SIRIUS ASTRONOMER

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The Newsletter of the Orange County Astronomers

September 2016 *Free to members, subscriptions $12 for 12 issues* **Volume 43, Number 9**

Orange County Astronomers extends its sincere condolences to the family and friends of long-time member William Hepner, who passed away after an accident on August 2 of this year. William was a fixture in the organization for many years, serving on the board of trustees and as a valuable mentor and outreach volunteer. He will be missed. Former OCA President Barbara Toy remembers William's contributions in depth on page 6, where you can see more of his astroimages as well. The above image of the Moon, created by William in November 2012, is placed here in his honor.

OCA CLUB MEETING

The free and open club meeting will be held September 9 at 7:30 PM in the Irvine Lecture Hall of the Hashinger Science Center at Chapman University in Orange. This month, Michael Rich of UCLA will present 'Clash of the Titans: Andromeda and the Milky Way's Future Encounter'

NEXT MEETINGS: Oct. 14, Nov. 11

STAR PARTIES

The Black Star Canyon site will open on September 24. The Anza site will be open on September 3. 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

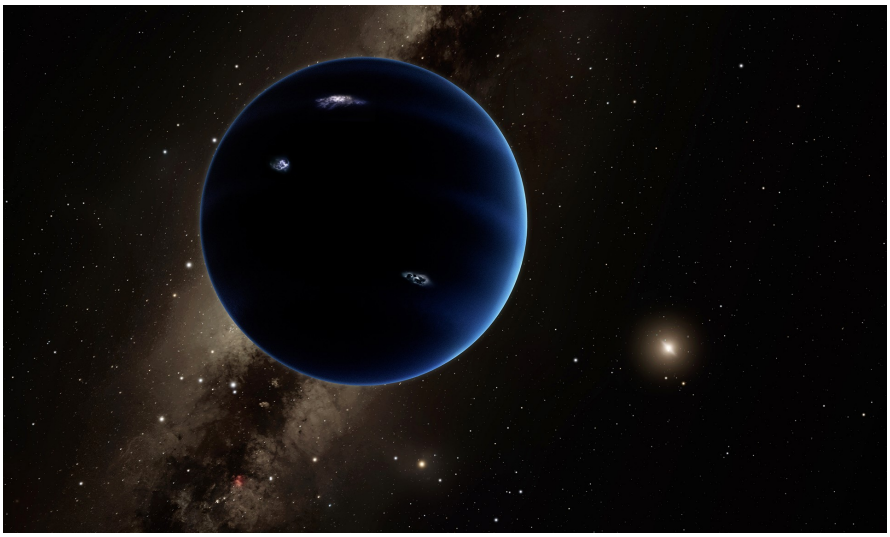
The next session of the Beginners Class will be held at the Heritage Museum of Orange County at 3101 West Harvard Street in Santa Ana on September 2. The following class will be held September 2.

NEW! Teenage SIG: contact Doug Millar
Astro-Imagers SIG: Sept. 13, Oct. 11
Remote Telescopes: contact Delmar Christiansen
Astrophysics SIG: Sept. 16, Oct. 21
Dark Sky Group: contact Barbara Toy

Is there a super-Earth in the Solar System out beyond Neptune?

By Ethan Siegel

When the advent of large telescopes brought us the discoveries of Uranus and then Neptune, they also brought the great hope of a Solar System even richer in terms of large, massive worlds. While the asteroid belt and the Kuiper belt were each found to possess a large number of substantial icy-and-rocky worlds, none of them approached even Earth in size or mass, much less the true giant worlds. Meanwhile, all-sky infrared surveys, sensitive to red dwarfs, brown dwarfs and Jupiter-mass gas giants, were unable to detect anything new that was closer than Proxima Centauri. At the same time, Kepler taught us that super-Earths, planets between Earth and Neptune in size, were the galaxy's most common, despite our Solar System having none.



A possible super-Earth/mini-Neptune world hundreds of times more distant than Earth is from the Sun. Image credit: R. Hurt / Caltech (IPAC)

The discovery of Sedna in 2003 turned out to be even more groundbreaking than astronomers realized. Although many Trans-Neptunian Objects (TNOs) were discovered beginning in the 1990s, Sedna had properties all the others didn't. With an extremely eccentric orbit and an aphelion taking it farther from the Sun than any other world known at the time, it represented our first glimpse of the hypothetical Oort cloud: a spherical distribution of bodies ranging from hundreds to tens of thousands of A.U. from the Sun. Since the discovery of Sedna, five other long-period, very eccentric TNOs were found prior to 2016 as well. While you'd expect their orbital parameters to be randomly distributed if they occurred by chance, their orbital orientations with respect to the Sun are clustered extremely narrowly: with less than a 1-in-10,000 chance of such an effect appearing randomly.

Whenever we see a new phenomenon with a surprisingly non-random appearance, our scientific intuition calls out for a physical explanation. Astronomers Konstantin Batygin and Mike Brown provided a compelling possibility earlier this year: perhaps a massive perturbing body very distant from the Sun provided the gravitational "kick" to hurl these objects towards the Sun. A single addition to the Solar System would explain the orbits of all of these long-period TNOs, a planet about 10 times the mass of Earth approximately 200 A.U. from the Sun, referred to as **Planet Nine**. More Sedna-like TNOs with similarly aligned orbits are predicted, and since January of 2016, another was found, with its orbit aligning perfectly with these predictions.

Ten meter class telescopes like Keck and Subaru, plus NASA's NEOWISE mission, are currently searching for this hypothetical, massive world. If it exists, it invites the question of its origin: did it form along with our Solar System, or was it captured from another star's vicinity much more recently? Regardless, if Batygin and Brown are right and this object is real, our Solar System may contain a super-Earth after all.

AstroSpace Update

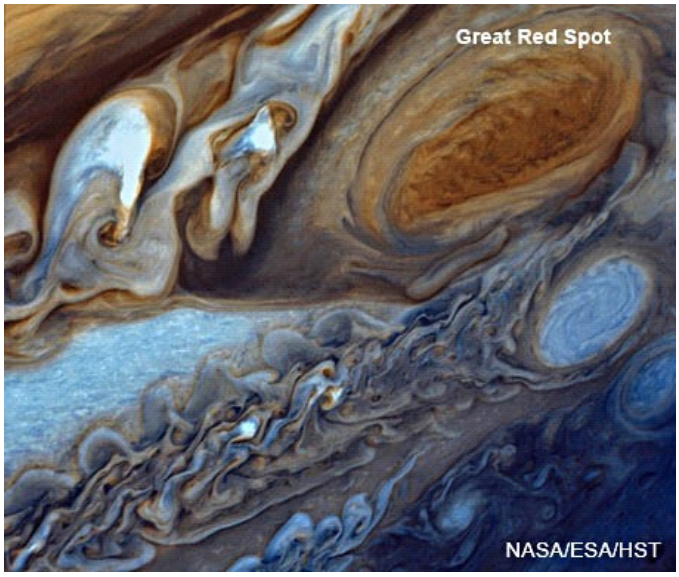
September 2016

Gathered by Don Lynn from NASA and other sources

Ceres' interior – Scientists have measured variations in dwarf planet Ceres' gravity by tracking subtle changes in the motion of the orbiting spacecraft Dawn. The new gravity map provides clues to Ceres' internal structure. Water and other light materials partially separated (differentiated) from rock during a heating phase early in its history. The divisions between different layers are less pronounced inside Ceres than the Moon and planets because it did not fully differentiate. As expected, Ceres is much less dense than Earth and Vesta (Dawn's previous target). High-elevation areas on Ceres displace mass in the interior, as if they are floating on the material below.

Ceres' exterior shows no signs of large impact basins. Yet small impact craters are found in abundance. From the numbers and sizes of impact scars on other bodies, Ceres had to have been hit by numerous large asteroids during its life. The scars from large impacts had to have been erased. Ceres' surface is known to contain large amounts of water ice. If the ice, or other low-density material, goes deep enough it could allow the weight of large features to slowly sink, or "relax". Spacecraft Dawn, now at Ceres, previously visited Vesta, and it has large impact basins. The difference is probably due to difference in composition at and near the surfaces.

Martian streaks – Dark streaks seen on slopes on Mars that appear to be on the surface have been dubbed recurring slope lineae (RSL). Those that cut into the surface are referred to as gullies. Both have been blamed on liquid water discharges, at least by some scientists. New study of the gullies shows they were likely not formed by running water. New spectroscopic data showed no evidence of clay or other hydrated minerals in most of the gullies studied, and the few that did were from erosional debris of ancient rocks. The best theory now is that sublimation of dry ice (frozen carbon dioxide) can erode gullies. The RSLs are a different story, however. As reported here last November, spectroscopic data show the RSLs DO show evidence of water. The best theory was that underground pockets of salty water were being released during the spring thaw. A new study shows that the sources of RSL often occur on ridges or isolated peaks, places that are very unlikely to harbor pockets of water. The next best theory is that the water condenses out of the atmosphere, but problems arise with that theory when scientists calculate how much water can condense in Martian conditions. More work is needed to explain RSLs.



Jupiter hot spot – Astronomers studied Jupiter's Great Red Spot (a storm that has raged for hundreds of years) using the 3-meter infrared telescope in Hawaii. They found that the atmosphere above the Red Spot is hundreds of degrees hotter than anywhere else on Jupiter. They believe that turbulence in the Red Spot causes 2 different types of waves in the atmosphere that collide and release energy about 500 miles above the Spot.

Cassini (Saturn orbiter) used its radar as an altimeter during a recent flyby of the moon Titan. It found that many channels seen on Titan's surface are deeper than thought (hundreds of yards [m] deep), have steeper sides, and have liquid methane at the bottoms. One network of channels named Vid Flumina was found to consist of narrow canyons (less than ½ mile wide [< 1 km]) with slopes steeper than 40°. Before this observation, it had not been clear if the dark material at the bottoms of some channels was liquid or sediment. The new data clearly showed the dark material was smooth like liquid, not as rough as sediment. Some of the liquid was found to be at the elevation of nearby seas, but some was higher, indicating those were tributaries flowing down.

Exoplanet atmospheres – Astronomers using the Hubble Space Telescope have conducted the 1st search for atmospheres around Earth-sized exoplanets. Previous exoplanet atmosphere observations have all been made on giant planets. The planets studied are designated TRAPPIST-1b and TRAPPIST-1c, located about 40 light-years away. They were discovered by a small robotic telescope in Chile named TRAPPIST. Though analysis has not been completed, hydrogen and helium have been found to be in low concentrations. This means those planets have atmospheres more like Earth and less like gas giant planets. The planets orbit a red dwarf star at least 500 million years old in Aquarius. 1b has a year of 1.5 Earth days, while 1c is 2.4, putting the latter in the habitable zone (where temperatures would allow liquid water to exist). The observations were made during a rare transit

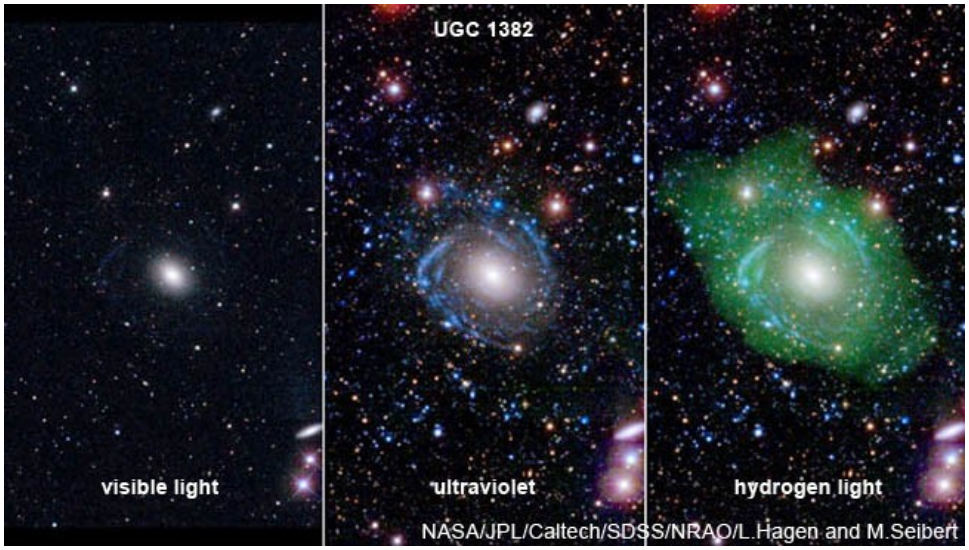
across their star of both planets within minutes, and measured the changes in starlight as it filtered through the planets' atmospheres. More observations are needed to detect methane or water. The James Webb space telescope, to be launched in 2018, should be sensitive enough to detect carbon dioxide and ozone at these 2 planets.

Kepler (planet-hunting space telescope) has discovered 104 more confirmed exoplanets, including 4 roughly Earth-sized planets in one system. The system is 181 light-years away, orbiting a dim red dwarf star. Its planets range from 20%-50% larger than Earth, and are likely rocky planets rather than gas planets. 2 of them get roughly the same sunlight as Earth does. Their years range from 5.5-24 Earth days. During its main mission, Kepler was staring at a region with few red dwarf stars, even though such stars are by far the most common type overall. But during its K2 extended mission, the space telescope has been directed at more red-dwarf-rich areas.

No light sterile neutrino – Data from the IceCube neutrino detector, buried deep in south polar ice, show that the light sterile neutrino likely does not exist. This theoretical particle had been a contender to explain what dark matter is. There are 3 known types of neutrino, but a 4th (dubbed "sterile") had been proposed, which would not be subject to the weak nuclear force, and therefore does not show up in any current neutrino detectors. Theoretically, the muon neutrino should occasionally change into a sterile neutrino, and this would show up as a slight deficit of muon neutrinos at a certain energy. Hints of this deficit had been seen in other neutrino detectors, but the new IceCube data showed no such deficit, even though it is more sensitive than other detectors. The sterile neutrino might still exist, but it would have to be much more massive to not show up in the IceCube data.

No WIMPs yet – The LUX project, located deep in the Homestake Gold Mine to protect it from outside interference, reports that it has failed to find any WIMPs, a leading theoretical candidate to explain dark matter. Theoretically, a WIMP should occasionally interact with a Xenon atom, and LUX has been watching 770 lbs (350 kg) of the stuff in the dark for a year. LUX is also trying to detect axions and similar theoretical dark matter candidates, but the result of that search has not yet been released. By 2020, the project will put into operation LUX-ZEPLIN, with 7 tons of Xenon, for increased sensitivity to WIMPs.

Strange galaxy – Astronomers studying ultraviolet images of galaxy UGC 1382 found that it had spiral arms, which are not seen in visible-light images. Imaging in hydrogen light, the galaxy is far larger than in visible light, larger even than the arms showing up in infrared. It is huge: about 7 times the diameter of the Milky Way. Further, they found that the youngest stars are in the innermost parts and the older stars in the outermost. This is opposite to where stars are in normal spiral galaxies. The best explanation for this strange galaxy is this: 1st several dwarf galaxies formed. Then a lenticular galaxy (disk-shaped like a spiral, but without arms) formed nearby. At least 3 billion years ago, the dwarf galaxies joined the lenticular and became spiral arms. Some astronomers are not convinced and are looking for another explanation. The galaxy is about 250 million light-years away.



Large cavities exist in the hydrogen gas in our galaxy and other galaxies. What causes these is under debate. One theory is that dense clouds of gas moving at high speed punch these cavities. A new observation by the Arecibo radiotelescope, found that a known high-velocity cloud, called HVC 040+01-282, is surrounded by a cavity. This is the 1st solid observation to support this theory.

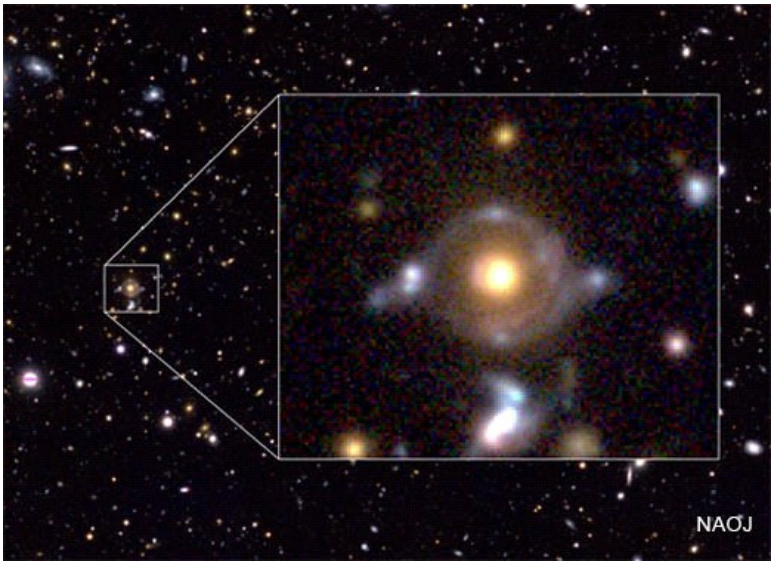
Lonely young star – An object called CX330 was discovered by the Chandra X-ray space telescope in 2009. To determine what the object was, observations from WISE and Spitzer (infrared space telescopes) were studied. It was found to likely be a young star that had been outbursting for several years. It had increased its brightness by a few hundred times over 3 years. Its behavior is something like the young outbursting star FU Orionis and about 10 other known similar stars. However, CX330 is by itself, not near any star-forming regions, while FU Orionis and the 10 others are all found in star-forming regions. So either CX330 formed by itself, or the rest of its star-forming region is somehow hidden. The outbursts of this type of star occur when the star consumes material from the disk surrounding it.

Supernova's past life – The Murchison radiotelescope array in Australia was used to observe the remnant of the supernova seen in 1987 in the Large Magellanic Cloud, our neighboring galaxy. This picked up material thrown off by the star millions of years ago when it was in its red supergiant phase. Previous observations have shown material emitted only as far back as during the later blue supergiant phase (the last phase before it exploded). The new observations used lower frequency radio than previous ones. It was found that the red phase lost its matter at a slower rate and generated slower winds that pushed into its surrounding environment than was previously assumed.

Instant AstroSpace Updates

The **MeerKAT** radiotelescope array in South Africa has taken its 1st images, though construction is only ¼ completed, finding 20 times as many galaxies in that image than were previously known there. Eventually MeerKAT will become part of the Square Kilometer Array radiotelescope.

Spacecraft controllers turned off the radio link on Rosetta (comet orbiter) that listens for its lander **Philae**. Rosetta needed the electric power for other purposes, and the lander has not been heard from for over a year, apparently due to its landing in a shadowed area.



A group of astronomers and their students have found a rare pair of galaxies, or perhaps triple, being lensed by the gravity of another galaxy in front of them. They are calling it the **Eye of Horus**.

Astronomers using the Keck Observatory in Hawaii have made the 1st accurate measurement of **oxygen** in a really distant galaxy (its light took 12 billion years to reach us). Oxygen is an indicator of past supernova explosions, galaxy superwinds, and interstellar gas falling into galaxies.

Curiosity Mars rover has been programmed to **autonomously select targets** for laser zapping and ChemCam analysis by analyzing images taken of nearby rocks, based on size, brightness or other characteristics. ChemCam has already analyzed 1400 targets that were until now selected by scientists on Earth.

Longtime member William Hepner, who passed away last month, was known for improvising novel solutions to imaging problems. His work is showcased here and on the following page. For more about William, read the retrospective on page 6.

A Farewell to Bill Hepner

We are sorry to report that Bill Hepner, an active member of our club for many years who has unfortunately been less active in recent years due to health problems, passed away on August 2, 2016 following an accident.

Although he did some imaging, I knew Bill as mainly a visual astronomer, who loved building things and tinkering to come up with better ways to view without getting into a lot of expense. He was the first person I knew who built a binocular viewer that had the viewer looking down into a mirror to view what was overhead, which was intended to reduce neck fatigue. It was an interesting idea, and fun to play with, and I think he had as much fun designing and building his particular version of it as he did viewing through it. Another project I remember was when he helped me convert my pre-goto ETX90 to a goto scope using motors cannibalized from a lower-end Meade refractor on a mount he modified to hold the tube of the ETX 90 and the motors – I still have it and appreciate his kindness and enthusiasm for the project, which did its duty in many outreach events back about 10 or 15 years ago.

I first got to know Bill and his good friend, Matt Ota, when we were all regular outreach volunteers in the early 2000s, and they both were trustees of Orange County Astronomers, I believe in 2004 and 2005. Bill was always tinkering with and improving on his equipment, and loved sharing his latest experiments and experiences as well as views of the night sky. He was generous in helping others come up with solutions to their problems as well, and was good at showing how to make the most of what one had – in an age when most people in the hobby seem to think automatically of what they can buy to improve their experience or deal with any problem they've been having, Bill's "do it yourself" attitude was a refreshing reminder of how creative people can be in finding ways to improve their experiences as astronomers.

I'm sure there are others in the club who have memories of Bill when he was more active in the club – if you are among them, I hope you'll share your memories on the OCAstronomers email group or send them to me (btoy@cox.net). If you have any pictures of Bill, please send copies as well.

Adventures in obtaining a classic 50-year-old Japanese refractor

By Craig Bobchin

In April of this year my girlfriend and I took a weekend trip to Big Bear. We like to check out antique and consignment shops, and it was at one of these that I came across a store with a bunch of telescopes set up in front. We decided to stop in and see if they had anything of interest.

The scopes they had set up outside were the cheap fast reflectors that typically get sold at Christmastime to those too gullible to know they're not very good. While talking to the proprietor about them, she mentioned that she had a telescope she didn't know much about but it looked different than the others she had.

She took me to the middle of the store and there she showed me a wood box that I opened. Inside I found a mid-20th century refractor and equatorial mount along with a wooden tripod and accessories. Even the original manual was included. This looked like an interesting find and potential purchase. The objective was a bit dirty/dusty and there was a small dent in the OTA. Aside from that, the scope and accessories looked to be in great shape and everything that was supposed to be there was.

Fig 1: My first look at the telescope.

The manual was for a Mayflower Model 815, a 60mm F/15 scope. I had a few questions, and told the owner that I was interested in it, but needed to do some research on the scope to know what it was and what it was worth. Among the questions I had were: How is it optically? At F/15, I was guessing it would be pretty decent on lunar/planetary viewing despite the small aperture, what is this worth in reality? Is it actually worth putting any money down on? As the last 60mm refractor I owned was a 1970's era Tasco on the cheap alt-az mount they had, I had no idea as to the quality of the telescope.

I turned to the classic telescope forum on Cloudynights.com for some answers. I quickly learned it was a 1960s era Japanese scope and was considered a good scope with good optics. The forum said it was probably worth about $150.00. I contacted the seller and gave her the information I had discovered and that I wanted to buy it. We agreed on a price of $125.00. Since I would be in Big Bear in a couple of weeks for RTMC I planned on picking it up then.

When I went to pick it up on Memorial Day weekend, I found the shop closed. I was frustrated. I wanted my telescope. I had a great time at RTMC and made plans to return to get it. It took a couple of weeks before I was able to make it back up the mountain to make my purchase.

Once I picked up the Mayflower 60mm I put it together gave it first light that same night. First some details about the scope; when I opened it up and put it together, I was really surprised as to the good shape it was in, there are a couple of small dents on the OTA, and some paint scraped from the finder scope where the screws go, but everything else is almost brand new condition. Furthermore, everything appeared to be in the box. The Dew shield even had its original cardboard wrapping around it.

Fig 2: Accessories

It came with a prism diagonal, terrestrial diagonal, 2x Barlow, 4 eyepieces all .965 Huygens (20mm, 12.5mm, 6mm and 4mm), screw in the eyepiece Moon and Sun filters, a solar projection screen, and lastly, a 6x finder scope.

Fig 3: Moon and Sun Filter

I was surprised to find out that the mount was both Eq and Alt-Az. This is pretty cool for a 50+ year old scope. The wood for the tripod is in good shape and the accessory tray gives some support to the tripod. The slow motion controls are in great shape, but the declination seems to have some stickiness and looseness to it.

The front lens is clean, though it seemed to be missing the tiny spacers between the two objective lenses. I didn't know if those were a newer thing and this scope never had them, or if sometime in the murky past someone tried to clean the objective and lost them.

I took it out for first light to see how it did on the moon and planets. Once I aligned the finder scope (which has no reticle BTW), the narrow field of view made for some hunting to get objects in the FOV. Once I got the Moon in the scope, I was greeted to a fuzzy hard to focus image. In addition to the objective lens needing a good cleaning, I think the diagonal and eyepiec-

Fig 4: The Assembled telescope

es are probably filthy and in dire need of cleaning as well. In short, my ES 127 ED had nothing to worry about. This wouldn’t be replacing it anytime soon.

Once I got the moon in focus it looked okay. About how I remember my 9-year-old self seeing it so many decades’ past. In the 20mm the Moon almost filled the FOV. I didn't notice any CA (at F/15 I'd have been surprised to) but the inside and outside focus images seemed to have some kind of a honeycomb or netting over them. I'd never seen anything like it. Could be just dirty optics, or something more serious?

The I was able to make out some craters and central peaks in some craters, but not a lot of detail, the image looked kind of soft.

The next target was Jupiter, and I could make out a white orb and small dots next to it, but I never really got a sharp image, and I saw no bands. Mars was similar to Jupiter. when I moved to Saturn, I was actually able to see the ring around it. It was still soft and in the 20mm small.

At this point I figured that I'd probably not use this very much, it was more a nostalgia purchase since my first scope was a Tasco 60mm on an Alt-Az mount.

Looking though the Mayflower was a trip through the past and got me thinking that I must have really been into astronomy for such poor views to hold my attention as they did back then. It's no wonder that I had so much trouble getting people to observe with me back then.

This is not what I expected after talking with good folks on the classic telescope forum, so I turned to them again to help diagnose the issue. In the meantime, I set about giving the optics a good cleaning and see if that would help. I posted some pictures of the objective lens to the forum after I’d removed it and cleaned it in hopes that someone could ensure that I was putting it together correctly. In short time I received responses about the objective being misaligned. They helped me figure out what to do to get spacers put in place by using small slivers of metal foil tape, as well as realigning the two halves of the objective correctly.

Once the optics were cleaned and realigned, it made a huge difference. The scope now works like I hoped it would. I get good views of The Moon, Saturn, and even Mars is more than a small blur. It showed dark and light areas, but that was all the detail I could see. With the 6.4mm ep I was just able to see the Cassini Division on Saturn.

I am very happy with my vintage telescope scope now and I’m sure I’ll use it more than I initially thought.

Magazine Subscriptions

Subscriptions to the Astronomy magazines are now due for renewal, if you subscribed for one year or would like to subscribe at the club rate. You may also extend an existing subscription that does not end in December for one year at the club rate. Bring your check made out to the OCA to the meeting or mail it to:
Charlie Oostdyk, Orange County Astronomers, PO Box 1762, Costa Mesa, CA 92628. ***Checks made out to the magazine publishers cannot be processed and will be returned to you***. If you already subscribe, please provide the mailing label or the billing invoice with your check. One-year rates are as follows:

	Club Rate	Regular Rate
Sky & Telescope*	**$33.00**	$42.95
ASTRONOMY	**$34.00**	$42.95

***Sky & Telescope subscribers please note: Due to a change by the publisher, renewals of current subscriptions should now be made directly through Sky and Telescope! New subscriptions at the club rate must still be made through Orange County Astronomers and then renewed through the publisher.**

***Astronomy subscribers can now renew on-line with a credit card. E-mail Charlie@CCCD.EDU for special instructions and the renewal code.**

The **DEADLINE** for subscribing at the club rates will be the **October monthly meeting, October 14th.** The publishers will send expiration notices to all current club subscribers about November 1st even if you renew through the club. It takes the publishers a few weeks to process renewals.

Jupiter Ridge #4 Pad for sale: This pad includes a good steel pier and a table that's in good condition. As with all Jupiter Ridge pads, the parking is excellent. $1,500. Either see me at JR#7 (the warming hut), or call or text me at 951-225-5920. Ray Stann

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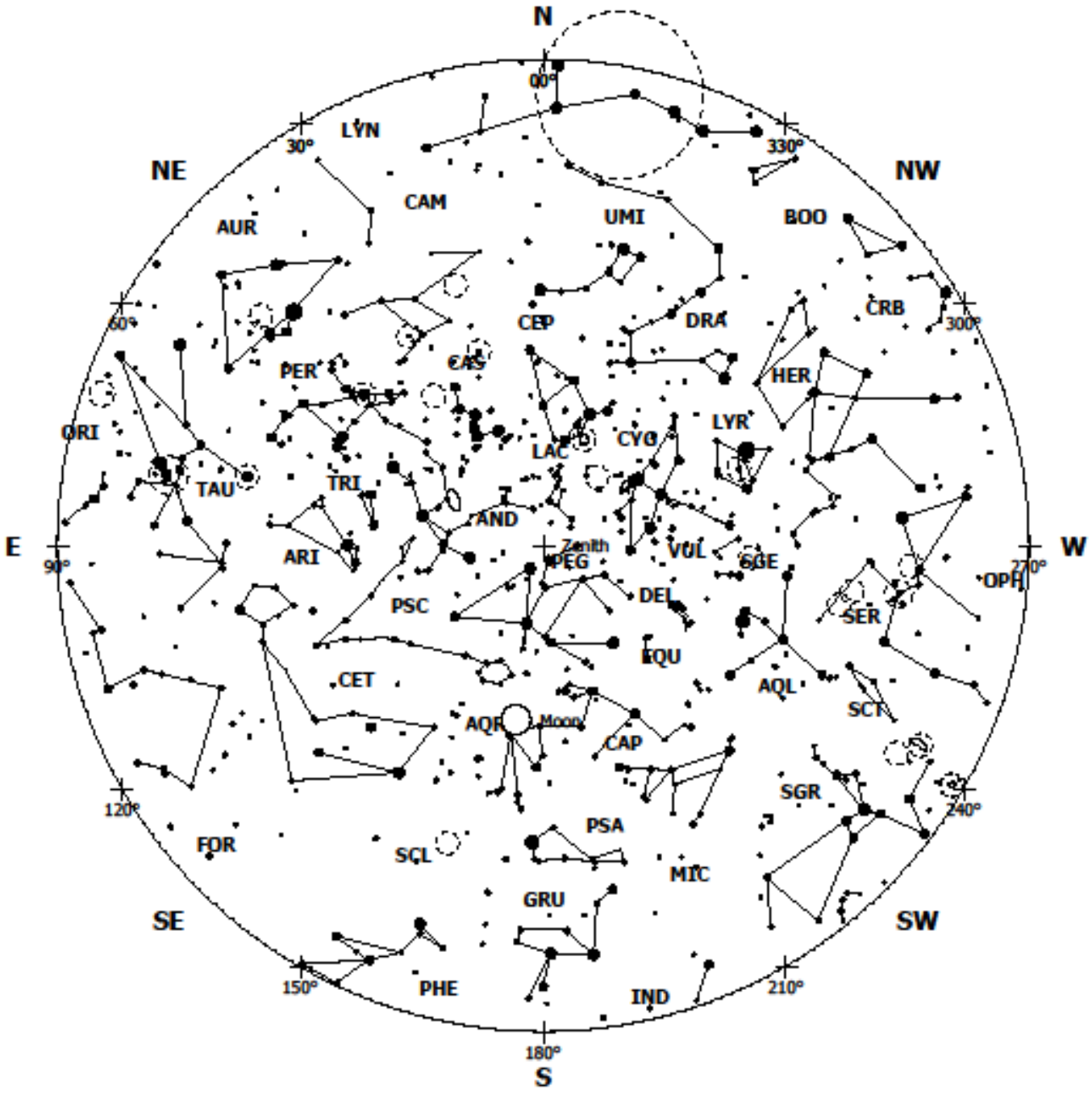
Astro Physics Mount for Sale
1. AP 1200 GTO Mount with keypad
2. 1200 Precision-Adjust Rotating Pier Adapter with Azimuth Bearing (1200RPA) for 10" ATS Pier.
3. One 18 pound Counterweight for 1.875" Diameter Shaft
4. 16" Mounting Plate
5. Losmandy Polar Alignment Scope - (PASILL4)
6. Polar Alignment Scope Cover - (Q12700)
$6,500.00
Contact Rick at 310-489-8561

Whole Sky Chart - September 2016



Symbols

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

Magnitudes

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

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: 2016-09-16 00:00:00
Universal time: 2016-09-16 07:00:00
Julian date: 2457647.79167
Sidereal time: 22h 49m 53s

View

Field of view: 200° 00′ 00″
RA: 22h 49m 53.15s, Dec: +33° 46′ 01.0″
Azi: 180° 00′ 00.0″, Alt: +90° 00′ 00.0″
Constellation: Pegasus

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SPECIAL INTEREST GROUPS (SIG's)			
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