nightwatch

Newsletter of the Pomona Valley Amateur Astronomers

We are drowning in information, while starving for wisdom.
E. O. Wilson

Volume 35 Number 9 ***nightwatch*** **September 2015**

Club Events Calendar

September 17, 2015, Board meeting, 6:15
September 25, 2015, General meeting

Oct. 9, 2015, Big Bear Solar Observatory Tour
Oct. 9-11, 2015, Joint Star Party with RAS at GMARS
October 22, 2015, Board meeting 6:15
October 30, 2015, General meeting

Nov. 5-8, 2015, Joint Star Party with RAS, Night Fall at Borrego Springs
November 12, 2015, Board meeting, 6:15
November 20, 2015, General meeting

December 3, 2015, Board meeting, 6:15
December 11, 2015, Holiday Party,

PVAA Officers and Board

Officers

President ….... Mathew Wedel 909-767-9851
Vice President .. Joe Hillberg 909-949-3650
Secretary ...... Howard Maculsay 909-624-1667
Treasurer .... Gary Thompson 909-935-5509
VP Facilities .....Jeff Felton 909-622-6726

Board

Jim Bridgewater (2016)........................ 909-599-7123
Karl Rijkse (2016) 909-428-1884
Ron Hoekwater (2017)......................... 909-391-1943
Cori Charles (2017) 909 646-0275

President's Message

Hi folks, just a few quick updates this time.

The PVAA trip to observe with the 100-inch telescope on Mount Wilson on the evening of Sunday, September 13 was a success. Unfortunately, I was down with a bad cold so I had to miss it. Hopefully we'll get a brief report at the meeting from the members who were able to attend.

Speaking of observatory visits, remember that Friday, October 9, is our visit to the Big Bear Solar Observatory. We'll send out more details about that trip as the date draws nearer.

There's something cool coming up before then: a total eclipse of the moon on the evening of Sunday, September 27. Observers farther east will get to see the whole thing, but from here on the west coast the moon will already be halfway into Earth's umbra when it rises at 6:38 PM. Maximum eclipse will be at 7:47 PM, and the moon will move out of the umbra between 8:23 and 9:27. It should be a good eclipse, with the moon moving deeply into Earth's umbra instead of skimming the edge as in some recent lunar eclipses. I hope the skies are clear - this will be the last total lunar eclipse visible from SoCal until January of 2018!

Our speaker this month is Dr. Tyler Nordgren, Professor of Physics and Astronomy at the University of Redlands. His talk is titled, "Stars Above, Earth Below: Astronomy in the National Parks". I hope to see you there!

Matt Wedel

Directors

Membership / Publicity.........
Gary Thompson 909-935-5509
Outreach .... Jeff Schroeder 909-758-1840
Programs .... Ron Hoekwater 909-391-1943

What's Up? - Radio Astronomy

Radio astronomy differs from optical astronomy in that it studies the heavens in radio frequencies. It started in 1931 when Karl Jansky was working for Bell Labs to locate sources of static that could interfere with radio telephone service. One mysterious source repeated at the same time every day. It seemed to come from a fixed astronomical location. Jansky pinned it down in Sagittarius near the center of our Milky Way Galaxy. Well, Bell wasn't paying him for such cryptic discoveries. It was up to an amateur radio operator Grote Reber to build a parabolic radio telescope (9m) in his backyard and make the first sky survey in radio frequencies. After WWII, Cambridge University became interested and built the first Radio Astronomy Observatory in 1950. But it would be new computer technology that could help sort out complex radio signals. Today there are some 200 radio telescopes all over the world made for different tasks and wavelength ranges. Merely one design is inadequate because the radio spectrum spans from a fraction of a millimeter to many meters in wavelength.

They're made of two components, a large radio antenna and a radio receiver. These usually dish shaped telescopes have discovered new objects that are unseen and unknown in visible light astronomy. These include radio-emitting galaxies, quasars, masars, pulsars, gravitational lenses, outbursts from out Sun and Jupiter, giant molecular clouds, merging galaxies, and that black holes in galactic centers. Just to mention a few.

The larger radio telescopes become the more they can receive in a high signal to noise ratio. But there's a limit to how big a tracking dish can get. The Russians have built some giant complex arrays at 600m. The world's largest single dish radio telescope is Arecibo (Puerto Rico) at 1,000 ft. in diameter. It's built into the ground and must use its hanging receiver to track. Originally constructed for anti-ballistic missile defense it became known for collecting data for SETI's search for E.T. radio transmissions. It's appeared in a James Bond movie and CONTACT, where Jodie Foster goes to visit aliens. Another historic dish is Australia's Parkes Radio Telescope (64m). It fell to this dish to transmit the 1969 Apollo 11 moon landing pictures to the world. This is dramatized in the film THE DISH. Besides radio astronomy, receiving and transmitting from outer space missions is extremely important.

But they need to be as big as possible without falling over (some have). This was solved by invention of the astronomical interferometer in which a group of radio telescopes (or optical ones) link and act together to form a single larger instrument. Greatly helped by computers, optical fibers and coaxial cable lines this technique operates by superposing or interfering signal waves from different telescopes into a combined visual or radio image. The Very Large Array in Socorro, New Mexico has 27 telescopes working on a long baseline interferometer. Also storing data and sending it to other telescopes in different countries throughout the world can create a Very Long Baseline Interferometry. Several radio telescopes have been sent into space creating even bigger distances between them.

Long Baseline Interferometry is such a complex and ongoing subject it's tempting to mention some of hundreds of individual radio telescopes. Because of their size they're very visually dramatic. One of the newest projects is ALMA, an interferometer with many scopes built by an international effort high on the dry Atacama Desert plateaus in Chile at 16,5000 ft (pictured). One of the oldest is Germany's Effelsberg (100m) near Bonn. Another historic dish is the 76m Lovell at Jodrell Bank Observatory in England. The largest in the U.S. is the 100m fully steerable Green Bank Telescope in West Virginia which has recently been rebuilt.

I have seen several with my own eyes and am always amazed by their sizes. PVAA visited the many Goldstone dishes in their remote Mojave Desert location. In contact with space probes at Saturn, Venus, and Mars these are the most sensitive radar dishes in the world. Our club members have all glimpsed the many Owens Valley Radio Telescopes as we travel to the Grandview star party site. I once drove out my way to get a glimpse of the remote Hat Creek dishes used by SETI in Northern California. Also I've seen the three unusual sub millimeter radio telescopes on 14,000 ft Mauna Kea in Hawaii.

So radio astronomy's amazingly rapid development has allowed us to view other wavelengths of radiation beyond the traditional visual light. It allows a combined in depth view into our infinite universe.

Lee Collins

Measure the moon's size and distance during the next lunar eclipse

The moon represents perhaps the first great paradox of the night sky in all of human history. While its angular size is easy to measure with the unaided eye from any location on Earth, ranging from 29.38 arc-minutes (0.4897°) to 33.53 arc-minutes (0.5588°) as it orbits our world in an ellipse, that doesn't tell us its physical size. From its angular size alone, the moon could just as easily be close and small as it could be distant and enormous.

But we know a few other things, even relying only on naked-eye observations. We know its phases are caused by its geometric configuration with the sun and Earth. We know that the sun must be farther away (and hence, larger) than the moon from the phenomenon of solar eclipses, where the moon passes in front of the sun, blocking its disk as seen from Earth. And we know it undergoes lunar eclipses, where the sun's light is blocked from the moon by Earth.

Lunar eclipses provided the first evidence that Earth was round; the shape of the portion of the shadow that falls on the moon during its partial phase is an arc of a circle. In fact, once we measured the radius of Earth (first accomplished in the 3rd century B.C.E.), now known to be 6,371 km, all it takes is one assumption—that the physical size of Earth's shadow as it falls on the moon is approximately the physical size of Earth—and we can use lunar eclipses to measure both the size of and the distance to the moon!

Simply by knowing Earth's physical size and measuring the ratios of the angular size of its shadow and the angular size of the moon, we can determine the moon's physical size relative to Earth. During a lunar eclipse, Earth's shadow is about 3.5 times larger than the moon, with some slight variations dependent on the moon's point in its orbit. Simply divide Earth's radius by your measurement to figure out the moon's radius!

Even with this primitive method, it's straightforward to get a measurement for the moon's radius that's accurate to within 15% of the actual value: 1,738 km. Now that you've determined its physical size and its angular size, geometry alone enables you to determine how far away it is from Earth. A lunar eclipse is coming up on September 28th, and this supermoon eclipse will last for hours. Use the partial phases to measure the size of and distance to the moon, and see how close you can get!

Ethan Siegel

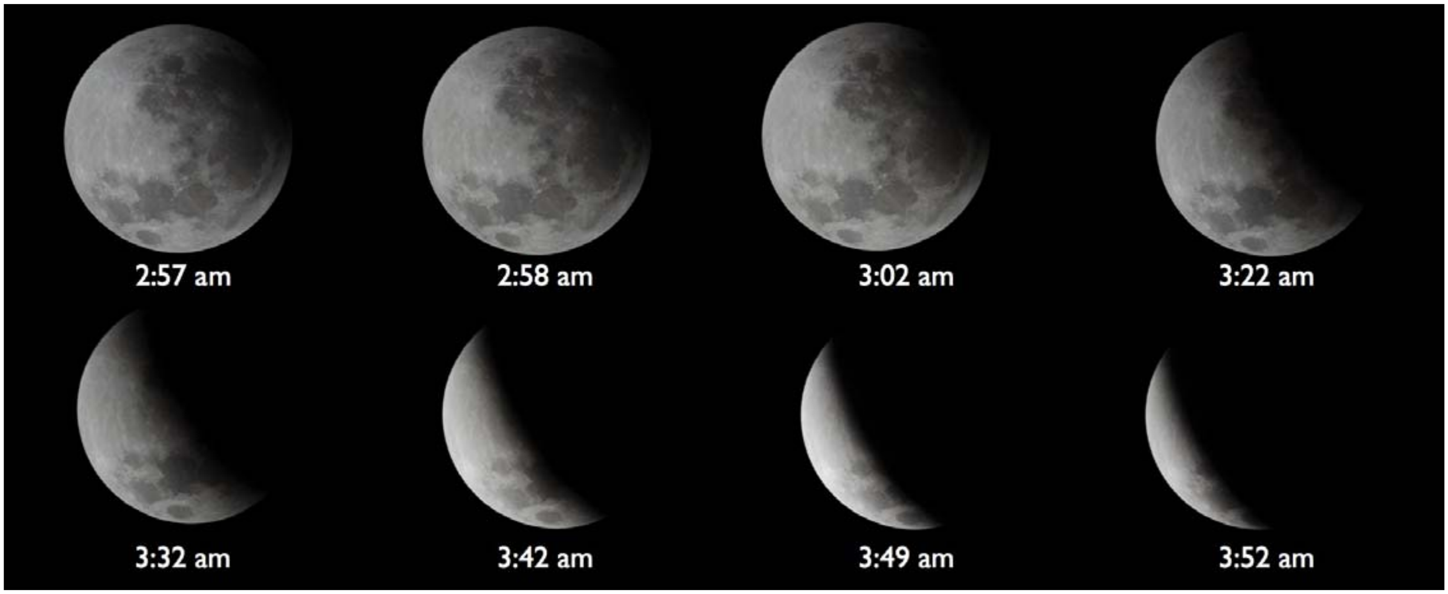


Image credit: Daniel Munizaga (NOAO South/CTIO EPO), using the Cerro Tololo Inter-American Observatory, of an eight-image sequence of the partial phase of a total lunar eclipse.

Objects observed with the Mt. Wilson 100" on 9-13-15
A dusk to dawn marathon of photons.

1. Alpha Herculis (Ras Algethi) Double star.
2. M10 Globular cluster in Ophiuchus.
3. NGC6309 The Box nebula in Ophiuchus.
4. M11 Open cluster in Scutum.
5. M57 Ring nebula in Lyra.
6. Epsilon Lyra. Double double.
7. PK 64+5.1 Campbell's hydrogen star in Cygnus.
8. NGC6826 Blinking planetary nebula in Cygnus.
9. Albireo Double star.
10. M15 Globular cluster in Pegasus.
11. NGC7009 Saturn nebula in Aquarius.
12. Neptune & Triton.
13. NGC7479 Spiral galaxy in Pegasus.
14. NGC7662 Blue snowball planetary in Andromeda.
15. G1 Brightest globular cluster in Andromeda Galaxy.
16. M32 Companion elliptical galaxy to M31.
17. M76 Little dumbbell planetary nebula in Perseus.
18. Gamma Andromeda Double star: gold and blue.
19. Uranus
20. M77 Seyfert Galaxy in Cetus.
21. NGC604 Starforming region in Galaxy M33.
22. Iota Tri. Double star in Triangulum.
23. NGC15 Crystal Ball nebula in Taurus. (Faint extended planetary)
24. NGC1535 Cleopatra's Eye planetary nebula.
25. M42 Orion nebula trapezium region.
26. NGC2022 Planetary nebula in Orion.
27. NGC2158 Dense open cluster in Gemini.

Jeff R. Schroeder

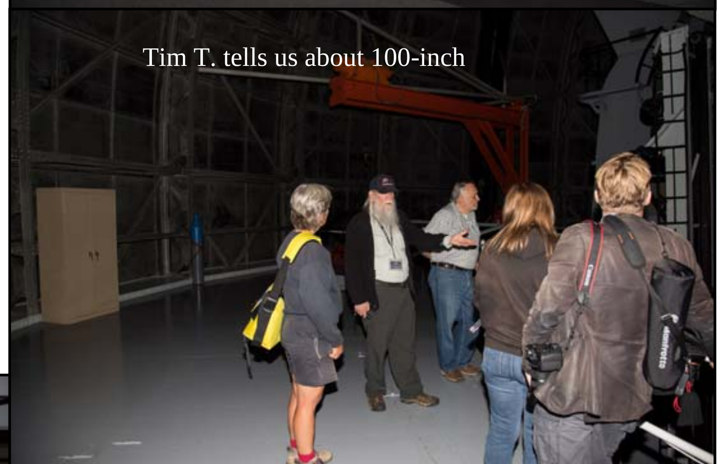
Here are a few more images from that night. One is of the group outside the 100" dome shot from above on the catwalk. The lightpainting of the 100" looking through the dome slit was done while observing NGC6826 (blinking planetary)

Jeff Felton

We arrive at 100-inch

Mt Wilson Photos by
Ron Hoekwater

Jeff S. comes out to greet us.



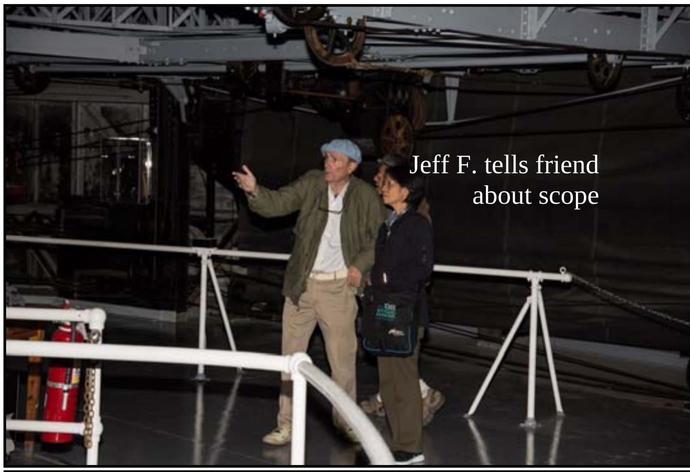
Tim T. tells us about 100-inch

Jeff getting everything ready for observing

Dome's fully equipped communication system

Jeff S. shows us controls for scope

Focuser - eyepiece



Jeff F. tells friend about scope

Ready to start observing.

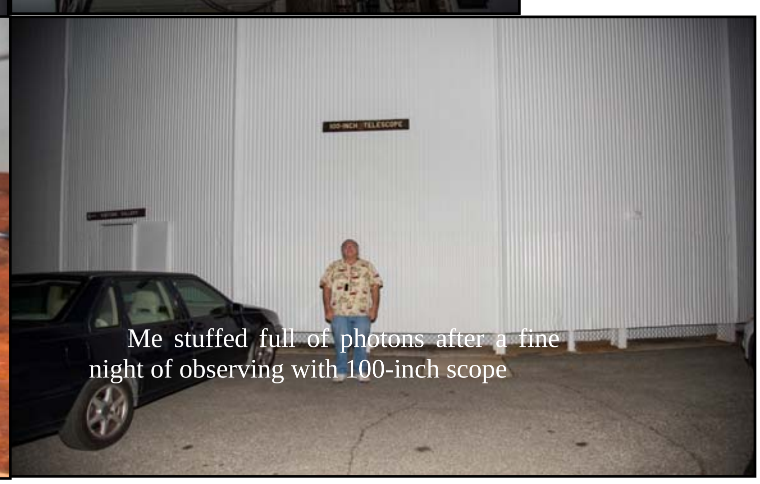
Dome control switches

The 100-inch scope

Being shown around

Mt Wilson Photos by Ron Hoekwater

Photo plate holder for 100-inch



Me stuffed full of photons after a fine night of observing with 100-inch scope