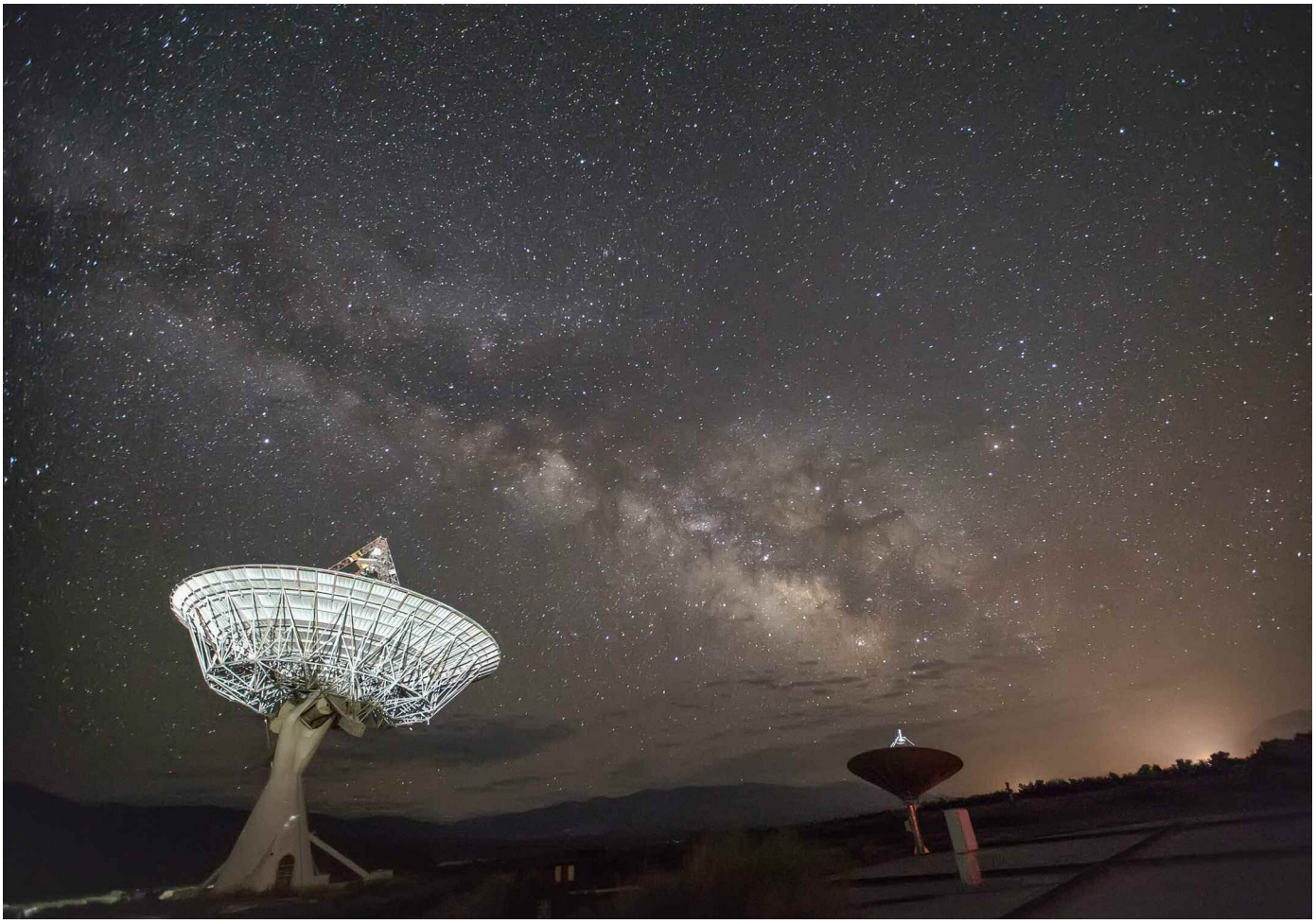


The Milky Way rises over one of the 27-meter solar array antennas at Owens Valley Radio Observatory during one of OCA's field trips on 6/23/17. Image captured by member Pauline Acalin using a Canon 6D for 25 sec at f/2.8, 16mm, ISO 6400.

OCA CLUB MEETING

The free and open club meeting will be held on February 9 at 7:30 PM in the Irvine Lecture Hall of the Hashinger Science Center at Chapman University in Orange.

This month, Anthony Piro from Carnegie Observatories will speak about "Seeing and Hearing the Universe at the Same Time."

NEXT MEETINGS:
March 9 – Ben Zuckerman on The Search for Extraterrestrial Intelligence, and Why It Will Fail
April 13 – (speaker TBA)

STAR PARTIES

The Anza site will be open on February 17. The Orange County site will open on February 10.
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 February 2 and March 2.

Youth SIG: contact Doug Millar

Astro-Imagers SIG: Feb 7, March 7

Astrophysics SIG: Feb 16, March 16

Dark Sky Group: contact Barbara Toy

President's Message

By Barbara Toy

Our annual election is now behind us, and we have a new Board – it looks a lot like the old Board, but we do have a new member, Cecilia Caballero, and we lost a long-time member, Kyle Coker, who decided to take a rest from being a trustee to give us a better chance of getting a new person to run for the position, and who will be very much missed. The officers are the same as last year, and our trustees for this year are: Cecilia Caballero, John Hoot, Andy Lowry (formerly Andy David), Doug Millar, Sam Saeed, Greg Schedcik and Gary Schones. I'm looking forward to working with everyone on the Board in 2018 – and if you have any questions about what we do and how we do it, you're welcome to come to our meetings, which are set in the odd-numbered months (January, March, May, etc.) and are posted on the calendar once they are set.

We have something coming up that will undoubtedly be much more entertaining than our Board meetings –

OCA Banquet on March 31, 2018, at 7:00 p.m.

The banquet will be at the same location as the one we had last January, at JT Schmid, across the street from the Honda Center in Anaheim, specifically at 2610 E. Katella. Rather than having a buffet or set menu, those who attend will order off the menu and pay for what they order directly to the restaurant – we discovered last time that this made it easier for everyone to get something they liked to eat, was generally less expensive for everyone than the banquets we've had in the past with a set buffet, and was easier administratively than having all the costs run through the club.

Former OCA President Helen Mahoney has agreed to be the banquet organizer (thanks, Helen!). We need to let the restaurant know in advance how many people we expect to come, so please email her to reserve a spot at (DrHelenMahoney@yahoo.com). Family and friends are welcome – please let Helen know how many people will be in your party. Please make your reservations as soon as you can; to give us time to make the necessary arrangements, we need them by March 15, 2018.

The theme for this banquet is the solar eclipse of August 21, 2017, and our plan is to have a slide show of eclipse-related images from various members running during the dinner, and then to have around four different presentations about the eclipse experience from different perspectives. Doug Millar volunteered to be the MC for the talks, and if you are interested in being one of the speakers, please contact him at (drzarkof56@yahoo.com) or contact Helen Mahoney (for those who don't have the privilege of knowing them, they are married, and assure me that they will share this information).

If you have images you would like to submit for the slide show, please send them to Alan Smallbone or me (asmallbone@earthlink.net or btoy@cox.net – we're also married and will share the information). We can't guarantee that all images that are submitted will be included (there's a limit on how long it can be), but we want to include as many as we can with as much variety as possible. Pictures of interest would include images from areas where there was a partial eclipse, not just from totality – I know there was a lot going on in areas that weren't in the path of totality that was memorable as well.

So, mark your calendars, email Helen with your reservations, send in your pictures, and we look forward to seeing everyone at the banquet on March 31!

We Need Some Website Help...

We are very fond of our current website and proud of all the content you can find on it, but it's based on old technology and not fully compatible with smartphones and other current devices. Because of its archaic structure, we're having more compatibility problems after various upgrades, most recently with Google Chrome not

recognizing data in our calendar, and we can expect increasing problems as time goes on. Our webmaster, Reza AmirArjomand, has been working hard to keep it running, with assistance from Charlie Oostdyk, but we really need to get an updated version in place before there's some crisis that they can't overcome.

One of our past trustees, Amir Soheili, was working on a redesign of the website before he was transferred out of state and had to leave us. We need one or more volunteers who can either work to complete what he started or work up a new design altogether. If you would like to be involved in this, please contact our club secretary, Alan Smallbone (asmallbone@earthlink.net). If you have questions about the current website, please contact Reza (reza@ocastronomers.org) or Charlie (Charlie@cccd.edu).

The website is important both for sharing information within the club and for introducing us to the general public – for most people, our website is their first contact with our club and their initial impression from the website is a major factor in whether they decide they want to know more about us or not. If you've got the skills and some time to help get this important feature of the club to the next phase in its development, we would really appreciate your help.

New Combination at Anza

Just a reminder – the combination on the locks at the Anza site was changed in December, so please be sure that you have the current combination if you're going out there, preferably by contacting Charlie Oostdyk, Alan Smallbone or me. Of course, once you have the new combination, please be sure anyone you share it with is a current club member; if you don't know their membership status for sure, please refer them to Charlie, Alan or me rather than giving them the number.

Another Sad Farewell – to Paula Knoll

For me, one of the unexpected pleasures of being the club's Observatory Custodian has been the chance to become friends with Pat and Paula Knoll. Those of you who have spent time in the club observatory at Anza may have seen Pat in action, applying his expertise in telescope repair to keeping the Kuhn Telescope running well (he used to be the telescope repair person at Oceanside Photo and Telescope), maybe with Paula among the group bantering with him as he worked and directed his crew on what to do. In past years, you may have had the pleasure of sharing a viewing session that included both Pat and Paula – it was always extra fun when they both were there – or you may have seen them in gatherings at Joe Busch's observatory on the main member observatory level that were filled with entertaining conversation and good cheer.

During most of the time I've known her, Paula always had her camera with her, and in past years she often roamed the Anza site for interesting bits of nature to photograph. Besides an interest in astronomy, she loved being out in nature, and spent almost all of the 30 years that she was a volunteer Canyoneer with the San Diego Natural History Museum leading hikes in different areas of San Diego County. Along the way, she collected voluminous information for the hiking program, which contributed to the weekly Roam-O-Rama column in the San Diego Reader and ultimately to the definitive hiking book for San Diego County, Coast to Cactus: The Canyoneer Trail Guide to the San Diego Outdoors (which was a group effort by the Canyoneers; Pat did the hiking maps).

I'm sorry to say that I never went on one of her hikes – I knew I didn't have the stamina for it – but it was fun to hear her talk about them and to get her comments on local flora and fauna. She was a woman of many interests with a strong sense of humor, and conversations with her were wide-ranging and entertaining, which was just one of the reasons it was so much fun to have her in the observatory for a viewing session.

2018 started on a very sad note for those of us who knew Paula, as she passed away on New Year's Day, after a long, difficult and courageous fight against breast cancer. She was always so vivid and alive, it's hard to think she's gone. We'll really miss her.

AstroSpace Update

February 2017
Gathered by Don Lynn from NASA and other sources

Martian ice – Ground-penetrating radar and other evidence determined years ago that there are large deposits of water ice not far below the surface of huge areas in the middle latitudes of Mars. Near the poles, the ice is exposed, but further from the poles ice only persists if covered with a layer of dirt. The radar measurements were not precise enough to determine how deeply the ice is buried. Astronomers believe that the ice originated as snowfall long ago. New observations from Mars Reconnaissance Orbiter found 8 places where eroded slopes have uncovered the ice layer. It appears layered, so probably reveals the history of snowfall over thousands of years or more. Climate should change on Mars over thousands or millions of years due to changes in the planet's tilt or orbit. A mission to examine one of these erosion exposures might be able to read the climate history. The areas found are 55-58° latitude, both north and south. Some of the exposures show over 100 yards (100 m) thick of ice, and some are within 1-2 yards (1-2 m) of the surface. This would make them accessible sources of water for future missions.

Solar System formation – A generally accepted theory has been that the Sun and its planets formed after a nearby supernova exploded almost 5 billion years ago. This explains why primitive meteorites have been found with daughter products of radioactive aluminum-26, a product of supernovas. However, more recent work has shown that meteorites don't have enough iron-60, another product of supernovas. A new paper explains this by theorizing that a Wolf-Rayet (W-R) star produced the heavy elements that formed our planets and meteoroids, not a supernova. W-R stars have stellar winds that throw huge amounts of heavy elements off into space, including much aluminum-26, but not much iron-60. The new paper posited that the Solar System formed within the bubble blown by W-R stellar wind. Other astronomers have disagreed on the location within such a bubble, but there is some agreement that a W-R star was involved.

More on Tabby's Star – Tabetha Boyajian and colleagues wrote a paper a couple of years ago describing how the star KIC 8462852 exhibited irregular dimming, unlike any other known star. It became known as Tabby's Star. It incited theories galore to explain the dimmings, including that it might be a megastructure built by aliens passing in front of the star (or comets, planets, rings, starspots, etc.). Astronomers watched it nearly continuously for 21 months, and the results were just announced. Only dust clouds passing the star fit these observations (sorry, no megastructure). Four episodes of dimming were caught. The amount of dimming was different at different wavelengths of light, eliminating the possibility of solid objects as the cause. Other observed properties ruled out the other theories, except dust.

More on neutron stars merging – As reported here in December, the observations of the merging neutron stars by LIGO (in gravitational waves) and in all wavelengths of light by about 70 telescopes left one major mystery: why were the gamma rays observed far weaker than expected? The first guess proposed was that gamma rays are strongly observed only if the jets are aimed at us, and this time the jets were aimed somewhat off. A new study has challenged this explanation, and suggested that a jet has to punch through surrounding material before gamma rays can be strongly observed, and this event failed to punch through. This theory is based on radio observations that continued for more than 100 days after the event. Those radio observations did not peak at the right theoretical time for the "bad aim" theory, but did support a shell of surrounding material. Other astronomers are trying to reconcile the "bad aim" with the later radio observations. Perhaps we are going to have to observe more neutron star mergings before we understand this.

Yet more – Another question left from the neutron star merging observations is whether the result was a larger neutron star or a black hole. A new study of the X-ray and radio observations of this event concludes that it was probably a black hole. Those observations best matched light expected to be produced by the shock where expelled gas hits interstellar matter, not from a debris disk or jet. Theory says that a resulting black hole would better match the shock source than a resulting neutron star.

Star formation rates – It has long been known that there are correlations between masses of galaxies, masses of central black holes, numbers of stars in galaxies, star formation rates, and other properties. But no theory yet explains the mechanism behind these correlations. Another piece of the puzzle has been found. A new study measured the

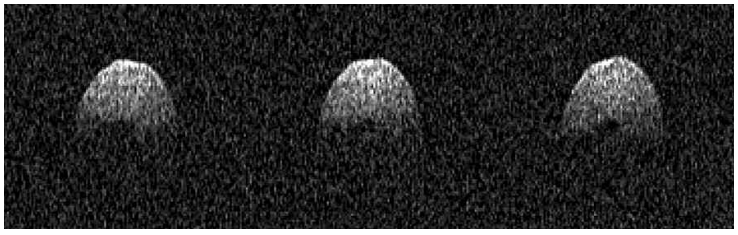
distributions of ages of stars (by spectroscopic means) in 74 galaxies, all of which had previously had their central supermassive black holes' masses measured. From the star ages, a history of when stars were formed was generated for each galaxy. The conclusions reached were: galaxies with more massive black holes had smaller rates of star formation throughout their history; galaxies with more massive black holes were sooner to reach quench (the time that star formation drops to nearly zero). This is the first time black hole mass and star formation rates have been found to be firmly related. These findings further constrain how theories can explain all these related galaxy properties.

Inclined planet – A planet (dubbed GJ436b) has been found to orbit its star over the star's poles rather than in the plane of the star's rotational equator. Stars should rotate the same as the ring of material about the star that originally formed planets, so this discovery is unexpected. It was already known that the planet is in a very eccentric orbit, closely approaching its star, then receding far from it. During the close approaches, the planet gets so hot that material evaporates off it, streaming a tail like a comet. A new study shows that another (massive) planet (as yet undiscovered) in the system could perturb GJ436b into a very eccentric and very inclined (over the poles) orbit. Astronomers will try to detect such a second planet.

Star mass – The best way to accurately determine the mass of a star is to measure the orbit of a companion star. But many stars don't have companions, and of those that do, most don't complete an orbit in a reasonable time. Other methods of determining mass don't apply to many stars and/or result in only a very rough number. A new method has been found to determine star mass. Last year, it was announced how to determine the diameter of a star using luminosity, temperature, and parallax in the calculation. The new step was to find that the surface gravity of the star correlates with the way that the starlight flickers. The total mass is easily calculated from the diameter and surface gravity. The method was tested on 675 stars with known mass and found to be within 25% of the true value, which is better than most mass-determination methods. With the GAIA space telescope currently measuring the parallaxes of a billion stars, the new mass-determination method should be highly applicable.

John Young, astronaut, died in early January at age 87. He accomplished a number of firsts: 1st manned flight of the Gemini spacecraft, 1st flight of the Space Shuttle, 1st to fly into space 6 times, 1st to land in the lunar highlands, and only astronaut to fly 3 types of spacecraft (Gemini, Apollo, and Shuttle). He was the second person to return to the Moon (orbited in Apollo 10 and landed in Apollo 16). (Jim Lovell in the ill-fated Apollo 13 was the first repeat lunar flight.) Now only 5 of the 12 people who have stood on the Moon remain alive.

Instant AstroSpace Updates

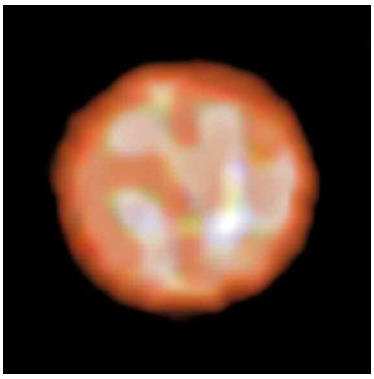


Credit: Arecibo Observatory/NASA/NSF

The Arecibo radiotelescope and radar have been returned to operation after damage from hurricane Maria, and one of the first observations was radaring asteroid **Phaethon** (the parent body of Geminid meteors) during its close pass. It is roughly spherical, has large depressions (probably impact craters), and is about 20% larger in diameter than previous estimates.

NASA has winnowed the proposals for the next **New Frontiers mission** from 12 to 2, with one to be selected in 2019. The two proposals: a sample return mission called CAESAR to Comet 67P, and a rotorcraft (helicopter-like) called Dragonfly to explore Saturn's moon Titan.

The **granulation patterns** on a star other than the Sun have been imaged for the first time. The star is π1 Gruis, a red giant, which has monster-sized granulations, and the observations were made in infrared with the Very Large Telescope in Chile.



Credit: ESO

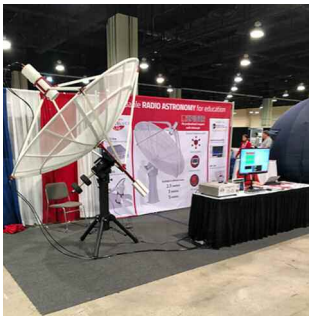
Greetings from Palmia Observatory

By George Robinson

Well, we are back in California after spending a wonderful week at the American Astronomical Society 231st meeting outside Washington, DC. I found it too exhausting to try to post some comments every day and I couldn't do the topics the just review that they deserved, but still wanted to give now a brief summary of, say, 5 of the more interesting topics that struck my fancy. Of course, I already commented on one of the most interesting in the last post, regarding the tension between the two best estimates of Hubble constant (km / sec / Mpc) , now found to be 66.9 +/- 0.6 by the CMB method and to be 73.24 +/- 1.74 by the supernova standard candle method. This post covers a brief summary of five more topics:

1. Use of radio astronomy to probe the epoch of reionizaton
2. Venus, our sister planet and why we should send more probes there
3. Search for very dim dwarf halo galaxies and stellar flows to read the history of galaxy formation
4. Water everywhere but where did it come from?
5. Simulating stellar mergers and supernovas and how the new "cocoon" approach best explains GW170817 afterglow and dim gamma ray pulse

One of the things I am still interested in is whether or not amateurs can participate in making radio astronomical observations? Well, we have seen many instances of this and the premier radio telescope for amateurs is something like the Primalucelab Spider system as seen below.

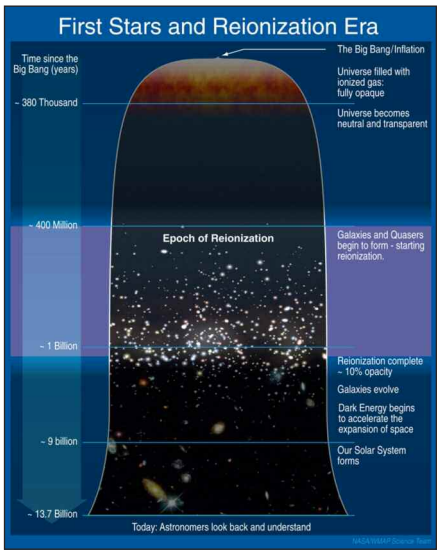


Getting your own radio telescope is easy to do today (Courtesy: Primalucelab booth at AAS 211)

I don't know about you, but I just do not have enough physical room and space for something like this, but I do like the concept. This setup is optimized for operation at 1420 MHz, which is the neutral hydrogen quantum mechanical spin flip frequency and can be used to trace the outline of neutral hydrogen in the universe, which can be correlated with the structure of the universe.

Many radio frequencies are of interest in astronomical observations. Recall that the Cosmic Microwave Background (CMB) is used to establish the current temperature of the radiation released just 300,000 years after the big bang. The radiation at that time was that of black-body thermal radiation left over as the big bang was still cooling off and was of much higher in frequency, which has now been stretched by the expansion of the universe. That epoch of recombination when the radiation could begin to freely stream throughout the universe was at a redshift of about z = 1100. Today's measured temperature of 3 K at redshift z = 0, was generated when the early universe would have been a hot ball of gas at a thermal temperature of about 3 * 1100 = 3300 F. Much can be learned by examining the spatial distribution of the this temperature today, including the amount of dark matter, dark energy and Hubble constant.

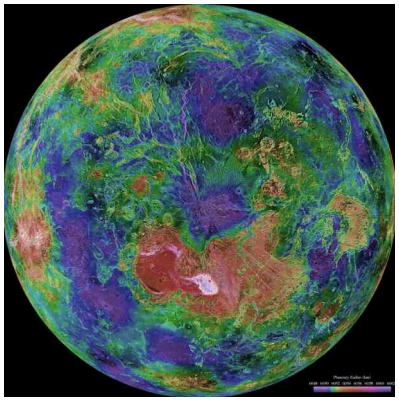
Another aspect of the history of the universe that can be traced by radio astronomy originates during the epoch of reionization. Remember that this is the time after the epoch of recombination that the CMB was released, up to the time when the first stars turn on and begin to reionize the neutral hydrogen gas. Up until that time, the universe was in the dark ages since nothing was shinning. The epoch of reionization is considered to have happened around redshift of z = 6 through z = 20.



Epoch of Reionization begins when the first stars turn on, about 400 Myr after big bang. (Source: NASA)

As the universe expanded from z = 20 down through history to z = 6, the 1420 MHz signal released at that time would have been stretched to much lower frequency by a factor of 1 / (1 + z), so the original signal would show up here now in the 60 - 200 MHz frequency range, depending on the actual redshift at the time. So making astronomical observations over this frequency range can probe back in time, corresponding to red shifts from about 6 to 20. In the chart below you can see that this time period corresponds to the early universe from somewhere between 400 million years and 1 billion years after the big bang. So that makes this frequency range the real history channel! Unfortunately, the Spider system has been optimized for operation at 1420 MHz and might not work too well at 60 - 200 MHz.

For the next topic, Darby Dyar, Planetary Scientist at Mount Holyoke College shared her vision and passion about Venus and that we should go back to Venus because Venus is our sister planet and the key to understanding how planets form and what happens to them as they evolve. She said that we have not visited Venus since the Magellan mission in 1990-1994 timeframe and that most "known" facts about Venus are really just myths. She said we can get better elevation data through the clouds and that Venus is not dead and does have hot spot volcanism and more water and is not as dry as commonly believed. Many planned missions to Venus have got pretty high up in the review process only to get scrubbed for other higher priority missions.

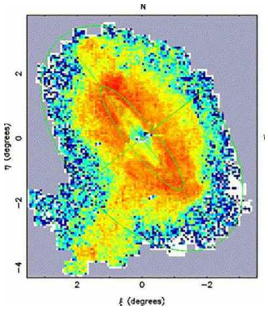


The hemispheric view of Venus centered on the North Pole, as revealed by more than a decade of radar investigations culminating in the 1990-1994 Megallan mission. (Credit: NASA)

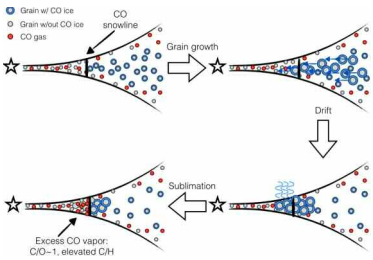
Next, Professor Ferguson, University of Edinbourgh, explained how history of how galaxies form and evolve is contained, and until recently, hidden, in the low surface brightness objects in the peripheries of the galaxies. This fossil record can be uncovered by tracing the paths of dim dwarf galaxies and stellar streams that show how galaxy interaction shreds some galaxies and enhances others as they evolve in their mutually gravitationally bound cluster of galaxies.

For instance in the photo (below right), similar to ones she showed in her presentation, you can see (well, the author says it is clearly visible) a stream of stars left over from some previous encounter among the galaxies that make up the Andromeda system. She said it takes a lot of work to find and identify these very dim dwarfs and collections and streams of stars associated with past encounters. A key requirement for the telescopes used in doing this is the ability to see very deep, with long exposures, but also wide field of view because the stellar streams are not easy to identify without seeing the larger structures. As an example she said to see these structures in Andromeda (M31) you need to have a field of view of about 30 degrees, which covers a distance of about 300 kpc. Most planetarium software tools list Andromeda of being only about 4-5 degrees across.

The technical session on water in the universe and where it comes from and how it is found in any particular solar system was also a very interesting session. First up was Joan Nagita, NOAO, who talked about the role of water in the accretion of dust grains into larger objects in the early protoplanetary disks around new stars. It turns out that water gloms onto the dust particles and this affects the "aerodynamic" drag on the particles and determines how far they migrate towards the new star. Water and organic compounds, formed or collected on the dust grains, and everything migrated in the protoplanetary disks.



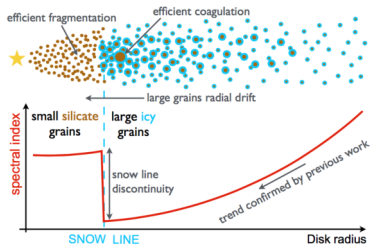
The Milky Way has tidally stripped stars that Sagittarius Dwarf. (Source: G Lewis, et al, arXiv/0401092v1)



The snowline for H20 and other molecules affects migration of dust. (Source: K Oberg and E Bergin, srXiv/1610.07859v1)

Radio observations, from ALMA and other observatories, using the 183 GHz water line, can identify where the water is located in the disks. This illustration (left middle) shows how the snow line is an easily identifiable location in the disk.

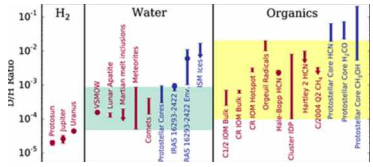
Harold Linnartz, Leiden Observatory, Netherlands, described some of the ongoing laboratory efforts to characterize how water behaves in the cold, vacuum conditions found in protoplanetary disks. These laboratory studies confirm and identify the spectra that should be found in observations. Water and CO are often found together and in under ultraviolet conditions various organic compounds can be formed along with the dust grains. The water, available as ice typically, can help shield these molecules from disintegration and also help form more complex molecules in some cases.



Radio spectral emissivity identifies the snow line in protoplanetary disks. (Source: A. Banzatti, et al, arXiv/1511.06762v1)

Measuring the fraction of heavy isotopes of water also helps identify where the water came from and what types of chemical fractionation processes have occurred. Recall that measurements of he Deuterium / Hydrogen ratio on comet 67P indicated that the water from comets is not where the water on Earth came from. Admittedly, this is only one water sample, but the evidence is pilling up that the water on Earth was here all along during its pre-history.

Also Edwin Bergin, U of Michiagan, was another presenter in this water session and he described how we can follow the trail of the water by using isotope ratio measurement and we can follow the trail of water through the history of these measurements. The amount of deuterium is like a fingerprint and tells us where the trail of water goes.

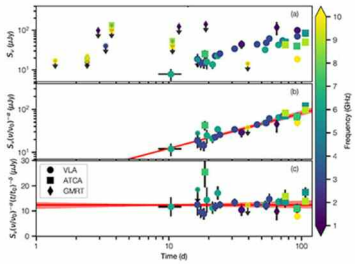


The deuterium enrichment is key research tool for tracking the water source. (Source: L Cleeves, et al, arXiv/1601.07465v1)

There were many sessions dealing with the new era of gravitational wave astronomy and this new window called multi-messenger astronomy, which includes in addition to optical viewing, looking at the IR, X-ray, gamma ray, and radio and neutrino emissions. Mansi Kasliwal, Caltech, made a very interesting and informative presentation on some of the electromagnetic counterparts observed after the GW170817 neutron star merger. He discussed how the arrival time here on Earth, even hundreds of days after the merger, leads to contradictions and evolution of new models to explain the processes involved in generating those signals. The slide (next page), from a paper by Mooley, et al, shows how the radio signature, as observed by three different observatories, shows received amplitude variation over days.

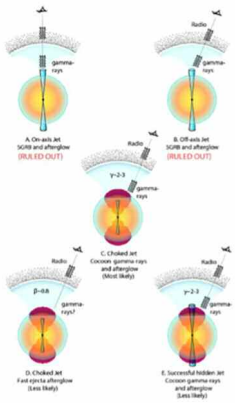
He also described how the early arrival of gamma rays was received about 1.7 seconds after the merger, but that the received amplitude was about 10,000 times weaker than many other gamma ray bursts (GRB), so the source of the GRBs is still not explained by this first example of merging neutron stars. More observations from future LIGO detections are needed.

The best leading explanation for the light curves and small gamma ray amplitude is called the "cocoon" theory and is illustrated in the cartoon below. The best explanation has to account for the small amplitude of received gamma rays, the late arrival of radio and x-ray signals and the color of received optical light also. Each of these signals is generated by different processes that occur during and after the merger event. There is a lot of physics in all of this and I can see that my homework load just increased.



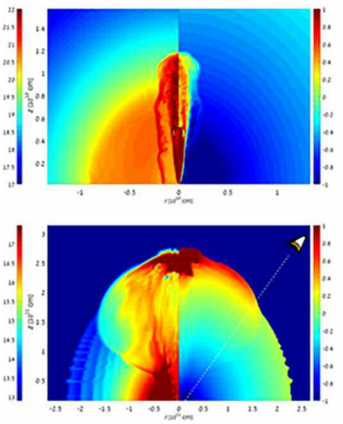
Some radio light curves for GW170817 observed from three telescopes (Source: K Mooley et al, arXiv 1711.11573)

The theoretical understanding of the physics of the merger is still being developed and the emerging capability of computer simulation models that can cover all of the detailed physics over the space dimensions necessary is still a very difficult field, although a lot of progress is being made. The presentation by Robert Fisher, U of Mass., showed some of the complexity in understanding how to model exploding white dwarfs and other merger events. One of the problems is the large dynamic scale in space over which the modeling simulation must extend, something like 15 orders of magnitude. Why so large? Well the simulation must start on the very small scale where the nuclear reactions and that first location where the density is so great that gravity can overcome the other forces and the reactions that start there must then propagate to other regions. As the nuclear reactions and energy released from gravitational collapse proceed, a lot of material is accelerated to up towards the speed of light. Now, if your simulation of interesting behavior needs to go on for several seconds, this material is going to cover large multi lightseconds of distance and the computer code has to still track all of the physics.



Cartoon showing cocoon conjecture best fit to explain GW170817. (Source: Mooley, et al arXiv/1711.11573)

Fisher showed the results of many simulations and the first thing that becomes apparent is that these explosions are not going to go on symmetrically, the cocoon generation being one of these effects. I couldn't find the references to the actual simulations which are very interesting to watch, but I did find a computer generated image, which shows an instance of a cocoon being generated. Now, I have to say, I still don't understand all of this plot, but it does show the beautiful and intricate way in which the explosion evolves. I tried to read this paper on the airplane coming back to California from DC, and even with the help of a glass of wine, I still couldn't quite understand it. It has something to do with the three different times scales needed in the simulation to account for the widely spaced events occurring in the explosion, or something like that. You can always dig deeper into this for yourselves by following the indicated references.

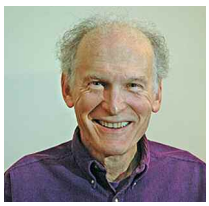


Computer simulation of stellar explosion with cocoon. (Source: Gottlieb, et al arXiv/1710.05896v1)

Ok, that is my little summary of these five great topics. There was so much happening at the AAS 231st meeting that it was hard to follow more than a few interesting tracks and sessions. Remember that the AAS has a special very low meeting fee for amateur astronomers, so take advantage of that when you can. I also found that I had to spend very strict attention to try to understand and capture what each presentation was all about and I missed probably as many things as I captured. They represent a lot of interesting physics and for this physicist wannabe, a lot more homework and study. I also escaped with only buying 3-4 books this time, which was pretty amazing given that a half dozen publishers had booths in the exhibit hall!

Until next time,
Resident Astronomer George

If you are interested in things astronomical or in astrophysics and cosmology, check out my blog at ***www.palmiaobservatory.com***



March Guest Speaker: Ben Zuckerman

The Search for Extraterrestrial Intelligence, and Why It Will Fail

For 40 or so years we humans have been searching for electromagnetic – primarily radio – signals from technological species in our Milky Way Galaxy. Following a brief review of some of these searches, I will describe reasons why I believe they will not be successful any time soon, if at all.

Ben Zuckerman is a Professor in the Dept. of Physics & Astronomy at UCLA. He received undergraduate and graduate degrees from MIT and Harvard. His major scientific interests have been the birth and death of stars and planetary systems. He has maintained a continuing interest in the question of the prevalence of life, especially intelligent life, in the Universe and since the mid-1970s regularly taught a course on *"Life in the Universe."* He also developed and taught a UCLA Honors course entitled *"The 21st Century: Society, Environment, Ethics"*. He has co-edited six books including, *"Extraterrestrials, Where Are They?"* Cambridge University Press 1995, *"The Origin and Evolution of the Universe"* Jones & Bartlett 1996, and *"Human Population and the Environmental Crisis"* Jones & Bartlett 1995.

VOLUNTEER OPPORTUNIES

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).

Website Designer for the OCA Website

The OCA website is a major resource for our members as well as where people most often get their first impression of us. Our current website has served us very well for over a decade, but it is based on old technology and urgently needs to be updated to meet our current needs, including an ability to work across multiple platforms (including smartphones and tablets). Amir Soheili, past OCA Trustee, was working on this project when he was transferred out of state earlier this year and had to give up his OCA activities.

If you are interested in getting involved in the redesign of the website, either as a solo project or as part of a group, please contact Alan Smallbone (asmallbone@earthlink.net) or Barbara Toy (btoy@cox.net).

Sale:

Stellar Vue Nighthawk 80mm, Stellar Vue 50 mm, iOptron MT mount

Accessories: Extensive set of eyepieces including several desirable Naglers and filters. Entire listing for $900.

Contact Philip at patrask2@cox.net or 949-837-6645

Space Patents

By Stephen Donovan

As of January 16, 2018 the United States Patent Office has granted 9,872,420 patents, and that's only the "utility" patents, for new, useful and not obvious machines, chemicals and new ways of doing things (such as new industrial processes), manufactured items and the like. There are also 808,109 design patents and 28,884 plant patents.

The first U.S. patent was granted to Samuel Hopkins on July 31, 1790, for a method and apparatus for making potash, an alkali useful at the time for making soap, glass, dyeing fabrics, baking, and so forth. That first patent was signed by George Washington.

Among the almost ten million or so U.S. patents granted to date are patents for space elevators, sea landing of space launch vehicles, aspects of orbits, Mars rovers and various telescopes. These patents present a great wealth of technological achievement and are a testament to the boundless creativity of inventors. Then, there is U.S. patent 6,025,810 issued on February 15, 2000 for a hyper light-speed antenna – the antenna comprising a heat source, a magnetic field source, an electromagnetic injection point, an accelerator and an electromagnetic signal inserter so that *"a communication signal may be generated through said signal inserter, thereby sending the signal at a speed faster than light".* The patent further states, *"The present invention has discovered the apparent existence of a new dimension capable of acting as a medium for RF (radio frequency) signals. Initial benefits of penetrating this new dimension include sending RF signals faster than the speed of light... The present invention takes a transmission of energy, and instead of sending it through normal time and space, it pokes a small hole into another dimension, thus, sending the energy through a place which allows transmission of energy to exceed the speed of light."* Yes, that's actual text from a granted U.S. patent.

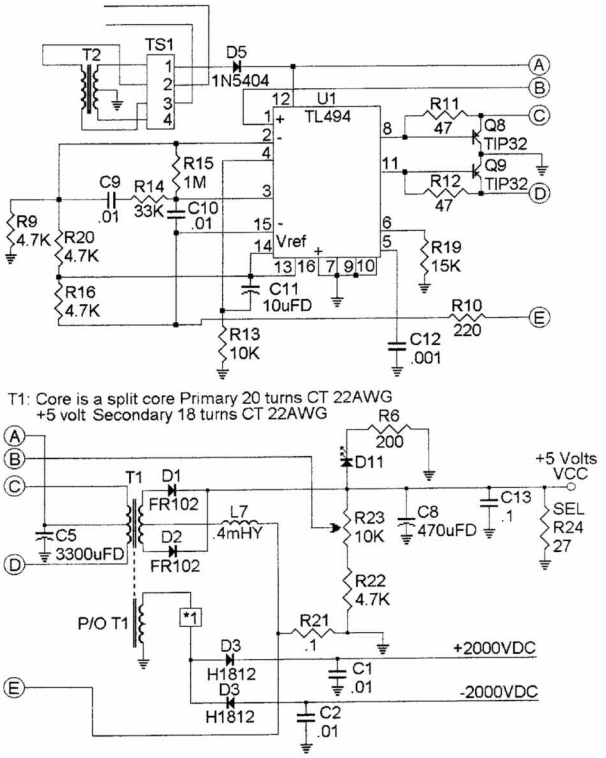


Diagram from page 1 of US patent 6,025,810.

Patent 6,025,810 has now expired (generally patents have a 20-year life as measured from the date the patent application was filed) so if you would like to make your own device for faster-than-light signal transmission, here is a schematic from the patent (above).

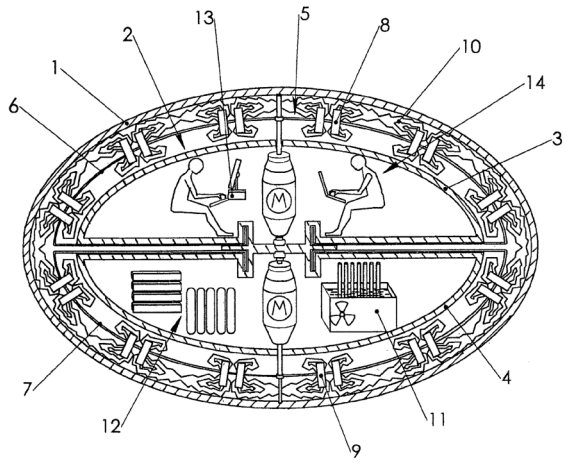
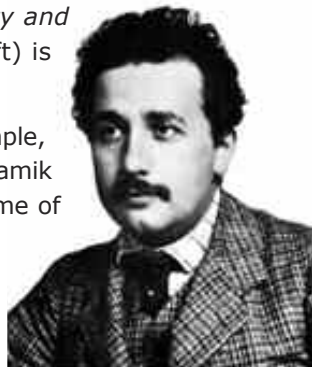


Figure 1 from US patent 6,960,975.

And for good measure, there is also U.S. patent 6,960,975, granted November 1, 2005, for a *"space vehicle propelled by the pressure of inflationary vacuum state"* which describes both faster-than-light travel and an anti-gravity device. Thus, the patent claims *"pushing said space vehicle forward in modified spacetime at a speed possibly approaching a local light-speed, the local light-speed which may be substantially higher than the light-speed in the ambient space"* and with only a touch of hubris also states *"Creation of spacetime curvature anomalies adjacent to, or around, the space vehicle, these anomalies characterized by the local gravity and light-speed change, has been the main object of this invention."* Here from the patent (left) is a cross-sectional view of the nifty spacecraft that can do all that.



Needless to say, the two patents summarized above have been roundly criticized based, for example, on the postulates of and conclusions drawn from special relativity; Einstein, A., Zur Elektrodynamik bewegter Körper, Annalen der Physik 17: 891 (1905). Einstein was only 26 years old at the time of that seminal publication, living in Bern, Switzerland and working at the Swiss Patent Office.

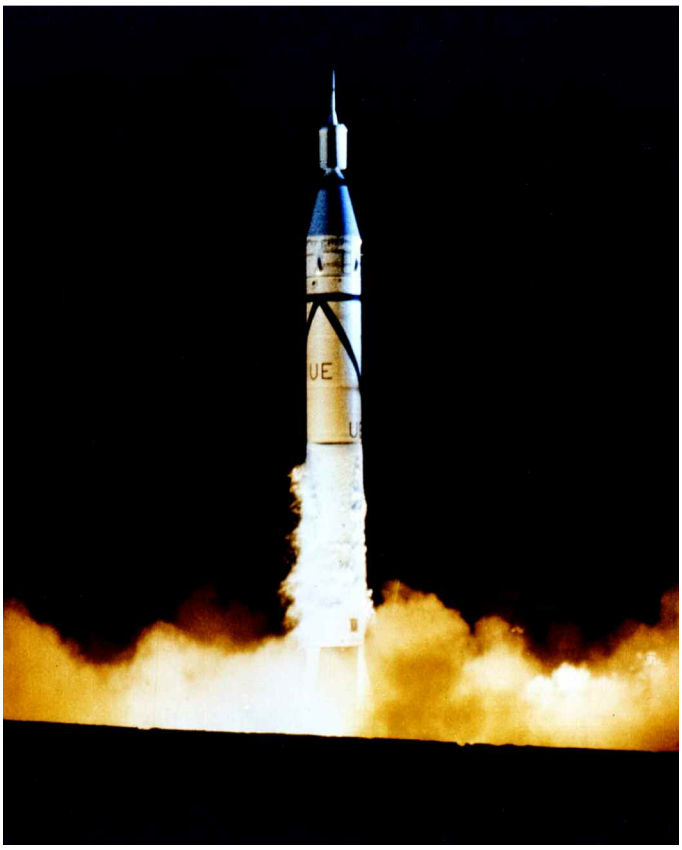
I'm happy to send a complete copy of each patent cited above to any requestant, for further perusal, just send the request to me at (jumping272002@yahoo.com).

Sixty Years of Observing Our Earth

By Teagan Wall

Satellites are a part of our everyday life. We use global positioning system (GPS) satellites to help us find directions. Satellite television and telephones bring us entertainment, and they connect people all over the world. Weather satellites help us create forecasts, and if there's a disaster—such as a hurricane or a large fire—they can help track what's happening. Then, communication satellites can help us warn people in harm's way.

There are many different types of satellites. Some are smaller than a shoebox, while others are bigger than a school bus. In all, there are more than 1,000 satellites orbiting Earth. With that many always around, it can be easy to take them for granted. However, we haven't always had these helpful eyes in the sky.



This photo shows the launch of Explorer 1 from Cape Canaveral, Fla., on Jan. 31, 1958. Explorer 1 is the small section on top of the large Jupiter-C rocket that blasted it into orbit. With the launch of Explorer 1, the United States officially entered the space age. Credit: NASA

The United States launched its first satellite on Jan. 31, 1958. It was called Explorer 1, and it weighed in at only about 30 pounds. This little satellite carried America's first scientific instruments into space: temperature sensors, a microphone, radiation detectors and more.

Explorer 1 sent back data for four months, but remained in orbit for more than 10 years. This small, relatively simple satellite kicked off the American space age. Now, just 60 years later, we depend on satellites every day. Through these satellites, scientists have learned all sorts of things about our planet.

For example, we can now use satellites to measure the height of the land and sea with instruments called altimeters. Altimeters bounce a microwave or laser pulse off Earth and measure how long it takes to come back. Since the speed of light is known very accurately, scientists can use that measurement to calculate the height of a mountain, for example, or the changing levels of Earth's seas.

Satellites also help us to study Earth's atmosphere. The atmosphere is made up of layers of gases that surround Earth. Before satellites, we had very little information about these layers. However, with satellites' view from space, NASA scientists can study how the atmosphere's layers interact with light. This tells us which gases are in the air and how much of each gas can be found in the atmosphere. Satellites also help us learn about the clouds and small particles in the atmosphere, too.

When there's an earthquake, we can use radar in satellites to figure out how much Earth has moved during a quake. In fact, satellites allow NASA scientists to observe all kinds of changes in Earth over months, years or even decades.

Satellites have also allowed us—for the first time in civilization—to have pictures of our home planet from space. Earth is big, so to take a picture of the whole thing, you need to be far away. Apollo 17 astronauts took the first photo of the whole Earth in 1972. Today, we're able to capture new pictures of our planet many times every day.

Today, many satellites are buzzing around Earth, and each one plays an important part in how we understand our planet and live life here. These satellite explorers are possible because of what we learned from our first voyage into space with Explorer 1—and the decades of hard work and scientific advances since then.

To learn more about satellites, including where they go when they die, check out NASA Space Place: ***https://spaceplace.nasa.gov/spacecraft-graveyard.***

This article is provided by NASA Space Place. *With articles, activities, crafts, games, and lesson plans, NASA Space Place encourages everyone to get excited about science and technology. Visit* ***spaceplace.nasa.gov*** *to explore space and Earth science!*

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