



# The Skyscraper

Vol. 36 No. 7

July 2009

Amateur Astronomical Society Of Rhode Island · 47 PeepToad Road North Scituate, RI 02857 · www.theSkyscrapers.org



## Seagrave Memorial Observatory is open to the public

weather permitting



Saturdays 9pm - 11pm  
See [www.theSkyscrapers.org](http://www.theSkyscrapers.org)  
for updates.

## Last Chance to Renew

Membership dues were due in April and are now past due. If you have not yet renewed, please complete the form on the back page of this newsletter and submit with your dues to the Treasurer at the July meeting.

## July 2009

3 Earth at aphelion

7 Full Moon

13 Jupiter 0.6° S of Neptune

13 Mercury at superior conjunction

15 Last Quarter Moon

21 New Moon; Total Solar Eclipse in India & Asia

28 First Quarter Moon

## July Cookout & Meeting with Kristine Larsen

Saturday, July 11, 3:00pm at Seagrave Memorial Observatory

### Stephen Hawking: Black Holes, Baby Universes, and Life's Battles

Stephen Hawking is arguably the most famous physicist since Albert Einstein. His decades-long struggle with ALS (Lou Gehrig's disease), combined with his singular brilliance as a cosmologist, has fascinated both the public and his colleagues in science. In this engagingly written biography, Kristine Larsen, a physicist and astronomer herself, presents a candid and insightful portrait of Hawking's personal and professional life. Avoiding the hero-worship sometimes found in popular works on Hawking, Larsen emphasizes that Hawking is first and foremost a scientist whose work has made significant contributions to our understanding of the nature and origins of the universe. Writing in nontechnical language for the lay reader, Larsen

clearly explains Hawking's complex scientific accomplishments, while telling the story of his challenging life.

Topics include Hawking's early lack of focus as a college student; the impact of ALS on his career and personal life; his groundbreaking work on radiating black holes; his later cutting-edge theories of black holes, cosmology, and the anthropic principle; the amazing publishing success of *A Brief History of Time*; and his status as a pop icon and spokesperson for the interplay of science and society. Larsen situates Hawking's sometimes-controversial work within the broader context of scientific peer review and public debate, and discusses his personal life with compassion, respect, and honesty.

## President's Message

Bob Horton

**Skyscrapers annual summer cookout** will be held on Saturday July 11th beginning at 3pm. All members and their guests are invited to attend. The cost is only \$7.50 per person (\$3 for kids under 12) for all you can eat. We will be serving hamburgers, hotdogs, veggie-burgers, clam chowder, corn on the cob, salads and deserts. Some members have asked if it is okay to bring some additional potluck items. Well the answer is "yes", the more the merrier! Just let me know what you're planning to bring so that we can coordinate our efforts.

Many of you have already sent in your money for the cookout, which

is greatly appreciated. If you have not already done so, please send us a check before July 3rd. Our address is Skyscrapers, Inc., 47 PeepToad Road, North Scituate, RI 02857. You may also pay at the door, but please let us know that you're planning to attend so that we know how much food we need to purchase. We're also looking for volunteers to help set up for the cookout, starting at noon on July 11th. If you are willing to help out, please let me know.

In addition to the cookout, a 90mm Coronado solar telescope will be set up to offer some spectacular views of the sun, weather permitting. And for

just for fun, Al Hall has some outdoor games for us to play. Prizes will be awarded to the winners!

Our evening program will begin at 7:30pm. Our speaker, Dr. Kristine Larson, who gave a wonderful talk about Women in Astronomy at our December meeting, is returning this month to provide us with a talk about famed physicist Steven Hawking. It is our privilege to welcome her back to Skyscrapers.

Now that summer is here, I am sure we are all hoping for better observing conditions. It sure has been a wet spring. Of the nine sessions planned for our CCD imaging workshops, only one session allowed us to take any images at all, and even then we had to deal with clouds coming and going. I guess the good side to all of this wet weather is that our lawn at Seagrave has never been greener, and the chorus of peep toads that live in the pond next door to us have never sung louder. In fact, the night sounds emanating from this little pond are so loud and prehistoric sounding that I half expect to see dragon flies with four foot wing spans flying overhead!

It was raining again the night of Saturday, June 20th, but quite a few members showed up at Seagrave to enjoy a wonderful program on The History and Science of Spectroscopy, presented by Dr. Savvas Koushiappas of Brown University. We plan to follow

up on his talk with an outdoor workshop later this summer, when Skyscrapers will have a hands-on opportunity to use a Sbig spectrograph, attached to our 16" telescope, to collect spectra of several different classes of stars. This workshop will be held on the first clear night we get on the following dates: August 8, 22 or 29th.



Here is the image of M3 that was taken during our 1st CCD imaging workshop. Not bad considering how we had to battle the clouds.

Looking ahead, we plan to offer CCD imaging workshops again this fall, which hopefully will have a greater abundance of clear nights. We're also considering having telescope making workshops. If you are interested in learning how to grind, polish and figure your own telescope mirror, please let me know. If enough members are interested, we probably could begin late this summer or early fall.



*The Skyscraper* is published monthly by Skyscrapers, Inc. Meetings are usually held on the first Friday of the month. Public observing is usually held every Saturday night at Seagrave Memorial Observatory, weather permitting.

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**Directions**

Directions to Seagrave Memorial Observatory are located on the back page of this newsletter.

**Submissions**

Submissions to *The Skyscraper* are always welcome. Please submit items for the newsletter by July 15 to Jim Hendrickson, 1 Sunflower Circle, North Providence, RI 02911 or email to jim@distantgalaxy.com.

**Email subscriptions**

To receive *The Skyscraper* by email, send email with your name and address to jim@distantgalaxy.com. Note that you will no longer receive the newsletter by postal mail.

# Occultation/Graze of Antares by Moon: June 6, 2009

Dave Huestis

I have watched the Moon occult stars in the Pleiades star cluster on many occasions. And I have also observed the Moon occult a planet or two during my 37 years of amateur astronomy. But just seeing a single star either pass behind the lunar limb or move tangentially to it never seemed to interest me.

Fortunately at the June monthly meeting of Skyscrapers, Bob Napier reminded everyone of the June 6 (Saturday night) occultation or graze of the bright star Antares (Scorpius) by the Moon. Here in Rhode Island we would be very close to the graze/occultation limit. I did not review any details about the event beforehand, but it was my belief my location up here in Pascoag would be north of the occultation point, but perhaps I would be able to observe a graze which would show Antares blinking in and out between lunar mountain valleys or crater walls along the limb.

During the late afternoon and early evening my wife and I attended a wedding shower down in Warren on the Bay. Soon after sunset low clouds rolled off the Bay and completely obscured the sky. Perhaps these clouds would not penetrate far inland I thought. Well, they did. On the ride home I got to Chepachet before the Moon was finally seen in a cloud-free sky. And it was perfectly clear at home in Pascoag at about 9:30 pm.

The Moon, only a few hours from full, was traversing a low trajectory across the southern sky. I knew I would not be able to observe the event from my high tree-lined property. I picked out a spot across the street at my neighbor's house where the tree-line towards the south would not block the Moon.

The event was to occur approxi-

mately between 11:00 pm to 11:30 pm. At around 10:45 pm I carried my 4 1/2-inch f/5 reflector across the street. And what did I see? Those clouds had finally reached further inland. Overhead was still clear, but the clouds (reminded me of the marine layer in San Diego) varying in thickness were constantly covering and uncovering the Moon. And these clouds were moving very fast. They looked more like smoke from a big fire than clouds, especially when they passed in front of the Moon.

I started observing with a 12mm eyepiece then quickly chose an 8mm, giving me a magnification of 64. Right away I could see Antares a short distance from the lunar limb. As the time passed I could see the distance between these two bodies decreasing. I still believed Antares would stay just beyond the lunar limb. Closer and closer they became. But then it seemed the two were not getting any closer. It looked like Antares was moving tangentially to the lunar limb. Actually, the Moon was moving eastward amongst the stars. I noted several "bumps" (mountains/craters) and watched Antares move relative to them. With the Moon just shy of being full, I thought possibly I'd see Antares disappear behind the slight unlit portion of the lunar surface.

The clouds thickened and thinned constantly, causing me to look toward the sky, then back to the eyepiece every few seconds. It was like watching a tennis match. And the turbulence or scintillation caused by the unstable air made it difficult to note whether Antares was passing in front of a limb feature or not. I decided it was not at this time.

Antares continued to "move" relative to the features. I noticed what

seemed to be a "pocket" on the limb, a little indentation. Perhaps it was a small valley or a crater wall. Antares seemed to sit right in it. Just before it got to this location it seemed like I was watching some "vehicle" skim above the lunar surface.

A thick mass of clouds obscured my view for a couple of seconds, and when the Moon was back to full brightness, Antares was gone. Though the scintillation had gotten a bit worse, I do not think it was responsible for my losing site of Antares. Antares was occulted by the Moon at approximately 11:10 pm.

Fortunately the cloud situation did not worsen. In fact, they seemed to retreat south of the Moon's location. I kept a vigilant eye on the lunar limb and at approximately 11:22 pm I observed Antares emerge from the edge of the Moon. I continued to observe for about 10 minutes, all the while watching as the lunar limb moved farther and farther from this red giant star.

I picked up my scope and chair and returned them to my garage. Though I did not keep accurate time measurements down to the second, when I checked my timings the next morning against the predictions for Providence (disappearance: 11:10:17pm; reappearance: 11:21:09 pm), I was pleased to confirm my measurements were in line with what was expected.

All in all I had a good observing session, and I encourage others to give it a try sometime in the future. And dozens of fireflies and a few mosquitoes kept me company the whole time. I know I will be out there should a future event be as conveniently well placed to observe.

# 40th Anniversary of Apollo 11 Moon Landing

Dave Huestis

Movies have often provided us with many unforgettable lines. Who can forget, "I'll be back." Or how about, "You're gonna need a bigger boat!" My favorite is, "Gentlemen, you can't fight in here! This is the War Room." And perhaps more appropriate to astronomy and space science, "Klaatu. Barada. Nikto."

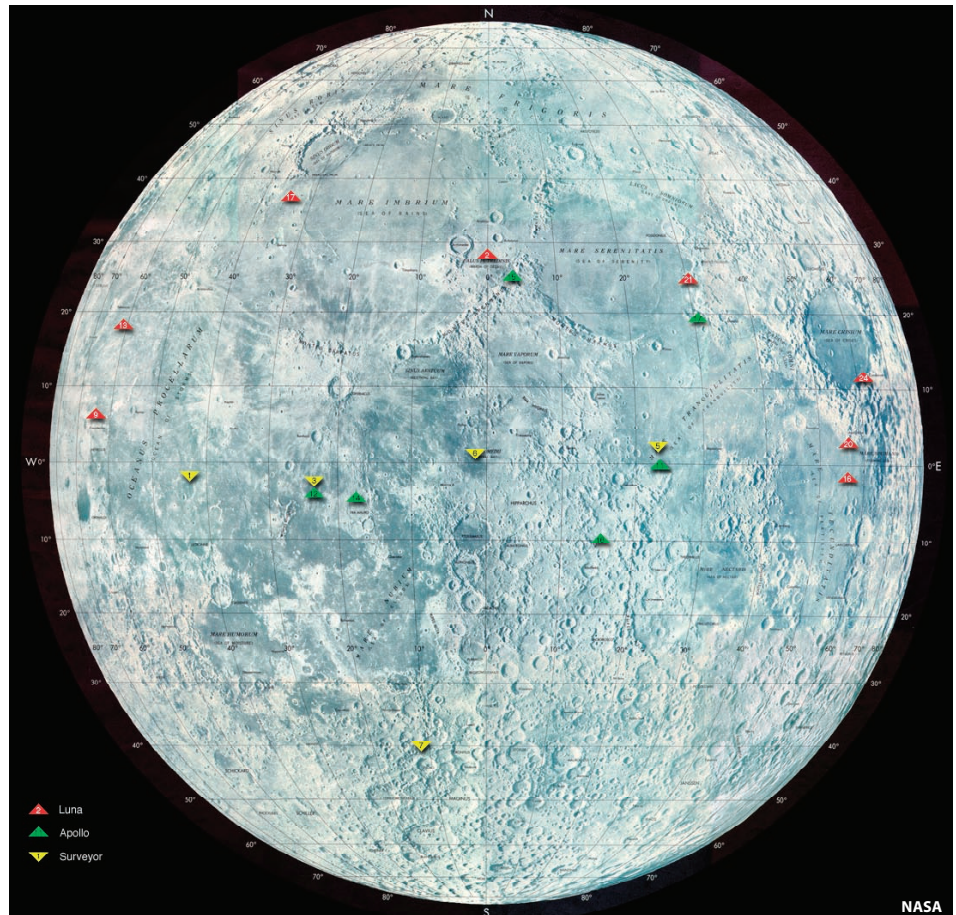
While some of these lines may not be known to all the peoples of the world, reality often provides us with memorable phrases that will not soon be forgotten. This month, we celebrate the 40th anniversary of mankind's greatest achievement when these words were spoken: "That's one small step for (a) man. One giant leap for mankind."







The date was July 20, 1969, and Neil Armstrong had just stepped off the ladder of the Eagle (the name for his LEM - Lunar Excursion Module) and set foot upon the lunar surface. He was shortly followed by Buzz Aldrin. Six more missions ensued. Apollo 13 astronauts never made it to the lunar surface after their near fatal accident, but Apollo 12, 14, 15, 16 and 17 brought ten additional moonwalkers to our desolate neighbor.

Many people remember the first two moonwalkers, but the other ten are a challenge to most. And when I ask if anyone remembers who was the third astronaut who remained in the command module circling the Moon, I sometimes encounter a quizzical look and the question, "There was a third?" I have to admit that as I prepared this brief tribute to the 40th anniversary of the Apollo 11 Moon landing, I too was unable to name all the command module pilots. In fact, I only got three out of seven.

So as we celebrate this crowning achievement of the US space program, we honor not only all the people who worked so hard on the Mercury, Gemini and Apollo missions, but also all the astronauts who paved the way for the Apollo 11-17 crews who had a rendezvous with destiny on the lunar surface.

Here is a table of the Apollo 11 through 17 crews (July 1969 - December 1972). The third named astronaut for



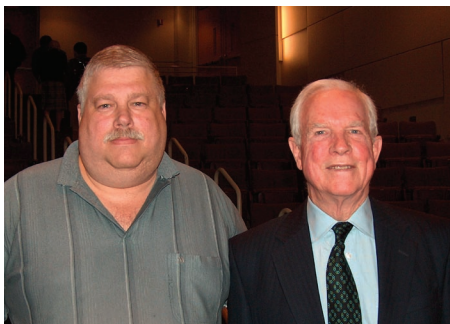
Mission	Patch	Commander LM Pilot CM Pilot	Launch Date Lunar Landing Date Splashdown Date	Lunar Landing Site
<b>Apollo 11</b>		Neil Armstrong Buzz Aldrin Michael Collins	July 16, 1969 July 20, 1969 July 24, 1969	Sea of Tranquility 0° 40' 26.69" N 23° 28' 22.69" E
<b>Apollo 12</b>		Pete Conrad Alan Bean Dick Gordon	November 14, 1969 November 19, 1969 November 24, 1969	Ocean of Storms 3° 0' 44.60" S 23° 25' 17.65" W
<b>Apollo 13</b>		Jim Lovell Fred Haise Jack Swigert	April 11, 1970 - April 17, 1970	Lunar Landing Aborted
<b>Apollo 14</b>		Alan Shepard Edgar Mitchell Stuart Roosa	January 31, 1971 February 5, 1971 February 9, 1971	Fra Mauro 3° 38' 43.08" S 17° 28' 16.90" W
<b>Apollo 15</b>		David Scott James Irwin Al Worden	July 26, 1971 July 30, 1971 August 7, 1971	Hadley-Apennine 26° 7' 55.99" N 3° 38' 1.90" E
<b>Apollo 16</b>		John W. Young Charles Duke Ken Mattingly	April 16, 1972 April 20, 1972 April 27, 1972	Descartes Highlands 8° 58' 22.84" S 15° 30' 0.68" E
<b>Apollo 17</b>		Gene Cernan Harrison Schmitt Ronald Evans	December 07, 1972 December 11, 1972 December 19, 1972	Taurus-Littrow 20° 11' 26.88" N 30° 46' 18.05" E

each mission is the Command Module Pilot who remained in orbit about the Moon as the others descended to the surface. See how many of the moon-walkers you can name before you review the list.

I am pleased to note I have had the distinct honor of meeting two of the above astronauts: Jim Lovell and David Scott.

The Moon is often a target for our telescopes at Seagrave Observatory when we are conducting an observing program for a scout or school group. These youngsters weren't even born when the last man walked on the Moon – Gene Cernan. Invariably we get the question, "Can the telescope show anything left behind by the astronauts on the Moon's surface?" The short answer is no, but this usually starts a discussion of the Apollo missions.

You know you are getting old when someone in the group pipes up and states, "Oh, we learned about that in history class!!"



### Meeting the Apollo Astronauts

**Top:** Commander David Scott & Dave Huestis, Brown University, October 11, 2007. **Bottom:** Captain Alan Bean & Jim Hendrickson, June 8, 2005.

# Astronomical Potpourri in July

Dave Huestis

Not that you would notice, but the Earth is at its farthest distance (94,508,863 miles) from the Sun during 2009 at approximately 10:00 pm EDT on July 3. Back on January 4th, the Earth was at its closest distance from the Sun for the year, a mere 91,404,995 miles. That difference is just over 3 million miles. This variance is the result of the Earth's elliptical, not circular, orbit about the Sun.

Something you might have noticed from time-to-time is that each Full Moon may look larger or smaller in our sky. It's no atmospheric trick. The Moon's distance from the Earth varies as well. On the 7th the Full Moon will be its smallest for 2009, since it will be 252,433 miles from the Earth. The largest Full Moon for 2009 occurred back on January 10th when it was at its closest distance to the Earth, 222,149 miles. Try to get a digital image of the Full Moon each month and compare your images side by side on your computer screen. You'll be amazed by the amount of change in apparent size.

Be sure to watch the news media on July 22 for images of the total solar eclipse which will occur over India, China and the Pacific Ocean. Totality lasts for a maximum of six minutes

and 39 seconds (the longest duration of totality this century) east of Iwo Jima. Shanghai residents will see about five minutes of totality. I'm hoping one of my Bryant University astronomy lab students, who lives in Shanghai, will send me an image or two.

And finally, during the last four days (28-31) of July there are two minor meteor showers, the Delta Aquarids (medium speed) and the Alpha Capricornids (slow with occasional fireballs). Once the Moon sets around midnight one can expect to see perhaps ten or fewer meteors per hour if you look towards the south. You might even spot a few early Perseids, which reach peak activity in mid-August, in the northeastern sky

Visit Seagrave Memorial Observatory on Peepoad Road in North Scituate any clear Saturday night and let our volunteers share their love of the heavens with you. Check the Skyscrapers website [www.theskyscrapers.org](http://www.theskyscrapers.org) for our summer month schedule. Admission is free.

Keep your eyes to the skies, and the next time you look up at the Moon, remember the men who first walked upon its surface 40 years ago.



I bought a new scope I hope to use at future Sky Parties and tried it out on the moon. It's a IOptron Cube mount and 70MM refractor. I decided to add the Orion Star Shoot CCD and took this shot on 6/2/09. It just shows that a relatively inexpensive scope and cheap camera can provide a good photo. This picture was a single frame requiring no mosaic due to the wide field of view the scope provides on a first attempt. Photo was processed with Adobe Photoshop.

– Tom Thibault

# Round and Round (the Celestial Pole) We Go...

Craig Cortis

Readers of my pieces in this newsletter will note that, on occasion, I like to preface an article by noting that not everyone will find my chosen topic to be useful or informing, simply because some people will already be well aware of things that others won't be—no writer can possibly write for everyone, all the time.

This month's contribution is intended for the benefit of those who might not be entirely clear as to what the term "circumpolar" means and why this concept is important for understanding the apparent motions of stars around the sky caused by Earth's continual rotation about its axis.

Sooner or later, any attentive observer of the night sky is bound to notice that the closer any given star is to Polaris (the northern hemisphere's Pole Star), the more circular its path around the sky will seem to be, through the passage of time. Another way to put this is to realize that the more northerly a star's declination from the Celestial Equator is, the smaller the diameter—in angular degrees—its perceived arc of motion will be as viewed over time. The best example of this would be an unguided, time-exposed image taken by a camera on a stationary mount having the image centered on the North Celestial Pole, or NCP.

Many of you will have seen such pictures in the various astronomy magazines or perhaps in some of the books you've looked into. The kind of picture I'm describing will feature numerous "star trails"—elongated, semicircular images of stars of different colors and brightnesses, as opposed to the clean and sharp points and dots that stars would appear as on a guided image by a camera on a tracking mount. Imagine a large, multi-ringed bull's-eye pattern with a tiny star trail very nearly marking dead center, but not precisely so. This is Polaris; its star trail is just a segment of a very small complete circle, most of which is not illuminated. Similarly, concentric circles of progressively larger diameter radiate outward from Polaris, each one only partially indicated by an illuminated star trail which will only

be a segment of a complete circle. The lengths of these star trails will correspond to image exposure times. A two hour exposure would capture star trails approximating one-twelfth the arc of a complete circle. (24 hours divided by 2 = 12.) The shorter the exposure time, the more abbreviated in length the star trail will be.

We're fortunate to have a reasonably bright star so closely indicating the true North Celestial Pole, an invisible, imaginary reference point on the sky to which is pointed Earth's axis. Polaris is currently about 45 minutes of angle ( $0.75^\circ$ ) away from the actual polar point, a distance which is very gradually decreasing to the closest projected position of only 27 minutes or so by the year 2102, after which the star's distance from the pole will widen. Sheer coincidence alone is responsible for the current placement of the 49th brightest star so close to the pole that the small displacement of  $0.75^\circ$  may be considered—for most practical purposes—almost negligible. The offset is so minimal, in fact, that you can align a telescope's equatorial mounting directly at Polaris for reliable tracking on objects for visual observation and even for astrophotography, provided the exposure time is not unduly long. (I'm not a photographer or CCD imager, so I really can't say what would constitute the upper limit for exposure time. Amateurs knowledgeable in this regard probably would agree that careful alignment on Polaris itself is sufficient without having to fine-tune the small offset to the actual pole.)

I mentioned the coincidental placement of Polaris close to the NCP, and that's all it really is—a lucky, chance position that serves (over several centuries) as a good indicator of true north on a clear night, as well as a means of determining one's latitude by measuring the altitude of the pole star above the northern horizon. Your latitude position north of the Equator—expressed in degrees—always exactly equals the altitude of the NCP above the north horizon. Some have trouble trying to imagine how this works, so we'll use a "thought experiment" to

clarify the concept.

Start by picturing yourself as being located directly on the Equator. The Celestial Equator—projected outward as a circular reference plane on the sky—is the astronomical counterpart to the terrestrial equator. We have a geocentric (Earth-centered) system for assigning precise positions on the sky for stars or other objects; this excellent celestial coordinate system uses the Celestial Equator as the plane of reference from which declination on the sky is determined. The CE itself is zero degrees and divides the sky into two hemispheres, northern and southern. Anything north of the CE is assigned a positive value in degrees and minutes of declination; the reverse is true for everything south of the CE. We would therefore identify the NCP as  $+90^\circ$  and the opposing SCP as  $-90^\circ$  of declination—the two polar points are  $180^\circ$  apart, half of a great circle running due north through due south. Unlike Right Ascension (east/west) coordinates, which are time-based and are the celestial counterpart of earthly longitude, declination values represent actual degrees of angle on the sky. For example, the declination of Arcturus is  $+19^\circ 11'$ . This star's position north of the CE is, in degrees and minutes of angle, equal to that value, which is how far north Arcturus "declines" from the zero degree reference plane of the CE.

An observer on the Equator would have the CE passing directly overhead, right through his or her zenith point above. The two celestial poles would lie precisely at the northern and southern horizons, each having an altitude of zero degrees. All stars, regardless of declination, would be seen to rise and set at opposing east/west points. The greater a given star's declination value north or south of the CE, the smaller in diameter its perceived arc of apparent motion across the sky would be, through time. (Just look at the parallels of latitude marked on a globe of Earth—you'll see what I mean.) It would be impossible for any star to be seen as "circumpolar"—none would circle around either pole,

because neither of the two celestial poles would technically have any altitude in the sky.

Polaris itself would actually rise and set through a tiny arc due to its offset from the true NCP; it could only be glimpsed at or near its culmination, or passage across the Celestial Meridian, the imaginary line running due north/south that connects the two polar points and cuts across an observer's zenith, the exact overhead point for each particular observer. (A friend standing just 100 feet in any direction away from you would actually have a slightly different personal zenith!)

Some readers could be excused for wondering what all this stuff about observing from the Equator possibly has to do with those of us who reside in this area, with our local latitude of approximately 42° north. All you have to do now is shift the equatorial concept to the north, by 42°. Polaris now stands the same number of degrees of angle above the northern horizon in altitude, the Celestial Equator is well south of our zenith, and the South Celestial Pole is situated 42° below the southern horizon and thus cannot be seen in the sky. Any star that lies within 42° of the NCP is circumpolar at our latitude, meaning it circles around Polaris in a counter-clockwise direction and neither rises nor sets at any time of day or night throughout the entire year. Such a star could, under ideal and perfect observing conditions, technically always be seen at or above the northern horizon on any night! Obviously this would be, in reality, a fantasy and must be considered only in the hypothetical sense. You'll almost always have something obscuring your actual horizon, whether it be trees, buildings, hills, etc. Light pollution, clouds, or hazy skies also will limit such observing exercises. The concept itself is what's important here.

We can easily figure a declination limit by which sky objects would qualify as circumpolar, at any given latitude. I'll use 42° north latitude as a base from which to work. The NCP (very closely marked by Polaris) stands 42° of altitude above the northern

horizon. The pole's declination north of the Celestial Equator is expressed as +90°. Simply subtract 42° (the radius of circumpolarity) from 90° to arrive at a declination value of +48°. Any point on the sky having a declination between +48° to +90° is therefore circumpolar as viewed from our latitude. You'll see stars and constellation groups gradually achieve enough altitude so as to first be seen coming up out of the northeast. As the night progresses, objects sufficiently near Polaris will display an apparent "wheeling" motion as they circle the pole counter-clockwise, rising ever higher in the sky until they transit the Meridian, then drawing lower to the horizon in the northwest. Remember: only circumpolar stars can display this circular apparent motion so dramatically. Our natural "sky clock" has its face centered on Polaris.

The more southerly-positioned stars (those having declinations south of +48°) show decidedly different arcs of motion across the sky—they all rise in the east and set in the west. Look far enough south and you'll note how certain stars seem to rise in the southeast and climb only to a low altitude above the southern horizon, even when they culminate at their highest altitudes while crossing (transiting) the Meridian. They'll then arc progressively lower to set in the southwest, thus displaying a much-reduced "arc of visibility" above the horizon—only a small segment of a complete circle. It all depends on what direction you're viewing and how much time you have to note changes during the night.

One of the best and simplest ways to observe the natural sky clock in action would be to start as early as twilight will allow on a good, clear night. Winter is actually best because darkness falls early and you probably would want to squeeze this two-part observation into a convenient time of night, because six hours of time are involved. The night owls among you can still manage trying this during summer, of course. Find Polaris in the northern sky, then look to the right for

any given star of sufficient brightness that will meet two criteria: 1) The star must be about the right distance from Polaris to function as the hour hand on a clock, not too close but not so distant that its circumpolar motion will not be easily noticed with respect to Polaris. 2) An imaginary line joining your star of choice to Polaris should be oriented horizontally over the horizon, such that the star could be considered as being at about three o'clock in its position of altitude. (Remember: Polaris is the center of the clock.)

Once you've chosen a star you know you can positively identify hours later, note the time. Just reobserve your star six hours later, which is one-quarter of a day. Presto! The star will have made one-quarter of a complete circle's arc and now stands directly above Polaris at the twelve o'clock position. The only difference from a normal clock is the direction of motion—it's counter-clockwise, because Earth rotates west-to-east.

I'll devote a future article to precession, the 25,870 year period during which the "wobble" of Earth's axis causes the celestial poles to actually move around the sky on great circles approximately 47° in total diameter. Polaris is only temporarily our North Pole Star, as others have been and will, in time, become so again. Perhaps I can include a listing of certain constellations that qualify as partial or entirely circumpolar, too. By the way, Polaris is a fairly easy double star and has a magnitude 8.8 visual companion just 18" of separation away. The primary is mag 2.0 and is a "quiet" Cepheid variable; very little change in brightness has been noted in recent years.

# The Cool Chemistry of Alien Life

Alien life on distant worlds. What would it be like? For millennia people could only wonder, but now NASA's Spitzer Space Telescope is producing some hard data. It turns out that life around certain kinds of stars would likely be very different from life as we know it.

Using Spitzer, astronomers have discovered the organic chemical acetylene in the planet-forming discs surrounding 17 M-dwarf stars. It's the first time any chemical has been detected around one of these small, cool stars. However, scientists are more intrigued by what was not there: a chemical called hydrogen cyanide (HCN), an important building block for life as we know it.

"The fact that we do not detect hydrogen cyanide around cool stars suggests that that prebiotic chemistry may unfold differently on planets orbiting cool stars," says Ilaria Pascucci, lead scientist for the Spitzer observations and an astrophysicist at Johns Hopkins University in Baltimore, Maryland.

That's because HCN is the basic component for making adenine, one of the four information-carrying chemicals in DNA. All known life on Earth is based on DNA, but without adenine available, life in a dwarf-star solar system would have to make do without it. "You cannot make adenine in another way," Pascucci explains. "You need hydrogen cyanide."

M-dwarf and brown dwarf stars emit far less ultraviolet light than larger, hotter stars such as our sun. Pascucci thinks this difference could explain the lack of HCN around dwarf stars. For HCN to form, molecules of nitrogen must first be split into individual nitrogen atoms. But the triple bond holding molecular nitrogen together is very strong. High-energy ultraviolet photons can break this bond, but the lower-energy photons from M-dwarf stars cannot.

"Other nitrogen-bearing molecules are going to be affected by this same chemistry," Pascucci says, possibly in-



Do alien planets around other stars have the right ingredients for a pre-biotic soup?

cluding the precursors to amino acids and thus proteins.

To search for HCN, Pascucci's team looked at data from Spitzer, which observes the universe at infrared wavelengths. Planet-forming discs around M-dwarf stars have very faint infrared emissions, but Spitzer is sensitive enough to detect them.

HCN's distinctive 14-micron emission band was absent in the infrared spectra of the M-dwarf stars, but Spitzer did detect HCN in the spectra of 44 hotter, sun-like stars.

Infrared astronomy will be a powerful tool for studying other prebiotic chemicals in planet-forming discs, says Pascucci, and the Spitzer Space Telescope is at the forefront of the field. Spitzer can't yet draw us a picture of alien life forms, but it's beginning to tell us what they could—and could not—be made of. "That's pretty wonderful, too," says Pascucci.

For news of other discoveries based on Spitzer data, visit [www.spitzer.caltech.edu](http://www.spitzer.caltech.edu).

Kids can learn Spitzer astronomy words and concepts by playing the Spitzer "Sign Here!" game at [spaceplace.nasa.gov/en/kids/spitzer/signs](http://spaceplace.nasa.gov/en/kids/spitzer/signs).

*This article was provided by the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.*



# June Meeting Notes

Friday, June 5, 2009; Seagrave Observatory

Jim Crawford

Monthly Meeting 7:30 p.m.

Bob Horton welcomed all members including several people attending for the first time.

Bob Napier introduced Guest Speaker:

Robert Naeye, Editor in Chief of *Sky & Telescope*. He presented the latest and best images of Mars in realistic 3-Dimensions. Robert provided updates on the status of the various ongoing Mars missions, and explained what we have learned about the history of water on the Red Planet. NASA missions, such as Mars Global Surveyor and the Rovers Spirit and Opportunity have shown that liquid water once flowed on Mars. On Earth, wherever we find liquid water, we also find life. His presentation was greatly enhanced by the use of 3-D viewers.

Business Meeting 9: p.m.

**Secretary's Report** was accepted by the membership.

**Financial Report** was accepted by the membership. In the past, we asked for any member to second for approval. The report does not require membership approval so in the future the President will ask if there are any corrections/additions, if not, then it will be "accepted as read".

**1st VP Bob Napier:** None

**2nd VP Steve Hubbard:** Hartness House in Vermont is hosting a dinner on August 14th for Astronaut Alan Bean who will also be the keynote speaker. If you're interested contact Steve for details. • Hartness House will also be hosting on August 13th a History Astronomy Workshop.

**Historian Dave Huestis:** Sold the last copy of the 2nd printing of "75 yrs of Skyscrapers". Only one reserved copy of the 1st printing is left and has not been claimed yet. If not claimed by June 15th it will be made available for purchase to the membership. • Dave recently found a small block of wood with a label on it. The small piece of wood, approximately 1" x 2" in size was from a larger block of wood used as



the mount for a telescope during a total solar eclipse on October 1, 1940. A brief explanation and the piece of wood can be viewed in the Museum Display case in the main Observatory.

**Librarian Bruce Merrill:**

Received video DVD of the May speaker's presentation from Jim Crawford. Jim also provided the DVD of the reinstallation of the

Clark Drive Governor.

**Star Party Coordinator Bob Forgiel:**

Joint Skyscrapers/ASSNE Star Party rescheduled for June 19th at Elmhurst Elementary in Portsmouth RI. Four Boy scouts completed the Merit Badge Program. Large group of High School students visited on June 18th for Public Night at Seagrave.

**Trustees Jim Brenek:** Did some work on the 12 inch roll off roof. The leaks and needed repairs were not as severe as first thought. The work party completed the repairs and put the bldg back in operation. The Observatory Committee had nothing to report.

**New Business:** New members J. Capen, E. Dettmann, H. Andre, R. Allen, T. Rodrigues, M. Masse, M. DeOliveira and Prof. S. Koushiappas were introduced. These members will be voted into Skyscrapers at the next meeting. • Annual Skyscrapers cookout scheduled for July 11th. To

get an accurate head count, we are asking members to contribute \$7.50 for adults and \$3.00 for children under 12. Make check out to "Skyscrapers" and mail to "Skyscrapers, 47 Peeptoad Rd., North Scituate, RI 02825. Please add "Cookout" to outside of envelope. The list of speakers will be posted by the cookout committee prior to the end of June. We are also looking for volunteers to help with the set up and food preparation.

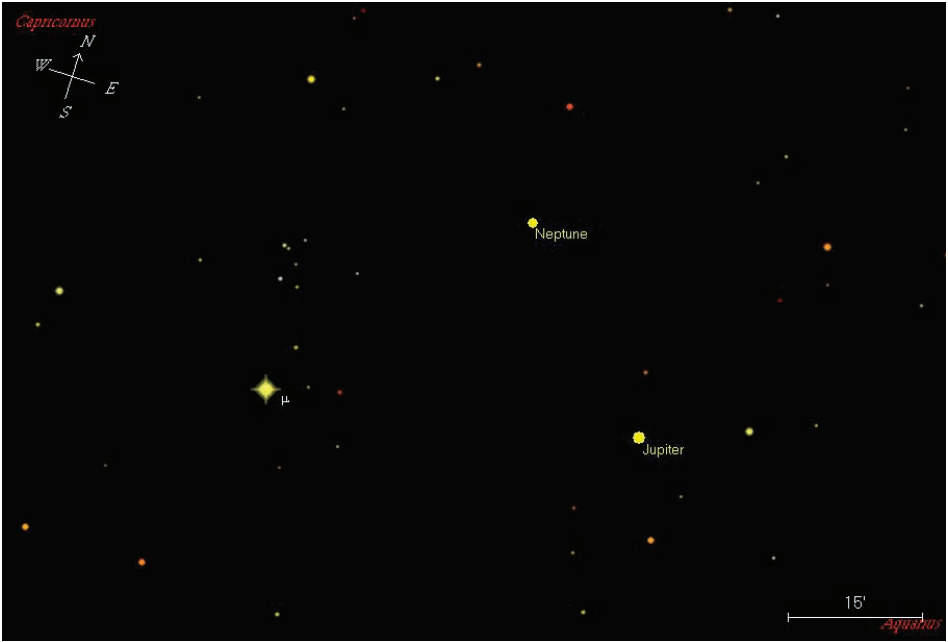
**Old Business:** New Members voted into Skyscrapers are Dave Emond and Joe St. Martin.

**Good of the Organization:** First CCD Imaging Workshop held May 30th. The next workshop will be on June 13th and will continue each week until end of June. Contact Bob Horton to sign up. • Stellafane folks in Vermont have invited Skyscrapers members to attend open house on June 20th. Bring your Telescope and Camping equipment. Contact Steve Hubbard for details and sign up.

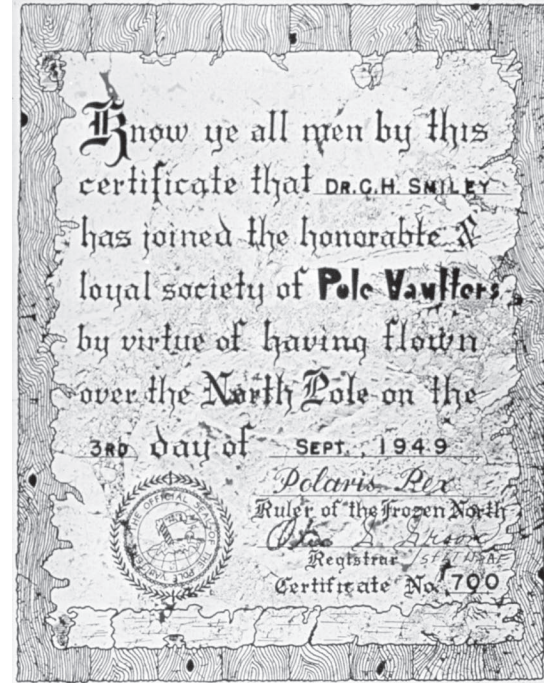
**Presidential Info:** A special workshop on Stellar Spectroscopy will be held at Seagrave on June 20th. The workshop will be presented by Professors Savvas Koushiappas and Ian Dell'Antonio. Contact Bob Horton for details. • E-Board meeting to be held on Saturday, June 13th, 4pm.

**Meeting Adjourned at 9:30pm**





Clouds hampered my getting a shot at Jupiter and Neptune at their closest point during their rare conjunction, but on the next morning, 5/31/09, they were still in my 120mm refractor's 1.5 degree field (25x) forming a triangle with Mu Capricorni. This is a 25 second exposure using a 40mm eyepiece, Sony DSC F-717, ISO400. Neptune is the 7.9 magnitude "top" of the triangle, Mu is at left (see map). Image is N up inverted. Jupiter's moons here are not all satellites of the planet. L-R they are Europa, Io is just barely visible in Jupiter's glare on the right side of the planet, then Ganymede, Callisto and the star TYC 581-839-1 lined up nicely with the real moons. Photo was taken from Little Compton, R.I. Bill Gucca



**FLIGHTS OVER THE NORTH POLE: AUGUST 23-SEPTEMBER 6, 1949** With the assistance of the Air Weather Service, Professor Smiley made a series of observations with the 375th Air Weather Reconnaissance Squadron, making the Ptarmigan flight across the North Pole and back.

# Messier 6 and Messier 7

Glenn Chaple

The song "Love and Marriage," contains a line that goes, "you can't have one without the other." The words aptly describe the open clusters M6 and M7 in Scorpius. This cosmic "horse and carriage" lies in the southern sky above the Scorpion's stinger.

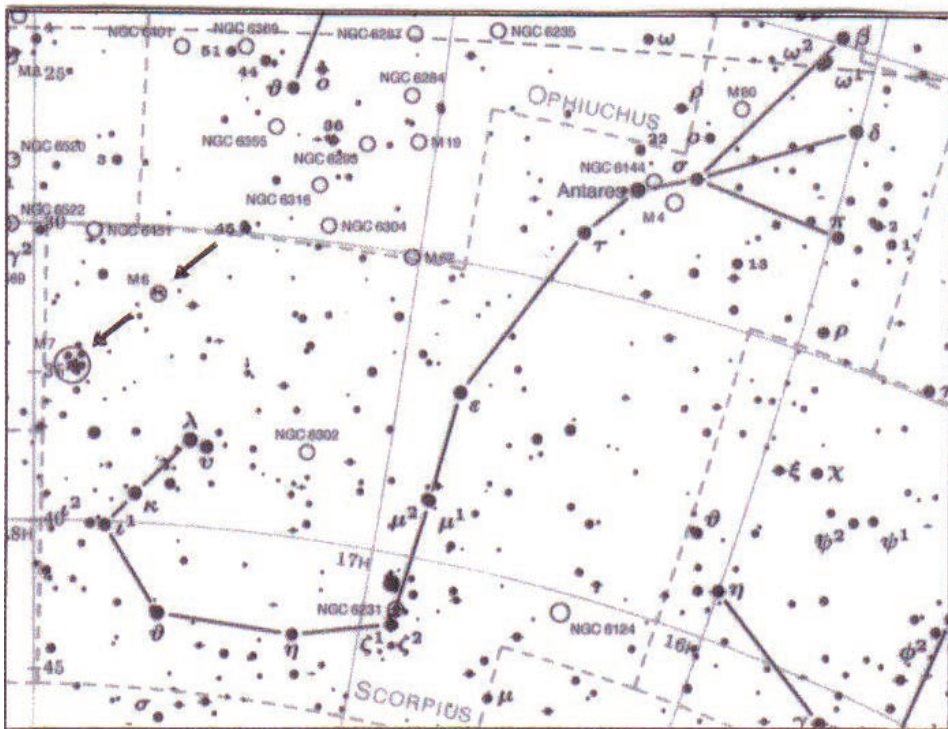
M7 is the brighter and larger of the two. With an overall magnitude of 3.3, it spans 80' – over twice the moon's apparent diameter. Readily seen with the unaided eye in the absence of bright moonlight or city lights, M7 was first reported by the Greek astronomer Claudius Ptolemy nearly two millennia ago. "Ptolemy's Cluster" is a dazzling sight in binoculars and small rich-field scopes – a striking aggregation of some 80 stars between magnitudes 6 and 10, immersed in a sparkling background of Milky Way stars. Because of its large size, M7 appears rather sparse in large-aperture scopes. Current studies indicate that M7 is 800 light-years away and is approximately 200 million years old.

Just five degrees northwest of M7 is its partner M6. This cluster, which is a magnitude fainter than M7 and one-third as large, lies just outside the glow of the Milky Way. Like M7, M6 is visible to the unaided eye and was recorded by Ptolemy. Rather than be saddled

with the nick-name "Ptolemy's Cluster II," M6 was dubbed the "Butterfly Cluster." The outline formed by its brightest stars does indeed resemble the outstretched wings of this insect. M6, like M7, is at its visual best when viewed with binoculars or small RFTs. With the latter, you can see about 80 stars brighter than 11th magnitude. The most luminous of the cluster's member stars is the reddish-orange semiregular variable BM Scorpii, whose magnitude fluctuates from 5.5 to 7.0 in a cycle of roughly two years. M6 is twice as remote as M7 and half its age.

Though the splashier M7 seems to get better reviews, I found M6 to be a more attractive sight when recently observed in the 1.5° field encompassed by my 4-inch f/4 Astroscan at 35X. M6 appeared as a tight little group, while M7 seemed sparse. Oddly enough, I was more impressed by M7 when I first viewed the two clusters with a 3-inch f/10 reflector at 30X back in the summer of 1977. Compare M6 and M7 and see what you think. Now if I can just get that "Love and Marriage" melody out of my head!

Your comments on this column are welcome. E-mail me at [gchaple@hotmail.com](mailto:gchaple@hotmail.com).



Finder chart for M6 and M7  
From Mag-7 Star Atlas  
(Copyright Andrew L. Johnson)

## Treasurer's Report

4/1/2009 through 6/26/2009

Lloyd Merrill

### INFLOWS

75th Anniversary Book 2nd Print	35.00
TOTAL Cookoutinc	182.33
TOTAL Donation	189.10
Dues	
Family	700.00
Junior	10.00
Regular	1,440.00
Senior	260.00
TOTAL Dues	2,420.00
Interest Inc	50.60
Magincome	
Astronomymaginc	204.00
Skytelmagincome	399.40
TOTAL Magincome	603.40
Magsales (Library)	19.00
Starparty	296.00
<b>TOTAL INFLOWS</b>	<b>3,785.43</b>

### OUTFLOWS

Collation	-18.00
Cookoutexp	34.78
Corporationfee	22.00
Membersubscriptions	
Astronomymagexp	204.00
Skytelexp	395.40
TOTAL membersubscriptions	599.40
Presidents Fund	25.00
Trusteeexp	131.06
Utilities	
Electric	42.37
Propane	37.35
TOTAL Utilities	79.72
Website Domain	34.99
<b>TOTAL OUTFLOWS</b>	<b>908.95</b>

### OVERALL TOTAL

**2,876.48**

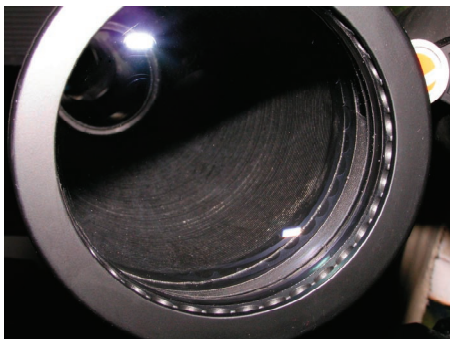
<b>Citizens Bank Checking</b>	<b>6,133.29</b>
<b>Capital One Money Market</b>	<b>16,214.45</b>
<b>Total Cash</b>	<b>22,347.74</b>

## Review Part 2: Celestron Skymaster 20x80 Binoculars

John Kocur

After returning my first pair of Celestron Skymaster 20 x 80 binoculars for replacement, I received a second replacement pair. To my disappointment, the second pair was worse than the first. Collimation was bad, severe cat's eye exit pupil on the right side. The right side had a foggy image. There was excess glue around the edges of both oculars giving a rough appearance to the edge of the field of view on both sides. Also, there was a long white synthetic fiber stuck to the inside barrel of the right optical tube. Needless to say, these binoculars were totally unacceptable. I sent them back for one more try. I asked the customer service rep at Telescopes.com to please have the third replacement pair inspected for defects before they were shipped back to me. Well, the third pair was bad, too!

Again, bad collimation, a large dust speck on the inside of the right ocular, and defective blackening inside the left optical tube. Most people would have just given up, but, I liked these binoculars because of the design, ergonomics, relatively light weight, durability, good coatings, light grasp, the potential for sharp optics, and the lifetime no fault warranty. I called Celestron Customer Service directly and explained the problems I had. Since they were under warranty, they said they would repair or replace the binoculars at no charge.



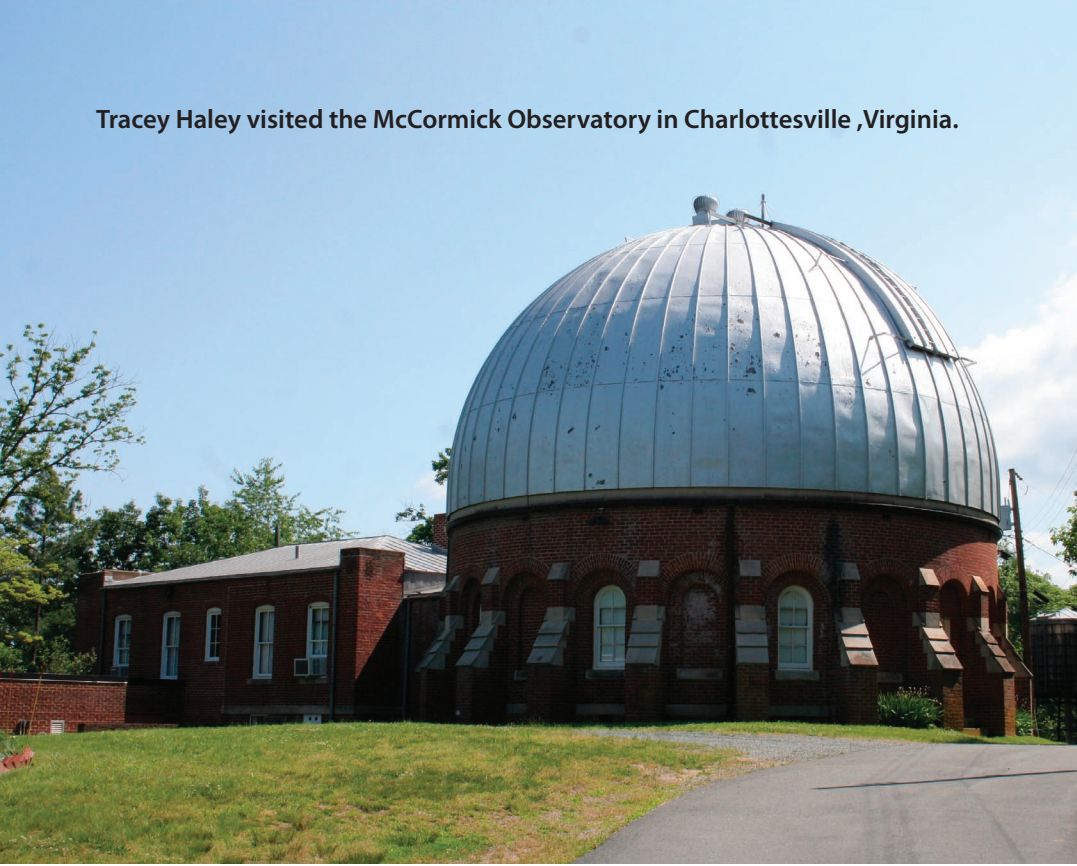
So I shipped them out at my expense to Celestron in Torrance, CA. After one month, I received what looks like a brand new pair. They were fully collimated and free of any optical defects. Finally, no cat's eye exit pupils. Still, there were a couple of minor cosmetic defects that I was able to correct myself. The trim ring of the left objective was cross threaded which made a gap between the body and the ring. I was able to clean the threads and seat it properly. The internal trim ring was loose which I was able to secure. There was also a small amount of excess glue at the edge of the left objective lens that I was able to safely remove with a toothpick. The lens was unaffected and is perfect. I purchased a hard shell instrument case for the binoculars at Harbor Freight. This case has metal reinforced edges, pluckable cubed foam and an egg crate foam pad in the lid. The price was under \$30.

### Conclusion:

I was pleased that Celestron was able to correct the problems I had with this particular model. When it comes to optics, attention to detail is very important. If you decide to get a pair of these binoculars you may fare better than I did. This may have just been a bad lot. Since these are mass produced in China, QC needs to be improved. I feel it was worth the effort to get these binoculars repaired. They really are quite well made. There is absolutely no slop or flexure in the focuser mechanism. The bumps on the rubber grips have a good slip resistant tactile feel. Excellent quality rubber armored exterior. The lens coatings are uniform throughout. No ghosting or stray reflections in this last pair. Wide 3.2 degree field of view. Sharp star images out to about 70% from the center.

Again, they should be mounted on a tripod. They can only be hand held for a short time before fatigue sets in. I recommend these binoculars to anyone interested in upgrading to a higher power binocular. Celestron backs these binoculars with a lifetime no-fault warranty which gives me peace of mind if anything should happen down the road. This is an example of why the warranty is important and these problems can occur with any manufacturer. Celestron Customer Service was courteous, helpful, and corrected the problems. With a dew removal system and my zero gravity chair, I can enjoy hours of binocular observing.

Tracey Haley visited the McCormick Observatory in Charlottesville, Virginia.



While traveling visiting stores for CVS, I was able to take this shot on 6/7 of the full moon rising above the San Francisco Bay and one of its bridges, enjoy. Tom Thibault



# Executive Committee Meeting Notes: May 9, 2009

Jim Crawford

Attendees: Robert Horton – President, Tom Barbish, Jim Brenek, Jim Crawford, Bob Forgiel, Roger Forsythe, Jim Hendrickson, Steve Hubbard, Dave Huestis, Dave Hurdis, Pat Landers, Mercedes Rivero Hudec, Joe Sarandrea, Kathy/Steve Siok, John Szelka, Tom Thibault

Discussion Items:

## **Issue 1: Safety issue concerning use of Laser Pointers**

Laser Pointers are currently used as educational tools during Public Nights and Star Parties to assist in location of night sky objects.

Bob Napier provided electronic emails detailing the various types, power and safe use of laser pointers. Included in his email was the website addresses to obtain State and Federal policy for safe use of lasers.

Bob Forgiel summarized much of what was in the email and emphasized that we should inform the membership that some higher power output lasers coming in from overseas (China) are being labeled as “flashlights” or “Ball Point Pens”. Members should be aware of local, State and Federal policy on the legal and safe use of laser pointers.

Pat Landers provided some insight on the potential for lawsuits, club liability or punitive damage if members or their guests misuse and are injured by a laser pointer.

All the attendees agreed that the lasers should only be used by those members experienced in proper use of laser pointers. It was suggested that Skyscrapers develop a set of procedures/policies for continued use of laser pointers. Other suggestions where:

- a. Ban the use of laser pointers or all the green type.
- b. Only members allowed to use them.
- c. Post laser pointer safety rules in specific locations or at each telescope.
- d. Safety handout with list of do’s and don’t’s
- e. Provide signed release forms from parents.
- f. Be aware of Air Planes overhead and Airport location.

g. Use lasers <5mw.

h. Safety Committee develop set of safety rules and guidelines.

Steve Siok made a motion to table laser discussion until the next E-board meeting. Motion seconded.

**ACTION:** Request that Pat Landers provide draft of Skyscrapers policy on safe use of laser pointers.

## **Issue 2: Group Visits to Seagrave – Limiting the number of guests.**

Skyscrapers conducts educational outreach during Public Nights and visits by large groups. Number of people in a group could reach up to 70 individuals. This many people at times has caused logistic, safety and security concerns.

Attendees discussed various issues concerning safety when walking around the bldgs and grounds. There are many tripping hazards.

We may not have enough members available to maintain proper security.

Bob Forgiel typically advises group contacts that we prefer limiting the size to around 30-40 per group.

Attendees suggestion:

- a. Have 1 chaperone per (X) number of kids
- b. Limit number of individuals per group.
- c. Limit size to 50 max. including chaperones
- d. Public nights can’t be controlled.

## **Issue 3: July Cookout**

Cookout scheduled for July 11th. The following suggestions were discussed:

- a. Port-a-John rental
- b. Advertise Cookout at next meeting.
- c. Charge \$7.50 per person.
- d. Do mass email to all members in June.

## **Issue 4: Membership Activities skipped due to time constraints.**

### **Issue 5: Property Repairs:**

- a. Structural repairs on the 12” Roll-Off (water and pest damages)
- b. Pesticide treatment of the bldgs.
- c. Meeting Hall – possible roof leaks
- d. Meeting Hall – damaged ceiling tiles replacements
- e. Better ventilation of the 16” Roll-

Off to prevent excessive heat buildup.

Steve Siok recommends prioritizing repairs. Members can volunteer to make repairs to reduce labor cost.

Item (a) above is considered high priority. Tentatively scheduled for weekend of May 16.

Item (b) Pesticide treatment done in Mar 09. Next treatment sometime midsummer. Maybe just before cookout.

Item (c) roof leaks maybe caused by some popped up roof tiles. Need to go up and take closer look.

Item (d) trustees should obtain cost for replacement ceiling tiles.

Item (e) No discussion.

## **Issue 6: Safety and Security – Scituate experiencing increase in break-ins.**

a. Audio/video Security System

b. Improved lighting/sensors during non-use of facility.

c. Limit Parking on the inner gate area. Load and unload only.

Concerns with ATVs cutting thru Seagrave from rear of property and bypassing the front gate. Neighborhood kids taking shortcut thru property.

Action: Trustees to research types and cost of 5 camera system. Provide best possible use and location of cameras.

## **Issue 7: Guest Speakers’ Dinner**

Although not recently done, past speakers were taken to dinner and paid by the executive members.

Bob Horton asked if members wish to continue with taking speakers to dinner.

Dave Huestis recalls one reason speaker dinners were stopped was that when the meetings were moved to 7:30 from 8 pm people couldn’t get to the meeting on time.

## **Issue 8: AstroAssembly 2009**

AstroAssembly to be held on Oct 3 at the Community Center

Steve Hubbard working on guest speaker

Meeting Concluded.

# Executive Committee Meeting Notes: June 13, 2009

Jim Crawford

Discussion Items:

## 1) Laser Pointer Policy.

The Board reviewed Pat Lander's proposed policy (printed below) and made modifications as indicated in red. We agreed to accept it as our official policy on the use of Laser Pointers.

Policy

In the interests of the safe use of laser pointers as educational tools in furtherance of the appreciation of astronomy for members and non-members alike, the use of nighttime laser pointers by Society members on Society grounds or at off-site Society events shall be expressly circumscribed as follows:

a) There shall be a 5 mW maximum limit for members' use or possession of laser pointers on Society grounds or at Society-sponsored events. Devices exceeding this 5mW limit may not be carried by Society members or at off-site Society events. To the extent practicable, such devices are not permitted on Society premises, either by members, non-members, or guests. To the extent practicable, such devices are forbidden at Society-sponsored events.

b) To the extent practicable, non-members may not use laser pointers of any type or strength on Society grounds or at Society-sponsored events.

c) Society members cannot allow guests or non-members use of their pointers of any type or strength on Society grounds or at Society-sponsored events.

d) Members must be responsible for the possession and location of their pointers, and cannot place them in a location accessible to the public.

e) Pointers of any type or strength can never be shined through a finder scope or at Society-sponsored events.

e) Pointer of any type or strength may never be shined through a telescope, with the exception of lasers specifically designed for optical collimation.

f) Pointers of any type or strength can never be aimed at a person, reflective surface, or any object below the tree line. Members, non-members, or guests who ignore this rule are subject to expulsion from the Society premises or Society-sponsored event.

f) Pointers of any type or strength should never be aimed at a person, reflective surface, or any object below the tree line. Members, non-members, or guests who ignore this rule are subject to expulsion from the Society premises or Society-sponsored event.

g) Members acknowledge that there are express laws against shining laser pointers in the vicinity of aircraft.

h) Pointers of any type or strength shall not be used at Society-sponsored events in the immediate vicinity of airports.

(The reason for the "to the extent practicable" phrase is that we have no law enforcement capabilities, right to search etc, so we're limited in how much we can police the goings-on on the grounds or at events. What I struggled with most is the extent to which we should try to prevent non-members use of their own pointers at events offsite. Arguably, we cannot enforce this if we're on, say, school grounds, and a parent brings a pointer--it's questionable how much of this we can forbid. It may also ruffle feathers with whatever school/group is hosting us. I would play it safe, though, and nevertheless try to regulate the use offsite by non-members at our events.)—Pat Landers

**2) July 11th cookout.** We will need to find volunteers to shop for food and supplies, set up tables, chairs and a tent, operate grills, monitor parking, etc.

**3) Review of membership renewals and making sure our records are up to date.**

It was agreed that only the President, 1st Vice President, Secretary and Treasurer would have access to the online data base. Furthermore, only the Secretary shall make changes to this data base.

## 4) Membership Activities.

We will review the New Member Information Packet currently being headed by Dave Huestis at the August 8th E-Board Meeting.

## 5) Property Repairs

I was going to bring up the fact that a squirrel was living in the ceiling of the meeting hall and that we needed to replace some stained ceiling tiles and

seal off the roof vents with screen to prevent the animal from coming back. However, Jim Brenek already took care of this, so this job is done. Thanks Jim!

## 6) Computer needs

∑ Computers and software to control both the 12" and 16" Meade Telescopes

∑ Laptop computer for use at monthly meetings and public programs.

Jim Crawford has donated (3) licensed operating software for our computers and Bob Napier will take care of the installation.

## 7) Security Issues at Seagrave

∑ Motion sensors for outside lights

∑ Security Cameras

Jim will investigate, report back.

**8) Holding monthly meetings at the Community House instead of Seagrave.**

∑ Crowded conditions in the meeting hall and insufficient parking space.

Most members of the E-Board felt it was important to continue having meetings at Seagrave, noting access to the observatories before and after the meeting. There was some discussion about reorganizing the contents of the meeting hall to make more room for chairs. The Trustees and the E-Board agreed to get rid of the old sofa, which we did. Parking may still present an issue though, and the President is concerned that we may still need to have our meetings at the Community House. Furthermore, the President is concerned about trying to pack even more people into our meeting hall. This issue will be discussed again at the next E-Board meeting scheduled for August 8th.

**9) Donation of 11½" f6.8 Maksutov telescope** by former member Allen Shepperton of Barrington, RI.

The Secretary will send a thank you note to Mr. Shepperton for his kind donation. We are currently unsure of what we will do with this telescope, which needs some restoration work.

6:45 pm Meeting Concluded

# SKYSCRAPERS, INC. MEMBERSHIP RENEWAL

NAME \_\_\_\_\_  
 ADDRESS \_\_\_\_\_  
 \_\_\_\_\_  
 CITY \_\_\_\_\_  
 STATE \_\_\_\_\_ ZIP \_\_\_\_\_  
 PHONE \_\_\_\_\_  
 EMAIL \_\_\_\_\_

## Membership Dues

	Annual Dues (choose one category)
JUNIOR (13-17) <input type="checkbox"/>	\$10
REGULAR <input type="checkbox"/>	\$40
FAMILY <input type="checkbox"/>	\$50
SENIOR (65+) <input type="checkbox"/>	\$10

### CONTRIBUTING

(any amount in excess of annual dues is gratefully accepted as a donation) \$ \_\_\_\_\_

### Magazine Subscriptions\*

Members may optionally subscribe to the following publications at a significant discount from their regular subscription rates.

\*Magazine subscription rates subject to change at any time.

ASTRONOMY  \$34.00\*

SKY & TELESCOPE  \$32.95\*  
 (\$10 savings)

**TOTAL** \$ \_\_\_\_\_

(Make check payable to Skyscrapers, Inc.)

Mail to:  
 Membership Secretary  
 Skyscrapers, Inc.  
 47 Peepoad Road  
 North Scituate, RI 02857



47 Peepoad Road  
 North Scituate, RI 02857

