SIRIUS ASTRONOMER

www.ocastronomers.org

The Newsletter of the Orange County Astronomers

July 2011 *Free to members, subscriptions $12 for 12 issues* **Volume 38, Number 7**

These hungry folks are participating in the OCA Starbecue back in July 1998. It's been an annual tradition at least since then, and if you want to get in on the fun, bring your appetite and your telescope out to Anza on July 30th! (photo by Jeff Gortatowsky)

OCA CLUB MEETING

The free and open club meeting will be held July 8th at 7:30 PM in the Irvine Lecture Hall of the Hashinger Science Center at Chapman University in Orange. This month, our featured speaker is Dr. Alison Coil of UCSD presenting 'Lighting Up The Dark: How Galaxies Trace Dark Matter on Large Scales'

NEXT MEETINGS: August 12th, September 9th

STAR PARTIES

The Black Star Canyon site will be open on July 23rd. The Anza site will be open on July 2nd and July 30th. 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 on Friday, July 1st at the Heritage Museum of Orange County (formerly the Centennial Heritage Museum) at 3101 West Harvard Street in Santa Ana. Next month the class will be offered on August 5th.
GOTO SIG: TBA
Astro-Imagers SIG: Jul. 19th, Aug. 16th, Sept. 20th
Remote Telescopes: TBA
Astrophysics SIG: Jul. 15th, Aug. 19th, Sept. 16th
Dark Sky Group: TBA

Around OCA for July, 2011

By Barbara Toy

OCA Observatory Custodian and Member Liaison

Now that we're into July we're past the period of ever-shortening nights, which ended with the summer solstice, and hopefully also past this year's "June Gloom." After far too many months of poor or downright bad weather around new moon, affecting both our Black Star Canyon and our Anza star parties, the weather for the June star party at Anza turned out to be surprisingly good, much better than the forecast – as astronomers, we don't really believe in omens, but maybe this is a good omen for the summer, June usually being on the overcast side. We'll have a chance to check that out twice in the coming month, as we have two Anza star parties in July, at the beginning and end of the month. Here's hoping for clear skies, good seeing and warm nights for both of them!

Starbecue 2011

Our annual Starbecue this year is on the second Star Party in July, on July 30. As usual, we will hold it in the parking area east of the main club observatory unless we're faced with rain – which did happen one year – in which case we will probably move it to Anza House. We're planning to have the club barbecue going, for what anyone may want to grill, and, as usual, the club will supply drinks for the event, along with plates and eating implements.

This is a potluck, so please bring something to share with six to eight other people. This can be meat, fish, fruit or vegetables to grill, some other main course-type dish, salads, side dishes, appetizers or desserts. We've never had a system where people sign up in advance for what they plan to bring, but somehow it always seems to work out fine, with a satisfying variety of food and plenty to go around. In addition to the barbecue, we have a microwave in the observatory, in case you need to warm something up.

The club has some tables that we use mainly for setting out the food, though last year we were able to use one of them for eating (I think that was because Jim Benet brought a folding table to give us more working area). It's best to bring your own chair, as we don't have many. Although you can drive up to drop off food and other things, please plan to park on another level, as we don't have room for many cars around the observatory, particularly when the parking area is mostly being used for the party itself.

We usually start setting up around 5:00, with eating starting around 6:00. If you'd like to help with setting things up, please let me know, or you can just show up at the observatory a bit after 5:00 – help is always welcome! We also need help cleaning up afterward, before everyone heads off for an evening of astronomical activities, and volunteers to take the bags of trash generated by the party from the site to dispose of it as we don't have trash service there.

By the way, please remember to take any leftovers from what you brought with you at the end of the party, as they'll only go bad if they're left at Anza.

These parties are a great chance to enjoy the company of fellow club members as well as a lot of good food, and we usually have more family members come out on Starbecue nights than for regular star parties, adding to the fun. If you haven't been out to Anza yet, Starbecue night would be a great time to make your first visit – and, if you haven't been out there for a while, that would be an excellent time to renew your acquaintance with the fun of an Anza star party and see the recent improvements to the site.

I look forward to seeing all of you out there!

New Club Imaging Observatory

Those of you who have visited our Anza site may have noticed the small observatory with the flat clam-shell roof located to the west of Anza House. We were originally hoping this would become a remote-use observatory, but we ran into too many problems and that project has ended. That left the club in the enviable position of having an observatory, a pier and a 10-inch LX200 telescope to use for other purposes, and we are now developing them into a club facility for members to do imaging at the Anza site.

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TOP TWENTY THINGS AN ASTRONOMER SHOULD SEE

3 A Transit of Mercury or Venus

By Helen Mahoney

As we get down into the lower numbers on my list, the phenomena are more spectacular, rare, and/or take more planning to experience. Transits are relatively rare, and therefore take planning and sometimes travel to see them. They are not as spectacular as a great meteor shower or aurora display, but they are absolutely cool! A "transit" occurs when a body passes in front of a larger body and appears to move across its face. If the closer one is larger from the vantage point of the observer, it covers the more distant one, and that is an occultation (as in article #4). An eclipse is a particular kind of transit, in which the nearer body is similar in size to the distant one.

Venus is seen making a transit of the Sun on through a break in the clouds on June 29, 2004. Photograph by the author

From Earth, we can see the "inferior" (meaning their orbits are inside of the Earth's) planets Mercury and Venus transiting across the face of the sun. For this to happen, the Sun, the inferior planet and the Earth all have to be in a line. Transits of Mercury happen more often than Venus, because Mercury is closer to the Sun and orbits more quickly. There are about 13 to 14 Mercury transits each century. They only occur in May and November, as those happen to be the times when the orbits of Earth and Mercury match up. Recent Mercury transits occurred on 11-15-99, 5-7-03, and 11-8-06. I brought a small telescope with a solar filter to work for the May 7, 2003 transit, and set it up in the parking lot. Mercury is so small that its silhouette was smaller than the sun spots. Still, it was fun to watch it slowly move across the bright disk of the sun. The upcoming Mercury transits will be May 9, 2016 and November 11, 2019.

Venus transits are much rarer. They are paired, with a gap of 121.5 years, then the next one eight years later. Venus is larger and closer to the Earth, so the silhouette of Venus is a much larger dot. In fact, it is easily naked eye (seen through solar eclipse glasses or a solar filter held up). When my husband Doug and I heard about the June 8, 2004 Venus transit, we put it on our list. The previous one was in 1882, which meant that no one alive had ever seen one! We looked on the NASA site for the map of the areas on the Earth where it was to be visible, and were disappointed to see that it would occur during Northern Hemisphere night. It fell in between our 2002 and 2006 solar eclipse trips, so we couldn't squeeze in another big (expensive) trip to Europe or the Middle East. But the chance to see such a rare and significant event just couldn't be missed.

As we stared at the map, we suddenly noticed that almost all of Alaska was in the "Full Transit Visible" section. How could that be if it happened at about 9:30 pm local time? Then we realized it—the transit occurred in June in the land of the Midnight Sun. A trip to Alaska was in our time and mileage plan budget, so we were in business! From Fairbanks, Alaska, we drove north along the Dalton Highway (the Ice Road Trucker's road!) with friends of ours who live in Anchorage. The road had thawed, but there were occasional patches of snow on the side of the road, even in June. We arrived at Coldfoot, the farthest north truck stop, which was built to accommodate the pipeline construction workers. We set up our solar telescope, and began to watch the Sun. It was surprising to see how large of a black dot Venus made against the solar disk. We watched it move across the Sun, and tried to get as many of the truckers and tourists staying in the truck stop to view it with us as we could. It was a double treat, and a chance to check two fabulous astronomical events off of my list at the same time—a Venus transit and the Midnight Sun.

There will be another Venus transit—the second of this pair—on June 6, 2012. Part of the transit will be visible in Europe (where the Sun will rise during the transit) and North America (where the Sun will set during the transit). The complete transit will be visible from Alaska again, but also Hawaii, Japan, New Zealand, Australia, and other great places to visit. More information on this transit can be found on the NASA website at http://eclipse.gsfc.nasa.gov/transit/venus0412.html and the HM Nautical Almanac Office website at http://astro.ukho.gov.uk/nao/transit/V_2012/.

If you want to check a Venus transit off your list, I recommend planning to see the 2012 one. The next one will be in 2117. I'd like to stick around to see that one, but it's a long shot.

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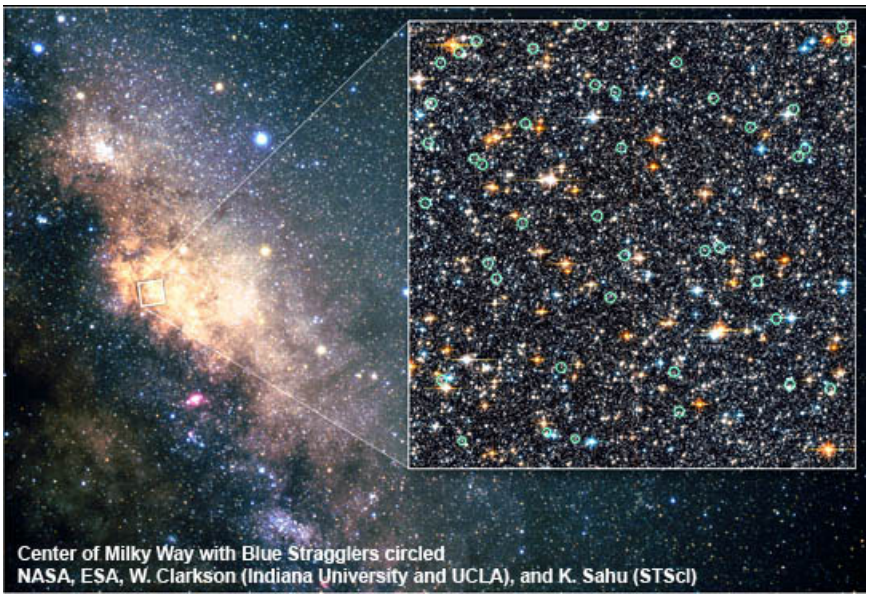
AstroSpace Update

July 2011
Gathered by Don Lynn from NASA and other sources

New type of supernova – A team of astronomers led by former OCA member Robert Quimby has discovered 4 supernovas (SN) (supernovae, if you like Latin plurals) that do not fit into any of the classifications of SN. The 4, as well as 2 previously discovered SN, have been found to have similar spectra to each other, but different than other classes of them. At first the previous 2 were thought to have different spectra, but when the redshift from expansion of the Universe was accounted for, the spectra became similar. They turned out to be 3 and 8 billion light-years away respectively, so had substantial redshift. This is follow-on work to the unusual SN that Robert mentioned to OCA when he was our meeting speaker last year. The characteristics of this new class are: about 10 times as intrinsically bright as most other SN, hot (10,000-20,000 °K), has no hydrogen in its spectrum, radiation is emitted over a large radius, it expands at high speed (6000 mi/sec = 10,000 kps), emits much ultraviolet, and is longer lived than most SN. These differences imply that the light of this new class is emitted by a different means than known classes of SN. Possible explanations for the means of emitting light include that the blast heats up previously emitted shells of material, or that an extreme magnetic field is producing a magnetar out of the remnant of the exploding star. The 6 known members of the new class all live in dwarf galaxies, not full sized ones. The visible-light spectrum of a member of this new class of SN is quite blue compared to other classes, since most of the light is emitted beyond the blue end, in ultraviolet. Quimby is a member of the Palomar Transient Factory, a team that uses the 48-inch Palomar Schmidt Telescope (named the Oschin Telescope, for a major donor) to repeatedly image large areas of the sky, and by computer locate any changes, such as SN. Spectra of these SN are then taken with other large telescopes, such as the Palomar 200-inch and the Keck Telescopes in Hawaii.

Chandra (orbiting X-ray telescope) has imaged a galaxy (NGC 3758 = Markarian 739) in X-rays, since observations of it with the Swift satellite had shown interesting features. The galaxy had long been known to have an active galactic nucleus (AGN), which is a supermassive black hole that is currently taking in large amounts of material. The Chandra observations showed that the galaxy has 2 AGN, not just 1. The 2nd black hole is about 11,000 light-years from the 1st. This is only the 2nd double AGN known that is relatively near Earth, that is, within a half billion light-years (NGC 6240 is the only closer one). The newly discovered double is about 425 million light-years from us. Supermassive black holes are commonly found at the centers of galaxies, but only about 1% of them are taking in enough material to be considered active. It is thought that galaxy collisions can trigger a black hole into becoming active, and also can result in a double black hole, at least until one of them captures the other. How did the 2nd black hole remain undiscovered for so long? It shows no evidence of being an AGN in visible, ultraviolet and radio light. So its discovery awaited the first high-resolution X-ray observations.

Hubble Space Telescope has imaged a distant galaxy that is being magnified (by 22 times) and brightened by a gravitational lens, and unlike most such lensing, the image is so little distorted that the spiral arms can be seen. Lack of perfect alignment usually causes considerable distortion in gravitational lenses. The lensing is caused by a cluster of galaxies centered in front of the galaxy. It has been designated Sp1149 and is 9.3 billion light-years away. The light left the galaxy when the Universe was about 1/3 its current age, so this is the best seen galaxy from that age. Further study is being done on this galaxy using adaptive optics on Earth-bound telescopes. Oxygen has been found to be concentrated in the center of Sp1149. This element accumulates where stars have lived out their lives and died. This suggests that star formation concentrated in the center of the galaxy during its early history.



Center of Milky Way with Blue Stragglers circled
NASA, ESA, W. Clarkson (Indiana University and UCLA), and K. Sahu (STScI)

Hubble has also found a rare class of stars called blue stragglers in the hub of our Milky Way, the first detected within our galaxy's bulge. Blue stragglers are so named because they seem to lag behind in the aging process, appearing younger than the other stars with which they formed. While they have been detected in many places, they have never before been seen inside the core of our galaxy. Blue stragglers definitely form when a small star, which ages slowly, acquires additional mass, though there is some disagreement on how that additional mass comes about. One theory is that a close companion star dumps material. The finding in our hub was based on a 7-day observation made in 2006 to find exoplanets orbiting any of the 180,000 stars seen in the observation. Of these, 42 are blue stars, possibly stragglers. Further observations were later made with Hubble to determine motions of the blue stars to find which were orbiting close to the galaxy center, weeding out stars that happened to be in the field of view, but are much closer to us. The majority of the 42 are probably true blue stragglers near the galaxy center. A few may be young blue stars that formed long after the other stars in the neighborhood, so are not stragglers.

Spitzer (infrared space telescope) has detected tiny crystals of a green mineral called olivine falling down like rain on a developing star. This is the 1st time such crystals have been observed in the clouds that collapse around forming stars. Temperatures as hot as lava are needed to make these crystals. Likely that occurred near the surface of the embryonic star, then the crystals were carried out to where they were seen by jets shooting out. This finding may explain why comets, which form in the frigid outskirts of our solar system, contain the same type of crystals. The Spitzer observations were made before it used up its liquid coolant in May 2009, but analysis took until now.

Herschel (European infrared space telescope) has imaged in far-infrared a cool twisting ring of rapidly orbiting gas clouds around the center of our Milky Way galaxy. It is about 330 by 200 light-years in size, and contains mass equivalent to 30 million Suns. The ring is oscillating, which gives it a shape like an infinity symbol (") when viewed from the side. Movement of gas across the bar of our galaxy may be sloshing and causing this oscillation in the ring. The ring orbits the supermassive black hole at the center of our galaxy at speeds of about 6-12 miles/sec (10-20 kps). However the black hole is somewhat off center in the ring. Gravitational effects of the galactic bulge may cause this.

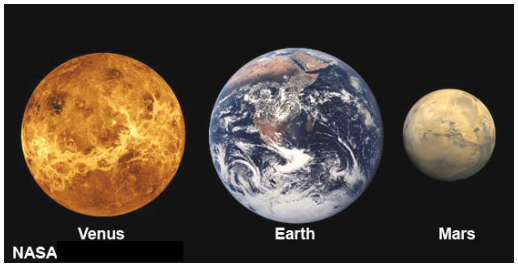
MOST (Canadian microsatellite telescope) has observed for the 1st time changes in the rate of mass loss in Wolf-Rayet (WR) stars. Wolf and Rayet (who else?) discovered the stars that now bear their name in 1867 when they noticed that certain stars display broad emission bands on an otherwise continuous spectrum. The MOST observations were of a WR eclipsing binary star. The depth of eclipses changed, which indicated the mass loss from the WR star had changed. Mass loss from WR stars is from powerful stellar winds throwing substantial amounts of material outward.

Distant gamma-ray burst – Images taken by the Gemini Telescope in Hawaii through different filters show that a gamma-ray burst (GRB) in April 2009 may be the most distant GRB ever seen, possibly the most distant object of any kind seen. Because a spectrum was not taken before the burst faded, there is some uncertainty about its distance. The best estimate is that light left the GRB only 520 million years after the Big Bang, or nearly 13.2 billion years ago. The implication of seeing a GRB from this early time is that the Universe was already a busy star factory. Although the afterglow of the GRB was seen briefly, searches made with various telescopes for the containing galaxy were negative, supporting the other evidence for the GRB being extremely distant.

Voyagers 1 & 2 are now in a region called the heliosheath, far beyond the outer planets that they explored decades ago. Analysis of their data from recent years shows that instead of the expected graceful arcs of the Sun's magnetic field, the area seems to be filled with a foam of magnetic bubbles. Voyager 1 entered this foam in about 2007 and Voyager 2 a year later. It appears that the magnetic field lines cross each other, then reconnect, leaving a magnetic bubble. This happens repeatedly, creating the foam of magnetic bubbles. The magnetic bubbles could be the 1st line of defense against cosmic rays entering our solar system. It is not yet known whether this is a good or bad defense. On one hand, such bubbles would seem to be a porous shield, allowing many cosmic rays through, but on the other hand, cosmic rays might get trapped inside the bubbles, which would be a good shield. It is hoped that further exploration of this region by the Voyagers will help decide how cosmic rays fare in this area.

Solar Dynamics Observatory (SDO) (solar space telescope) has imaged for the first time waves in the Sun's atmosphere resembling ocean surf. Scientists call this type of wave Kelvin-Helmholtz instabilities. Since scientists know how such waves in water disperse energy, they can use this information to better understand the waves in the Sun's corona. It is not a surprise that such waves exist in the Sun, since they appear in so many places in nature including clouds on Earth and between the bands of Saturn. SDO is just the 1st to catch them, since it has better resolution and more continual coverage than previous solar telescopes. Kelvin-Helmholtz instabilities occur when 2 fluids of different densities or different speeds flow by each other. In the case of the solar atmosphere, the 2 flows come from an expanse of plasma (hot electrically charged gas) erupting off the Sun's surface as it passes by plasma that is not erupting. Scientists were not sure Kelvin-Helmholtz instabilities would occur on the Sun because the magnetic field there might be too stabilizing to allow such. But the SDO observations show that such occurs on the Sun at least occasionally.

Lunar water – A team of researchers has measured for the 1st time water from the Moon in the form of tiny globules of molten rock which have turned to glass-like material trapped within crystals. Data from these newly-discovered lunar melt inclusions indicate the water content of lunar magma is 100 times higher than previous studies suggested. The inclusions were found in the famous "orange glass soil" of volcanic origin collected during the Apollo 17 mission in 1972. The team used an ion microprobe instrument to measure the water of the inclusions, which were formed during eruptions on the Moon approximately 3.7 billion years ago. The results challenge the "giant impact theory" of how the Moon was created. That theory has predicted very low water content of lunar rock. In contrast to most volcanic deposits, the lunar melt inclusions are encased in crystals that prevent the escape of water during eruption. The study also implies that some of the water ice recently detected in craters at the lunar poles may have come from volcanic eruption eons ago rather than comet impacts.



Mars – Planetary scientists have long wondered why Mars is so small compared to Earth and Venus, even though they formed in the same region of the solar system. A new computer simulation of the forming solar system has an answer. It has generally been believed that Jupiter migrated somewhat inward toward the Sun shortly after it formed, then migrated outward to its present orbit when Saturn formed and began perturbing Jupiter. But until this new simulation, it had been assumed that Jupiter could not have migrated into the asteroid belt without

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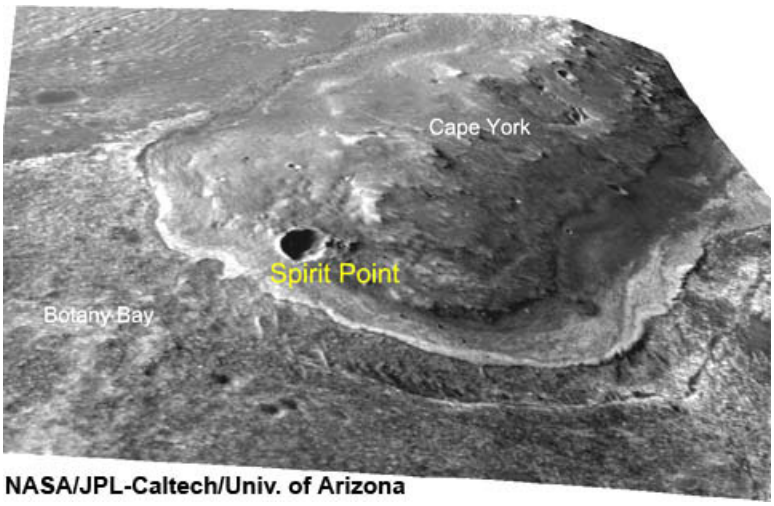
destroying that belt. The new result showed that Jupiter could have migrated nearly to Mars, right through the asteroid belt. That would have cleared out much of the material around Mars, thus starving the still-forming Mars from growing as large as Earth. The new simulation showed that not only did the asteroid belt survive Jupiter's passage inward and then outward through it, but that sorted the asteroids into an inner region of rockier asteroids, and an outer region with different composition, which matches what is found today.

More Mars – Another new study believes that the small size of Mars can be attributed instead to the planet forming much more quickly than the Earth did. It is thought that the Earth took 50 to 100 million years to grow to its present size. The new study showed Mars could have formed in only 2-4 million years. Then it simply never collided with any other planet embryos. The Earth probably repeatedly had such collisions, which is how it grew. The evidence for a fast formation came from analyzing radioactive decay in meteorites that are known to be pieces of Mars. Hafnium, thorium and tungsten were analyzed in this study. These were compared with those in chondrite meteorites, which are believed to be relatively unaltered since the formation of the solar system.

Mars rovers – Rover Opportunity for some time has been targeted to travel to the rim of Endeavour Crater, by far the deepest crater in its area. This will allow seeing the layers of geological history in the walls of the crater that were penetrated by the impact that formed the crater. Less than 2 miles (3 km) remain to reach that point, and Opportunity has already driven 18 miles (30 km) since landing in early 2004. The rim is crinkled due to erosion. One of the crinkled points on the rim has been selected as the first contact by Opportunity, and that point has now been named Spirit Point in honor of the apparently succumbed other rover. Spirit's mission was officially declared over by NASA after a year of no response. As suspected, the Martian winter was too severe for Spirit to survive at the location and tilt where she was left when the surface crust broke underneath and she sank into soft sand. Spirit drove 4.8 miles (7.7 km), more than 12 times the goal set for the mission. The drives climbed slopes up to 30 degrees, and covered more than ½ mile after the right front wheel became immobile in 2006. The rover returned more than 124,000 images. It ground the surfaces off 15 rocks and scoured 92 targets with its brush to prepare for inspection with instruments. One major finding came, ironically, from the inoperable wheel dragging up material that was analyzed to be nearly pure silica, likely formed in hot springs or steam vents. Spirit showed us that early Mars had water and hot rock interacting, a dramatically different world than the cold, dry Mars of today. Spirit also found carbonate, which is formed by wet, non-acidic ancient environment that may have been favorable for microbial life. Even though Spirit's mission is officially over, the Deep Space Network may occasionally listen for signals from the rover when time permits, just in case…



NASA/JPL-Caltech/Univ. of Arizona

Comet Hartley 2 – While studying this comet, researchers saw for the 1st time several gases change amounts in the same way at the same time. This had not been seen before with other comets, indicating Hartley 2 is a new class of comet. The new study used Earth-based observations both before and after the Deep Impact spacecraft flyby. The water vapor and 7 other volatile molecules rose and dropped in the vicinity of the comet nucleus in unison from night to night. This would appear to imply that the core of the comet is a uniform mixture of these 8 molecules. Yet the spacecraft data showed that water and carbon dioxide amounts rose and fell independently (carbon dioxide was not one of the molecules observed in the new study), and water and carbon dioxide were emitted from different areas of the comet nucleus. Also the new study found that ethane was emitted from the comet in different directions than was water and methanol. This shows that the core is not a uniform mixture. Clearly more work with comets is needed to understand these results.

Amino acids in meteorites – In January 2000 a large meteoroid hit the Earth's atmosphere and exploded over Canada, dropping fragments across the frozen surface of Tagish Lake. Pieces were collected within days and kept preserved in their frozen state. This ensured that there was very little contamination from the Earth. Analysis of the Tagish Lake meteorites showed that they are rich in carbon and contain an assortment of organic matter including amino acids, the building blocks of proteins. Such has been found analyzing previous meteorites, though none as uncontaminated. What was different about Tagish Lake was that different pieces have greatly differing amounts (up to 100 times) of amino acids. Only 1 other meteorite fall, called Almahata Sitta, matches Tagish Lake in terms of diversity, but that one came from an asteroid that appears to be a mash-up of many different asteroids. Identifying the different minerals in each fragment showed how much each had been altered by water. Various fragments had been exposed to different amounts of water, suggesting that water alteration may account for the diversity in amino acids. Water percolating through the parent asteroid caused some molecules to be formed and others destroyed. Although Tagish Lake was the most pristine meteorite recovery, the scientists wanted to rule out Earthly contamination. Analysis was done on the isotopes of elements present. Life processes tend to favor carbon 12 over carbon 13. But the amino acids in the meteorites were found to be enriched in carbon 13, ruling out life processes in the formation of the amino acids, and favoring natural processes in space.

Reflective exoplanet – The little data we have regarding hot Jupiters, those gas giant exoplanets that orbit close to their stars, indicates that they are dark. That is, they absorb much visible light. However the reflectivity of one of the exoplanets found by the

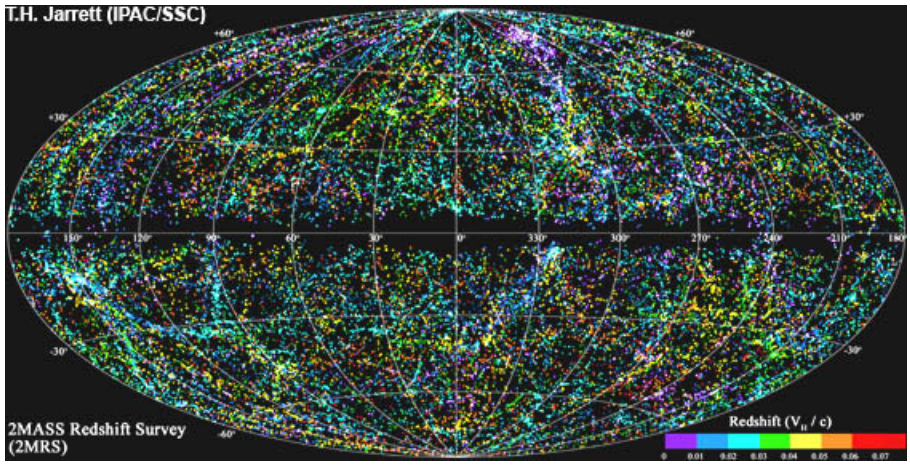
Kepler space telescope (designated Kepler-7b) has been measured by 2 different groups at 32% and 38%, which is fairly reflective. A couple of other hot Jupiters also seem to be more reflective. The conclusion is that these have a different cloud structure than other hot Jupiters, having light colored high clouds. Another possibility, though, is that their atmospheres simply lack the chemicals (such as sodium, potassium, etc.) that absorb so much light. More work needs to be done to understand this.

Multiple exoplanet systems – Of the 1235 planet candidates found by the Kepler spacecraft so far, 408 are located in multiple-planet systems, showing that planets tend to form in groups. The 408 reside in 170 groups that range from 2-6 members each. The number of multiple-planet systems found far exceeded theoretical predictions made beforehand. The systems newly found are flatter than our solar system, that is, the planets' orbits are more tightly constrained to a single plane. Their orbits are within 1° of the same plane, while our solar system deviates by as much as 7° (and was even worse before Pluto was demoted). The flatter systems could be due to the search method being more sensitive to planets in the same plane, or could be because those newly found systems lack Jupiter-sized planets. Gas giants like Jupiter tend to gravitationally stir up other planets' orbits. All the Kepler multiple-planet systems have planets no larger than Neptune. Multiple planet systems found by other means have sometimes contained gas giants, and they tend to have larger departures from a single plane. Transiting planets (Kepler detects transiting planets) in multiple systems allow a new method of measuring those planets' characteristics: planets tend to gravitationally perturb their neighbors' orbits, which results in tiny differences in their time of transit. So checking for early or late transits can allow calculation of masses of the neighboring planets.

Free exoplanets – A team of astronomers, known as the MOA group, using a telescope in New Zealand monitored thousands of stars toward the center of our Milky Way galaxy, looking for microlensing events. These are caused by the gravity of an object transiting (passing in front of) one of the monitored stars. During the observations (done in 2006-7) 10 events occurred caused by planet-sized objects at distances of 10-20 thousand light-years (well within our galaxy). None of these had stars near them. Theory had long predicted that planets without stars should exist, and in fact a very few had been found previously. But this was the 1st systematic search for them. The number found over the small area searched implies statistically that the Milky Way contains 1.8 times as many free planets as it does stars. This is somewhat larger than the number of planets thought to be orbiting stars in our galaxy. The microlensing survey is not sensitive to planets smaller than Saturn, but other evidence shows that smaller planets are more numerous than large ones. So there are probably more free planets of Earth size than of gas giant size. There are 2 theories about the formation of free planets: 1) they are formed like stars form, but with smaller mass, or 2) they are ejected from planetary systems by close gravitational encounters while forming about stars. The best guess, based on probabilities, is that the ejection scenario caused most or all of the newly discovered free planets. Another microlensing survey, called OGLE, confirmed some of the MOA events and confirmed the analysis showing free planets are so numerous.

Star age – A star's rotation slows down steadily with time, so rotation can be used to determine its age. The most common method of determining a star's age is to analyze the cluster containing the star (based on stars forming nearly simultaneously within a cluster), looking for the turn-off point (the mass beyond which stars have ended their main sequence life). But of course this does not work for stars not in a cluster, while the rotation method does. A new study of Kepler spacecraft data has been used to calibrate the rotation technique. While Kepler was looking for planets passing in front of (transiting) stars, it also detected rotation of any of the stars with sufficient star spots to affect their brightness. A billion-year-old cluster (NGC 6811) lies in the Kepler field of view to allow checking against the traditional star-age method. The study had to carefully sort out the foreground stars that happen to lie in front of the cluster. The study found rotation periods in the cluster ranging from 1 to 11 days, depending on mass (larger mass stars were found to spin faster). Taking into account mass, the age and rotation rate were confirmed to strongly correlate. Because older stars tend to have fewer and smaller star spots and rotate slower, it gets increasingly difficult to measure rotation as stars age. Kepler is extremely sensitive to small brightness changes, more so than any Earth-based telescope, so it was the perfect telescope for this study.

Spinning black holes – A new study using radio, visible light and X-ray data has found that supermassive black holes are on average spinning faster now than in the early Universe. The likely explanation is that black holes spin faster after colliding with other black holes. Thus as time passes, continuing collisions of black holes raise the average spin of them.



2MRS – The 2-Micron All Sky Survey (2MASS) was released about a decade ago, and consisted of infrared images of the entire sky, in 3 wavelengths. Now it has been re-released with redshift distances, adding the 3rd dimension. The new release is called the 2MASS Redshift Survey (2MRS). Because infrared penetrates our Milky Way better than visible light, less of the Universe is hidden behind Milky Way in 2MRS than is hidden in visible light surveys.

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One of the problems we have with this observatory is serious condensation on the roof and walls, heavy enough to rain down from the roof when it is closed and humidity is high. This seems to be related to the size and configuration of the observatory and also its metal structure seems to pull moisture out of the air very efficiently, and the support ribs for the roof make excellent drip-edges. This caused a lot of equipment damage while we were using the observatory for the remote telescope project, and we need to solve this problem before we can put the telescope or any other electronic equipment back in the building. This may require changing the roof and/or making other changes in the building (including improvement of the insulation), and we may need to raise some funds or seek donations of materials and labor in order to do this, once we decide on the best approach. As of the time I'm writing this, Gary Schones, John Castillo and others are looking at our options, and hopefully we'll have a plan in place by the time this issue of the Sirius Astronomer reaches you.

When I sent out notice of this project to the club's email groups, we needed a computer monitor and had no cameras that could be used for imaging or as a guide camera. Since then, Jim Benet generously donated a monitor for the project, and also donated a Canon 20D DSLR camera. John Hoot (who donated the LX200 we are using for this facility several years ago) also contacted me about donating a camera, which would be very helpful. Several other people offered computers of different types; at this point, we have a computer that can be used for telescope control, and we haven't worked out what additional computer equipment we will need – many thanks to all of you who responded, and I may indeed be calling on you when we are further along in the planning process and have a better understanding of what additional computers we'll need.

As you may have gathered, we are at the very early stages of this project, and we will need the help of our experienced astroimagers to make this a success. Initially, members using this facility will most likely be using their own cameras and other equipment, but we are hoping that we will be able to have a range of club-owned cameras available, including one we could use as a guide camera (I'd like one for the Kuhn, too, for that matter). We will also need appropriate software, and the assistance of our imagers to determine what that should be and how this system should be set up, as well as what training we will need to give to anyone using the facility.

We will probably have a new special membership for those who would use this facility, similar to the Star Membership for use of the Kuhn telescope in the main club observatory. This will most likely involve a fee to help support the new facility and training in the use of the telescope and related equipment before a member would be able to reserve it for his/her own use. When we get to that point, I expect that the reservations could be handled in the same way I handle reservations for the Kuhn – requests for reservations would be emailed to the person responsible for that aspect of the operation, who would confirm the availability of the observatory and put the reservations on the club's website calendar so everyone knows what nights are taken and by whom.

If you are interested in getting involved in this project, please email me at btoy@cox.net. We will probably need people to help with modifications to the observatory, and we will most definitely need experienced imagers to help set this up right, and to develop operating procedures and a training program, among other things. I would also like to hear from you if you think you would be interested in using this facility once it is ready to go, including any comments you have about how you think you might want to use it and features you think it should include. For those who might be interested in doing some science, Bob Buchheim used this particular telescope very successfully for his astrophotometry work before he built his own observatory.

When we discussed this project at the last Board meeting, we were all very enthusiastic about it, and I hope all of you will share our enthusiasm and join in on making this a reality!

Need a Volunteer for Another New Program…

I guess the creative juices were flowing unusually strongly at the last Board meeting – in addition to the Imaging Observatory project, we had a lot of discussion about a new volunteer position, which we are tentatively calling our "Beginners Observing Coordinator." As many of you know, we have had a Telescope Loaner Program for many years, which is currently coordinated by Mike Myers. This program has a number of telescopes available for club members to borrow, and Mike has added several small Newtonian scopes that are good for basic observing and also have the advantage of being quite rugged, so they are pretty low-maintenance as telescopes go. If you're interested in borrowing one of the scopes in the Loaner Program, please contact Mike (see the contact information on the back of the Sirius Astronomer).

A number of members have expressed interest in borrowing more complex scopes, and we have the possibility of developing a collection of more advanced scopes for use of club members on a loan basis. These would be more challenging to use than the scopes in our Loaner Program, and also will most likely require more maintenance and repair. Because of this, we need to have someone in charge of it who would be willing and able to maintain the scopes and related equipment, and who would also

be willing and able to do more training of the members who would be borrowing them than we have done in the past in our Loaner Program for this program to be a success.

The training could be done either by the Coordinator or by people assisting the Coordinator (no reason we couldn't have more than one person involved in this program). The training would be both for the safety of the scopes and to help the members who borrow them use them with confidence and really enjoy that experience. We expect that a lot of the members who would participate in this program would be relatively inexperienced and that training them properly to use these scopes might require more than one session. The result should be members coming out of the program with new skills that would help them with any other telescopes they might use – and knowledge to make a better choice when they decide to get a scope of their own.

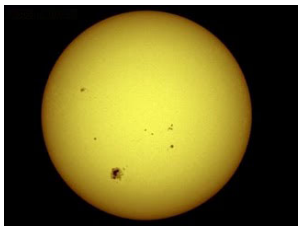
We are really excited about this new endeavor, and if you are interested in helping us develop this new program, we would be delighted to hear from you – please contact me or any member of the Board.

Take the Next Step

By Tom Koonce

The moderate summer evenings are finally here and the best time of year to observe the sky has arrived. I have written at length in the past about how to get started in amateur astronomy, but this month we'll step it up a few notches with a discussion of what I think a beginner needs to take observing to the next level. I have no business association with any of the companies mentioned in this article, but have extensive experience to back up each of my recommendations below. I'm calling it as I see it. Your actual mileage may vary.

First, get a *Telrad* for your telescope. This "1X spotting scope" is the most useful accessory you'll get and many star guides, maps and books are written that use it's illuminated 0.5, 1.0 and 2.0 degree centering circles. I also recommend installing a "blink" kit on the Telrad to cycle the red illumination on and off to help your night vision when locating very dim deep-sky objects. There are other 1 X finders on the market that you can use, but I think the Telrad holds up the best over time.
Next, you're going to be considering getting eyepiece filters and maybe even a new eyepiece. Here's what I think are the essentials and I list them in priority order.



Get a *Thousand Oaks Solar Filter* for your telescope. By doing so, you will have instantly doubled the utility of your scope because you'll also be able to observe during the day with your telescope. The Sun is our nearest star and a high quality glass solar filter will last you many years.

Make sure that you have *decent quality eyepieces* that will yield magnifications of approximately 50X through 200X. I recommend TeleVue, Meade or Celestron Super Plossls. It's essential that you have great eyepieces to match the great telescope that you are using. Go to a Star Party with your telescope and set up next to someone who can lend you several different eyepieces for you to try out. Find ones that you really like and buy ones just like them. Don't buy any eyepiece that you haven't had a chance to use. On the question of whether or not to buy 1 ¼" or 2" eyepieces, I'll say that if you really enjoy amateur astronomy, you will eventually be buying 2" eyepieces, but they are expensive and you need to have a good idea of the kind of observing you will be doing most of the time. Eyepieces hold their value very well, so hold off on buying the 2" eyepieces for now and get the best 1 ¼" eyepiece that you can afford. If you've been reading my articles over the years, you'll know that I recommend that buying eyepieces that are in excellent shape from amateur astronomy-based websites like Astromart.com and build up your collection, but you should also consider companies which offer great prices for brand new eyepieces such as Woodland Hills Telescope and Oceanside Pacific Telescope.

Get a high quality *O-III* (pronounced "Oh-three") *narrow band-pass filter* that screws into the base of your eyepieces. This is the most useful deep sky filter. If you enjoy observing deep-sky objects like the Ring Nebula, Swan Nebula, or would like to observe the Veil Nebula, then get the O-III before you buy a light pollution filter, a set of color filters, or a moon filter.
If you have a Schmidt-Cassegrain telescope, get a "Skylight" filter to seal the back of the telescope tube. Then get a high quality, 2" diagonal with a 1 ¼" adapter. I like the 2" TeleVue diagonal.

If you have a Newtonian telescope, get a quality *barlowed laser collimation tool*. 90% of all of the newtonians / dobsonians people have me look through at star parties are incorrectly collimated and are thus performing at far less than their optical potential. The collimation tool will help you attain new levels of focus with your Newtonian. I use the Howie Glatter barlowed laser collimator and am extremely pleased with it.

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Dark energy – A 5-year survey of 200,000 galaxies, stretching back 7 billion years (by observing galaxies up to 7 billion light-years away), has led to one of the best independent confirmations that dark energy is accelerating the expansion of the Universe. The survey used data from GALEX (ultraviolet space telescope) and a telescope in Australia. The analysis of the survey supports that dark energy works as a constant force, uniform throughout the Universe and uniform over time. This contradicts theories that have gravity acting differently (than Relativity), even negatively, at great distances. The new survey made a 3-dimensional map of bright young galaxies (which are easily seen in ultraviolet) and analyzed the distances between galaxies and their speeds of Universal expansion. Comparing how these changed over the last 7 billion years allowed calculation of how the expansion has changed over that time period. The result showed an acceleration, or dark energy. The method is entirely independent of the supernova surveys that 1st detected the acceleration of the expansion of the Universe.

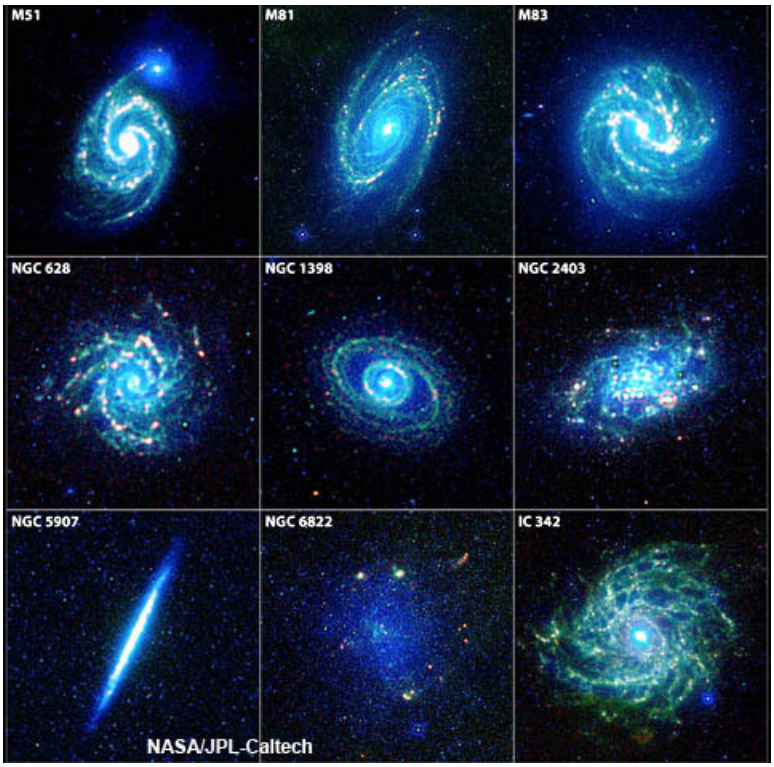
OSIRIS-Rex – NASA has chosen its next mission in the New Frontiers program, and it is a visit to an asteroid that will take a sample from its surface and return it to Earth. The mission is called OSIRIS-Rex. It won over proposals to go to the far side of the Moon and to the surface of Venus. Asteroids are believed to hold relatively unchanged material from the time that planets formed in our solar system. The asteroid to be visited is 1999 RQ36, a near-Earth object, and launch is scheduled for 2016, followed by arrival in 2020. An arm will extend from the spacecraft and retrieve from a few ounces to a few pounds of material. This will be sealed in a container that will be dropped in the Utah Test Range. The mission will also measure accurately for the 1st time the Yarkovsky effect, which slowly alters asteroids' orbits from radiated heat. When the mission is complete, the spacecraft is expected to have sufficient fuel to be retargeted to some new destination. Previous missions in the New Frontiers series are New Horizons (Pluto mission) and Juno (soon-to-launch Jupiter mission).

New crew space vehicle – NASA announced that the next spacecraft to carry people into space (designated Multi-Purpose Crew Vehicle [MPCV]) will be based on the Orion vehicle design, but with a smaller service module, reducing the maximum time in space to about 21 days. It will hold 4 astronauts. The announcement is no surprise, since the Orion was the best design for a crew vehicle last time Congress told NASA to design a new vehicle. By continuing with the work already done on Orion, it appears NASA is going to survive this disrupting mandate from Congress to start over again.

Gravity waves – Plans were unveiled in May for the Einstein Observatory, a gravity wave detector to be built in Europe. It will be similar to the US LIGO, but 100 times more sensitive, particularly to low frequency waves (2-40 Hz). Merging black holes and collapsing and exploding stars are thought to emit gravity waves that are strong enough to be detectable. It will be built about 300-600 feet (100-200 m) underground to shield it from surface motions. It will have 3 nested detectors, each with an L shape 6 miles (10 km) long.

Instant AstroSpace Updates

The **WISE** (infrared all-sky survey space telescope) team has begun releasing infrared images of the largest 1000 galaxies. The 1st batch included such favorites as M51, M81, M83 and NGC 2403.



The Kepler (planet-finding space telescope) mission announced their 2nd confirmed **rocky planet**, designated Kepler 10C. Like the 1st, it is expected to be a scorched molten planet orbiting too close to its star for liquid water to exist, so is hardly Earth-like.

Using Earth-based observations of **Comet Hartley 2**, a research team found that the comet tumbles, or changes its rotation direction, as well as slowing in rotation. Hartley 2 is a relatively small comet (1.2 miles = 2 km) and is highly active (emitting gas) for its size, which probably affects the rotation.

At the beginning of June, the **Dawn** spacecraft was close enough to its 1st target asteroid Vesta to take images with about the same resolution as the Hubble Space Telescope. It is scheduled to have slowed to 75 mph (120 kph) relative to Vesta by July 16, when it will go into orbit.

A team using radiotelescopes spread across the southern hemisphere has produced the most detailed **image of particle jets** erupting from a supermassive black hole in a nearby galaxy (Centaurus A). The jets race at about 1/3 the speed of light and interact with the surrounding gas.

Chang'e-2 (Chinese Moon orbiter) has completed its objectives in lunar orbit, including imaging the polar regions and taking high-resolution shots of Sinus Iridium in anticipation of a future mission landing there, and has been commanded to leave orbit to reach a point in space about 0.9 million miles (1.5 million km) from Earth.

A team of astronomers has made the deepest wide-field radio images of the sky in the relatively unexplored part of the spectrum around 150 megahertz, using the new (still under construction) **LOFAR** radio telescope array.

Atlantis is scheduled to begin a 12-day mission to the International Space Station (ISS) on July 8, delivering Raffaello, the last ISS module, and spare ISS parts. It is the last Space Shuttle flight before they are retired and sent to museums.

Robert Bigelow, owner of a vast real estate empire and Bigelow Aerospace company, predicts that he will have a functioning multi-unit **inflatable space station** in orbit by 2016 and be selling 30-day stays in it for about $29 million, less in future years. A small prototype has been in orbit since 2006.

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Get an *adjustable red light flashlight*. Make sure that the brightness can be dialed down very close to the off position so that minimum light is illuminated. Now that you're taking the next step in amateur astronomy, you're going to have to pay more attention to your might vision. After your eyes become dark adapted, most of the single switch red flashlights are too bright and are useful only to upset other observers around you. Begin to pay more attention to observing etiquette. You shouldn't walk up to other observers with your red flashlight on its cord around your neck, turned up to high, thus affecting other's night vision. It is encouraged for you to park with your car headlights pointed away from the general observing area and to turn your car's interior dome lights off at the beginning of the evening.

Get a *polarizing moon filter*. This is made up of two polarizing filters that can rotate about each other so that you can "dial" the brightness of the moon up or down to counter the brightness when directly observing the moon. You'll find this much handier than a single neutral density filter for changing brightness of the phases.

Get a good *night sky atlas*. If you have an eight inch or larger telescope, I prefer the large "Sky Atlas 2000.0 Deluxe Laminated" atlas, with black stars on a white background. For smaller scopes, you can take a look at Sky & Telescope's "Pocket Sky Atlas". This is the right time to re-read the great book "Night Watch – A Practical Guide to Viewing the Universe".
Get a *portable table* to take with you observing. A sturdy folding card table works well. You'll need a place to put your maps and eyepieces.

Begin working on your Messier Pin. This is an observing challenge sponsored by the Astronomical League. By completing the observation of all of the Messier objects, you will truly know the night sky.

Dedicate an *old blanket, carpet, or artificial turf* to put beneath your telescope when observing. It will keep dirt and dust off of your scope, and when you drop that new eyepiece or little retaining screw out of your diagonal at 2:00 am, it will help spare those around you from hearing a staccato of four letter words punctuating the night. Not that *I've* ever done such a thing myself…

This will get you started. I didn't mention other items such as an observing stool to sit on, color filters, a warm jumpsuit, or large camp chair for taking a break. You can add these as you go forward. Advancing in amateur astronomy is not about the *equipment*, but about *honing your observing skills*. Each item I've mentioned will either enable or simplify the technical portion of observing so that you can concentrate more on the sky and less on whether or not you have the necessary resources at hand.

Clear Skies, Tom

FOR SALE: Skywatcher 80mm f/11 refractor with equatorial mount and electronic drive; red dot finder; 2 Plossl eyepieces; diagonal; moon filter; accessory tray and 2x Barlow, $75. 4.5 inch f/4.7 Newtonian with table top equatorial mount and slow motion cables; 2 eyepieces; 6x30mm finder telescope and barlow lens, $50. Val Akins (949) 382-1869 (call anytime or leave message)

FOR SALE: TeleVue 5mm Radian Eyepiece, $125.00. Contact Bill Llano at 714-255-0845 or BELMARDUK@EATHLINK.NET

FOR SALE: 5x8X4 foot, 3500 limit load, enclosed trailer with 15inch wheels, removable top, carpeted floor with 4 tie downs, and 12 volt winch that raise/lower tail gate or pulls in anything on wheels. Trailer specifically designed to transport large dobsonian telescope. $1000. Equatorial telescope tripod for 10-15 lb optical tube assembly, build-in polar align finderscope, slow motion manual axis controls and counter weight. $80. Contact Dave at 949-492-5342

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