http://www.raclub.org/

The StarGazer

Newsletter of the Rappahannock Astronomy Club | No. 3, Vol. 4 November 2015–January 2016

A Progress Report on the Mark Slade Remote Observatory (MSRO)

by Jerry Hubbell

Progress on the Mark Slade Remote Observatory (MSRO) has been nothing short of amazing—mainly the result of the hard work of several RAClub members. Myron Wasiuta has been the main driver in this effort so far, with the help of members Linda and Bart Billard, Ron Henke, and me. This project officially started the first week of November with the design (Figure 1), and as of mid-January, the first phase of the facility was completed and houses the Meade 12-inch LX200 Classic SCT and other instruments.

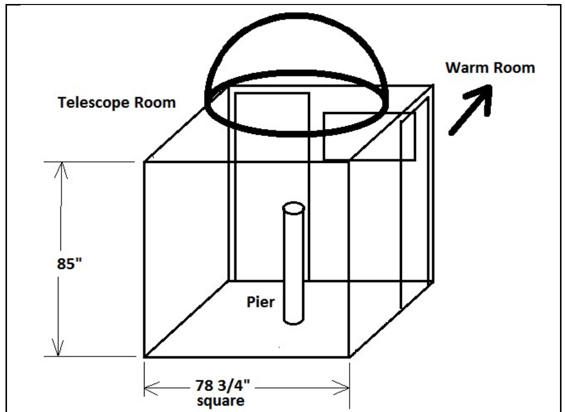

Figure 1: MSRO Phase 1 Telescope Room Design Concept. Source: Jerry Hubbell

The construction started in Myron's garage after purchase of the necessary materials, including the main entrance door, the 2x4's, and the siding. The fabrication was completed on the main walls and the dome skirt by the week before Christmas (Figure 2). Myron and his son then moved the completed wooden structure to the observatory location. Myron, Ron, and I completed the construction of the MSRO dome, a Technical Innovations 6-foot HomeDome (Figure 3).

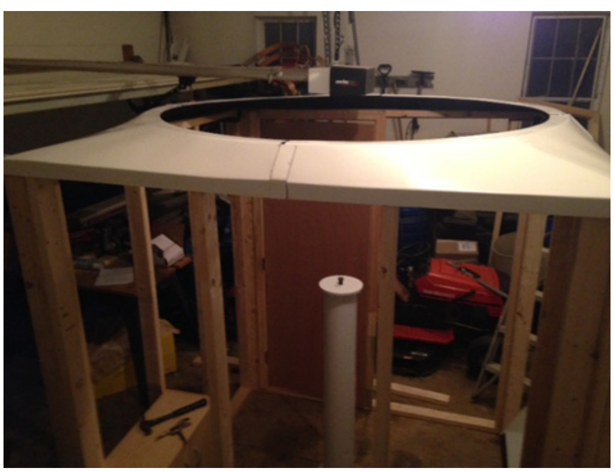

Figure 2: Construction of the telescope room for the MSRO. **Source: Myron Wasiuta**

Figure 3: Ron Henke works on completing construction of the MSRO telescope room, including installation of the 6-foot Technical Innovations HomeDome. Source: Myron Wasiuta

The Mark Slade Remote Observatory Commission was formed on January 9 to manage the construction, operation, and maintenance of the observatory. The following people were appointed to the commission, followed by the election of the commission officers: *(continued on page 5)*

How to Join RAClub

RAClub is a non-profit organization located in the Fredericksburg, Virginia, area. The club is dedicated to the advancement of public interest in, and knowledge of, the science of astronomy. Members share a common interest in astronomy and related fields as well as a love of observing the night sky.

Membership is open to anyone interested in astronomy, regardless of his/her level of knowledge. Owning a telescope is not a requirement. All you need is a desire to expand your knowledge of astronomy. RAClub members are primarily from the Fredericksburg area, including, but not limited to, the City of Fredericksburg and the counties of Stafford, Spotsylvania, King George, and Orange.

RAClub annual membership is $20 per family. Student membership is $7.50. Click here for a printable PDF application form.

The RAClub offers you a great opportunity to learn more about the stars, get advice on equipment purchases, and participate in community events. We meet once a month and hold regular star parties each month on the Saturday close to the dark of the Moon. Our website, www.raclub.org is the best source of information on our events.

We also have an active Yahoo group that you can join to communicate with the group as a whole. Just click the link, then the blue Join this Group! button, and follow the instructions to sign up.

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Website: www.raclub.org
Yahoo Group:
http://tech.groups.yahoo.com/group/rac_group/

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Calendar of Upcoming Events

Star Party, Caledon State Park	February 13
Star Party, Caledon State Park	March 5
Family Day—Astronomy, Marine Corps Museum	March 12
Star Party, Caledon State Park	April 9
Star Party, Curtis Park, Stafford	April 16

Recent Outreach Events Completed

Star Party, Caledon State Park	November 7
Star Party/Presentation, Kenmore Inn	November 13
Presentations (2), Park Ridge Elementary	December 11

President's Corner

Welcome to New RAClub Members (November–January)

- Bill Setzer
- Ryan Fard

Even though it's winter, there is still a lot going on as you can see from this latest issue of the The StarGazer. This is especially true of the Mark Slade Remote Observatory (MSRO). This has been a passion of Myron Wasiuta's since Mark passed away. Mark's equipment and observatory were donated to the club by Mark's wife.

The club also participated in two outreach events. Glenn Holiday gave a talk on the History of Astronomy during Historic Kenmore Plantation's event called Night in George Washington's Day. He will give this talk to the club in October. David Abbou gave two presentations on the Moon at Park Ridge Elementary on the same day. Actually, they were more of question-and-answer sessions because the kids had prepared many questions in advance.

This issue includes a number of technical articles. Leading off is Linda Billard's discussion of the Large Binocular Telescope Observatory (LBTO) in Arizona. Currently, the LBTO is studying volcanic activity on one of Jupiter's Moons, Io. Tom Watson next describes how to determine the components of a meteor.

On page 10, Terry Barker describes how to use Twitter in relation to astronomy. Terry will be retiring soon and moving back to Richmond to reside full time. Terry, you will be missed. Thanks for everything you've done for RAC.

Bart Billard describes his experiences with occultations and two different methods of measuring asteroids. This an excellent way for the amateur astronomer to add directly to the body of science.

As we get close to spring, the pace of our outreach event schedule will pick up. So check our website to see where we are and what we are doing. We always like visitors.

Until the next edition, clear skies, Ron Henke

Astronomy Math by Scott Busby

The Hubble Ultra-Deep-Field (HUDF) is a famous photograph of a tiny portion of the sky that captures images of about 10,000 galaxies over an exposure time of 1 million seconds (s). At this rate, how many years would it take to photograph all of the estimated 100 billion galaxies in our observable Universe?

This is a rate problem that tells you that time equals amount divided by rate.

In this problem, the amount is the number of galaxies to be photographed (100 billion, or 100×10^9), and the rate can be found using the information given in the problem statement. Specifically, because it takes 1 million s (1×10^6 s) to take a photograph that contains 10,000 galaxies (1×10^4 galaxies), the rate is:

Rate = amount/time = 1×10^4 galaxies/1×10^6 s = 0.01 galaxies/s

Using this rate, the time to photograph 100 billion galaxies is:

Time = amount/rate = 100×10^9 galaxies/0.01 galaxies/s = 10^{13} s or about 318,000 years!

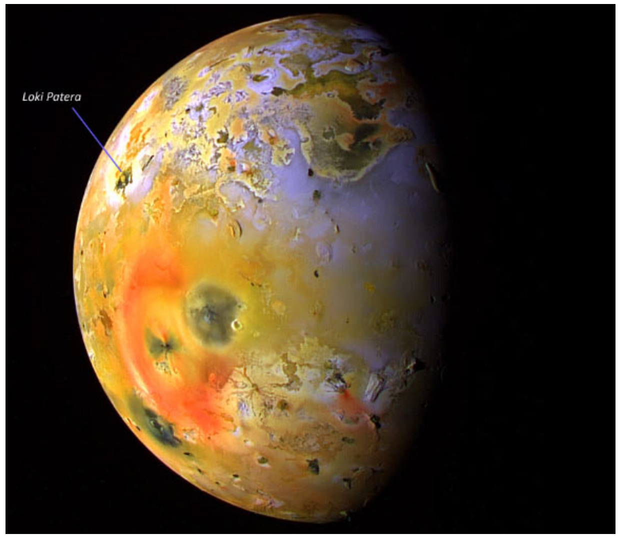
Don't think anyone will be starting this project real soon.

http://hubblesite.org/newscenter/archive/releases/2014/27/image/a/format/web

Large Binocular Telescope Observatory—Investigating Io's Volcanic Activity

by Linda Billard

Until recently, astronomers using ground-based telescopes had to cope with poor seeing conditions that blurred images of distant objects (the "twinkle" effect). While advancements in adaptive optics[1] technology have aided in correcting for this atmospheric blurring, the Large Binocular Telescope's (LBT) innovative system truly takes this concept up a notch. Its developers claim the system provides sharpness *10 times* better than the space-based Hubble Telescope.



1997 view of Io taken by NASA's Galileo spacecraft from more than 310,000 miles away, showing the Loki patera. Sulfur dioxide frost is white and grey while the yellow and brown areas are likely other sulfurous materials. Red materials and "black" spots mark areas of recent volcanic activity usually associated with high temperatures and surface changes. Source: NASA/JPL/Univ. of Arizona.

The telescope's binocular design uses two identical 8.4-m telescopes side by side on a single alt-az mount for a combined collecting area equivalent to a single 11.8-m telescope. The two primary mirrors are 14.4 m apart (center to center). This binocular design, combined with integrated adaptive optics to compensate for atmospheric blurring, provides a large effective aperture, high angular resolution, low thermal background, and exceptional sensitivity for the detection of faint objects.

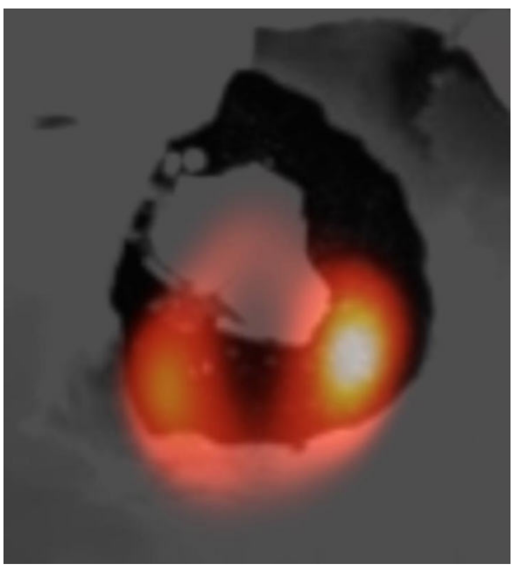


Image taken by LBT of the lava lake at the volcano Loki (in orange) on Io laid over a Voyager image of the volcanic depression. Source: LBTO/NASA.

The LBT Observatory (LBTO), located on Mount Graham in southeastern Arizona, is an international collaborative effort of the University of Arizona, Italy's Istituto Nazionale di Astrofisica; Germany's LBT Beteiligungsgesellschaft; and the Tucson–based Research Corporation for Science Advancement, which represents the universities of Minnesota, Virginia, Notre Dame, and Ohio State.

One of projects the LBTO team tackled was getting a closer look at Io and its volcanoes. Io, one of Jupiter's Galilean moons, is the most geologically active body in our Solar System. Its surface is studded with hundreds of volcanic areas. The largest, Loki, is a lake-like structure called a patera. Until recently, Loki—only 125 miles across and 373 million miles from Earth—was too small to be viewed in any detail from a ground-based optical/infrared telescope.

Using the LBT Interferometer, an international team of researchers was able to observe details of Loki never before seen from Earth, measuring brightness (heat emissions) coming from different regions of the lake. For the first time ever, researchers on Earth were able to capture detailed images of the heat rising from an active volcano on another body in the Solar

[1] Adaptive optics measures atmospheric distortions in the incoming light from an astronomical object and sends electronic signals to a deformable mirror that can change its shape rapidly to correct for these distortions. The light reflected from the telescope mirror is divided into many smaller beams or areas. When the system looks at these separate beams, some have deviated because of atmospheric turbulence. The electronic circuits in the system compute the altered shape of a mirror surface that would realign the separate beams so that they all go in the same direction. Then a signal is sent to the deformable mirror to change its shape in accordance with these electronic signals, resulting in an undistorted beam.

System. "We have seen bright emissions…'pop-up' at different locations in Loki Patera over the years. New images from the LBTI show for the first time that these emissions arise simultaneously from different sites in Loki Patera," said Prof Imke de Pater of the University of California, Berkeley. These and other data suggest that the denser ("cooler") lava crust on top of the Loki lava lake intermittently sinks, resulting in an increase in the thermal emission we detect from Earth as the hotter lava below comes to the surface.

Addendum: In the course of LBTO's research of Io's volcanic activity, happenstance resulted in a remarkable video of Io being occulted by another of Jupiter's Galilean moons, Europa. Loki and another "hot spot" are visible as Europa passes in front of Io. To view the video, click here.

MSRO Progress Report (continued from page 1)

(Continued from page 1)

Dr. Myron Wasiuta—Commission Member and Chairman
Jerry Hubbell—Commission Member and Vice-Chairman
Dr. Bart Billard—Commission Member and Secretary
Linda Billard—Commission Member
Ron Henke—Commission Member

The Chairman will serve as the Observatory Director and manage the MSRO budget and observatory operations. The Vice-Chairman will serve as the Assistant Observatory Director and work closely with the Observatory Director in the management of the observatory and the budget. The commission will be working over the next several weeks to create and approve the MSRO Commission By-Laws and Vision and Mission statements. The next meeting of the MSRO Commission will be on Friday, February 12.

Figure 4: M1 the Crab Nebula "first-light" image taken on January 10, 2016 from the MSRO. Source: Myron Wasiuta and Jerry Hubbell

Figure 5: The completed MSRO Telescope Room. Source: Myron Wasiuta

The observatory unofficially celebrated "first-light" on January 10. We obtained a couple of images of M1, the Crab Nebula, and M33 to help us measure the accuracy of the polar alignment. (Figure 4) The seeing was very poor (on the order of 10 arc-sec), but we were able to capture and measure the declination drift to refine the polar alignment. The Telescope Drive-Master (TDM) drive corrector was installed and tested satisfactorily. The TDM instrument was donated to the MSRO by Explore Scientific. During the week of January 18, further work was completed to test the network connection of the MSRO computer system and successfully test the remote control connection to the observatory over the Internet.

The completed telescope room (Figure 5) was able to withstand the snow storm that occurred on the weekend of January 22–24 with nary a problem. The dome shed the snow with no problem, and the building seems to be very weatherproof at this time. Future funding requirements include the completion of the warm room extension and the purchase of a few instruments. Overall, we have made excellent progress on the MSRO and look forward to completing the commissioning activities and placing the observatory in service for the RAClub and local community.

Probing the Makeup of a Meteorite

by Tom Watson

The cosmos is made up of many forms of objects, including planets, stars, comets, and asteroids. When an asteroid, typically made of metal, rock, or frozen water, comes into contact with the Earth's atmosphere, it typically burns up, producing a luminous streak across the sky sometimes called a shooting star. Asteroids and other similar objects that encounter our atmosphere are referred to as *meteors*, and if they reach the ground, they become *meteorites*. Over the years, many of these objects have crashed into the ground, rather than wholly burning up in the atmosphere. Sometimes, these collisions are very tiny, resulting in a small fragment that can be recovered. On rare occasions, a meteor impact has been so large that it has caused devastation from a vast explosion. It is even believed that a large meteorite likely caused the extinction of the dinosaurs more than 65 million years ago!

The study and classification of meteorites combines astronomy, geology, and often many other disciplines. Meteorites can bring the subject of astronomy to life for children and provide an interesting subject for the amateur astronomer to test his/her skill. To this end, one possible and important test that can be performed is an analysis of what materials make up a meteorite, from iron and nickel, to copper and vanadium.

Meteor Crater, Winslow Arizona. Source: Tom Watson

Meteor Crater

Near the end of the Pleistocene epoch, approximately 50,000 years ago, a large meteor composed of iron and nickel entered our atmosphere, slamming into the high desert in northern Arizona at a velocity of at least 12 km/s (H. J. Melosh and G. S. Collins).[2] The resulting explosion blew vast quantities of material into the air surrounding the enormous crater (1.186 km diameter) with tiny fragments of the original asteroid, as well as one giant fragment later recovered from the center. This impact site has come to be known as Meteor Crater, situated just west of Winslow, Arizona.

While it is known that this asteroid was composed of primarily nickel and iron, one of the fundamental tenets of science is to retest known results to determine whether they continue to withstand scientific scrutiny. To this end, the amateur astronomer can test, in the home laboratory, a sample from a meteorite, such as Meteor Crater, to determine whether it does, in fact, contain nickel and iron. There are many different methods to determine the complete composition of the meteorite beyond the basic nickel and iron detection methods used in this analysis.

What Is X-Ray Fluorescence?

As high-energy ionizing particles strike matter, they sometimes cause an orbiting electron to be ejected. If the ejected electron is from a very low-energy state and there are other electrons existing around the same atom at a higher energy, some of these higher energy electrons descend into the lower energy state, a preferable position for them, energetically speaking. This change in energy from a higher energy state to a lower energy state requires that the surplus energy be removed. To conserve that energy, a photon is emitted whose energy is equal to that surplus.

[2] H. J. Melosh and G. S. Collins. *Nature* 434, 157(10 March 2005). doi:10.1038/434157a

Uranium fluoresces in the visible spectrum under UV light. Source: Tom Watson

When a group of atoms is exposed to ionizing radiation and then emits secondary x-rays as a result of this exposure, these x-rays are said to x-ray fluoresce from the atoms. This is analogous to the ultraviolet fluorescence one might encounter on clothing at a party. Many are familiar with black lights, which emit ultraviolet radiation and cause neon-colored clothing to fluoresce in the lower energy visible spectrum. The key intriguing aspect of x-ray fluorescence, which makes it useful to science, is the unique energies emitted by each element. Like a fingerprint, the specific energies can be used to determine the atomic composition of an object by simply bombarding the object with ionizing radiation and observing the x-ray fluorescence energies emitted. This technique has been used by scientists for decades and is commonly referred to as x-ray emission fluoroscopy, or XRF.

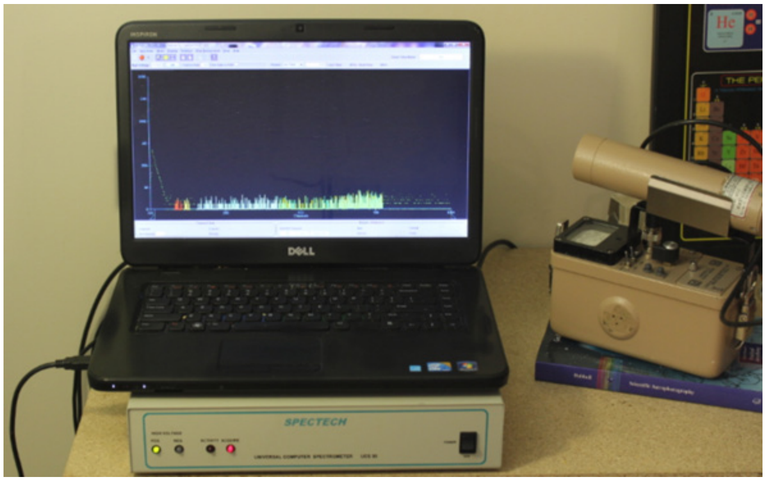
Of these possible x-ray emissions, perhaps no other is as important as the K-Alpha emission. K-Alpha x-ray emission occurs when an electron in the K-shell, the lowest possible shell an electron can occupy around the nucleus, is ejected via bombardment with ionizing radiation. To fill this important electron-hole, electrons from higher shells, such as L or M, descend into the now open K-shell. The K-alpha emission occurs when an electron from the L-shell, the next most energetic shell, descends to fill the empty place in the K-shell. Second to this in importance is the K-beta emission, which occurs when the M-shell fills the space in the empty K-shell, instead of an L-shell electron.

How Do We Test?

I purchased a small sample of the meteorite in the gift shop at Meteor Crater. The literature with the sample claims that it is part of the meteorite that formed Meteor Crater and describes the composition as 92-percent iron, 7-percent nickel, and 1-percent other. If this is true, XRF testing should reveal the iron and nickel makeup of the sample and perhaps even allude to nature of the remaining 1 percent.

Small meteor fragment sampled. Source: Tom Watson

The ionizing radiation source I used was a single NRC-exempt quantity sample of radioactive ^{60}Cobalt. The ^{60}Cobalt sample had an activity of 15,019.9 Bq (±0.05, assayed against NIST traceable mixed-gamma source SRS: 80899-854) at the time of the test. The source provided gamma energies for the purposes of ionization at the energies of 1173.24 keV and 1332.5 keV, as well as a series of secondary x-rays and Compton Scatter, mostly existing above the energy range where XRF is conducted. I calibrated my spectrometer against known x-ray energy points using the Americium 241 contained in a simple household smoke detector placed close to the spectrometer.



X-ray spectrometer and computer. *Source: Tom Watson*

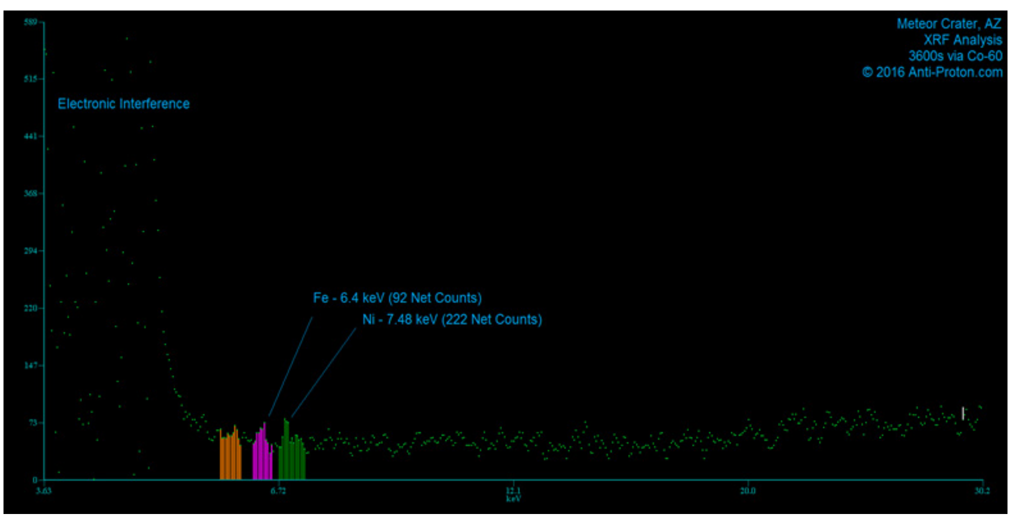
I put the sample in a lead and copper shielded testing chamber and exposed it to gamma radiation from the source while a thin crystal (25.4mm dia. x 1mm thick) CsI(Tl) x-ray scintillation detector measured the secondary x-rays emitted as a result of the x-ray fluorescence of the meteorite. The purpose of the shielding around the detector was to reduce background radiation as well as other possible x-ray contamination from the test, thereby increasing the likelihood of a valid identification. I tested the sample for 3,600 seconds, i.e., 1 standard hour, and then performed the same test in exactly the same way with the sample not present. This produced a background spectrum without the sample. The background spectrum was removed from the original sample spectrum to produce the net results. These results can be matched against the periodic table of known x-ray emissions.

Findings

X-ray fluorescence was indeed detected at the proper locations for iron, 6.4 keV, and nickel, 7.48 keV, as well as a significant amount of lead fluorescence from the lead shielding surrounding the detector. Although the test did not calculate the quantity of each element, it did, in fact, determine the presence of both of these common meteorite elements. We can, therefore, conclude that the originally stated elemental composition of the meteor is, at least, correct with respect to iron and nickel.

	K-Alpha	K-Beta
Iron	6.4 keV	7.06 keV
Nickel	7.48 keV	8.26 keV

The x-ray emissions for the iron and nickel K-alpha and K-beta shells. Source: Tom Watson



X-ray spectrum of meteor. Only the labeled regions of interest are of note. Source: Tom Watson

Memories of Astronomy

by Myron Wasiuta

I thought you might enjoy these goofy poems I wrote for a 6th grade project on December 20, 1976, when I was 13 years old. Each is prefaced with a short description of what I remember about what each of the poems meant to me or their inspirational meanings.

The poem **"A Message from Heaven"** is about a bright bolide I witnessed in 1969 as a 6- or 7-year old while living in rural central Pennsylvania. I was outside in the yard of our trailer playing after dark when my eye was stabbed by a brilliant moving light. It's one of my earliest memories of an astronomical nature and may be one of the reasons I became interested in astronomy several years later. I took considerable poetic license when writing because I didn't know the constellations at all when I witnessed the meteor. I do remember it was spectacularly bright and took about 5 to 7 seconds to break up. Its light was so bright that the trees in our yard cast flickering, moving shadows across the ground. I was terrified and captivated at the same time. I believe fragments were recovered in New Jersey, as reported in an old *Sky and Telescope* article. I also remember a sonic boom.

A Message from Heaven

Out of the sky it came,
Beginning its flight to glory and fame.
Flying with tremendous speeds,
Heat and friction are all it needs.

Shooting down from Heaven as bright as day,
Down through the Square of Pegasus
And into the Milky-Way.

Its streak grows feeble, its speed decreases,
A thundering sound is heard, it flies to pieces.
The messenger from God, whose braveness has shown—
Left me wondering—All Alone!

The Super-Nova

A faint star shining on the high-
Becomes the giant of the sky.
Outshining other stars by far,
Its diameter greater than Achernar.

Only too long is it king of the skies-
Then it is crushed and shrivels and dies.
And Sirius,
Once again, commands on the high.

In 1976, I had saved up money from a paper route and, with some help from my parents, purchased my first real telescope-a 6-inch F8 Criterion RV-6 reflector. Dale City was pretty dark back in those days, and I would search for supernovae in galaxies I could find with that telescope. I would make a sketch of the galaxy and include as many field stars as I could see—often it would take several hours at the eyepiece before I felt confident I had placed the stars correctly and recorded all the ones that were visible. Then, over the next few months, I observed the galaxy and compared it to my sketch in hopes of spotting a supernova. Eventually, I was monitoring about 20 galaxies this way. I never did discover a supernova, but in the process learned the sky pretty well! I think perhaps my poem, **"The Super-Nova,"** was inspired by these searches.

From 1974 to January 1976, I lived in Monterey, California, while my father attended the Naval Post-Graduate School. We lived in a development called "La Mesa," which was on a flat hill overlooking the Monterey Bay and the Pacific Ocean. I could hear the barking of seals on the rocks at night and see the blue cold waters of the Pacific from our outdoor balcony. It was here that my interest in astronomy and love of the stars was born. My first view of Saturn through a telescope was from that balcony. But it was the sunsets I remember, and there was no place I enjoyed watching them more than at a nearby park that had swings and see-saws. As luck would have it, the swings faced west, and the park had sweeping views of the low coastal mountains to the west. I'm not sure why we called it See-Saw Park, but that's how we referred to it as kids. I do know that even to this day, almost 40 years later, I still recall fondly the times I spent swinging at this park admiring the spectacular sunsets and contemplating life and our meaning in the Universe. The poem, **"A Sunset at the See-Saw Park,"** was a feeble effort to capture in words how that park moved me.

A Sunset at the See-Saw Park

If ever you should pass the See-Saw park,
You don't hesitate to look west in the evening—
Because what you see may make you stagger!

The sky is fierce and angry-
Yet so beautiful!
While the sun sinks lower in the sky,
It becomes deep red—then purple.

And the stars wake up one by one-
And hence you are in the shadow of the Earth.

If you are lucky you will see Venus
Smiling down on you.
And this is a clue that the sun still is-
For it is possible it may never rise again!

And finally, one last short poem whose meaning and inspiration have been lost to time.

A Balloon (1976)
Up, Up into the sky,
Faster and faster,
I don't know why.
Disappeared, Disappeared
Into the sky,
Don't ask me,
I don't know why.

I Want You to Do One Thing Tonight on Twitter

by Terry Barker

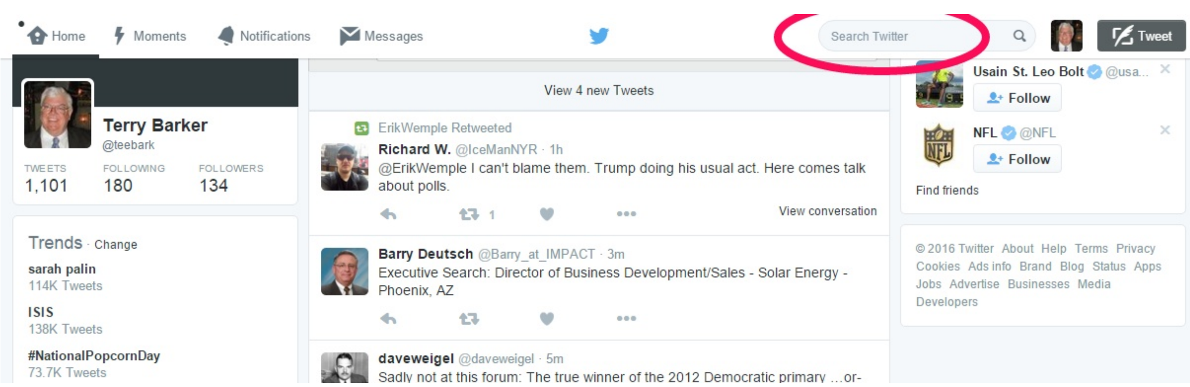
After you sign up, of course. You may have noticed some tweets at the bottom of the RAC page. And you might have wondered why they're there. After all, we have the webpage for notifications and news, and we have the Yahoo group page where we can send emails within the membership.

The answer of course, is that social media are taking over the world, and resistance is futile. Twitter offers a number of advantages over webpages and email:

- It's worldwide, and anyone can see any tweet (unless you go out of your way to make it private).
- You can browse by subject (aka hashtags—more on that later).
- You can follow experts without having to know their email addresses.
- Young people are more likely to read a tweet than an email (email is so 2015).

But I don't want you to get bogged down in the details, especially if it's new to you, so here's your first assignment:

- Join Twitter.
- Go to the search window and enter #astronomy.



You'll see a list of tweets appear. Just page down and notice some things:

- They all have #astronomy somewhere in the text.
- You'll see links to webpages, with articles for more information.
- You'll see other symbols, such as @ in front of words.
- There are no long tweets—you're limited to 160 characters per tweet.

#astronomy, by virtue of the # symbol, is a hashtag. It's a way to index tweets so that you can do a search on that particular string. The string can be anything. You can invent your own hashtag, just by including it in a tweet. But people usually choose things that other people can guess might represent something they're searching for. Like #science, #chess, #math, etc. Some are specialized, and represent an organization, like #nasa or #espn.

You can have a lot of fun when there's a really big event on TV, like a football game or a political debate (#DemDebate). You don't have to pay attention to upper and lower case—it's all the same. You will be amazed at how quickly they stream to the page—after all, it's worldwide.

You're not limited to using a hashtag in the search window—anything will work, but if you want to limit the tweets to the hashtag, instead of all the tweets that just happened to mention the word in a tweet, like "I hated doing my science homework last night" then you'll likely have better luck with a hashtag.

Regarding the @character, that's how you can do a search on a user. Like mine is @teebark, and the club's is @raclubva. You can also send a tweet to that user and that user only, but do some further googling and you'll see how that works.

One more thing—on your desktop on Twitter, look in the left hand margin and you'll see Trends. These are the hottest items people are tweeting about today.

To get to Trends on a smart phone, just click the search icon, and it'll pop up.

There is much, much more to Twitter, but I just wanted to give you an idea of what you can do without making your head hurt. Give it a try, and if you make some progress, send me a tweet.

Video Occultation Timing

by Bart Billard

Occultation timing is a good option for an amateur who wants to get involved in observations that contribute to science. It allows determination of size and shape of asteroids, can detect companion bodies in orbit around them, and helps improve knowledge of orbits and star positions. Amateur measurements can have an effective resolution much better than telescope size and atmospheric effects normally allow. Even small asteroids can be measured, and close double stars can be resolved.

My September club meeting presentation dealt with how the DSLR drift-scan technique might be a good starting point if you already had a DSLR. By calibrating the camera's clock against a GPS video timing device, I was able to get reasonable timing accuracy recording an occultation by (1197) Rhodesia in August. I needed only an adapter to attach the camera to the telescope and a Barlow lens cell. (I found a Barlow that lets me detach the lens cell from the part that holds the eyepieces and screw the cell onto my camera adapter to help it reach focus.) My camera allows programmed shooting schedules so I can have it record a star trail with the predicted occultation in the middle of the exposure. A gap in the trail showed when the occultation occurred.

Since then, I have started using video timing again. I had had trouble recording my video, first because of a balky used camcorder and then because of driver problems with an Orion video capture device (VCD) I bought as an alternative. The VCD had driver problems with Windows 7 that were fixed by a Windows 10 upgrade. In this update, I discuss the advantages and disadvantages of video timing compared with DSLR drift scan timing for someone who does not own either kind of camera yet.

First, video timing can provide very good accuracy because of the update rate (30 frames per second for NTSC video, each consisting of 2 fields that are 16.7 milliseconds (ms) apart) and the ability to accurately time the video fields as they are recorded. I am still assessing the accuracy of the DSLR drift scan method, but the estimate for my observation in August was a timing uncertainty of 80 ms, equivalent to about 5 fields of video. For accurate timing or calibration of the camera or camcorder clock using either method, you also need to have (or have access to) a GPS video time insertion (VTI) device, but I recommend deferring this expense while getting started. However, it is worth noting that a VTI is simpler to use with video timing.

Second, the cost for video timing may be less than for drift-scan timing for someone starting out having not yet purchased either camera. For video timing, you need a low-light camera with a rechargeable power supply, an adapter from the camera to the telescope, and a frame grabber (for recording on a laptop computer) or a camcorder. The camera, adapter, and frame grabber can be purchased for about $240, less than many DSLRs would cost with the telescope adapter. (In addition, for a DSLR to reach focus with Newtonian telescopes, a Barlow lens cell ($60–$70) may be needed.)

On the other hand, video camera sensors tend to have a much smaller format than DSLRs, making it trickier to get lined up on the target to catch an occultation. In my setup, I have added a focal reducer to increase the field of view and help recognize more stars. A focal reducer that mounts directly to C-mount video cameras and serves as the telescope adapter is available from Agena Astroproducts, and another option is an OWL Astronomy Products focal reducer available as a package with a C-mount adapter. A spacer can be added to reduce the telescope focal length more than the focal reducer alone.

I have found the sensitivity of my video camera to faint stars is not quite as good as my DSLR. A more expensive video camera that can integrate (stack) frames on the fly could be a fairer comparison, although I have gotten the same enhancement by processing the video to stack frames after recording. An integrating camera would add about $60 or more to the approximately $240 cost of getting started.

(1172) Rusthawelia merged with the star 2UCAC 39469594 (arrow) at about the same time the shadow passed nearby, but missed, my location. The Coordinated Universal Time annotation at the bottom was inserted during the recording by the IOTA VTI. The times for the two fields making up this video frame are indicated by the two four-digit fractional second values following the time in whole seconds. Source: Bart Billard

Practice makes perfect. After missing one predicted event with my video timing setup, I successfully observed three in a row. To verify the telescope is pointed at the right spot in the sky to record the event on schedule, it is convenient to have the Coordinated Universal Time from the VTI displaying in the live video as you locate a "pre-point" star or watch subsequent pre-point stars drift through at the appropriate time before the event. The figure shows the field of view for a predicted occultation by (1171) Rusthawelia on January 15. Dark subtraction and stacking brought out some stars fainter than the 11.7 combined magnitude of the target star and asteroid (see arrow). For more practice, I have been trying to record events even though the predicted shadow path is far enough away to give me a low probability of seeing the asteroid occult the star.

Highlights of Recent RAClub Presentations

Abstracted from Bart Billard's Meeting Minutes

Note that there was no presentation in November because the election of club officers was held.

December 2015—A Tribute to Mark Slade

Myron Wasiuta began by telling us a little about the beginnings of our club, originally called the Triangulum Astronomical Society and started in the early 1990s by Al Ventura. Myron told us he was a former president of the club and also served as club historian. The club was where he got to know Mark Slade, and he said he had organized his presentation as a chronology of his experiences with Mark.

Myron said Mark's wife, Laura, was originally from Minnesota, and they would go there for visits in the summer. Eventually, Mark lobbied her for a winter visit because the short summer nights gave him little darkness to enjoy the night sky. Going in the winter gave him the opportunity to see and photograph auroras.

Aurora by Mark Slade. Source: raclub.org

Mark loved photography and had his camera with him whenever possible. Much of what he did was film-era photography. More recently, he had started doing digital photography, but he became inactive about 2009–2010 when he and Laura began building their new house. Myron noted the club website has a gallery of Mark's photographs, including auroras, and encouraged us to view it. Mark would call up Myron and arrange to visit whenever he found a promising aurora prediction. Myron mentioned some of the film types and techniques Mark used, including ordering Kodak PPF 400 in bulk and keeping it in the refrigerator because it was his favorite and not readily available.

When Myron moved into his current house, Mark asked him how he could have chosen the one lot with a streetlight right next door. Together they talked with the neighbor, offering to put a shield on it, and assuring him it would actually increase the light going down into his yard. Eventually the neighbor agreed, and Mark and Myron installed the shield. (Mark had access to a bucket truck.) Myron said the shield is no longer there, but trees now block the glare into his yard. Apparently the utility company did not replace the shield when the lightbulb needed replacement, and perhaps lost it. Someone did come back later and applied some black tape.

Mark and Laura moved into their new house in May–June 2014. He had laid cables for an observatory and purchased components over time as he found good deals. He purchased the dome in 2006 or 2007.

Myron showed the telescope he and Mark put together in 1994 in anticipation of the Comet Shoemaker-Levy impact with Jupiter. They also got an early digital camera, which Myron showed us. They set up a remote observatory of sorts at Myron's house. The telescope mount was permanently set up in the yard and covered with a tarp when not in use. They would take the telescope out and mount it, and had cables run to the house so they could control the telescope and take images from indoors. Clouds forced them to wait until July 20 to get images of the impact areas, and the seeing was much worse than for the earlier images Myron showed of tests they made in preparation for the event. He pointed out they recorded the images by photographing the computer monitor, which was Mark's idea.

Myron showed us another test photograph with multiple images of a planet. He explained that Mark showed him how to make multiple images on one frame of film so that he could try different exposures to see what worked without using up a lot of film.

Comet Hyakutake visited in 1996. Myron said it was the comet of the century, better than Hale-Bopp. It got publicity in the paper, and the club had almost 500 people visit the star party at Caledon on March 23. He showed us spectacular images, including one with the tail spanning more than 25 degrees, past the handle of the Big Dipper and into Draco. At the time, Myron and Mark had a roll-off roof observatory housing the earlier observatory telescope with a rebuilt aluminum tube, and Mark would bring his 10-inch telescope to do deep-sky photography while Myron did planetary photography.

Hale-Bopp by Mark Slade. Source: raclub.org

They planned for Comet Hale-Bopp for about a year, considering type of film and where to go for dark skies and the right backdrop. Myron showed photographs with structure in the comet nucleus. There were "hoods" that changed in structure over time. One of the pictures shows a curved tail that the comet sported shortly after perihelion.

Myron showed pictures of the observatory he and Mark built in the backyard of Myron's current house. Part of the deck was isolated for their Dobsonian telescopes. The dome was located at the other end of the deck, with a concrete footer underneath for the telescope pier.

Mark witnessed the 1966 Leonid meteor storm, and he and Myron planned to see another in 1998. It turned out to be something spectacular. The Earth passed through a cloud of larger than usual particles from the comet that year, and the shower produced many fireballs.

January 2016—Remote Observatory Planning Session

The program for January was a planning session to learn about using the Sierra Stars Online Network (SSON) as an example of remote observing. Jerry Hubbell led the session with the help (via Skype) of Rich Williams, owner of SSON. Topics covered were the telescopes SSON offers, the basics of registering and purchasing credits for telescope time, how to select an object for imaging from the catalogs available, and how to schedule images of a selected object.

Rich described the five SSON telescopes, saying he started with his own 24-inch telescope located in Markleeville, CA. He added the University of Iowa Rigel 14 1/2–inch telescope (now replaced by a 20-inch telescope) in Sonoita, AZ. This addition was a collaboration with Dr. Robert Mutel, a pioneer in robotic telescope technology who facilitated expansion of the network. The network now also includes a 24-inch and a 32-inch telescope at Mt. Lemmon, AZ, and a 20-inch telescope at Warmbungle Observatory in Australia.

Jerry had the SSON website up to illustrate the steps for using SSON, from selecting an object from the catalog to planning and scheduling the exposure. Along the way, he pointed out the links for registering and purchasing credits. Credits represent exposure time on the telescopes, with the number of credits per hour depending on the telescope used. Scheduling starts with the “JOBS” dropdown by clicking the “CREATE SCHEDULE” choice. It brings up a form with five steps, starting with choosing an object. Jerry and Rich advised that the scheduling software works best to optimize when your object is imaged (near its transit, for example) as long as you allow it to do so by not choosing a specific time—and Jerry further warned that it is easy to make a mistake trying to specify the best time. He also mentioned that he uses the planetarium program Cartes du Ciel, which he has set up as if it were at the observatory location when he is planning a job. It helps avoid picking an object that is not going to be up in the night sky for months.

To select an object, you can use a number of catalogs grouped into moving objects catalogs (asteroids and comets, for example) and stationary objects catalogs, or enter the object’s coordinates on the form. Next, the form asks for a title and observer name to identify the job, followed by an optional date and time (per Jerry’s recommendation, you might only want to enter a date).

Hubble image of Tarantula Nebula. Source: http://hubblesite.org/newscenter/archive/releases/2014/02/image/a/

We finished the session by going through the steps of setting up a job for imaging the Tarantula Nebula in the Large Magellanic Cloud. For the catalog lookup, Myron Wasiuta came up with the NGC number (2070). The telescope needed for this object in the southern hemisphere was the Warmbungle Observatory telescope in Australia. Our job would use 300 seconds for each filter, with filters RBV and Clear selected from the available filters for the telescope. The “visual” filter (V) is a green filter developed for photometry to help standardize the response of various detectors. Rich told us that 300 seconds is the maximum exposure that should be used for one image, and longer exposures can be obtained by taking more images and stacking. We chose three as the number of images per set. One of the reasons for limiting the exposure time is less data is lost if a satellite or meteor happens to pass through the field of view.

During the summary and question period, we learned you can check the weather for each telescope site. Also, the cameras on the telescope are not designed for planets. The image scale of these telescopes is unlike that of 8- or 10-inch telescopes that many amateurs may be used to. Another tip was that some of the favorite deep sky objects may not fit in the field of view, but for pretty pictures it is possible to get a lot of detail in smaller (1 to 2 arc minutes) objects and obtain good aesthetic images.

After the SSON planning session, Myron provided an update on the Mark Slade Remote Observatory (MSRO). He said the computer is now in the observatory and currently communicates via wireless, which has allowed confirmation that remote access works. Cables still need to be in place to provide the bandwidth needed to control MSRO remotely.

In comparison with SSON, Myron noted MSRO is a hands-on type of telescope, not a queued system. The polar alignment and the tracking with the Drive Master are now pretty good. He showed some early pictures made with lousy seeing and cruder polar alignment. We could still resolve six stars in the Trapezium in one image with a 1-second exposure. Myron and Jerry have found there is more magnification than desirable, and they plan to add a focal-reducer/corrector lens when the focuser is upgraded.

Myron showed an Orion Nebula image he took with his DSLR after Bart suggested trying a DSLR in the meantime. He said the image was a stack totaling 5 minutes, and it was indicative of being able to track well enough for such exposure lengths.

Finally, Myron summarized what still needs to be completed. The shutter for the dome is not yet motorized. He is planning to add automatic dome rotation capability with Digital Dome Works. A weather station is ready to install and connect up. Referring to the surprise snow shower that started just before the meeting in advance of the record storm projected for the weekend, Myron noted he and volunteers had taken advantage of the previous good weather to get a lot done—now we may have to wait for good weather.

Outreach Events

Night in Washington's Day at Kenmore Plantation—Glenn Holliday

Historic Kenmore invited us to present a program on the History of Astronomy at its larger event Night in Washington's Day on November 13. Although I wasn't able to present in Colonial costume or show a period telescope, I did enjoy going out to Kenmore with a program for the public. Kenmore is the plantation house of Fielding Lewis and his spouse Betty, who was the sister of George Washington. (It is not the Kenmore Inn, which is several blocks from the plantation house.)


History Kenmore Plantation. Source: wikitravel.org

I was stationed in the kitchen with a projector. An interpreter inside the plantation house told of historical events there, while another interpreter showed the constellations on the front lawn. The staff rotated groups of visitors through the three stations. Attendance was about 50 people, which made for 3 groups, and I gave my half-hour program 3 times in 2 hours.

We had a good night, mild and clear. At the beginning of the evening, we had a beautiful view of the setting crescent Moon over the roofs of century-old Fredericksburg homes, which I pointed out to the Kenmore photographer. Unfortunately, the first group of visitors came to the kitchen just after moonset—too late to view it.

I started each group with a quick look at the sky. I didn't want to just talk about the stars without giving the group a chance to appreciate what we are talking about. Also, I wanted to point out the shape of the Pleiades so they could judge whether a graphic I showed later was really an image of that asterism.

David Abbou at Park Ridge Elementary

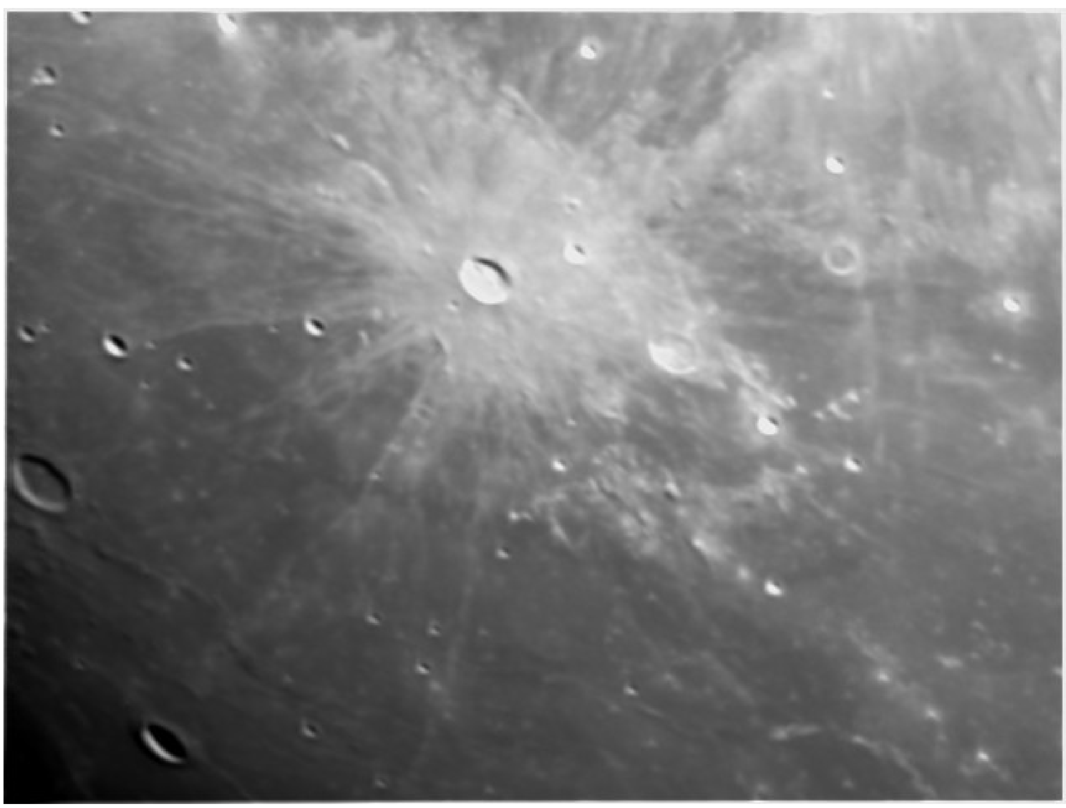
Then we retired to the kitchen where I projected images to accompany my words. The crowd was a mix of ages, mostly families. I was gratified that many youth seemed to plug in to and enjoy what I was sharing. I was able to refer the group to the Rappahannock Astronomy Club and hand out my club cards.

I will be doing a "History of Astronomy" program for your amusement at our October monthly club meeting this year.

Park Ridge Elementary School—Dave Abbou

December 12, I went to Park Ridge Elementary School in Stafford to give two astronomy presentations. Much of the presentation time consisted of Q&A because the kids had prepared many questions about astronomy and the space program. Between the two classes, there were approximately 70 students. The picture at left was taken by one of the teachers.

Image of the Quarter



Marius Crater in the Oceanus Procellarum by Ron Henke

Specs: NexStar 8 SE, ImagingSource Planetary Imager, 500 frames, Processed in Registax 6