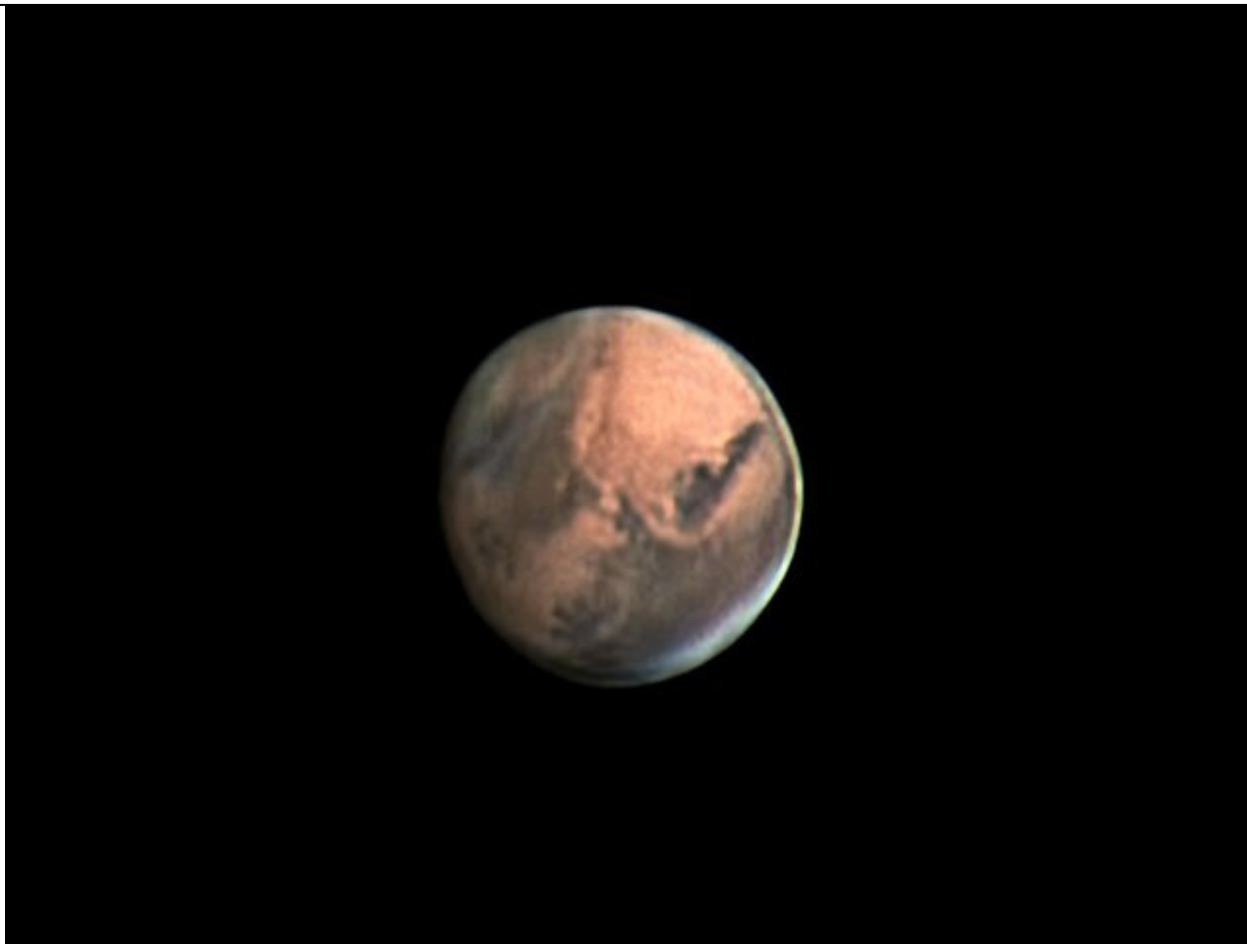
SIRIUS ASTRONOMER

www.ocastronomers.org

The Newsletter of the Orange County Astronomers

July 2016 *Free to members, subscriptions $12 for 12 issues* **Volume 43, Number 7**



We wanted images of the Mars opposition, and Pat Knoll delivered! This image was obtained on June 16, 2016 from Pat's observing site at Kearney Mesa, CA (near San Diego). Pat used his Meade LX-200 with a ZWO ASI 120MC imager and 2X Barlow to obtain this image. Pat's notes indicate poor seeing, but you can't tell from this image!

OCA CLUB MEETING

The free and open club meeting will be held July 8 at 7:30 PM in the Irvine Lecture Hall of the Hashinger Science Center at Chapman University in Orange. This month's speaker is Jeffrey Lovelace of CSU Fullerton, discussing the observation of gravitational waves from merging black holes.

NEXT MEETINGS: August 12, Sept. 9

STAR PARTIES

The Black Star Canyon site will open on July 30. The Anza site will be open on July 2 and July 30. 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 July 1. The following class will be held August 5.

NEW! Teen Observers Group: contact Doug Millar
GOTO SIG: contact Mike Bertin
Astro-Imagers SIG: July 12, Aug. 9
Remote Telescopes: contact Delmar Christiansen
Astrophysics SIG: July 15, Aug. 19
Dark Sky Group: contact Barbara Toy

Hubble's bubble lights up the interstellar rubble

By Ethan Siegel

When isolated stars like our Sun reach the end of their lives, they're expected to blow off their outer layers in a roughly spherical configuration: a planetary nebula. But the most spectacular bubbles don't come from gas-and-plasma getting expelled into otherwise empty space, but from young, hot stars whose radiation pushes against the gaseous nebulae in which they were born. While most of our Sun's energy is found in the visible part of the spectrum, more massive stars burn at hotter temperatures, producing more ionizing, ultraviolet light, and also at higher luminosities. A star some 40-45 times the mass of the Sun, for example, might emits energy at a rate hundreds of thousands of times as great as our own star.

Image credit: NASA, ESA, and the Hubble Heritage Team (STScI/AURA), of the Bubble Nebula as imaged 229 years after its discovery by William Herschel.

The Bubble Nebula, discovered in 1787 by William Herschel, is perhaps the classic example of this phenomenon. At a distance of 7,100 light years away in the constellation of Cassiopeia, a molecular gas cloud is actively forming stars, including the massive O-class star BD+60 2522, which itself is a magnitude +8.7 star despite its great distance and its presence in a dusty region of space. Shining with a temperature of 37,500 K and a luminosity nearly 400,000 times that of our Sun, it ionizes and evaporates off all the molecular material within a sphere 7 light years in diameter. The bubble structure itself, when viewed from a dark sky location, can be seen through an amateur telescope with an aperture as small as 8" (20 cm).

As viewed by Hubble, the thickness of the bubble wall is both apparent and spectacular. A star as massive as the one creating this bubble emits stellar winds at approximately 1700 km/s, or 0.6% the speed of light. As those winds slam into the material in the interstellar medium, they push it outwards. The bubble itself appears off-center from the star due to the asymmetry of the surrounding interstellar medium with a greater density of cold gas on the "short" side than on the longer one. The blue color is due to the emission from partially ionized oxygen atoms, while the cooler yellow color highlights the dual presence of hydrogen (red) and nitrogen (green).

The star itself at the core of the nebula is currently fusing helium at its center. It is expected to live only another 10 million years or so before dying in a spectacular Type II supernova explosion.

This article is provided by NASA Space Place.

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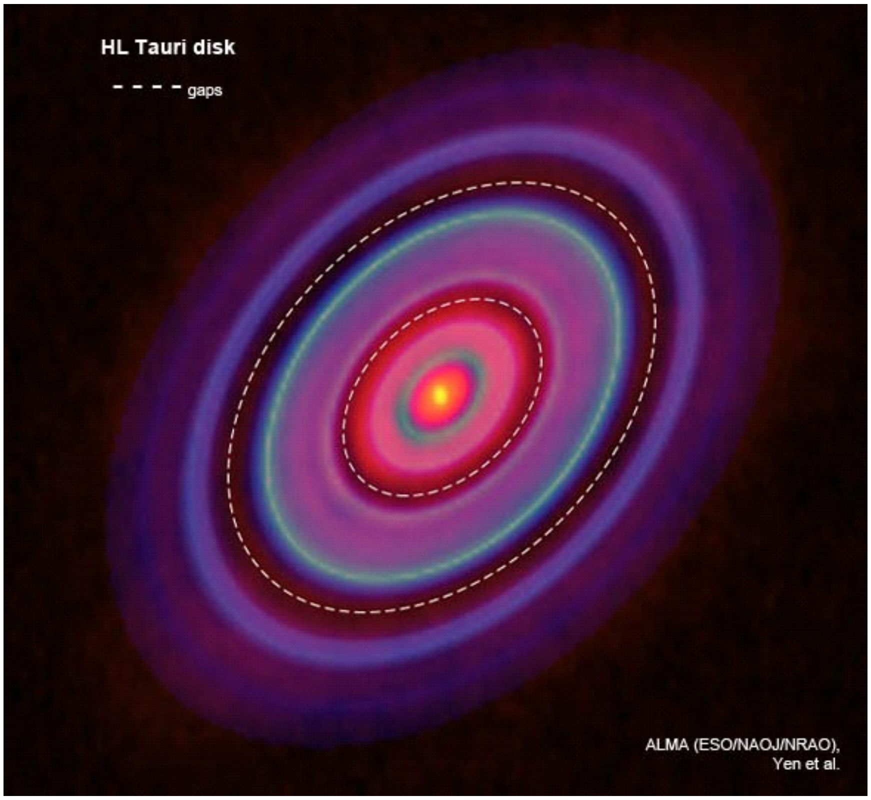
AstroSpace Update

July 2016

Gathered by Don Lynn from NASA and other sources



Planet formation – In 2014 ALMA (radiotelescope array in Chile) imaged a disk with gaps in it surrounding the young star HL Tauri. Such gaps usually indicate that a planet, too small to be seen, is gravitationally pulling in the disk material in order to cause the gap. But planet formation theory says that a planet should take longer to form than the million year age of the star. ALMA imaged the dust in the disk. A new study measured the gas in that disk. A planet would clear out the gas in its gap, while other explanations for the dust gap would not also have a gas gap. There are gas gaps in HL Tauri's disk. The sizes of the gas gaps allow calculation of the size of planets that would create them: 0.8 and 2 Jupiter masses. In addition, a large planet has been discovered orbiting the star CI Tauri, which is also theoretically too young for a large planet to form. Planet formation theorists need to rework.

Star feeding frenzy – In 1936, the young star FU Orionis began gobbling material from its surrounding disk of gas and dust. During a 3-month binge, the star became 100 times brighter, heating the disk to as much as 12,000°F (7000°K). FU Orionis is still devouring gas to this day, although not as quickly. This brightening is the most extreme event of its kind confirmed around a star the size of the Sun. The intense baking of the star's surrounding disk likely changed its chemistry, permanently altering material that could one day turn into planets. It is about 1500 light-years away. A new study compared new infrared observations from SOFIA (airborne observatory) to observations made with Spitzer Space Telescope in 2004. Using these and other historical data, researchers found that FU Orionis had continued its ravenous snaking after the initial brightening event: The star has eaten the equivalent of 18 Jupiters in the last 80 years. The recent measurements showed researchers that the total amount of visible and infrared light energy from FU Orionis decreased by about 13% over the last 12 years. Astronomers predict that FU Orionis will run out of hot material within the next few hundred years. At that pint, the star will return to the state it was in before the 1936 event. Scientists are unsure what set off the feeding frenzy. If our Sun had an event liked FU Orionis back when the Sun's planets were forming, this could explain why certain elements are more abundant on Mars than on Earth.

Exoplanets found – A university student has discovered 4 new planet candidates in Kepler (planet-finding space telescope) data. The computer program being used to find planets (or planet candidates until confirmed) being used by the Kepler team had missed these. One of the newly found planets is Mercury-sized, one is slightly larger than Neptune, and the other 2 are roughly Earth-sized. The largest one is in the habitable zone (where liquid water could exist) of its star. However, it is likely a gas giant like Neptune, so would have no rocky surface. But if it has moons, they might have oceans and possibly support life. It takes 637 Earth days to orbit its star, and is 3200 light-years from us. Of the 5000 Kepler planet candidates, only 20 have longer orbits than this.

Limestone planet – A group of researchers using the Keck I telescope in Hawaii and the Hubble Space Telescope have discovered a planet that is having its surface layers devoured by its white dwarf star. The material being devoured appears to be calcium carbonate, which is what limestone is made of. Limestone on Earth is principally made from the shells of marine life. There are non-biological ways to make calcium carbonate, so this is not proof that life existed on the planet. The new observations showed large enhancements of carbon and mild enhancements of calcium and oxygen in the material being accreted by the star. The high levels of carbon are unseen elsewhere.

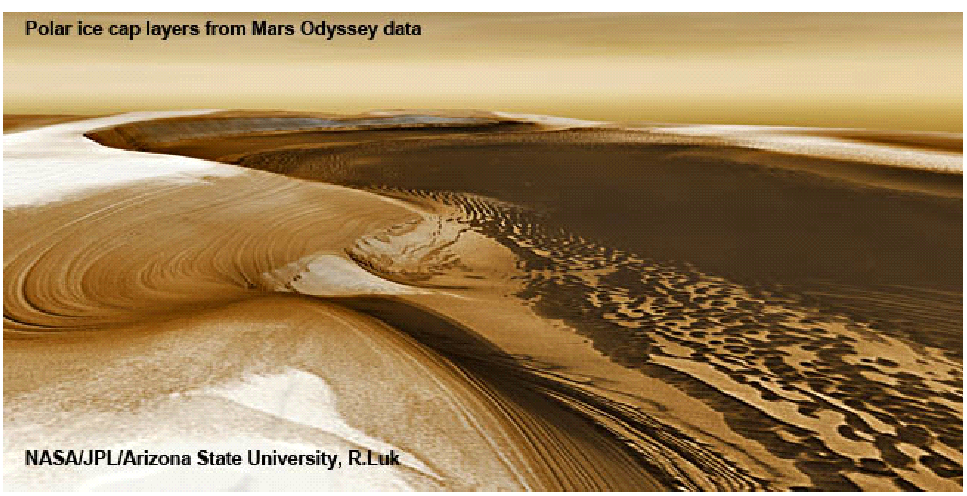
Black hole seeds – Researchers combined data from Chandra X-ray Observatory, Hubble Space Telescope, and Spitzer Space Telescope to identify cosmic seeds in the early Universe that should grow into supermassive black holes. It has long been debated whether the supermassive black holes found in the centers of nearly all large galaxies grew all the way from black holes merely the mass of a star (which are known to be formed by supernovas) or if a much larger black hole could form from collapse of a giant gas cloud. The new study supports the latter. The study found strong candidates for black hole seeds. Both matched the theoretical profile in infrared and X-ray data, of a giant cloud collapsing to a black hole. Estimates of the candidates' distances suggest we are seeing them as they were less than a billion years after the Big Bang. The team plans to obtain further X-ray and infrared observations to check whether these objects have more of the properties expected for black hole seeds.

Hubble Constant – Continued measurement of supernovas in galaxies has allowed a more precise number to be calculated for the Hubble Constant, which is the rate of expansion of the Universe. It is 2.4% smaller than the best previous measurement. We also have a very good measurement of what the Hubble Constant was at the time of the Cosmic Microwave Background (CMB) creation, 380,000 years after the Big Bang. There is a mathematical formula showing how that should change over time, and the new Hubble Constant measurement does not quite fit within the accuracy bounds of that formula applied to the CMB measurement. The formula depends on the amount and properties of dark energy, dark matter, and ordinary matter, so one of those or one of the Hubble Constant measurements has an unexpected error in it.

Heavy elements – The Big Bang created almost exclusively hydrogen and helium. The elements between helium and iron in the periodic table are created slowly by the nuclear reactions in ordinary stars. The elements with atomic weights beyond iron are more difficult to create, and yet fair amounts of them are found in planets, asteroids, stellar disks, and interstellar material. Any process that creates them has to add a whole lot of neutrons or protons and a huge amount of energy to lighter material in a very short time, before the intermediate products have time to radioactively decay back toward lighter elements. Theoretically such heavy elements can be created in supernovas and in collisions with neutron stars. A new study of the dwarf galaxy Reticulum II showed it to be particularly rich in elements beyond iron. 10 other similar galaxies in the same study showed far lower levels. The measurements of Reticulum II best fit what would be expected if 2 neutron stars collided there several billion years ago, supporting the collision theory over the supernova theory.

Leoncino – A faint blue galaxy, known as AGC 198691 and nicknamed Leoncino, about 30 million light-years away in Leo Minor may shed new light on conditions at the birth of the Universe. Astronomers recently found that the galaxy contains the lowest level of elements heavier than helium of any galaxy, or for that matter, any gravitationally bound system of stars. Low heavy-element abundance is a sign that very little stellar activity has occurred. The galaxy is 29% lower than the previous record holder. Leoncino is a dwarf galaxy, only about 1000 light-years across and containing only several million stars.

Hypervelocity stars – Astronomers can use the motions of stars to determine where mass is located in our Milky Way. New studies are using hypervelocity stars in this quest. When a star is moving so fast that it will escape our galaxy, or nearly so, it is termed hypervelocity. Most of these were flung out by gravitational interaction of a (formerly) double star with the supermassive black hole at the center of our galaxy. Thus they tie together conditions at the galaxy center and at their current location. Statistical arguments based on the number of binary stars near the center of the galaxy show that there should be more than 1000 hypervelocity stars currently within 33,000 light years of the center, and far more in the outer reaches of the Milky Way's halo. However, only a few dozen have yet been found. The 1st one was found in 2005. The search is on to find more hypervelocity stars, so that we can learn about the mass distribution of the Milky Way in more areas, and so that statistical work can be done on them. The Gaia satellite, launched in 2013, is measuring velocities of perhaps a billion stars, so should discover many hypervelocity stars, and should give more precise information on the known ones. At least one is known to have been kicked into hypervelocity by a different mechanism, that involving its companion star exploding in a supernova. Hypervelocity stars seem to be more common at certain galactic longitudes, and that has yet to be explained.



Martian ice age – Scientists using data from the SHARAD radar aboard the Mars Reconnaissance Orbiter have found a record of the most recent Martian ice age recorded in the planet's north polar ice cap. The new results agree with previous computer models that indicate a glacial period ended about 400,000 years ago, as well as predictions about how much ice would have been accumulated at the poles since then. Mars undergoes variations in its tilt and the shape of its orbit over hundreds of thousands of years. These changes cause substantial shifts in the planet's climate, including ice ages. Analysis of hundreds of radargrams showed a boundary in the ice that extends across the entire north polar cap. Above the boundary, the layers accumulated very quickly and uniformly, compared with the layers below them. On Earth, ice ages occur when the high latitudes become cooler than average for thousands of years, causing glaciers to grow toward the mid-latitudes. In contrast, Martian ice ages occur when its poles become warmer than lower latitudes. Then the polar caps retreat and water vapor migrates toward the equator, forming ground ice and glaciers at mid-latitudes. When the warm polar period ends, polar ice begins accumulating again, while ice is lost from mid-latitudes. This polar regrowth after the ice age is exactly what the new study found.

Martian tsunamis – A new study found that about 3.4 billion years ago 2 huge meteoroids smashed into the ancient ocean on Mars. This created 400 ft high tsunamis that reshaped the ocean shoreline and left behind areas of sediments and boulders. Previously evidence of the shoreline of the ancient ocean was found, but there are missing pieces. The ancient tsunamis can explain the missing parts. The 1st tsunami left large backwash channels. The 2nd apparently happed when the climate was colder and left deposits of frozen debris. Impacts with tsunamis likely occurred multiple times, so the study team will continue to look for more tsunami evidence.

Uranus glows more faintly than Neptune in terms of released internal heat, and the reason has been a long-standing mystery. A new theory of the internal composition may explain this. It is believed that the mantle of Uranus has ice inside and gas outside. The new theory says that there is a transition layer between the ice and gas, and that slows the movement of interior heat toward the surface.

Europa (Jupiter's moon) – A previous study of Europa's under-ice ocean showed that conditions conducive to life exist if there are volcanic heat sources at the bottom of the ocean. A new study showed that conditions conducive to life should exist without volcanic activity, due to chemical reactions that are believed to be going on in the ocean. Hydrogen should be produced at the bottom of the ocean by a reaction between sea water and rock known as serpentinization. Oxygen and other oxidants are being produced on the moon's surface by Jupiter's radiation. It is believed that some surface ice, along with the oxidants, is cycled down into the ocean. Hydrogen and oxygen in the ocean gives a source of energy for any possible life. Sunlight on Earth supplies much of the energy used by life here, but other energy sources would be required on Europa, since sunlight does not penetrate the ocean's surface ice.

King Tut – In 1925, an iron-bladed dagger was found in the wrappings of King Tutankhamun's mummy. The problem with this is that King Tut died about 600 years before Egyptians developed the technology to smelt iron from ore. A team of scientists using X-ray fluorescence spectrometry on the dagger found that the nickel and cobalt content of the dagger matched that of iron meteorites. So the blade of the dagger was hammered into shape from an iron meteorite, and so did not require iron smelting technology. Iron, available only from meteorites, would have been more valuable than gold in those days.


Daniela Comelli/Polytechnic University of Milan

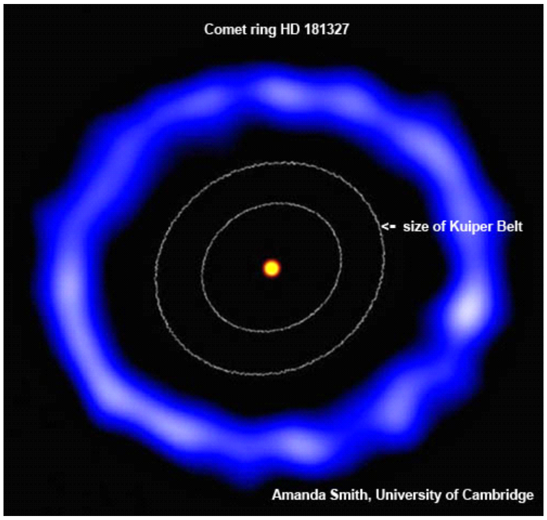
Asteroid impact – A layer of glass spherules, created by an asteroid impact, has been found in sediment that is 3.46 billion years old in northwestern Australia. Also levels of platinum, nickel, chromium and other elements were found to match asteroids. The object and its impact were likely much larger than the more famous one 65 million years ago. The crater would have been hundreds of miles (km) across, but would be eroded away by now. So the location of the impact is not known.

LISA Pathfinder, launched last December to the L_1 Lagrange point a million miles toward the Sun, is in operation and working better than predicted. The spacecraft has 2 tiny test masses isolated from practically all known forces, save the ripples in space-time that are gravitational waves. It will not detect gravitational waves, but only test the technology necessary to detect them in space. It was designed to measure the distance between the test masses to picometers (trillionth of a meter or yard), but is working to femtometers (quadrillionths of a meter). There are now no known technical issues impeding building the planned eLISA, which will detect gravitational waves from space. eLISA is planned for launch in the early 2030s. It will orbit in the Earth's orbit about the Sun, but 20° behind, and slightly inclined. It will consist of a triangle of spacecraft spaced 600,000 miles (1 million km) apart, and be able to detect gravitational waves from much larger objects (supermassive black holes) than the Earth-based LIGO, which discovered gravitational waves from small black holes colliding. eLISA will be able to pinpoint the source of gravitational waves to within 1 arc minute.

Instant AstroSpace Updates

Using ALMA radiotelescope, astronomers have imaged a cometary belt around the star HR 8799, comparable to the Kuiper Belt in our Solar System. Previous images of the star have shown 4 planets orbiting it; the size of the inner edge of the newly image belt indicates that a **5th planet** may be clearing this inner edge.

ALMA found carbon monoxide around the star HD 181327, consistent with the levels in our Solar System's **comets**. This is the 1st evidence of such a belt around a Sun-like star.



KUHN TELESCOPE OUT OF ACTION

Unfortunately, the Kuhn Telescope is in need of repair and so will not be available for use by Star Members or for viewing during star parties until the repairs can be made. We are working on the problem as quickly as we can, but it is proving harder to repair than originally hoped. Nobody is to use it until it is repaired, as we don't want to make matters worse.

Thank you for your patience as we work on the repairs, and many thanks to Pat Knoll and Trey McGriff for their efforts to find the problem and to figure out what will be needed to fix it!

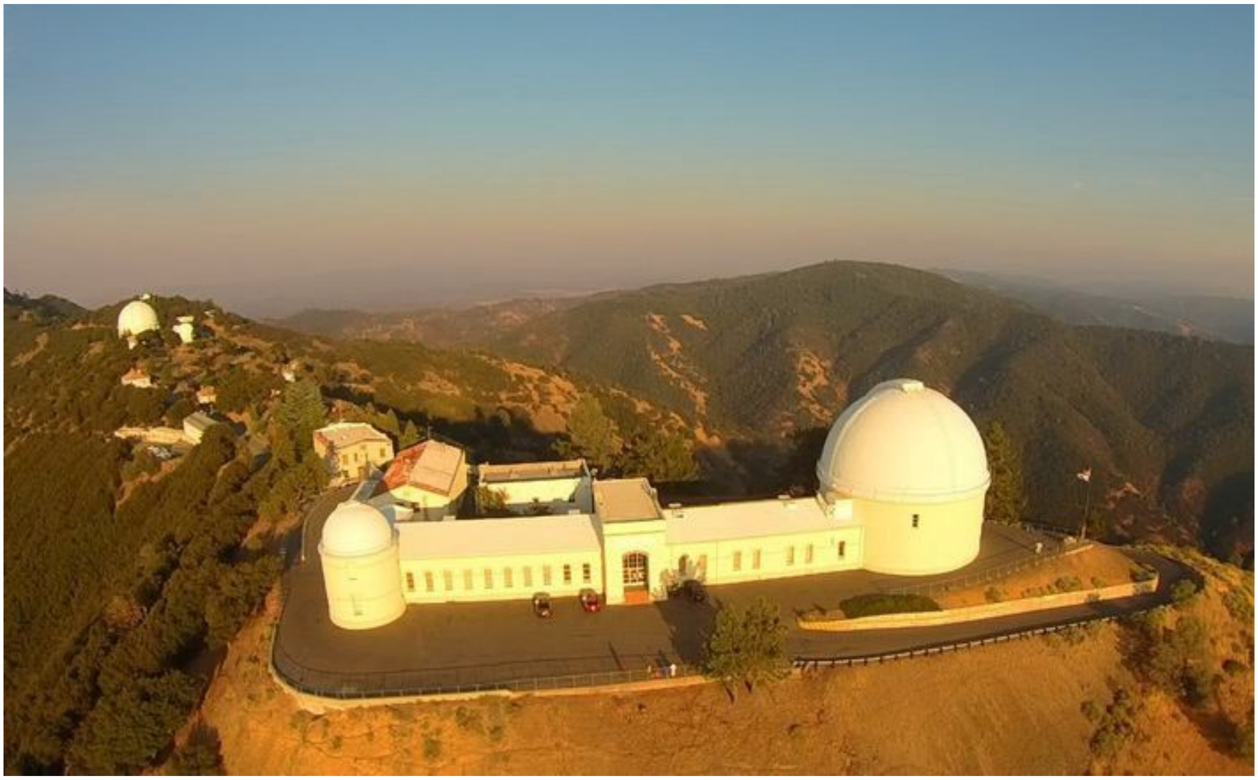
Barbara Toy
Observatory Custodian

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

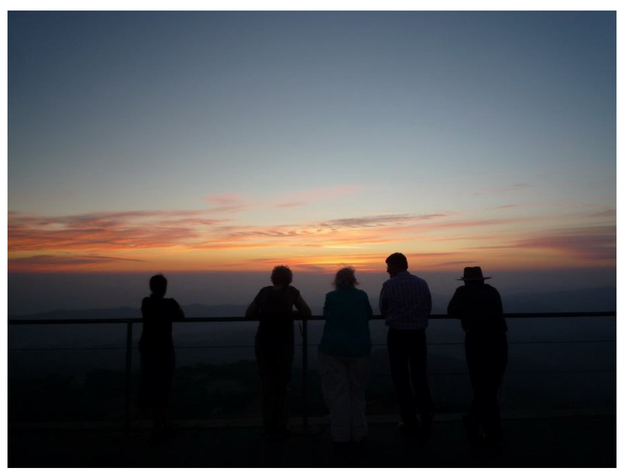


How to get time on a REALLY BIG telescope

by Don Saito

(from the New Pacific Stargazer, September 2015 edition)

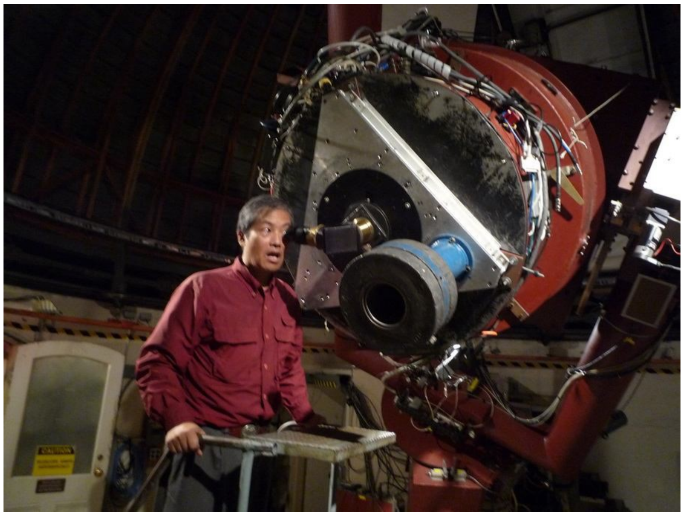
On the evening of August 16, 2015 thanks to the organizing efforts of SF Bay Area local amateur astronomer Bob Minor, a group of astronomy buffs braved the long and winding 20 mile road leading from San Jose, California, up to Mt. Hamilton, home of the Lick Observatory! Lick is available to small groups up to 30 persons for ~4 hour private viewing sessions at the low, low price of $1,150 ($38 per person if there are 30 people). Bob invited a bunch of family, friends and likely acquaintances up, and so up we went. I live in San Jose, myself, so it wasn't that big a deal for me, though my main mode of transportation these days is a motorcycle, and while that road is very nicely paved, the steep hairpin curves going up or down really got my attention.



A short bit of history: James Lick grew up under the strict tutelage of his father to become a master woodworker, who went on to become a successful entrepreneur which brought him a great deal of wealth. Near the end of his life in the late 1800s, he wanted to leave a lasting and beneficial legacy, and was convinced to donate $700,000 for the construction of the world's first mountaintop observatory.

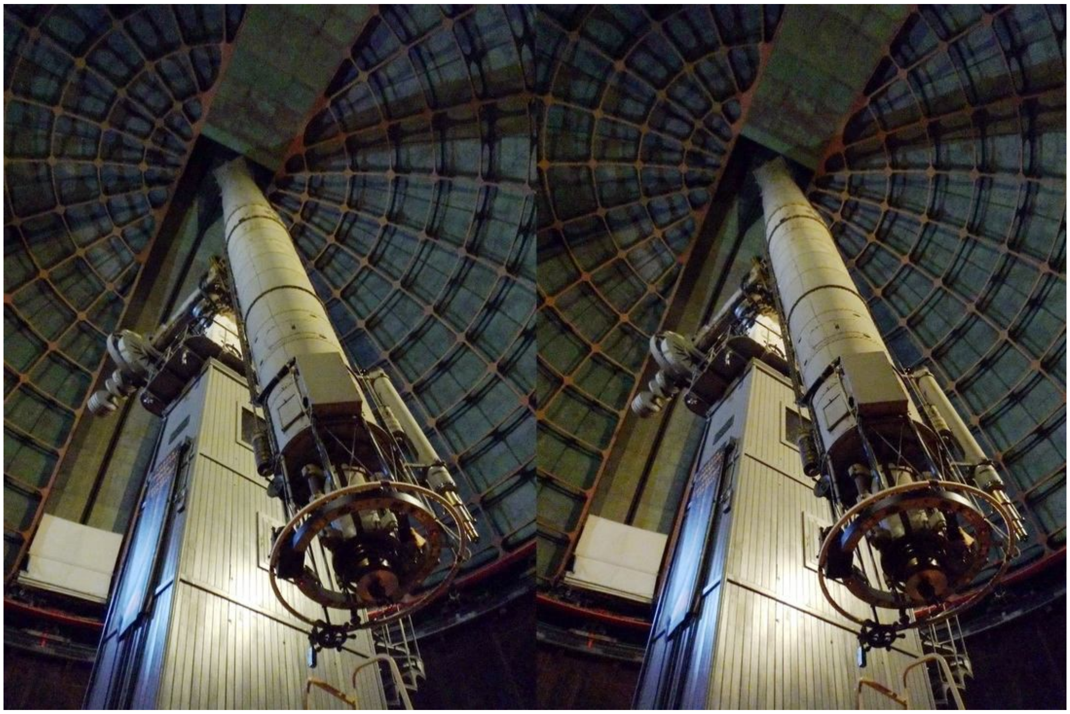
While its telescopes are no longer the largest, they are still highly productive and valuable assets to the University of California who owns and operates them, to the public who are given some access to them, and to the scientific community, where cutting edge research and instrument development still goes on.

The good news was: we did get to see Saturn through the 40-inch Nickel reflector telescope, which looked awesome due to some pretty good seeing conditions. But the bad news was: due to all the smoke from several different fires happening around California, we only got that one view before we had to close that telescope, and never were able to even open the gigantic 36-inch refractor. Still, we had a lot of fun as the staff and volunteers showed us the inner-workings of the facility, getting a demonstration of how that massive 36-inch is manually positioned using its motion control wheels, allowing us to actually move the 36-inch by hand (it's *hard*), and visiting the final resting place of James Lick at the base of the 36-inch telescope's pier. A bunch of us gathered in the dark outside and pointed out constellations with green lasers. Inside there was food and drink, and we got a talk on the history of the facility.



Don Saito is flabbergasted by the amazing view of Saturn through the Nickel 40" reflector

Finally, the evening ended at 01:00; many people paid extra to stay overnight in the astronomer's dorm, while I made the trip back down the mountain, being extra-watchful for giant feral pigs the color of asphalt that the regulars up there said sometimes show up. I was actually a little disappointed I never saw one :-(



This is a 3D photograph of Lick Observatory's gigantic 36" refractor. To view it in 3D, try the following: Look at the image and cross your eyes slightly. You'll notice the two images begin to join into an out-of-focus third image that appears between the two in the photo. Adjust the amount of eye-cross and head-tilt to bring the third image into a defined (middle) third image, and refocus your eyes to bring that middle image into sharp focus. It will now appear 3D! It helps to pick a spot in the photos that are visually striking, such as the center of the dome where the top end of the telescope points. Use that as a guide to make bringing the two images together, easier. With practice, you can do this quickly and automatically.

If you'd like to take 3D pictures, yourself, all you need to do is hold your camera vertically, compose your shot, and take the picture, but do not lower the camera, yet. Without tilting the camera, move it to the right a few inches, and take another shot..Once you retrieve the pictures, you can combine them into one image using your computer's software, or even by taping the printed photos together, side-by-side.

A couple of things: It's easier to use this cross-eye technique if your pictures are vertically aligned. It can be done if they're horizontal, but you'll need to cross your eyes more, *and that can be a bit of a strain. If you move back, away from the images, making them smaller in your field of view, this also makes doing this technique easier. An increased separation distance between the two shots (when you're taking the pictures) will exaggerate the 3D effect. For distant scenes, such as mountains, the distance between the two shots could be several feet, but this is tricky to manage without introducing unwanted camera tilt, which renders the end product difficult to "view." It's a good idea when composing the first shot to take note of "markers" in the corners of the picture frame to help align the second shot to the first.*

Mercury Transit

By Dennis Ammann
San Diego Astronomy Association

About six of us San Diego Astronomy Association (SDAA) members drove out to Sycamore Canyon (West), located in Mission Trails Regional Park by Scripps Ranch 7:00am to watch the transit of Mercury across the Sun. I was out there too with my 10" Dobsonian telescope. As soon as I arrived, I remembered I forgot my sun filter! ... Didn't matter though, there were four other scopes to look through and what a view it was!

To compare it to the Venus transit of 2012, Venus was a lot larger and one could see it cross the sun without a telescope by using solar filter glasses. Venus was a better view with a telescope, back then. Mercury was different, one needed a telescope to view this one. Even with a telescope, Mercury was just a tiny black circle moving across the sun.

Looks like everyone was using about 40 power. We all watched it until 8:00am when the Sun disappeared behind the marine layer and only poked out during a hole in the clouds for about 3 minutes around 9:30am. After waiting and hoping the marine layer would burn-off, we finally gave up and left at 11:30am when the transit was over.

Although disappointed at the San Diego coastal marine layer, we did get to see it for about one hour and had a lot of fun just socializing with each other. It's fun to exchange information about the latest telescopes, eyepieces, star parties, etc. Also fun to see each other in the daytime (kind of scary... LoL). Seems like we only know each other by our voices, being in the dark all the time, while viewing the dark night skies.

Oh well, we'll see Mercury transit again on 11 November 2019 but not Venus unless we're still breathing air on 11 December 2117... let's see, I'll be 166 years old.

My astronomy mentor, Jose Magsaysay took the attached picture with his refractor telescope.

VANDENBERG AFB LAUNCH SCHEDULE

Brian Webb

Launch Alert

http://www.spacearchive.info/newsletter.htm

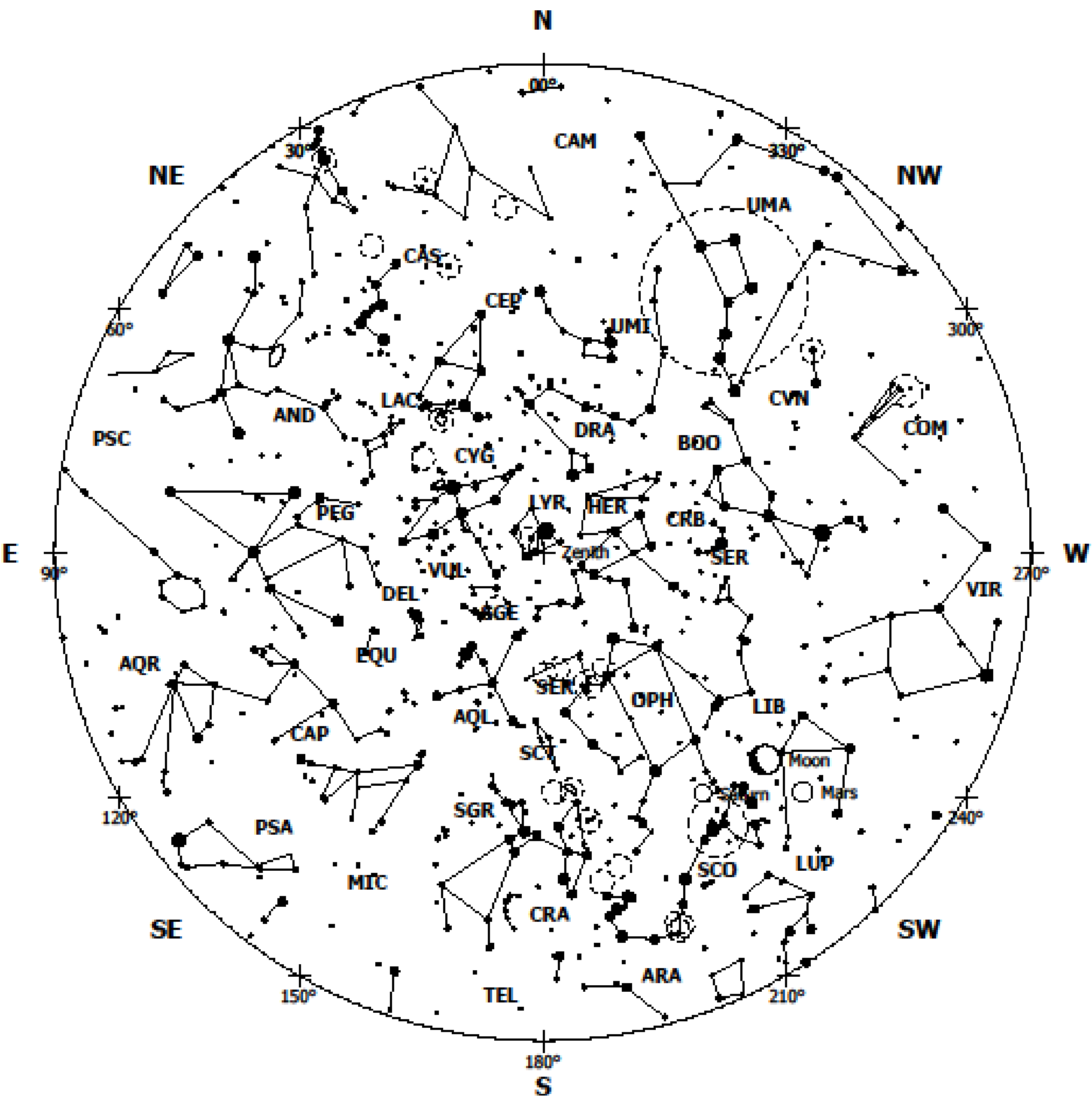
Date	Launch Time/ Window (PDT/PST)	Vehicle	Pad/Silo	Payload
July	TBA	Falcon 9	SLC-4E	Vehicle will launch Taiwan's Formosat 5 satellite and the Sherpa dispenser carrying several small payloads
July	TBA	Falcon 9	SLC-4E	Vehicle will launch 10 Iridium Next commercial communications satellites
Sept. 15	TBA	Atlas V	SLC-3E	Vehicle will launch the WorldView 4 earth observation satellite for DigitalGlobe
October	TBA	Falcon 9	SLC-4E	Vehicle will launch 10 Iridium Next commercial communications satellites
Oct.-Dec.	TBA	Minotaur C	SLC-576E	Vehicle will launch six SkySat earth observation satellites

The above schedule is a composite of unclassified information approved for public release from government, industry, and other sources. It represents the Editor's best effort to produce a schedule, but may disagree with other sources. Details on military launches are withheld until they are approved for public release. For official information regarding Vandenberg AFB activities, go to http://www.vandenberg.af.mil.

All launch dates and times are given in Pacific Time using a 24-hour format similar to military time (midnight = 00:00, 1:00 p.m. = 13:00, 11:00 p.m. = 23:00, etc.).

The dates and times in this schedule may not agree with those on other online launch schedules, including the official Vandenberg AFB schedule because different sources were used, the information was interpreted differently, and the schedules were updated at different times.

July 2016 Whole Sky Chart



Symbols

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

Magnitudes

-6	-5	-4	-3	-2	-1	0	1	2	3	4	5

Location	Time	View
United States, CA, Long Beach	Local time: 2016-07-15 00:00:00	Field of view: 200° 00′ 00″
Lon: 118° 11′ 18″ W, Lat: 33° 46′ 01″ N	Universal time: 2016-07-15 07:00:00	RA: 18h 41m 30.26s, Dec: +33° 46′ 01.0″
Time zone: GMT-08:00	Julian date: 2457584.79167	Azi: 180° 00′ 00.0″, Alt: +90° 00′ 00.0″
Elevation: 29 feet above sea level	Sidereal time: 18h 41m 30s	Constellation: Lyra

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The Newsletter of the Orange County Astronomers

**NEWSLETTER OF THE
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