SIRIUS ASTRONOMER

www.ocastronomers.org

The Newsletter of the Orange County Astronomers

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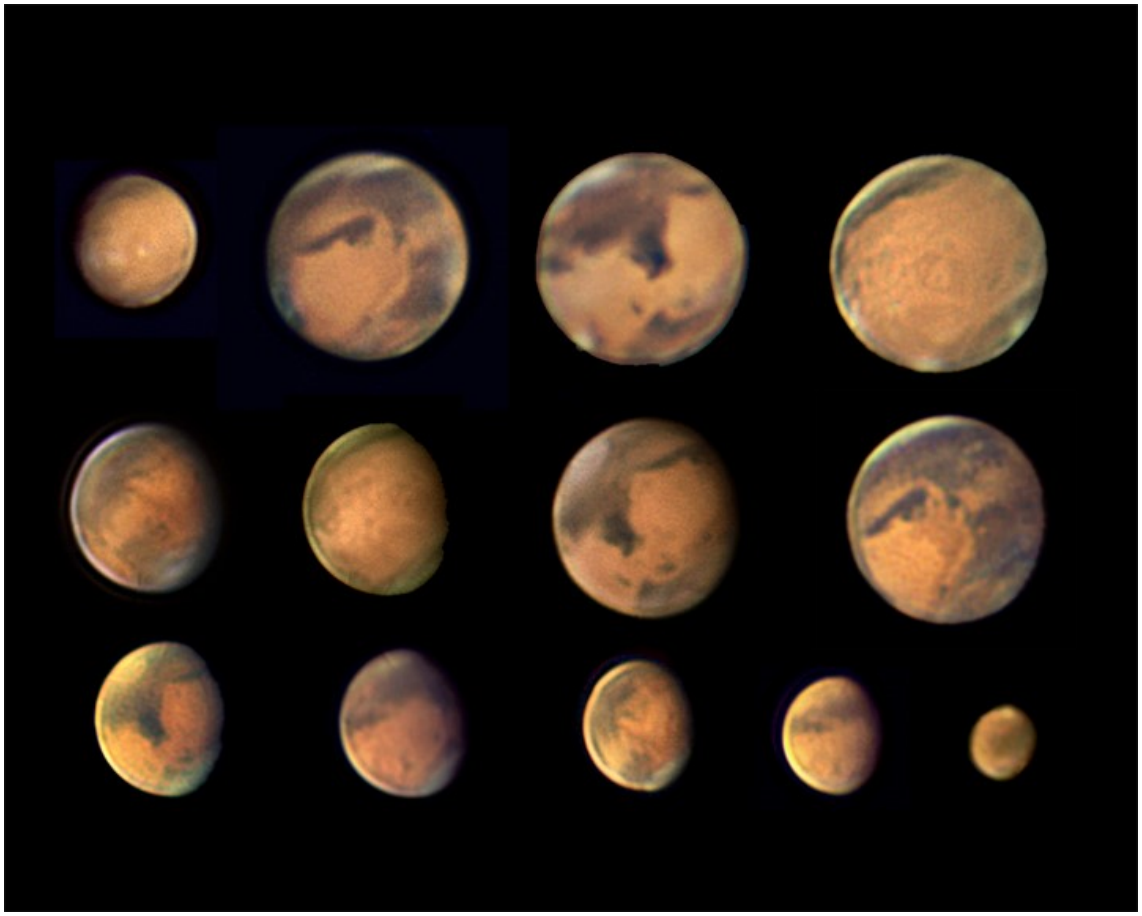
OCA Board Elections This Month! Don't Forget To Vote!



Bill Hall created this montage of last year's Mars opposition between March and December from his observing site in Yorba Linda, CA. Bill used a Celestron C8 on a Super Polaris mount with a Neximage5 imager at f/30 and a 3X Barlow. Did you miss your chance to get close-up images of Mars? July 2018 is your next best bet!

OCA CLUB MEETING

The free and open club meeting will be held January 13 at 7:30 PM in the Irvine Lecture Hall of the Hashinger Science Center at Chapman University in Orange. This month, Dr. Christopher Trinh of NASA will discuss the SOFIA Mission: Our Infrared Window on the Universe

NEXT MEETINGS: Feb. 10, Mar. 10

STAR PARTIES

The Black Star Canyon site will open on January 21. The Anza site will be open on January 28. 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 session of the Beginners Class will be held at the Heritage Museum of Orange County at 3101 West Harvard Street in Santa Ana on January 6. The following class will be held February 3.

Youth SIG: contact Doug Millar
Astro-Imagers SIG: Jan. 10
Remote Telescopes: contact Delmar Christiansen
Astrophysics SIG: Jan. 20
Dark Sky Group: contact Barbara Toy

Big Science in Small Packages

By Marcus Woo

About 250 miles overhead, a satellite the size of a loaf of bread flies in orbit. It's one of hundreds of so-called CubeSats—spacecraft that come in relatively inexpensive and compact packages—that have launched over the years. So far, most CubeSats have been commercial satellites, student projects, or technology demonstrations. But this one, dubbed MinXSS ("minks") is NASA's first CubeSat with a bona fide science mission.

Launched in December 2015, MinXSS has been observing the sun in X-rays with unprecedented detail. Its goal is to better understand the physics behind phenomena like solar flares – eruptions on the sun that produce dramatic bursts of energy and radiation.

Astronaut Tim Peake on board the International Space Station captured this image of a CubeSat deployment on May 16, 2016. The bottom-most CubeSat is the NASA-funded MinXSS CubeSat, which observes soft X-rays from the sun—such X-rays can disturb the ionosphere and thereby hamper radio and GPS signals. (The second CubeSat is CADRE — short for CubeSat investigating Atmospheric Density Response to Extreme driving - built by the University of Michigan and funded by the National Science Foundation.) Credit: ESA/NASA

Much of the newly-released radiation from solar flares is concentrated in X-rays, and, in particular, the lower energy range called soft X-rays. But other spacecraft don't have the capability to measure this part of the sun's spectrum at high resolution—which is where MinXSS, short for Miniature Solar X-ray Spectrometer, comes in.

Using MinXSS to monitor how the soft X-ray spectrum changes over time, scientists can track changes in the composition in the sun's corona, the hot outermost layer of the sun. While the sun's visible surface, the photosphere, is about 6000 Kelvin (10,000 degrees Fahrenheit), areas of the corona reach tens of millions of degrees during a solar flare. But even without a flare, the corona smolders at a million degrees—and no one knows why.

One possibility is that many small nanoflares constantly heat the corona. Or, the heat may come from certain kinds of waves that propagate through the solar plasma. By looking at how the corona's composition changes, researchers can determine which mechanism is more important, says Tom Woods, a solar scientist at the University of Colorado at Boulder and principal investigator of MinXSS: "It's helping address this very long-term problem that's been around for 50 years: how is the corona heated to be so hot."

The $1 million original mission has been gathering observations since June.

The satellite will likely burn up in Earth's atmosphere in March. But the researchers have built a second one slated for launch in 2017. MinXSS-2 will watch long-term solar activity—related to the sun's 11-year sunspot cycle—and how variability in the soft X-ray spectrum affects space weather, which can be a hazard for satellites. So the little-mission-that-could will continue—this time, flying at a higher, polar orbit for about five years.

If you'd like to teach kids about where the sun's energy comes from, please visit the NASA Space Place: http://spaceplace.nasa.gov/sun-heat/

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!

AstroSpace Update

January 2017

Gathered by Don Lynn from NASA and other sources

Dark matter too smooth – A survey of cosmic shear over large parts of the sky have announced results, and they show that the dark matter of the Universe is less clumpy than expected, but only by about 10%. Cosmic shear is the effect that gravitational lensing has on the apparent shapes of galaxies, so can be used to determine where mass (regular or dark matter) is located. The amount of clumpiness was predicted by running computer simulations of the evolution of the Universe, starting with the shapes seen in the cosmic microwave background (CMB). This means that at least one of the following needs adjusting: Our understanding of the properties of dark matter, our understanding of the properties of dark energy, the evolution computer simulations, or possibly even our understanding of gravity. 2 other cosmic shear surveys are underway, but they have not progressed far enough yet to release results.

New Horizons (Pluto flyby mission) – More results have been announced from analyzing data from the flyby of Pluto. It appears that Pluto once had a liquid ocean beneath its frozen surface, and that it eventually froze (but only partially, as shown below), expanding and cracking the surface. Such cracks were found, but they are in the wrong place. This likely means that Pluto has a dense spot on one side, and tidal interactions with the moon Charon pulling on the dense spot have slowly changed the rotation of the planet. That would move the cracks from where they should form to where they are now seen. Computer simulations show that the dense spot has to be the smooth bright area known as Sputnik Planitia. This area is believed to be an impact basin (a basin is larger than a crater) that later filled with nitrogen ice. Although nitrogen ice is denser than the water ice that forms much of the crust, it does not seem to be enough extra mass. This likely means that there is still a portion of liquid ocean that has not frozen, and it welled up under the Sputnik area. Liquid water supplies that extra density over the surrounding frozen water that is needed to have changed Pluto's rotation by the amount observed.

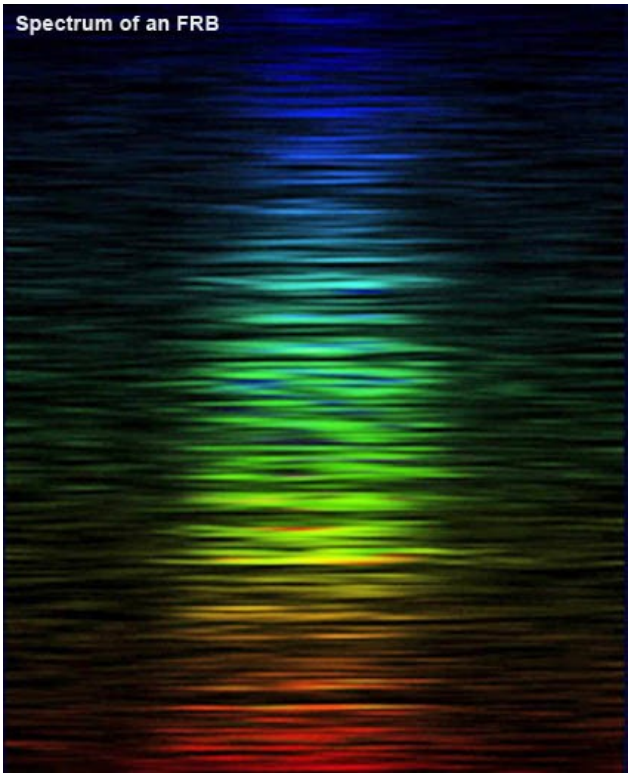
Dawn (asteroid mission) – Ceres does not look icy. Images have revealed a dark heavily cratered world whose brightest area is made of highly reflective salts, not ice. But newly published studies show 2 lines of evidence for ice at or near the surface. Ceres' uppermost surface is rich in hydrogen, consistent with ice. Researchers used Dawn's GRaND instrument (gamma ray and neutron detector) to determine the concentrations of hydrogen, iron and potassium in the uppermost yard (m) of Ceres. GRaND measures the number and energy of gamma rays and neutrons coming from Ceres. Neutrons are produced as galactic cosmic rays interact with Ceres' surface. Some neutrons get absorbed into the surface, while others escape. Since hydrogen slows down neutrons, it is associated with fewer neutrons escaping. On Ceres, hydrogen is likely to be in the form of frozen water. The results showed that there is likely a porous mixture of rocky materials in which ice fills the pores, rather than a solid ice layer. Ice is about 10% by weight in that top yard. GRaND data also showed that materials were processed by liquid water within the interior.

A second study of **Dawn** data focused on craters that are persistently in shadow in Ceres' northern hemisphere. They are so chilly that very little of the ice turns into vapor in the course of a billion years. Researchers found deposits of bright material in some of these craters. In one crater that is partially sunlit, Dawn's infrared mapping spectrometer confirmed the presence of ice. Ice in cold traps has previously been spotted on Mercury and the Moon. All of these bodies have small tilts with respect to their axes of rotation, so their poles are extremely cold and peppered with persistently shadowed craters. Scientists believe impacting bodies delivered this ice to Mercury and the Moon, or it was generated by solar wind. On Ceres, however, it could also have come from Ceres' crust. Water molecules on Ceres have the ability to form vapor in one place and freeze again in cold places, such as shadowed craters.

Vacuum birefringence – The theory of virtual particles popping in and out of existence everywhere, as part of quantum theory, was developed about 80 years ago. The idea is that the extremely tiny length of time that the particles exist keeps their properties smaller than the Heisenberg uncertainty, so they don't break the laws of conservation of energy. Some consequences of virtual particles have been verified in experiments with subatomic particles, but the fact that the virtual particles should polarize passing light, known as vacuum birefringence, has not been observed. This is because it takes an incredibly strong magnetic field to produce the effect strongly enough to measure. Recent observations of a neutron star (they are strongly magnetic) 300 light-years away have shown polarization of about the amount predicted for birefringence. However, not all other sources of polarization have been ruled out, so further work is needed before concluding vacuum birefringence has been observed. The effect should show more strongly in X-rays than in visible light, but none of the current X-ray space observatories is equipped to measure such polarization.

Non-supernova – I reported here in March that the brightest supernova ever had been observed. Cancel that. A new study proposes that the light came from a supermassive black hole of at least 100 million solar masses ripping apart and swallowing a star that passed too close. Such an event is even rarer than a superluminous supernova, since only about 10 star swallowings have ever been seen. Such events do not normally produce so much light, at least with such massive black holes, but calculations show that brightness could occur if the black hole is very rapidly spinning. The event occurred in a galaxy about 4 billion light-years away.

Star oblateness – The faster a star rotates, the more centrifugal force pushes out it middle, making the equatorial diameter more than the polar diameter. This flattening at the poles is called oblateness. A team of researchers found a way to measure the equatorial and polar diameters of a star by observing the vibrations that echo through the star. The Kepler planet-finding space telescope is good at observing such vibrations. The technique was applied to a star known as Kepler 11145123, a known slow rotator, and the surprising result is that it is even closer to round (less oblate) than its slow rotation should produce, only 1 part in 500,000 difference between the diameters. This is the roundest natural object ever measured. The astronomers involved suggest that magnetic fields in low latitudes could explain why it didn't measure up to theory. They intend to use the technique on other Kepler stars.



Fast radio bursts (FRB) – Another FRB has been observed. Only a few dozen have ever been seen, many in archived radio data, and they typically last about a millisecond, so no follow up observation is possible, unless they can also be observed in non-radio wavelengths and they last longer there. Follow up observations have been attempted in other wavelengths, such as visible light, but so far nothing has turned up. At different radio frequencies each burst arrives slightly delayed, and the amount of delay is typical for a radio signal that has traversed intergalactic space (ionized particles between galaxies cause the wavelength-dependant delay). The direction of the latest FRB was fairly well determined, and only 6 distant galaxies lie within the possible source area. It likely came from one of those 6. The spectrum of this burst tells us a lot about the space that the burst traveled through on the way to Earth. So we still do not know what causes FRBs, but progress is being made.

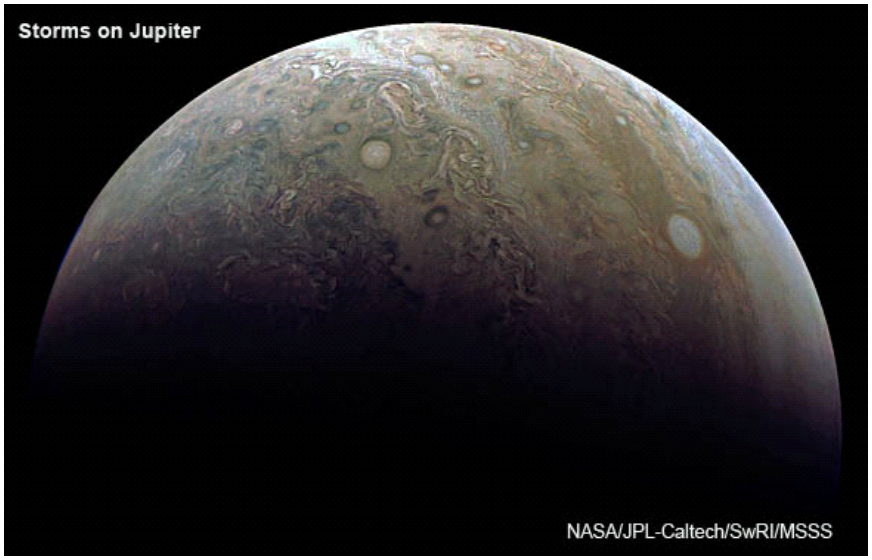
Schiaparelli (European Mars lander) – Progress is being made investigating the Schiaparelli failure on October 19. The device that measures inertia of the spacecraft was expected to overload when the parachute deployed, so the spacecraft control computer was programmed to ignore it for a short time. Unfortunately the short time was too short, and erroneous inertia data was used in the calculations of height above the surface, resulting in the retro rocket shutting off when Schiaparelli was still 2.3 miles (3.7 km) up, and it dropped to the surface rather hard. It probably exploded on impact since most of the rocket fuel remained unused. The ExoMars Trace Gas Orbiter, which shared the ride with Schiaparelli most of the way to Mars, is in orbit and operating normally.

Beagle 2 (British Mars lander) – Progress is being made investigating the Beagle 2 failure in December 2003. The craft was actually found in images taken by the Mars Reconnaissance Orbiter (MRO) in early 2015 (it took so long to find it because it wasn't where it was targeted to land), but it was difficult to tell much since the spacecraft showed up as only a few pixels in the best images. A new technique was used: software was used to generate what should have been seen by MRO under different sun angles and with different levels of deployment of the spacecraft on the surface. The condition that best matched the MRO images was with only 3 of the 4 solar panels deployed. Until the last solar panel deploys, the radio antenna is blocked, and will not operate. So Beagle 2 likely landed safely, but failed to deploy the last solar panel, and never gained radio contact with Earth. The next best match in images was where all solar panels deployed, but the spacecraft landed on a steep slope. This could alternatively explain the failure. Mars Express, which shared the ride with Beagle 2 most of the way to Mars, is still in orbit and operating normally after 13 years.

Curiosity (Mars rover) is finding varied patterns of rock composition as it climbs up Mount Sharp, indicating that the conditions changed in the early history of Mars as those layers of sediment were laid down, apparently at the bottom of a lake. Also the minerals that later filled cracks in the sediment varied, showing a long history of changing environment on the red planet. For example, the higher regions have hematite as the predominant iron mineral, where lower elevations had magnetite. Hematite suggests warmer conditions when it formed. Boron has increased with elevation. Boron on Earth is often found in deserts where mineral-laden water has evaporated.

John Glenn, the first American to orbit the Earth, in February 1962, has died at age 95. Two astronauts had previously flown suborbital flights, and the Soviet Union had orbited 2 cosmonauts. Much of the American public felt Glenn's flight had caught up the U.S. with the Soviets in the race to space. With Glenn's death, none of the original group of 7 astronauts is still alive. Glenn was a decorated pilot during World War II and the Korean conflict. He spent 24 years as the Senator from Ohio. At age 77 he talked NASA into an experiment to see how older people survive the rigors of space travel, and so made his 2nd flight to space, this time on the Space Shuttle. The country has lost a hero.

Star names – The IAU accepted official names and boundaries for the constellations in the 1920s. They thought about approving official names for the stars, but didn't come to agreement for about 90 years. Numbered or Greek letter names were OK, like Alpha Orionis, but not traditional or common names, like Betelgeuse. In an overachievement, the IAU this past year approved 212 common star names. Bet you never heard of most of them (like Merga, Azelfafage or Mesarthim). Actually, the IAU approved a few previously, mostly names invented in the last few years for bright stars with exoplanets known to orbit them. For example, 51 Pegasi, which has a planet, officially became known as Helvetios. Well, it's long overdue, since some stars were commonly known by 2 or more different names, and a few different stars were known by the same names. Then there were the spelling variations. Now star names are official. Of course there are hundreds more stars that have been referred to by common names that didn't make the IAU list, not yet.



Juno (Jupiter orbiter) has still not performed its engine burn that is intended to lower Juno's orbit to the planned science orbit, due to slow engine valve operation during test. However, the perijove (low point in its orbit) is low enough to perform all planned science; it just takes longer between the low science-gathering passes. Controllers are still working on how to safely lower the orbit, but it does not present a problem even if not lowered. Great images of Jupiter's poles have been taken, along with other data.

Instant AstroSpace Updates

The return-to-flight launch of the SpaceX **Falcon 9** rocket, since the explosion of one during a routine fueling test September 1, has been postponed from December to January in order to complete the accident report and obtain FAA approval for the launch. It is a launch of 10 advanced Iridium satellites from Vandenberg in California.

Another supply craft heading for the International Space Station (ISS) failed, this time a Russian **Progress** that suffered an "anomaly" (failure) during 3rd stage firing. All supplies onboard ISS are at good levels however.

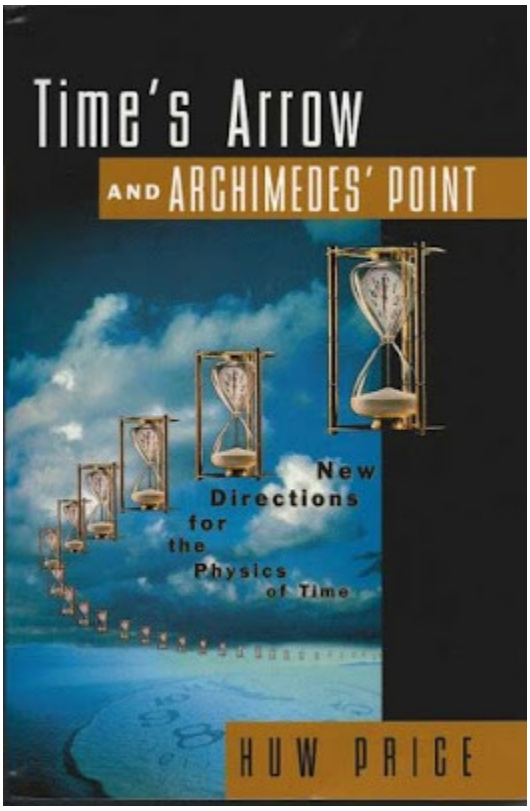
Construction of the **James Webb Space Telescope** has been completed, and it will undergo testing until its planned launch in October 2018. It is considered the replacement for the Hubble Space Telescope, with over 7 times the light-gathering power, though it is skewed toward infrared observations more than Hubble is (because really distant objects are red-shifted into infrared).

Greetings from Palmia Observatory

This week the weather has just been terrible for most observing opportunities. The planned observing of the light curve for eclipsing binary star Algol was itself eclipsed by clouds and rain. The OCA black star canyon party was also cancelled, not because of clouds on Saturday, but
because of the very wet soaking in the canyon. But all is not lost and we have a lot to report on this week including one unscheduled observing practice session and plenty of indoor physicist wannabe activity.

So, before getting to the one Algol practice observing session, I wanted to review the direction of time controversy, the latest release of top ten fails in astronomy (mostly amateur astronomy) and the online availability of a Python programming class.

First up, remember the books I mentioned in the November 5 post that we had available on our recent Mediterranean cruise, one of which was "The physical basis of the direction of time", by Dieter Zeh. In the November 22 post, I mentioned the book that had the most pages read. Well as previously reported, I didn't make any progress on that book, but during the recent rain induced indoor activity, I had a chance to begin studying it. Well, I found it a little too difficult, essentially in its level of mathematics, so I opted to begin reading an easier book on the same topic. See the book cover below. Well, I've got through maybe a hundred pages and Price's book is little easier to read, but he takes along time to get going. Remember that the whole issue regarding the direction of time is that the laws of microphysics, such as quantum mechanics, and many laws of macrophysics, just consider that laws of motion of balls on a pool table, are valid for both positive time and negative time. If you are shown a portion of a video of balls moving on a pool table it is often not clear how to tell if you are viewing the video in the forward direction or the reverse direction. The same with physical laws which are valid for positive and negative time. It's only when we consider longer portions of time, when the 2nd law of thermodynamics, and situations of life, birth and decay occur, that we are sure that time only moves in the positive direction. But Price and Zeh argue that we should not be so fast to dismiss the alternative view of negative time, after all if the laws of quantum physics are valid for both positive and negative time, where does this apparent time asymmetry come from? My impression is that it comes about because of the very low entropy at the time of the big bang and we just naturally move in the direction of increasing entropy. But Price and Zeh again caution against going with the situation, which seems no natural to us, that we might be getting fooled. Who knows and how will we tell? For me, at least this topic forces me to review the laws of physics I am currently studying and asking that question, What happens if I use negative time in the equations?



This book is easier and a big picture review of the direction of time controversy

Anyway, we will see what happens in the next hundred pages. Where do you stand on this time direction issue?

I got an email from Science Squad and Gravity Guy, Ken, who forwarded another blog (hey, what are you doing reading somebody else's astronomy blog anyway?) which provided a very humorous list of the top 10 astronomy fails. Readers of this blog now full well some of the failures that happen as amateur astronomers try to improve their observing skills. I myself have personally done more than half of these fails, but these fails offer a chance at a lesson learned and an opportunity to get better. I've experienced the effect of cold on my batteries, and of screws coming loose and of typing in the wrong date and having the scope slew to below the horizon when the target is obviously high in the sky. Anyway, all amateur astronomers will recognize at least a couple of these fails. They are all funny, especially after you calm down and just enjoy the humor of the situation. Check them out at: https://thebrainbank.scienceblog.com/2016/12/12/top-ten-astronomy-fails/

Thank you for that funny reference, Ken!

The last topic for physicist wannabes is a new online course on Python programming available from UCI. I think I am going to sign up for this course. I used to do a lot of C programming over my working career and was a little disappointed that the programming community is moving away from C to newer languages like Python. Python is widely used in the astronomical community for analysis and I want to be able to understand it and maybe even do a little programming. At the same time, at various physics colloquia, I hear that even Python is being left behind for newer languages. Wow, what to do? I think I will still give it a go and try my hand at it. If anybody else is interested in courses starting up in January, then check out: https://ce.uci.edu/courses/

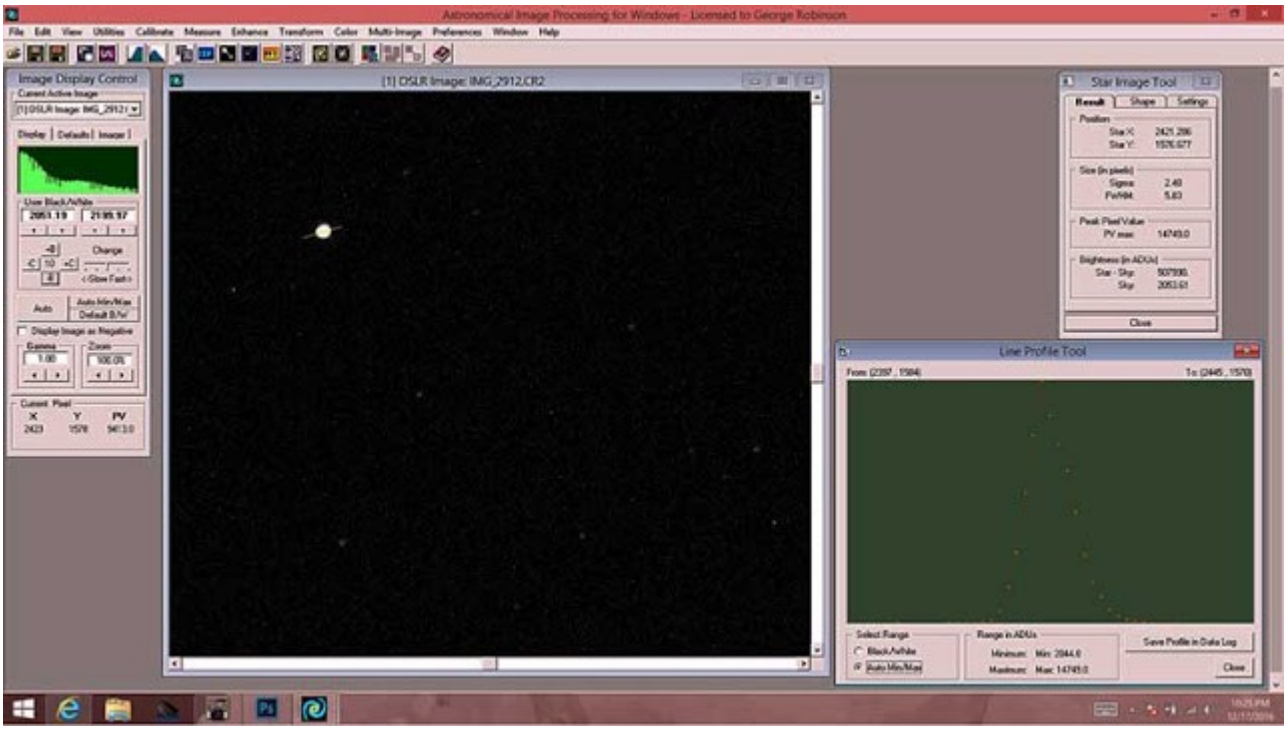
Finally, we can get to the latest photos and analysis gathered during the one clear evening last week. Remember that in the December 6 post, I described the recognition of a possible flaw in the observing plan. For my location in polluted city lights, I am not likely to be able to see and spot and move my camera to point at the dim Algol at magnitude 3.3. So, remember, because of this, I enlarged the camera field of view by using 150mm focal length rather than the previously set 600 mm focal length. The following photo shows the entire field of view for 150 mm telephoto lens.

The field of view with this lens setting is 5.5 by 8.3 degrees. Hopefully, this is large enough that any pointing error is small enough that the dim Algol is still in the camera frame. Since this image was taken using the old fashioned approach of star hopping from one recognized star to another until finally arriving at the target, Algol, the image was submitted to Astrometry.net and the screenshot below shows, yep, the camera was indeed pointing in the right direction.

Algol, brightest star near center in this frame, using 2 second exposure with 150mm telephoto
The other dim stars in this view are measured to be around magnitude 6.1, much dimmer than Algol at 2.1

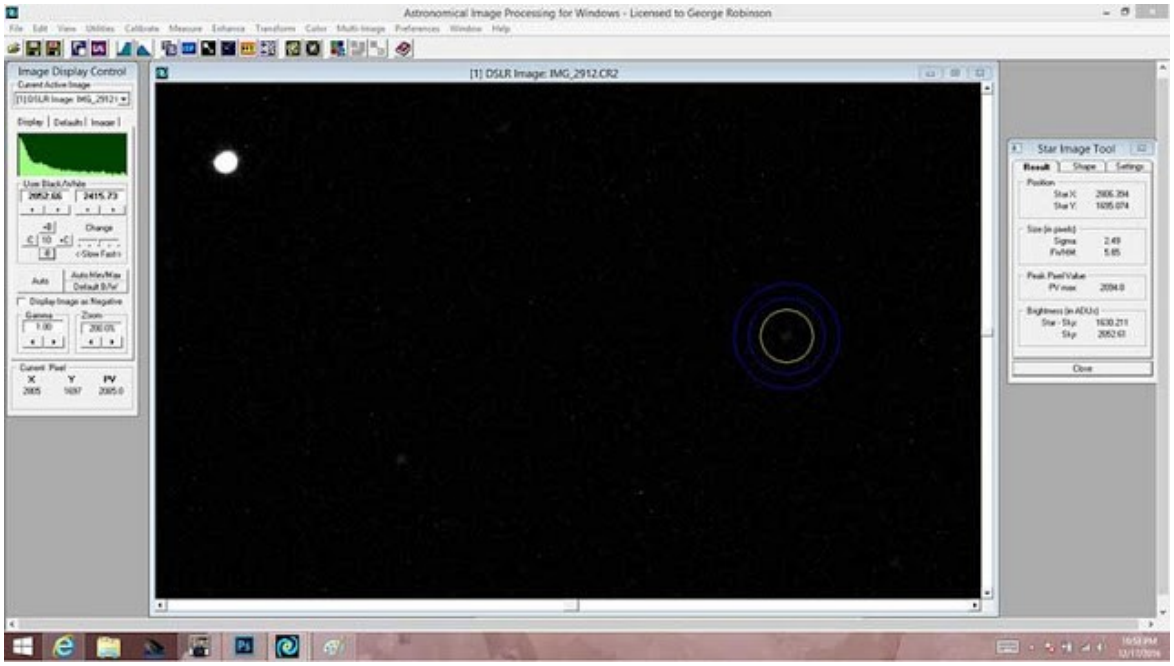
Astrometry.net screenshot showing that the camera frame does indeed include Algol near center
Note the large number of NGC objects in the same field of view around Algol

The other part of the observing plan that needed to be verified is what the proper exposure setting for 150 mm telephoto lens should be. My previous estimate was that 2 seconds would be required, rather than the 1/2 second used for 600 mm lens setting. The AIP4WIN software analysis of Algol's image shows that 2 seconds is just a little bit too long. Note in the screenshot below that the light profile, along the chosen line going right through Algol, shows just one or two pixels with values of 14,749 counts. This value is just a bit too high and means the light curve measurement will be off due to the saturation at these levels. For a one second exposure, the maximum pixel count value should drop to about 1/2 that high value and this should be a good setting and even when the minima is captured there should still be enough pixel counts to get a good reading and sufficient signal to noise ratio.



AIP4WIN screenshot showing star profile and total pixel brightness for Algol

Using the analysis tools in AIP4WIN, the dim fuzzy objects show up at about magnitude = 7.1 in the screenshot below. Note having a lot of bright objects around Algol is actually a good thing because during each eclipse, when Algol dims to 3.3, it will still be easy to identify Algol, since it will be much brighter, by a couple of magntidues, than anything else in the image, the one exception being a (assumed, based on initial measurements) magnitude 4.7 star



Expanded screenshot view of fuzzy objects just dimly visible in 2 second exposure

So, with the December 15 eclipse date overturned by rain, the next opportunity is December 18. But now I have found a discrepancy in when the eclipse will occur. My Sky and Telescope annual paper calendar lists the eclipse minima occurring at 8:20 pm PST, and the Sky and Telescope online eclipse calculator shows the minima to occur at 7:46 pm PST. Which one is the right time? I don't know, so I fired off an email o Sky and Tel magazine, but have not received an answer yet. Maybe, if I am able to gather some measurements and can plot the light curve we will see exactly when the eclipse is at minima. The big difference for my observing plan is that I had always been planning to do this measurement at about 11:20 pm, which was the eclipse minima on December 15. At the earlier time now, Algol will not be as high in the sky and my preferred observing location might not work. I think I will just have to move my site from the backyard patio to the front parking lot. I still prefer not to drive to some dark sky site because the total observing time is expected to cover 4-5 hours and I do prefer the comforts afforded here at the observatory.

So, based on the above findings, the revised observing plan for the next Algol eclipse is to use 1 second exposure, instead of 2 seconds. The next eclipse is for Sunday (tonight), but unfortunately the weather forecast is for mostly clear but with winds between 23-33 miles per hour with gusty wind up to 53 mph. Wow, it doesn't look too good, but I will probably take a try at it anyway. If my tripod tips over, well, I guess it was just nature's way of saying I needed a new camera (and hey, its just before Christmas, perfect timing?).

Until next time,

If you are interested in things astronomical or in astrophysics and cosmology

Check out my blog at www.palmiaobservatory.com

Astrophotography need not be intimidating for the beginner. Afocal imaging is challenging but can be a very rewarding way of breaking into this aspect of the hobby. Laura Macdonald of Lakewood, Colorado took this picture of the Moon with her cell phone and a small refractor on December 9th. For one of her first pictures, this is an excellent effort and we expect to see more pictures from her in the future!

On another note, Ms. Macdonald came to my attention via a Facebook astronomy group where she posted her first images, and was derided by (supposedly) more experienced astronomers for basic errors. The anonymity of social media is no excuse to abandon fundamental respect for others, in astronomy or any other endeavor. We are ambassadors of our hobby so let's do our best to make sure we don't run off the newcomers! After all, each of us was once a newbie, and none of us know all there is to know about the hobby.

Let's make 2017 great by committing to a more enlightened approach on social media to our hobby in particular and life in general!

Meade Classic LX200 10" Telescope For Sale. Eyepieces Included (1.25"): Televue Panoptic 22mm; Televue Panoptic 35mm; Televue Nagler Type-2 12mm; Meade Super Plossl 26mm. $1850. Call Chris at 714-296-7683

Astro Physics Mount for Sale

1. **AP 1200 GTO Mount with keypad**
2. **1200 Precision-Adjust Rotating Pier Adapter with Azimuth Bearing (1200RPA) for 10" ATS Pier.**
3. **One 18 pound Counterweight for 1.875" Diameter Shaft**
4. **16" Mounting Plate**
5. **Losmandy Polar Alignment Scope - (PASILL4)**
6. **Polar Alignment Scope Cover - (Q12700)**

$6,500.00

Contact Rick at 310-489-8561

OCA 2017 Banquet

Date: January 14 2017 (Saturday night)

Theme: 2017 Solar Eclipse

Time: 7:00 PM - 9:30 PM

Place: JT Schmid's, Anaheim

2610 E. Katella Ave, Anaheim, CA 92806

Cost: Free entry, but you must pay for the meals & drinks you order. Dinner menu ranges from $12 salads, $15 hamburgers to more expensive full dinner meals.

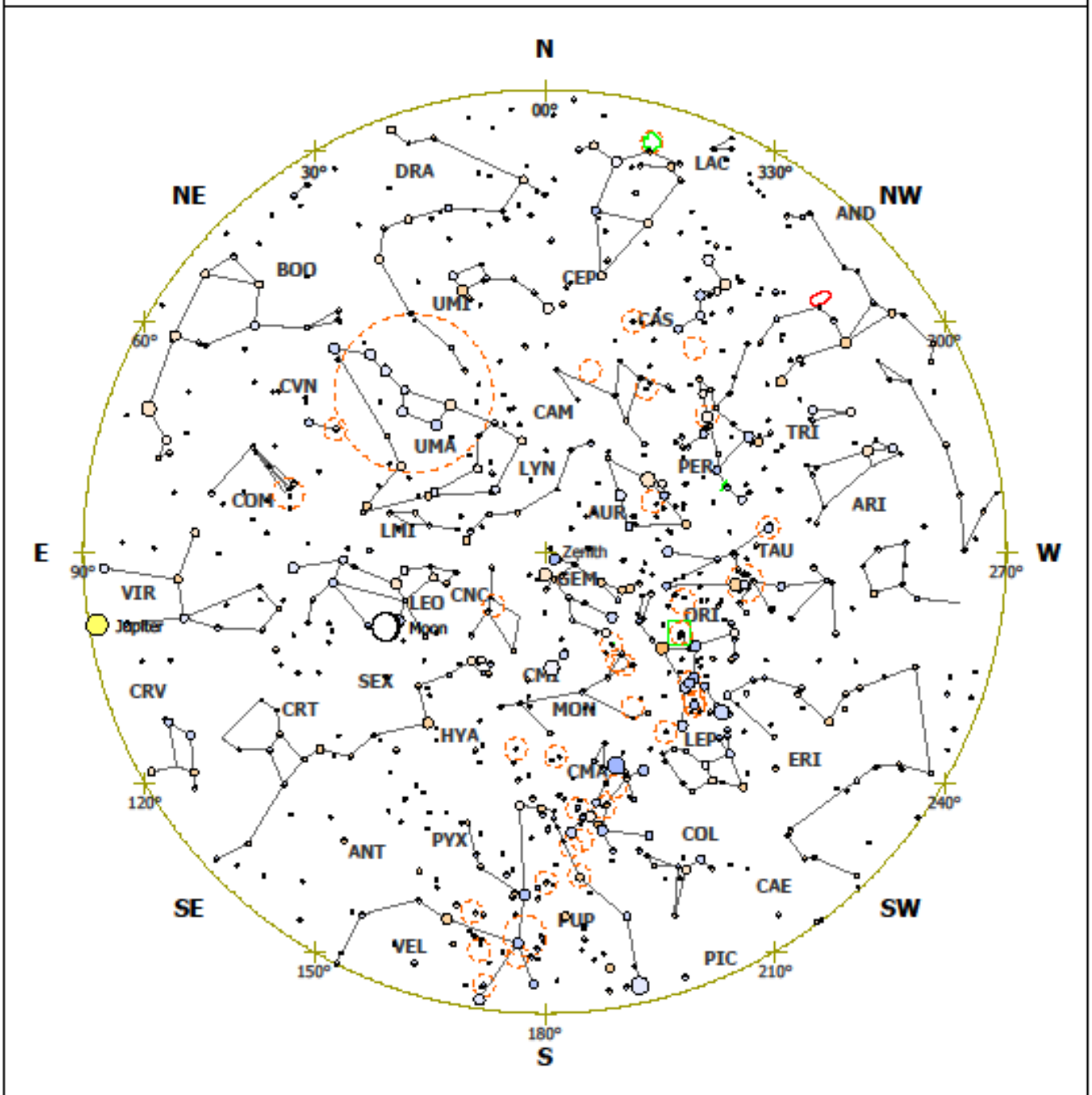
Plenty of free parking in the Artic Transportation lot A behind JT Schmid's.

Speaker: Joel Harris, Solar Eclipse Expert

Will raffle off a few prizes, including an Anza Pad paid for 1 year along with a few restrictions.

Seating will be limited so please email Steve Short to reserve the number of people in your party. (nightskytours@hotmail.com)

Whole Sky Chart - January 2017



Symbols

- Galaxy
- Quasar
- Globular cluster
- Open cluster
- Bright nebula
- Dark nebula
- Planetary nebula
- Supernova remnant
- Antisolar point
- Asteroid
- Comet
- Meteor shower

Magnitudes and temperatures (× 1000 K)

-6	-5	-4	-3	-2	-1	0	1	2	3	4	5
40	25	20	15	10	8	7	6	5	4	3	2

Location

United States, CA, Long Beach
Lon: 118° 11′ 18″ W, Lat: 33° 46′ 01″ N
Time zone: GMT-08:00
Elevation: 29 feet above sea level

Time

Local time: 2017-01-15 00:00:00
Universal time: 2017-01-15 08:00:00
Julian date: 2457768.83333
Sidereal time: 07h 47m 06s

View

Field of view: 200° 00′ 00″
RA: 07h 47m 06.17s, Dec: +33° 46′ 01.0″
Azi: 180° 00′ 00.0″, Alt: +90° 00′ 00.0″
Constellation: Gemini

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The Newsletter of the Orange County Astronomers

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